

Seminar

Institute for Plasma Research

Title: A Nitrogen Alternative: Use of Plasma Activated Water as Nitrogen Source in Hydroponic Solution for Radish Growth

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Date: 9th May 2024 (Thursday)

Time: 03.30 PM

Venue: Seminar Hall, IPR

Abstract

The study investigates the potential of Plasma-Activated Water (PAW) as a nitrogen supplement in hydroponic cultivation (HS-N+PAW), specifically focusing on radish seed germination and plant growth. PAW, produced using a dielectric barrier discharge pencil plasma jet using air as plasma forming gas, is compared against conventional hydroponic solution (HS) and hydroponic solution without nitrogen (HS-N).

PAW treatment completely eliminates microbial growth in seeds. Radish plants cultivated with HS-N+PAW display approximately 30% and 3% longer roots compared to those grown with HS-N and HS, respectively, with shoot length increasing by ~16.5% (HS-N) and <1% (HS). Root weight sees a substantial increase of ~51% with HS-N+PAW compared to HS-N, while the increase with HS is not significant. Similarly, shoot fresh weight sees a notable increase of 50% (HS-N) and 10% (HS).

In terms of biochemical composition, radish roots show a significant increase of approximately 15.3% in soluble sugar concentration with HS-N+PAW compared to HS-N. Protein concentration in radish leaves increases by ~5.1% and ~19.0% with HS-N+PAW compared to HS-N and HS, respectively. Heightened soluble sugar and protein concentrations in HS-N+PAW-grown plants, indicating enhanced metabolic activity and nutrient uptake. However, variations in chlorophyll and carotenoid concentrations in leaves among different growth media are statistically insignificant. H₂O₂ concentration root and shoot remains consistent across growth media, electrolytic and phenolic leakage, along with antioxidant enzyme activities, exhibit differential responses, underscoring the impact of growth conditions on plant stress responses.

Furthermore, sensory evaluation and physical attributes analysis underscore the negative effects of nitrogen deficiency in radish plants grown with HS-N. Conversely, HS-N+PAW cultivated plants exhibit improved visual appearance, surface texture, and overall acceptance, highlighting PAW's potential as a nitrogen source for enhancing plant growth and quality in hydroponic systems.
