Exploring the Impact of Lactobacillus rhamnosus on Nitric Oxide Stimulation of Peanut Roots

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Peanuts are an important oil and food crop. The calcium essential to pod growth and peanut productivity is obtained mainly via roots, so root growth is of key importance. Research has shown that low, stable concentrations of exogenous nitric oxide (NO) can activate Ca^(2+) cell membrane channels and increase Ca^(2+) concentration in cytoplasm, thereby stimulating root growth. In addition, nitrogenous fertilizer deposits in soil have been a problem, and these could be ideal nitrogen sources. We propose that bacteria can be used to convert ammonium or nitrate into NO, which is a more ecologically friendly method than chemical conversion. This project demonstrated this conversion using lactobacillus strains and observed the effects of NO stimulation on plant growth. We selected strains that can decompose ammonium and identified a fast-growing one by monitoring propagation in MRS culture media. We then confirmed NO generation using myoglobin culture plates. Finally, we planted peanut plants in-pot, irrigated them with various concentrations of MRS solution, and recorded growth periodically. Results showed that Lactobacillus rhamnosus is a fast-growing strain that uses ammonium to generate NO. The in-pot experiment showed improved root growth (64%) and stem growth (68%); increased number of main stems (3x), flowering loci, and pegs; and increased productivity (84%). It's reasonable to conclude that this effect was due to the increased concentration of NO through ammonium to NO conversion, and it's possible that this method could be used commercially to improve productivity of peanuts and other crops. Further study could explore the details of NO conversion, absorption by peanuts, and resulting stimulation of root growth, to better understand and optimize this method.

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