# Waxy plant substance key for absorption of water, nutrients

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(PhysOrg.com) -- While proving a long-held theory that suberin blocks water and nutrient absorption in plants, a Purdue University scientist learned more about manipulating the substance to better feed plants.

It has long been believed that suberin, a waxy substance between some plant cells, acts as a barrier for the movement of water in a plant's roots. David E. Salt, a professor of plant molecular physiology, discovered a mutant form of the plant Arabidopsis - enhanced suberin 1 or ESB1 - with twice as much suberin as wild varieties, giving him a way to test the theory. The results of Salt's study were published Friday (May 22) in the early online version of the journal PLoS Genetics.

Salt also discovered which pathways particular nutrients use to get into a plant's shoots based on suberin concentration. By adjusting the amount of suberin in roots, Salt said plants could be engineered to allow for easier absorption of beneficial nutrients.

"This is the first time that the dogma in the textbooks has been tested genetically. It's been known for a long time that this material exists in the cell, but there's been no genetic proof to show what it does," Salt said. "We now have another tool in our toolbox to manipulate how plants take up water and mineral nutrients."

Using the plant with twice the amount of suberin, Salt showed that the plant activated a defense mechanism to keep from wilting. Since suberin was restricting water absorption, the plant allowed less transpiration, or

evaporation of water from the leaves.

To further prove the theory, Salt was able to cut shoots off the wild-type plants and graft them onto mutant roots, and vice versa. The nutrient compositions in the shoots changed, reflecting the effect suberin in the roots had on the plants' absorption ability.

"You put a mutant root onto a wild-type shoot and the elemental composition in the wild-type shoot starts to look like a mutant shoot," Salt said. "We saw the same thing with water loss."

Some nutrients use a symplastic route, moving through cells' cytoplasm to gain access to the plant. Others use an apoplastic route, moving through the outer cell walls. The suberin acts as a filter, blocking some water from passing through cell walls. The more suberin, the more difficult it is for nutrients to pass through the cell walls.

"Just like animals, plants want to select the things they take in," Salt said. "They want a certain amount of potassium or a certain amount of nitrogen. This allows them to choose how much they get."

In Salt's experiments, the plants with more suberin had less calcium, manganese and zinc in their leaves, meaning a significant amount of those nutrients pass apoplastically through the root. Sodium, sulfur, selenium, molybdenum and arsenic showed higher concentrations, meaning they are generally absorbed symplastically.

The plants with more suberin - which decreased transpiration - used the water they were able to absorb more efficiently. Salt said plants could be genetically engineered for specific amounts of suberin so they would more easily absorb beneficial nutrients and use less water in a more efficient manner.

The National Science Foundation funded Salt's research. The next step is to determine the role of the ESB1 gene in suberin biosynthesis.

Provided by Purdue University (news : web)