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Biomimetic Root oxygen Bioavailability Sensor using hybrid optical/electrochemical methods

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Category
Agriculture, Nutrition, & AgTech/Precision Agriculture & Smart Farming

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Researchers at Purdue University have developed a biomimetic method to measure root oxygen bioavailability (ROB). The innovation leverages sensors that simulate biophysical transport processes to directly assess root oxygenation by mimicking the oxygen consumption of a living root. Traditional oxygen concentration measurement techniques, such as Redox electrodes and oxygen selective electrochemical sensors, measure the concentration of oxygen in a particular position in soil, but are significantly limited by their inability to determine the availability of oxygen of a rapidly growing root. The sensor developed at Purdue instead integrates biotic and abiotic factors affecting oxygen bioavailability, providing a more accurate assessment of root redox status. This method will be invaluable for understanding the availability of oxygen in soil to determine root health and their ability to uptake essential mineral nutrients.

Technology Validation:

The sensor is in the mature prototype stage and has been used for research application on a NASA microgravity experiment. Currently a generic sensor is available that will require further refinement in order to achieve plant species specificity. Materials are currently available for viewing and/or testing.

Advantages:

-Sensors' ability to consume oxygen simulates the activity of a real root

-Ensures accurate root microenvironment simulation

-Advances understanding of root dynamics in soil and implications for plant health in soil irrigation control

Applications:

-Ag Field Monitoring

-Irrigation Control

-Environmental Monitoring

TRL: 4

Intellectual Property:

Provisional-Patent, 2024-12-04, United States

Keywords: Biomimetic oxygen sensor,Root oxygen bioavailability,Soil microenvironment simulation,Plant root health monitoring,Redox status assessment,Soil oxygen diagnostics,Agricultural sensor technology,Irrigation optimization,Environmental monitoring tool,Microgravity plant research