Boosting crop yields in Australia

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Andrew Hansen grows wheat, barley, canola, and oats on his farm at Coomandook in South Australia, where his family has farmed the land for more than 60 years. But now the family's way of life is threatened.

As Australia's climate has changed, the water table under Hansen's farm has been rising. Saline-laden water rises to the surface and dries out in summer, increasing the salt concentration in the soil and retarding the growth of crops. Once-valuable croplands have been turned into pastures used primarily to feed stock.

A new technology developed at UConn that enhances salinity tolerance in plants holds out hope for improving the crop yields of farms in saline areas, like Hansen's. The vacuolar pyrophosphates (AVP1) technology has already shown significant improvement in barley yields in field tests in Western Australia, and has now been secured by the Australian Centre for Plant Functional Genomics to help improve crop yields in the country.

Saline soils affect the growth of crop plants by reducing shoot growth and interfering with metabolic processes, such as enzyme activities and protein synthesis, leading to significantly reduced yields.

According to Greg Gallo, director of life sciences for UConn's Office of Economic Development, "Essentially plants utilizing UConn's AVP1 technology display larger root systems and other enhanced physiologic changes that improve growth characteristics and increase the tolerance of the plants to adverse conditions – in this case soils with high salinity

and with restricted water availability."

Michael Gilbert, general manager of the Australian Center for Plant Functional Genomics, says the UConn technology is "looking very promising in our field trials, which are being conducted under very saline conditions at a farm in Corrigin." Corrigin is located in the central Wheatbelt region of Western Australia and serves as the region's key agricultural center.

A global issue

Cereal crops – grains produced by plants belonging to the grass family – account for more than half of human energy and protein needs, and cereal plants occupy two-thirds of all cultivated land.

Soil salinity is a major issue for grain growers worldwide. In the United States it is estimated that yield reductions occur due to salinity on approximately 30 percent of arable land, and in Australia, 67 percent of all grain growing areas are affected by salinity.

UConn's Gallo anticipates a future where genetically engineered drought- and salt-tolerant plants could provide an avenue to the reclamation of farmlands lost to agriculture because of salinity and lack of rainfall.

The AVP1 technology was developed at UConn by Roberto Gaxiola, then an assistant professor of plant science in the College of Agriculture and Natural Resources.

Gaxiola, now a researcher at Arizona State University, developed the AVP1 technology after witnessing farmers in his native Mexico struggle to maintain cereal crop yields.

"Mexico, like many countries around the world, is facing the soil salinity problem in very productive agricultural areas like the Northwest, where most of the cereal crops are grown. This technology, together with other technologies that work to improve the quality of water used for irrigation, will allow us to grow relevant crops like wheat, barley, corn, and rice in areas of the planet that have been salinized."

For Australia's Hansen, like many farmers worldwide, addressing soil salinity is key to the viability of his family's farm for the next generation. His farm's grain yield on certain fields has been cut in half, and he has seen other hard-hit farms nearby lose full production on some of their fields.

He is hopeful about the promise of the new technology: "There would be a much better yield potential," he says. "Some parts of the farm have gone too far, but more salt-tolerant crops would mean that you could probably reintroduce cropping on some parts of the farm that have been lost."

Reclaiming those fields and increasing yields will make farming his family's land more viable for future generations.

Provided by University of Connecticut