Australian scientists identify crucial barley gene

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Adelaide scientists have identified the major gene responsible for boron toxicity tolerance in barley, allowing breeders to select with 100% accuracy barley varieties that are tolerant to boron. The findings have today been published in the journal, *Science*.

The discovery was made by a research team led by Dr Tim Sutton of the Australian Centre for Plant Functional Genomics at the University of Adelaide's School of Agriculture, Food and Wine at the Waite Campus.

The gene, known as Bot1, was first discovered in a boron-tolerant African barley known as Sahara.

Bot1 helps barley plants survive in soils containing high amounts of boron, common to much of Southern Australia, Asia and Africa. The gene works by preventing the entry and accumulation of boron in the plant, which causes the damage and limits growth.

Since the early 1980s scientists have known about the toxic effects of boron on cereal crops in southern Australia.

"Highly boron-tolerant barley landraces (crop varieties) had been previously identified, but nothing was known about the molecular basis of their tolerance," says Dr Sutton. 'We used genomics, which is a combination of modern molecular biology techniques, to identify the sequence of the boron-tolerant gene from Sahara, and the underlying molecular mechanism that provides the tolerance."

“Boron is an essential micronutrient for plants but they require just the right amount, and boron toxicity and deficiency severely limit crop production worldwide,” says Professor Peter Langridge, CEO of the Australian Centre for Plant Functional Genomics. “This discovery means that farmers growing barley in high boron environments will be able to choose varieties of barley more suited to their soils, therefore minimising crop loss to this condition.”

Scientists can now work towards transferring this gene into commercially important barley varieties using either conventional breeding or transformation techniques.

The paper, *Boron toxicity tolerance in barley arising from efflux transporter amplification* (2007) by Tim Sutton, Ute Baumann, Julie Hayes, Nicholas C. Collins, Bu-Jun Shi, Thorsten Schnurbusch, Alison Hay, Gwenda Mayo, Margaret Pallotta, Mark Tester and Peter Langridge, appears in the 30 November issue of *Science*.

Boron toxicity appears in the tips of the older leaves first, turning them yellow with characteristic brown spots. It then extends down the leaf as toxicity increases until it causes tissue death and eventually plant death.

Barley is a main ingredient in the production of beer and confectionary. In Australian barley crops, yield has been estimated to be reduced as much as 17% as a result of boron toxicity.

Thirty per cent of South Australia’s grain growing soils are affected by high levels of boron.

Source: University of Adelaide