The new method of increasing nitrogen use efficiency can help enhance crop yield sustainably

Researchers have shown that reducing nitric oxide (NO) levels significantly boosts nitrogen uptake and NUE in rice and Arabidopsis. This breakthrough paves the way for sustainable agricultural practices and inspires further exploration of NO reduction strategies in plants.

Limitations of Existing NUE Technologies

Traditional NUE improvement methods, like split-dose application and slow-release nitrogen fertilizers, come with high operational costs and environmental drawbacks. These practices emit excessive nitrogen oxides (NOx) and contribute to global greenhouse emissions during fertilizer production. Addressing food security and environmental challenges requires innovative alternatives.

Novel Approach by NIPGR

The National Institute of Plant Genome Research (NIPGR) has demonstrated a systemic method to enhance NUE by modulating NO levels, which regulate nitrate transporters, particularly high-affinity transporters (HATs). Researchers achieved this through pharmacological and genetic manipulation of NO, offering a sustainable solution to improve crop yields with lower nitrogen inputs or under nitrogen-deficient conditions.

Research Highlights

- The team, including Dr. Jagannath Swain, Dr. Jagadis Gupta Kapuganti, Dr. Nidhi Yadav, and Dr. Sanjib Bal Samant, employed a pharmaceutical approach by treating wild-type (WT) plants with NO donor (SNAP) and NO scavenger (cPTIO) to monitor NUE.
- Overexpression of phytoglobin, a natural NO scavenger, enhanced the expression of HATs like NRT2.1 and NRT2.4, enabling efficient nitrogen uptake, especially under low NO conditions.
- NUE was measured by analyzing shoot nitrogen levels, amino acid content, and plant growth, demonstrating significant improvements.

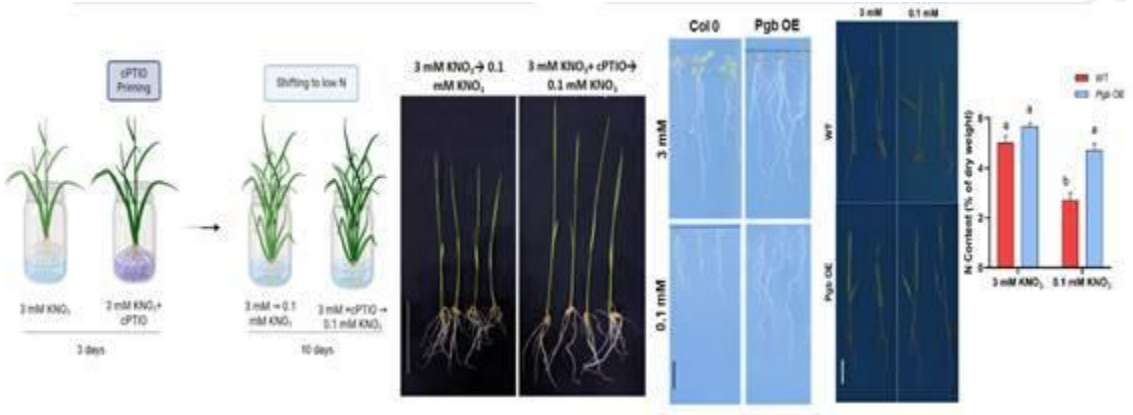
Sustainable Benefits

This innovative strategy bypasses costly and environmentally harmful fertilizers by using genetic and pharmacological interventions to regulate NO levels and activate HATs. The nitrosylation of proteins, driven by NO, plays a key role in this process, dynamically enhancing nitrogen utilization and plant growth.

Future Prospects

It's supported by the ANRF (formerly SERB), established under the ANRF Act 2023, this research offers a transformative approach to improving NUE. Dr. Kapuganti emphasizes the potential for developing NO scavenging formulations applicable to diverse agroecosystems. The team is also identifying soil bacteria that can act as NO scavengers, further enhancing NUE and reducing nitrogen fertilizer dependency.

This breakthrough aligns with global efforts to achieve sustainable agricultural growth, ensuring food security while mitigating environmental impacts.



Reference

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