

Enhancing Nitrogen Use Efficiency in Lettuce Using Pepton Animal-Protein Biostimulants

pepton

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1. Background

Excessive nitrogen (N) fertiliser use leads to environmental issues and poor nitrogen use efficiency (NUE). Amino acid-based biostimulants from the Pepton line — derived from hemoglobin — offer a sustainable strategy to enhance nutrient uptake, photosynthesis and biomass production, especially under N-limited conditions.

2. Objective

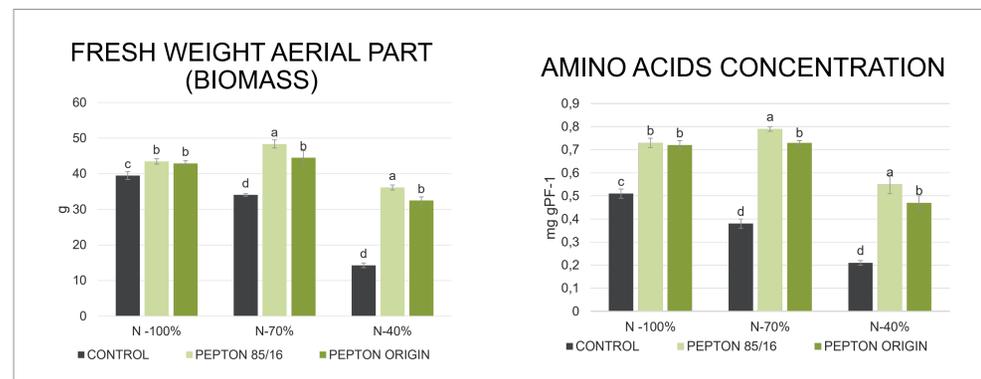
To evaluate whether Pepton biostimulants could support more efficient nitrogen use under reduced fertiliser input conditions, in line with current efforts to increase the sustainability of intensive horticulture.

3. Materials and Methods

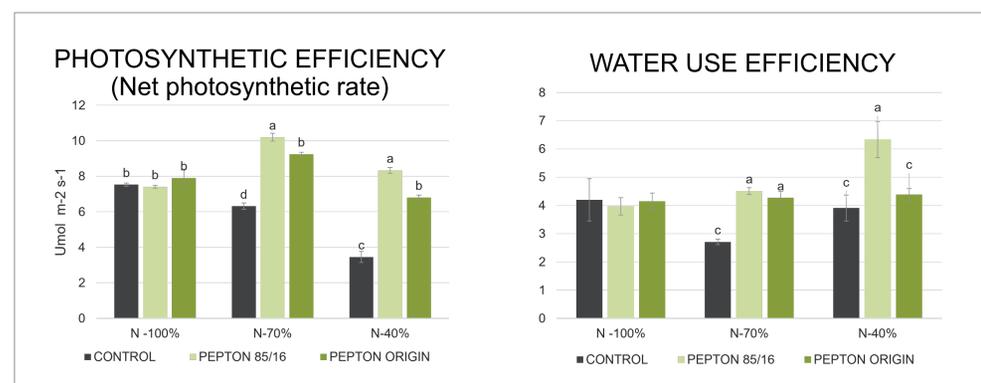
- Lettuce (*Lactuca sativa* cv. *Isasa*) under N-100%, N-70%, and N-40% conditions.
- Substrate: 1:1 vermiculite-perlite mixture; fertigation with modified Hoagland solution.
- Biostimulant treatments: *Pepton 85/16* and *Pepton Origin* at 2 g/L, root-applied weekly. (4 applications).
- Parameters measured: Biomass [fresh weight, dry weight (DW), leaf area]; photosynthetic rate; stomatal behavior (transpiration rate, stomatal resistance, intercellular CO₂ concentration); water use efficiency; nitrate reductase (NR) and glutamine synthetase (GS) activities; soluble proteins; amino acids; nitrogen content; and nitrogen use efficiency metrics [recovery efficiency (RE), internal efficiency (IE), agronomic efficiency (AE), partial factor productivity (PFP), and nitrogen efficiency (NE)].

4. Results

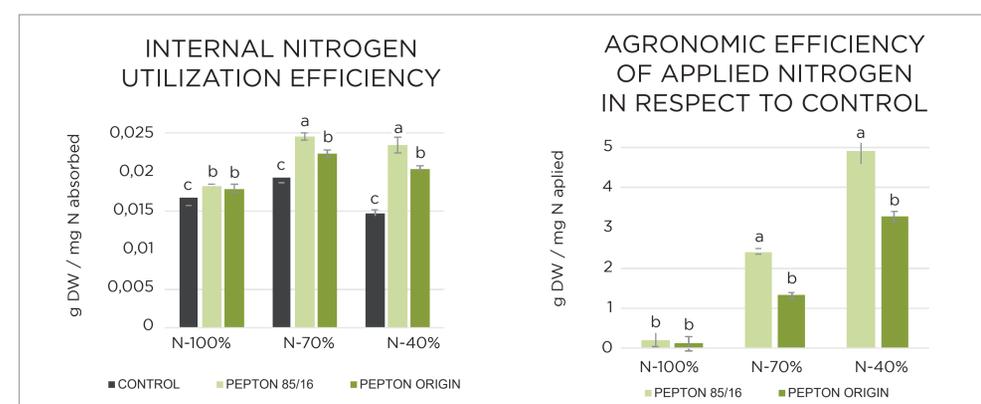
- Pepton biostimulants increased biomass and amino acid concentration under reduced nitrogen (N-70% and N-40%), restoring or surpassing N-100% levels.



- Both biostimulants improved photosynthetic rate and water use efficiency under limited N.



- Pepton significantly enhanced NR and GS activity, reducing nitrate/ammonium accumulation.



- NUE metrics (RE, IE, AE, PFP and NE) improved markedly with Pepton biostimulants in low N conditions.



5. Conclusions

These results demonstrate that Pepton biostimulants (*Pepton 85/16* and *Pepton Origin*) can improve nitrogen use efficiency in lettuce under reduced N-input conditions. Both formulations delivered comparable benefits, supporting the use of Pepton as a sustainable tool to optimise fertiliser programmes and maintain crop performance.

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