PENN CENTER FOR INNOVATION

GRP8 as a target for improving plant stress response to water and nutrient starvation

Genetically engineered plants for increased resistance to nutrient stress

Inventor
Brian Gregory, Assistant Professor of Biology

STATE OF DEVELOPMENT

- Proof-of-concept testing

INTELLECTUAL PROPERTY

Provisional pending

REFERENCE MEDIA

Manuscript in preparation

APPLICATIONS

- Crop plant trait improvement
- Improve energy efficiency by reducing need for fertilizer application

DESIRED PARTNERSHIP

License
Co-development

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Problem

The plant root epidermis absorbs water and nutrients from the environment, using long hair-like projections from root hair cells to increase surface area. Plants regulate the ratio of root hair to nonhair cells based on environmental signals, with plants grown under nutrient-poor conditions developing higher density and longer hair cells. Roots can only absorb inorganic phosphates, present at very low concentrations in soil, making phosphate starvation one of the most common nutrient stresses in plants. Furthermore, the molecular mechanisms regulating root hair cell fate and phosphate starvation response are not well understood.

Solution

The Gregory lab has discovered that the overexpression of the *GRP8* gene (glycine-rich RNA-binding protein) increases the number of root hairs on the surface of plant roots, increasing the surface area for water and nutrient absorption. This finding is the first identification of GRP8 as a promising target for crop plant trait improvement, with connections to stress response to water and nutrient deprivation. GRP8 overexpression was also determined to improve plant tolerance to phosphate starvation, with acid phosphatase levels in *Arabidopsis* roots correlating with *GRP8* abundance. By measuring the expression of phosphate starvation response genes under normal growth conditions, GRP8 was found to positively regulate the transcripts of phosphate transporters and their upstream activators.

Advantages

- *GRP8* gene is highly conserved among ground plants
- Enhanced resistance to environmental stress conditions, including drought and nutrient deprivation

Image Caption:

Images of root hairs with normal in (A), upregulated production in (B), and downregulated production in (C).