Wheat hybrid holds potential for drenched, saline conditions

December 23 2013, by Jessica Theunissen

The wheat-cross was not of a bread-wheat quality and was more likely to be of feed grain quality. Credit: Dag Terje Filip Endresen

Wheat tolerance to salinity and waterlogging has been improved through genetic cross-breeding, according to a study by UWA scientists.

The study, published in the Functional Plant Biology journal, investigated ways to improve the salt and waterlogging tolerance of wheat (Triticum aestivum L.) through hybridisation with sea barleygrass (Hordeum marinum Huds.).

Sea barleygrass is a wild relative of wheat and is found growing naturally in salt marshes.

"[Sea barleygrass] has possibly the highest tolerance to salinity and waterlogging within the Triticeae," the authors write.

"[It] can withstand the combined effects of salinity and waterlogging by maintaining better leaf ion regulation whereas wheat is more sensitive to the interactive effects of these two stresses."

Wheat is moderately tolerant of salinity but is sensitive to waterlogging which lowers the availability of O2 in the root zone.

The researchers crossed bread wheat with the wild relative to create an amphiploid containing both genomes. The resulting H. marinum-wheat amphiploids were then tested to determine whether they possessed the desirable traits. The cross had lower leaf concentrations of sodium and chlorine and a higher ratio of potassium to sodium, which is associated with salt tolerance, compared to its wheat parent. However, it was not as salt tolerant as sea barleygrass.

The researchers found several disadvantages to using this particular cross: The wheat-cross was not of a bread-wheat quality and was more likely to be of feed grain quality. The cross was also found to have low fertility.

UWA School of Plant Biology Winthrop Professor and co-author Timothy Colmer says that low fertility is a key issue that will impact on whether there is a practical or commercial use for the cross in agriculture.

W/Prof Colmer says that undesirable traits such as low fertility may be able to be bred out through various breeding strategies.

While there are undesirable traits there is the advantage of using an adaptive wild relative, which is a new approach, he says.

"Salinity is increasing over large parts of the world's arable land," the authors write. "Salinity impacts adversely on crops by reducing water availability and causing ion toxicity.

"We need to have an integrated approach to the revegetation of saline areas… a salt tolerant crop is not going to solve the whole problem but it has a place," W/Prof Colmer says.

More information: Alamri Saud A., Barrett-Lennard Edward G., Teakle Natasha L., Colmer Timothy D. (2013). "Improvement of salt and waterlogging tolerance in wheat: comparative physiology of Hordeum marinum-Triticum aestivum amphiploids with their H. marinum and wheat parents." *Functional Plant Biology* 40, 1168–1178. dx.doi.org/10.1071/FP12385

Provided by Science Network WA