Wheat Response to Zinc

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Background

Zinc (Zn) is an essential trace element required by plants. It is needed for a range of metabolic activities including enzyme function, growth hormones, starch formation, chlorophyll synthesis, seed development and maturation.

Response to Zn fertiliser has traditionally been recorded on high pH clay soils, particularly those that have been levelled for flood irrigation. Crops such as maize, sorghum and durum wheat are renowned for being susceptible to Zn deficiency.

Recently there has been interest in the potential for Zn responses in wheat on lower pH soils in the central west. This has been based on observations of low soil Zn levels and anecdotal evidence of crop responses to Zn.

Zn response trials were sown at three CWFS regional sites to measure potential responses in wheat.

Methods

To determine the response of wheat to zinc application, trials were conducted at Gunning Gap, Wirrinya and Mulyandry (Table 1). The trials consisted of +Zn and Nil Zn treatments replicated 3 times on a paired plot basis. All plots were pre-drilled with the same amount of nitrogen and phosphorus (50 kg N/ha) prior to sowing. The +Zn treatment was applied as zinc-coated DAP fertiliser at a rate of 2.5 kg Zinc /ha. The Nil Zinc treatment received only uncoated DAP.

Table 1. *Details of trials conducted in the Forbes district*

Location	Paddock History	Date sown	Herbicides
Gunning Gap	Canola	23/5/00	Tristar Advance + Tigrex
Wirrinya	Canola	20/5/00	Ally + MCPA
Mulyandry	Canola	2/6/00	Tristar Advance + Tigrex

Table 2. *Soil test details*

Location	Soil Type	pH (CaCl2)	Zn (DTPA) Ppm	P (Colwell) Ppm	CEC meq/100g	Profile N (0-60cm) kg/ha
Gunning Gap	Red loam	**4.5**	**0.4**	**25**	5.56	**81**
Wirrinya	Clay loam	**5**	**0.4**	**20**	9.41	136
Mulyandry	Clay loam	**5.8**	**0.4**	**25**	16.52	106

Results and Discussion

Soil tests at all three locations revealed low Zn levels (Table 2). Trial results show no appreciable response of wheat to Zn (Table 3). The lack of Zn response supports other Zn trials conducted on lower pH soils, such as the 1999 Zn response trial at Wirrinya (Motley and Rice, 2000). Two years of trial results at Forbes suggest that on acid -neutral pH soils, **a** soil Zn measurement of 0.4 ppm (DTPA) is not low enough to be a responsive level.

However, some agronomists continue to support Zn fertiliser use on wheat where trial results suggest otherwise. This gap between trial evidence and anecdotal evidence may be due to three important factors:

1) Soil type variability. Often there is tremendous soil variability across a paddock, and Zn deficiency symptoms will be isolated to particular parts of a paddock. This usually involves areas of high pH clay soils. This may mean a Zn response trial will show variable results depending on its location in a paddock.

2) Zn response seems to be affected by seasonal conditions. Zn is very immobile in soil, relying on root interception for plant uptake. Seasonal conditions that affect plant and root growth such as cold wet weather can temporarily induce a Zn deficiency. This means that a Zn response recorded in one year may not be recorded in another year.

3) Sulphonylurea (SU) herbicides are well known for their pruning effects on secondary roots in plants. It is thought that this may make wheat grown on soils treated with these chemicals more susceptible to Zn deficiency. Some agronomists are recommending Zn at economic levels to help overcome possible SU herbicide damage on low Zn soils. O'Keeffe and Wilhelm (1993) reported applications of SU herbicide on low Zn soils causing yield penalties in wheat by intensifying Zn deficiency. They also reported yields were not reduced when SU herbicide was applied to the plots treated with Zn fertiliser. Good and Dang (2001) reported zinc deficiency in the presence of SU herbicide at Merriwagga in 2000. Of particular interest were the reduced plant tissue concentrations of both zinc and phosphorus in the treatments treated with SU herbicide. However, they recorded no yield response. Test strips are valuable in trying to help diagnose a possible Zn deficiency. They can take a broad scale account of soil variability, and if done over a number of seasons will help establish any seasonal effects.

Table 3. *Wheat Zn response at Forbes in 2000*

Site	Nil Zinc			+ Zinc		
	Yield (t/ha)	Protein (%)	Screenings (%)	Yield (t/ha)	Protein (%)	Screenings (%)
Gunning Gap	2.13	15.5	4.8	2.14	15.3	4.5
Wirrinya	4.41	14.3	4.5	4.53	14.2	4.8
Mulyandry	2.62	13.2	5	2.66	13.2	4

Data not statistically analysed. Mean results presented.

Conclusions

Two years of trials at Forbes on low Zn soils show no indication of wheat response to Zn fertiliser. There is some evidence that Zn deficiency in wheat can be intensified by SU herbicides. However, the critical soil Zn levels needed to justify Zn fertiliser use in wheat grown on lower pH soils treated with SU herbicides is unknown. Fertiliser test strips over a number of years have an important role to play in determining potential Zn responsiveness.

References

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