

Researchers report breakthrough on salt-tolerant durum wheat

March 11 2012

A team of Australian scientists has bred salt tolerance into a variety of durum wheat that shows improved grain yield by 25% on salty soils.

Using 'non-GM' crop breeding techniques, scientists from CSIRO Plant Industry have introduced a salt-tolerant gene into a commercial [durum wheat](#), with spectacular results shown in field tests. Researchers at the University of Adelaide's Waite Research Institute have led the effort to understand how the gene delivers salinity tolerance to the plants.

The research is the first of its kind in the world to fully describe the improvement in salt tolerance of an [agricultural crop](#) - from understanding the function of the salt-tolerant [genes](#) in the lab, to demonstrating increased grain yields in the field.

The results are published today in the journal [Nature Biotechnology](#). The paper's senior author is Dr Matthew Gilliam from the University's Waite Research Institute and the ARC Centre of Excellence in Plant Energy Biology. Lead authors are CSIRO Plant Industry scientists Dr Rana Munns and Dr Richard James and University of Adelaide student Bo Xu.

"This work is significant as salinity already affects over 20% of the world's [agricultural soils](#), and salinity poses an increasing threat to food production due to climate change," Dr Munns says.

Dr Gilliam says: "Salinity is a particular issue in the prime wheat-

growing areas of Australia, the world's second-largest wheat exporter after the United States. With [global population](#) estimated to reach nine billion by 2050, and the demand for food expected to rise by 100% in this time, salt-tolerant crops will be an important tool to ensure future food security."

Domestication and breeding has narrowed the [gene pool](#) of modern wheat, leaving it susceptible to environmental stress. Durum wheat, used for making such food products as pasta and couscous, is particularly susceptible to soil salinity.

However, the authors of this study realised that wild relatives of modern-day wheat remain a significant source of genes for a range of traits, including salinity tolerance. They discovered the new salt-tolerant gene in an ancestral cousin of modern-day wheat, *Triticum monococcum*.

"[Salty soils](#) are a major problem because if sodium starts to build up in the leaves it will affect important processes such as photosynthesis, which is critical to the plant's success," Dr Gilliam says.

"The salt-tolerant gene (known as *TmHKT1;5-A*) works by excluding sodium from the leaves. It produces a protein that removes the sodium from the cells lining the xylem, which are the 'pipes' plants use to move water from their roots to their leaves," he says.

Dr James, who led the field trials, says: "While most studies only look at performance under controlled conditions in a laboratory or greenhouse, this is the first study to confirm that the salt-tolerant gene increases yields on a farm with saline soils.

Field trials were conducted at a variety of sites across Australia, including a commercial farm in northern New South Wales.

"Importantly, there was no yield penalty with this gene," Dr James says.

"Under standard conditions, the wheat containing the salt-tolerance gene performed the same in the field as durum that did not have the gene. But under salty conditions, it outperformed its durum wheat parent, with increased yields of up to 25%.

"This is very important for farmers, because it means they would only need to plant one type of seed in a paddock that may have some salty sections," Dr James says.

"The salt-tolerant wheat will now be used by the Australian Durum Wheat Improvement Program (ADWIP) to assess its impact by incorporating this into recently developed varieties as a breeding line."

Dr Munns says new varieties of salt-tolerant durum wheat could be a commercial reality in the near future.

"Although we have used molecular techniques to characterise and understand the salt-tolerant gene, the gene was introduced into the durum wheat through 'non-GM' breeding processes. This means we have produced a novel durum wheat that is not classified as transgenic, or 'GM', and can therefore be planted without restriction," she says.

The researchers are also taking their work a step further and have now crossed the [salt-tolerance](#) gene into bread wheat. This is currently being assessed under field conditions.

This research is a collaborative project between CSIRO, NSW Department of Primary Industries, University of Adelaide, the Australian Centre for Plant Functional Genomics and the ARC Centre of Excellence in Plant Energy Biology. It is supported by the Grains Research and Development Corporation (GRDC) and Australian

Research Council (ARC).

Provided by University of Adelaide

Citation: Researchers report breakthrough on salt-tolerant durum wheat (2012, March 11)
retrieved 26 April 2024 from

<https://phys.org/news/2012-03-breakthrough-salt-tolerant-durum-wheat.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.