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Breeding wheat varieties for acid soils

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Southern are not yet understood, but they could be linked to the role of nitrogen, either in clover nodulation or soil mineralisation, or the effects on soil wetting properties.

Measurement of soil pH in the 0-10 cm layer is not a good indicator of lime responsiveness.

Manganese deficiency can be induced by liming some south coast soils, especially in the Manypeaks-Kalgan Valley area, thus reducing the growth of cereals and the growth and seed production of clover. This effect may persist for several years after liming.

Acknowledgement

The research undertaken from 1981-83 was funded by the Australian Wool Corporation.

Table 4. Effect of rate of lime on trace element concentration of clover on black sandy soils.

Rate limesand t/ha	Nil	0.25	0.5	1.0	2.0	4.0	8.0
Trace elements in clover leaf petiole				ppm			
Manganese	31.3	24.0	21.7	18.3	20.0	15.7	13.7
Molybdenum	1.7	1.6	2.2	2.3	2.2	2.5	3.1
Copper	11.7	11.7	11.3	10.7	11.0	10.7	11.3
Zinc	60.3	51.3	53.7	48.0	54.7	51.0	49.3

Breeding wheat varieties FOR Acid Soils

By I. R. Barclay, Plant Breeder, Division of Plant Production

Wheat varieties with improved tolerance of acid soils could increase yields by perhaps 20 per cent or more over a substantial area of Western Australia's eastern wheatbelt.

Aluminium toxicity is probably the main cause of poor root growth and therefore reduced yields on these soils.

Aluminium tolerance

The wheat varieties grown today are intermediate between barley, which is sensitive to acid soils, and oats which tolerates them.

Wheat varieties differ in their tolerance of high levels of aluminium. Most Australian wheats, for example Egret and Warigal, are sensitive to high levels of aluminium. Gamenya is less sensitive, as is Olympic and Eagle.

The best aluminium tolerance is found in wheat varieties from Brazil. No Australian wheat can match the tolerance of Brazilian wheats such as Cotipora or Carazinho, which have a tolerance equivalent to that of the oat varieties commonly grown here. But, in other respects, these Brazilian wheats are not adapted to the eastern wheatbelt. They have a relatively low yield potential in this environment, are of poor agronomic type and have red grains.

The Department of Agriculture has started a breeding programme to incorporate greater tolerance of aluminium into varieties for the eastern wheatbelt.

The use of a root tip staining technique in the laboratory has simplified the screening of early generations of breeding lines for aluminium tolerance.

Varieties tolerant of aluminium tend to accumulate less aluminium in their root tips than less tolerant varieties. This accumulated aluminium can be easily seen by staining with the dye hematoxylin.

The germinating seedlings are put into a solution containing aluminium for a few hours, stained with hematoxylin and the pattern of root tip staining noted. The seedlings with the heaviest stains—the aluminium intolerant lines—are then eliminated before field testing.

Breeding lines

The University of Western Australia has co-operated with the Department of Agriculture in screening breeding material by this method. Breeding lines which show improved tolerance of aluminium are being tested in field trials. This level of tolerance is still well below that of the Brazilian wheats, and further crossing and selection of lines with higher levels of tolerance has started.

The benefits of having tolerant wheat varieties are likely to be considerable. About 25 per cent of the eastern wheatbelt soils have subsoils which are acid enough to restrict root growth and reduce crop yields. Tolerant wheat varieties will be better adapted to these soils.

■ The wheat seedlings showing the darkest staining in the root tips are sensitive to aluminium and are eliminated from the breeding programme.