

“We Are” The Future Of Smart Fertilizers: Enhancing The Efficiency Of Phosphorus At Penn State

Penn State University



More than 90% of phosphorus mined today is applied to agricultural fertilizer, yet plants use only 10-30% of the traditional phosphates. Being the second most common nutrient used in food production worldwide, phosphorus' finite supply makes this system significantly inefficient.

To address this issue, Jonathan Lynch, a faculty member in the Department of Plant Science at Penn State University, began researching a method to provide plants with phosphorus at levels that are both sufficient and optimal for the plants' performance. Lynch's patented research served as the foundation for a 2016 Penn State senior undergraduate project conducted by Hunter Swisher. Swisher decided to commercialize Lynch's research by forming Phospholutions, resulting in RhizoSorb®.

“Jonathan Lynch's patented approach starts with increasing fertilizer efficiency to improve plant growth, root architecture and yield, reduce depletion rates of our known reserves and minimize the environmental impact,” said Matthew Smith, Sr. Technology Licensing Officer at Penn State.

Embedded into small granules, RhizoSorb® is a smart fertilizer technology that optimizes the release of this nutrient dependent on the plant's needs – a plant-driven release. The unique metal oxide composition of RhizoSorb releases phosphorus on a chemical concentration gradient, rather than environmental and soil conditions that traditional fertilizers rely on. As a result, less water and fertilizers are needed for healthy plants with vigorous root growth that promotes greater drought tolerance.

In traditional fertilizers, many of the nutrients become tied in the soil, becoming trapped and unavailable for plant uptake. This is especially detrimental for finite resources like phosphorus. As a reversible phosphorus reservoir, RhizoSorb stores, releases into depleted soils, withholds and even reclaims phosphorus to minimize phosphorus runoff.

RhizoSorb reduces harmful environmental effects associated with traditional fertilizer, reducing runoff potential by 58%, leaching by 87% and decreasing greenhouse gas emissions by more than half.

“The technology promotes increased grower profitability and reduces environmental impact to contribute to a more sustainable future for farming,” noted Carl Casale from Ospraie Ag Science (OAS), an investor in Phospholutions Inc.

Swisher founded Phospholutions, a Penn State alumni-funded startup, to develop and commercialize RhizoSorb. Swisher has raised over \$15 million in investment from sophisticated, early-stage investors and leading fertilizer companies to develop and commercialize RhizoSorb as one of his company’s signature technologies. With the assistance of Lynch, Smith and entrepreneurial resources available at Penn State University, venture capital fund 1855 Capital and the Pennsylvania economic development initiative, Ben Franklin Technology Partners, Phospholutions has pioneered and promoted award-winning solutions surrounding sustainable agriculture.

Expanding beyond an idea at Happy Valley, Phospholutions has introduced RhizoSorb to farmers in other countries, including India, New Zealand and Turkey. In 2024, Phospholutions intends to expand to other countries, beginning field trials in China, Brazil and Canada, expanding RhizoSorb to enhance sustainable agriculture worldwide.

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