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Research offers plant efficiency hope

A study from the University of Nottingham could pave the way for crops more hardy towards climate change

Researchers have discovered how a protein in plant roots controls the uptake of minerals and water - a finding they say could improve the tolerance of crops to climate change and reduce the need for chemical fertilisers.

The research, published in Current Biology, shows that members of the blue copper proteins family, the Uclacyanins, are vital in the formation of Casparian strips. These strips are essential structures that control mineral nutrient and water-use efficiencies by forming tight seals between cells in plants, blocking nutrients and water leaking between.

Researchers say this is the first evidence showing the implications of this family in the biosynthesis of lignin, one of the most abundant organic polymers on earth. The study reveals that the molecular machinery required for Casparian strip lignin deposition is highly ordered by forming nano-domains which can have a huge impact on plant nutrition, a finding that could help in the development of crops that are efficient in taking in the nutrients they need.

Food security represents a pressing global issue, the scientists point out, and crop production must double by 2050 to keep pace with global population growth. This target is even more challenging given the impact of climate change on water availability and the drive to reduce fertiliser inputs to make agriculture become more environmentally sustainable. In both cases, developing crops with improved water and nutrient uptake efficiency would provide a solution and this.

Guilhem Reyt from the School of Biosciences and Future Food Beacon at the University of Nottingham, who led the research project, said: "This research is important in revealing the molecular mechanics underpinning efforts to improve mineral nutrient and water-use efficiencies and enhanced stress tolerance, making crops more able to withstand flooding, drought, nutrient deficiencies and trace element toxicities.

"Such improvements in agricultural and horticultural crops could also potentially benefit subsistence farmers with limited access to inorganic fertilisers which include nitrogen, phosphate and potassium and also sulphur and magnesium. This would help to reduce the cost burden such fertilisers impose and reduce the environmental and ecological damage their production and excess use causes. Improved water-use efficiency and stress tolerance will also improve yields for subsistence farmers cultivating marginal lands.

"An improved understanding of how roots acquire important trace element and minerals should provide an important molecular mechanistic underpinning to efforts to improve food quality by helping to increase the content of essential mineral nutrients

and reduce toxic trace elements in food crops."