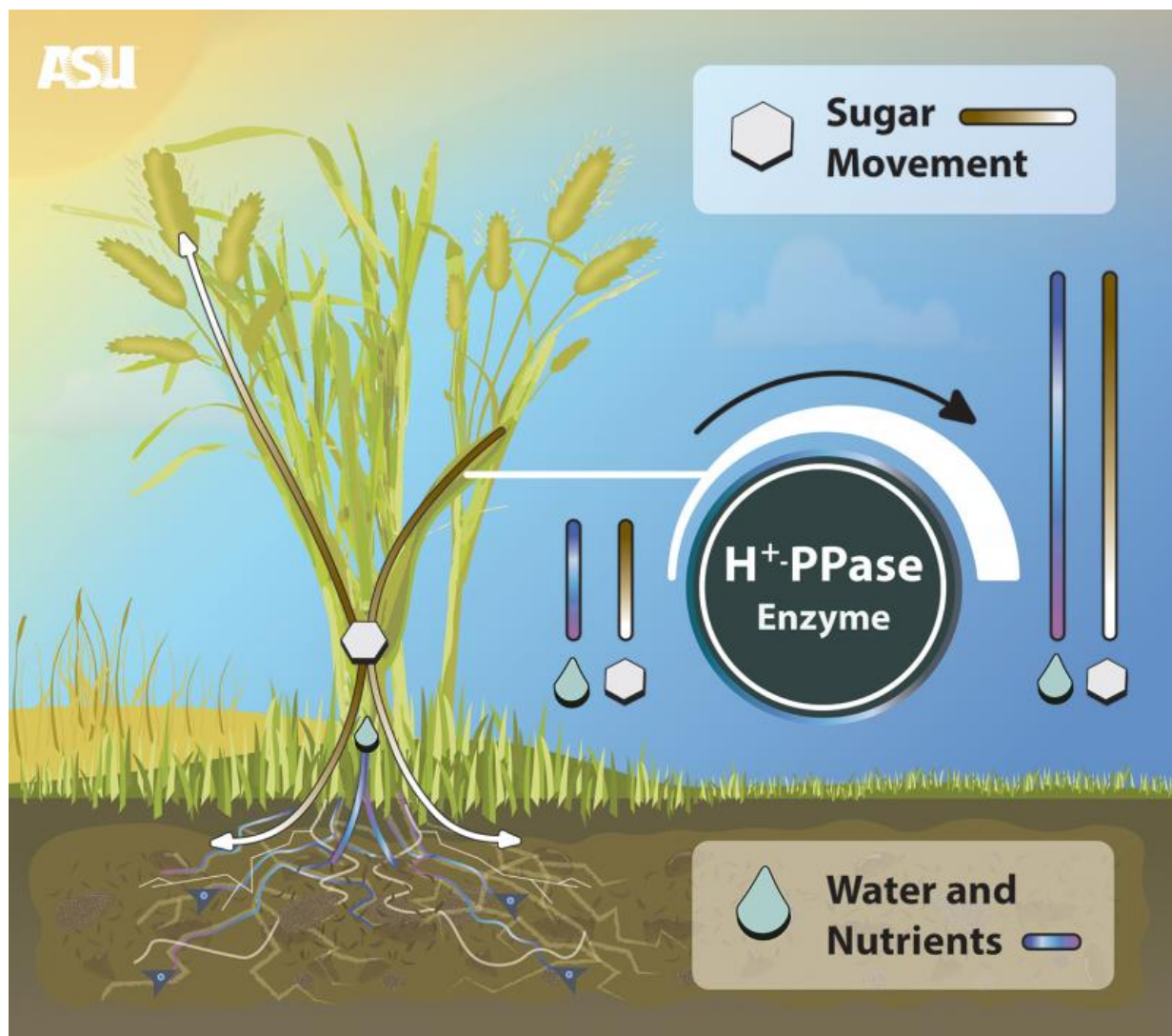


Researcher improves crop performance with new biotechnology

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Researchers with ASU School of Life Sciences discovered a way to enhance a plant's tolerance to stress, which in turn improves how it uses water and nutrients from the soil. These improvements increase plant biomass and yield. This

discovery could be instrumental in agriculture and food security by improving crop sustainability and performance. By increasing the expression of the enzyme H⁺PPase, plants can more effectively move sugar, water and nutrients to the places they need them to grow better roots, fruits, seeds and young leaves.

Credit: David Kiersh

With the world's population exploding to well over 7 billion, feeding the human race is getting even more challenging. Increasing the yield from crops such as wheat, maize, rice and barley, is paramount to growing enough food.

In addition, [crop production](#) is now affected by stressors such as drought, climate change and the salinization of fields—presenting obstacles to our future food supply.

Researchers with Arizona State University's School of Life Sciences, University of Arizona, University of North Texas and with the USDA/ARS Children's Nutrition Research Center, Baylor College of Medicine, have discovered a way to enhance a plant's tolerance to stress, which in turn improves how it uses water and nutrients from the soil. These improvements increase plant biomass and yield.

The study's findings are published in the scientific journal *Trends in Biotechnology*.

Associate professor Roberto Gaxiola with ASU School of Life Sciences said this discovery could be instrumental in agriculture and food security by improving crop sustainability and performance.

"We have learned how to modify the expression of a gene that codes for a plant proton pump," said Gaxiola, lead author of the study. "This gene

helps to move photosynthates—or molecules made by photosynthesis in the leaves—to the places plants need them in order to grow better roots, fruits, young leaves and seeds. This gene is called type 1 H⁺-PPase and is found naturally in all plants."

Current agricultural methods often overuse fertilizer, causing environmental problems by polluting water with phosphates and creating dead zones in oceans downstream. Over-fertilization can also cause plants to have small roots—something that was not anticipated when fertilizers were developed in the early 1900s.

By changing how effectively a plant uses water and nutrients, farmers would be able to use fewer resources to grow their crops.

"Larger roots allow plants to more efficiently acquire both nutrients and water. We can optimize inputs while minimizing environmental impacts. This is advantageous for our environment and for all consumers," said Gaxiola.

Altering the expression of this gene in rice, corn, barley, wheat, tomato, lettuce, cotton and finger millet caused better growth in roots and shoots, and also improve how the plants absorbed nutrients. These crops also saw improved water use and tolerance to salt. In finger millet, researchers also discovered an increase in antioxidants, but further studies would be needed to know whether this is the case with other crops as well.

Gaxiola suggested the next step is to further study this simple biotechnology in order to maximize its agricultural potential.

Provided by Arizona State University

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