

## Phosphorus requirements of wheats and barleys grown in South Australia

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In South Australia, phosphorus (P) fertilizer use has declined significantly as fertilizer prices have increased since 1975 (1). If this trend continues, to maintain production, some knowledge of the plant P requirements of commercial cereal cultivars will become important. There is ample overseas (2) and some Australian research (3) which demonstrates a degree of genetic variability in P use efficiency, particularly within wheat. The research reported here aims to examine fertilizer applied P responses and P requirements of wheats and barleys grown in S.A.

### Methods

In 1987, 12 wheat and 12 barley cultivars (commercial and unnamed breeders selections) were sown respectively in two adjacent experiments on a known P deficient soil (3 mg/kg-1 NaHCO<sub>3</sub> extractable P) at Parilla, S.A. Each experiment contained 8 rates of applied P fertilizer (0, 5, 10, 12.5, 15, 25, 35 and 60 kgP ha<sup>-1</sup>) and 3 replicates within a split plot design. P uptake was determined from plant shoots sampled at 'soft dough' corresponding to maximum uptake of P (4). Regression analysis and GLIM statistical procedures were used to determine the grain yield at zero applied P (Y<sub>0</sub>), maximum grain yield (Y<sub>MAX</sub>), grain yield response to applied P (Y<sub>MAX</sub>-Y<sub>0</sub>/ΔP; ΔY/ΔP, external P requirement (P rate at 90% Y<sub>MAX</sub>; P<sub>EXT</sub>) and internal P requirement (shoot P content at 90% Y<sub>MAX</sub>; P<sub>INT</sub>).

### Results and discussion

**Table 1. Mean, Range and F probability for wheat and barley cultivar responses to fertilizer applied P, Parilla S.A. - 1987.**

		Y <sub>0</sub> tha <sup>-1</sup>	Y <sub>MAX</sub> tha <sup>-1</sup>	ΔY/ΔP kg grain kgP <sup>-1</sup> ha <sup>-1</sup>	P <sub>EXT</sub> kgP ha <sup>-1</sup>	P <sub>INT</sub> mgP 100 plants <sup>-1</sup>
<u>Wheats</u>	Mean	.78	2.86	42	31.2	27.9
	Range	.59-.93	2.55-3.47	34-51	25.7-46.4	19.4-56.7
	F Probability*		.1	.96	.17	.002
<u>Barleys</u>	Mean	.41	2.75	55	28	30.5
	Range	.24-.64	2.40-3.28	42-70	24.5-31.7	14.9-52.8
	F Probability*		.00	.45	.12	.002

\* probability of a value equal or larger than the observed F(11,263) value.

This preliminary experiment indicates some differences between species in response to applied P. Wheats on average produced more grain yield than barleys in the absence of applied P (P<sub>0</sub>). However barleys were more responsive (yield increase/kgP applied/ha) to applied P than wheats. Within species there appeared no difference in terms of absolute response but there were differences in both external and internal P requirements for near maximum yield. Within both wheats and barleys there was a strong positive correlation between cultivar ranking for external and internal P requirement. This research is continuing together with studies on the relationship between root morphology and P acquisition by wheats and barleys.

1. Reuter, D.J. et al (1988), S.A. Dept. of Agric. Tech. Report No. 139

2. Clark, R.B. (1983), Plant and Soil 72: 175-196.

3. Batten, G.D. (1986), Ann. Bot. 58: 49-59.

4. Schultz, J.E. and French, R.J. (1976), Aust. J. Exp. Agric. Anim. Husb. 16: 887-892.