



Fostering the Transition to Sustainable Food Systems:
Embracing Novelty and Overcoming Challenges

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ABSTRACT BOOK

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PEF Priming of Seeds for Microgreen Production: A Complete Comparative Study

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Aim: Seed priming with Pulsed Electric Fields (PEF) is a potential novel approach to enhance early plant development and crop quality. In this work, a multidisciplinary framework was applied to evaluate the effects of PEF priming on microgreens derived from Beetroot (*Beta vulgaris*), Arugula (*Eruca vesicaria*), and Basil (*Ocimum basilicum* L.).

Method: Seeds were subjected to three PEF protocols (PEFA: 2 kV/cm; PEFB: 3 kV/cm; PEFC: 4 kV/cm) and compared to untreated controls.

Results: PEF priming significantly influenced water uptake and conductivity (σ) during the imbibition phase. Beetroot seeds treated with PEFB and PEFC exhibited significantly higher water uptake ($p < 0.001$, $\eta_p^2 = 0.459$), while basil presented the highest values under PEFC for both water uptake ($p < 0.001$, $\eta_p^2 = 0.38$) and σ ($p < 0.001$, $\eta_p^2 = 0.926$). These results indicate increased water membrane permeability due to electroporation.

Germination indexes (DGI, CGI, CV, SVi) and radicle length were positively and significantly affected, with PEFC showing the best results for Basil ($p < 0.001$) and Beetroot ($p = 0.004$), while PEFB was the most successful for Arugula ($p < 0.001$).

Chlorophylls and Total Carotenoid analysis revealed a decrease in both treated Beetroot ($p > 0.05$) and Arugula, with the latter showing the largest decrease under PEFB ($p < 0.001$, $\eta_p^2 = 0.759$). Interestingly, this same treatment also resulted in the highest increase in radicle length and CGI, suggesting that pigment dilution may be linked to enhanced tissue development and greater compound distribution across tissue. In contrast, basil showed an increase in pigment concentrations under PEFB and PEFC ($p = 0.001$).

Nutritional and Antioxidant Capacity were also assessed. FT-NIR profiling indicated increased Protein and Starch in Beetroot, Fat and Protein in Arugula, and Fat in Basil, especially under PEFB and PEFC. Crude Fiber and Ash generally decreased due to PEF amongst all species.

Overall, although sensory analysis indicated some influence on some attributes (increased Sweetness in Beetroot, Pungency in Arugula, and Aroma Intensity in Basil), statistical analysis showed no significant differences.

Conclusion: These findings support the potential of PEF as a sustainable pre-sowing technology to enhance early development without compromising quality. The species-specific responses indicate the potential of PEF as a sustainable pre-sowing technology to improve functional and agronomic traits in microgreen production. Further studies are necessary to optimize parameters and transpose this technology to industrial reality.