reported in hydroponically grown leafy greens, where certain cultivars exhibit enhanced phytonutrient concentration under controlled nutrient and environmental conditions.

The relatively lower and fluctuating performance of La Procesa Swamp Cabbage-1 (V2) indicates moderate adaptability to NFT hydroponic cultivation. Variability in SPAD values and yield suggests less stable chlorophyll synthesis and photosynthetic efficiency over time. This may be due to cultivar-specific differences in nutrient absorption efficiency or root system architecture, which are critical factors in NFT systems where nutrient delivery is continuous but shallow.

Overall, the effectiveness of the NFT system observed in this study supports its potential for year-round swamp cabbage production with efficient water and nutrient use. NFT hydroponics minimizes soil-related constraints, reduces water consumption, and allows precise nutrient management, making it particularly suitable for regions with limited arable land, poor soil fertility, or urban and peri-urban environments. The present findings are consistent with earlier reports that hydroponic systems enhance yield stability and quality of leafy vegetables when appropriate cultivars are selected.

Authors' contributions

Afrin Fardous designed and conducted the experiment. Md. Sifat Ullah analyzed the DAT and prepared the manuscript. Shreef Mahmood provided technical guidance and reviewed the manuscript. All authors read and approved the final manuscript.

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Conflict of Interest Disclosure

The authors affirm that this research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

References

Ahmed R., Rahman M.S., and Khan A., 2023, Advancements in hydroponic farming for urban agriculture, Bangladesh Journal of Agricultural Research, 15(3): 12-25.

Ahmed M., Rahman S., and Hossain T., 2022, Study on the suitability of swamp cabbage cultivars for intensive cropping systems under hydroponics, Journal of Horticultural Research, 34(2): 145-158.

Baiyin T., Wang J., and Zhou L. 2021, Effects of nutrient solution management on hydroponic vegetable yield, International Journal of Hydroponic Research, 8(1): 18-27.

Das R., Sharma V., and Patel S., 2022, Automation in hydroponics: A case study on swamp cabbage, Journal of Agricultural Engineering and Technology, 9(2): 35-48.

Farajzadeh M., and Nagizadeh E., 2003, Spectrophotometric determination of ascorbic acid in plant tissues, Journal of Analytical Chemistry Research, 7(2): 89-97.

Haque M., Alam S. and Hasan R., 2021, Morphological adaptations in high-yielding crop varieties under stress conditions, Journal of Crop Science Research, 18(3): 215-228.

Haque M., Alam S., and Hasan R., 2022, Root systems and their role in improving agricultural resilience, Journal of Agronomic Studies, 19(2): 145-159.

Jensen M.H., 1997, Hydroponics worldwide: A technical overview, Acta Horticulturae, 481: 719-729.

Karim A., Ahmed S., and Rahim M., 2018, Influence of branching traits on crop yield and resource efficiency in agricultural systems, Journal of Agricultural Innovations, 14(1): 55-62.

Khan R., Malik Z., and Hussain T., 2021, Growth of swamp cabbage cultivars under controlled environments during off-season, Journal of Controlled Agriculture, 16(2): 145-156.

Khan Z., Malik F., and Rahman A., 2020, Chlorophyll-b: Its role in light harvesting and plant resilience, Journal of Plant Physiology and Biochemistry, 13(4): 275-283.

Khan Z., Malik F., and Rahman A., 2020, Leaf morphology and its effect on crop yield potential: A comparative study, Journal of Plant Physiology and Biochemistry, 13(4): 275-283.

Kowalczyk C., Nowak M., and Zielinski P., 2014, The role of genetic traits and environmental interactions in crop yield and biomass composition, Journal of Crop Productivity Research, 10(3): 112-119.

Kumar A., Sharma P., and Gupta R., 2023, Optimizing hydroponic systems for sustainable farming, Agricultural Systems Journal, 6(4): 102-115.

Murashige T., and Skoog F., 1962, A revised medium for rapid growth and bio assays with tobacco tissue cultures,Physiologia plantarum, 15(3). https://doi.org/10.1111/j.1399-3054.1962.tb08052