Enhancing Phosphate-Use Efficiency

VTIP 20-119: "Utilizing Slow-releasing Fertilizer Processed from Phosphate-hyperaccumulating Plant"

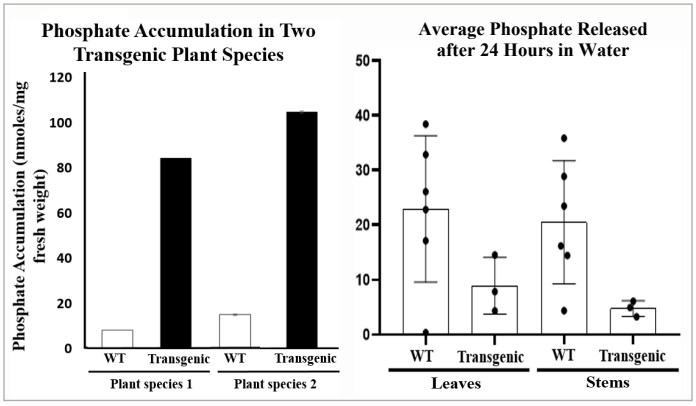
THE CHALLENGE

Mineable Phosphorus, while essential for maintaining food security worldwide, is becoming increasingly scarce as the global population increases. Furthermore, this nonrenewable resource is inefficiently allocated in urban and agricultural areas and detrimentally impact the environment. Wastewater treatment and overfertilization lead to significant Phosphorus accumulation in aquatic environments, resulting in toxified watersheds from algae blooms. Humanity's future depends on enhancing Phosphorus use-efficiency to prevent the total depletion of our mineral reserves while protecting the environment and our watersheds.

Algal blooms caused by enrichment of Phosphorus in aquatic environments.

OUR SOLUTION

Our team found that overexpression of a unique gene in plants causes the leaves to hyperaccumulate inorganic phosphate along with other metals. The impact of our invention is two-fold. First, our proposed invention will uniquely express this gene in a variety of plant species to reclaim Phosphorus from polluted environments. Additionally, we will process the plant material into a form which can be redistributed to agricultural areas as a slow-releasing fertilizer. Our invention and strategy will enhance Phosphorus-use efficiency by reclaiming Phosphorus from polluted environments and redistributing to nutrient-poor areas.



(Left) Inorganic phosphate content of two different transgenic plant species, grown on soil, n=1-3. There is an 8-10 fold increase in both transgenics, regardless of species type. Asterisks denote values are significantly different. (Right) Percentage of inorganic phosphate released from processed plants in water after 24 hours in WT and the transgenic line. Lower numbers indicate slow-release of phosphate. Mean with SD, n = 1-2.

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