Soil and plant analysis for the prediction of copper deficiency in wheat.

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A large number of soil and plant tests have shown varying success in trials to predict copper disorders in wheat(1). As part of a 2 year experimental program begun in 1985, the usefulness of some of these tests for areas of SW Victoria was assessed.

Materials and Methods.

Five representative commercial wheat farm sites with a history of no copper application were selected on each of five main soil types in the Hamilton district. Four treatments (replicated 4 times) were established; Nil and 75 q of foliar copper applied at Z (Zadox growth stage) 23 , 41 and 23 + 41 . Grain yield was determined by quadrat cuts. Composite Al and A2 horizon soil samples from each site were analysed for EDTA (0.75%,1:5 soil; extract, l hour) extractable copper. Youngest fully emerged leaf (YL) and Whole plant (WP) samples were taken at growth stages Z21, 23 and 41 and analysed for total copper. Regression analysis using linear (below) and 2 curvilinear models was carried out.

Results and discussion.

Yield response (Pooled data) was significantly related to copper level in the Al and A2 horizon, however Variance accounted for improved to 20% when mean A horizon copper was used. Three plant Cu measurements were significantly related to Yield Response. Variance accounted for improved for earlier YL samples and later WP samples. Low Variance accounted for % were possibly due to climatic and soil variation across sites. Soil variation influences extraction efficiency and climatic variation influences growth pattern and nutrient redistribution (1)

Z21 plant Cu levels were significantly related to Z23 and 41 levels. Z21 sampling could thus give farmers a timely indication of Cu levels during later, critical growth phases.

Table 1: Regression coefficient (b) and Variance accounted for (% VAF) from the linear regressions of (1) yield response and various measures of plant copper (PC), (2) Yield response and various measures of soil copper (SC), (3) Plant and leaf copper levels at different times.

(1)			(2)			(3)			
PC	b	% VAF	SC	b	% VAF	PC1	PC2	b	% VAF
YL Z21	-3.25	13	Cu A1	-14.0*	16	YL Z21	YL Z23	0.95*	60
YL Z23	-2.53	17	Cu A2	-10.0*	14	YL Z21	YL Z41	0.79*	54
YL Z41	-5.16*	19	Cu $\overline{A}$	-13.5*	20	WP Z21	WP Z23	0.51*	22
WP Z21	-5.42*	17				WP Z21	WP Z41	0.79*	39
WP Z23	-4.85*	14							
WP Z41	-5.92	12							

*P>0.05

This experiment has shown that while soil and plant copper levels are related to yield response, they alone give a limited indication of the presence of copper deficiency in wheat. Yield response is most closely related to whole Plant Z41 and mean copper level in the A horizon. Early (721) sampling may give advanced warning of copper deficiency.

1. Robson, A. & Reuter,D.(1981) in 'Copper in Soils & Plants' Academic Press.