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—Scientific Note—

Influence of Nutrient Management Practices on Crop Productivity and Quality in High Tunnel Organic Production of Leafy Greens

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The interest in using high tunnels for organic vegetable (OV) production is growing in Florida along with increasing demand for local organic vegetables. Leafy greens (LG) are among the most common high-value crops in high tunnel systems (Hochmuth and Toro, 2014). Integrated nutrient management in organic high tunnel vegetable production is crucial for optimizing crop productivity and enhancing soil health (Bi et al., 2021). However, the information regarding optimal nutrient management for organic LG in high tunnels is still limited. The objective of this study was to examine the impacts of soil and fertility management practices, including cover crops, compost, and organic fertilizer (OF), on yield and quality attributes of LG to provide research-based information on integrated nutrient management for high tunnel OV systems under Florida conditions.

This three-year study was conducted during 2018–20 in a multi-bay high tunnel on certified organic land at the University of Florida, Institute of Food and Agricultural Sciences (UF/IFAS) Plant Science Research and Education Unit in Citra, FL. A split-split plot design with three replications was used each year. Cowpea (*Vigna unguiculata* 'Iron Clay') cover crop and weedy fallow plots were established before the LG season as the whole plots, while OF application (preplant granular OF vs. weekly injection of liquid OF) was the subplot factor. Different types of composts (yard waste-based compost, cow manure-based compost, vermicompost, and no compost control) were included in the sub-subplots. After terminating the cowpea cover crop, pac choi (*Brassica rapa* subsp. *chinensis* 'Mei Qing Choi') was transplanted in Sept. or Oct. and harvested after about five weeks. The subsequent crop included direct-seeded spinach (*Spinacia oleracea* 'Corvair') or lettuce (*Lactuca sativa* 'Outredgeous'), followed by tomatoes each year prior to cowpea planting. All nutrient management treatments were implemented during the pac choi season. Each treatment plot remained in the same location across different seasons. Plant fresh biomass was collected weekly until the final harvest during pac choi production, while lettuce and spinach were measured only at harvest. The dynamics of fresh biomass and nitrogen (N) accumulation in pac choi were evaluated. Vegetable phytochemical contents were assessed in 2019 and 2020, including ascorbic acid, total phenolic content, and total antioxidant capacity. Data were analyzed in the GLIMMIX procedure using SAS (SAS Institute, Cary, NC) with Fisher's least significant difference test ($P \leq 0.05$).

There were no consistent interactions found among the cover crop, organic fertilizer, and compost factors for fresh biomass and vegetable phytochemical content. Results showed that the cowpea cover crop had little influence on crop yield performance. Further research is needed to evaluate the cover crop contribution to vegetable crop N management under different levels of N fertilization. In 2018 and 2019, granular fertilizer led to significantly higher fresh biomass of pac choi two weeks after transplanting, while liquid fertilizer resulted in significant increases of fresh biomass three weeks after transplanting in all seasons. A similar trend was observed for N accumulation of pac choi. Weekly application of liquid fertilizer might have better matched crop nutrient demand to help improve crop yield. However, the magnitude of yield increase resulting from liquid fertilizer generally declined from 2018 to 2020, suggesting a possible legacy effect of organic granular fertilizer on soil fertility. The long-term impact and cost effectiveness of different types of organic fertilizers on nutrient supply deserve further examination. Compared with no compost plots, yard waste compost significantly increased marketable pac choi yield in all seasons, and spinach yield in 2018. Yard waste compost also led to enhanced fresh biomass and tended to increase N accumulation in pac choi three weeks after transplanting. Granular fertilizer led to a significant increase in ascorbic acid content of pac choi in 2019 and 2020, and tended to increase total phenolic content of lettuce in 2019 relative to liquid fertilizer. Overall, compost application did not affect the phytochemical content of pac choi, but a reduction of ascorbic acid content and total antioxidant capacity in lettuce was observed in some compost treatments in 2019. More systematic research is needed to optimize integrated nutrient management practices for enhancing nutrient availability and use efficiency, soil health, and crop yield and quality in high tunnel OV production systems.

Literature Cited

Bi, G., T. Li, M. Gu, W.B. Evans, and M. Williams. 2021. Effects of fertilizer source and rate on zinnia cut flower production in a high tunnel. Horticulturae 7(10):333. https://doi.org/10.3390/horticulturae7100333

Hochmuth, R.C. and D.E. Toro. 2014. Characterization of the Florida fresh fruit and vegetable industry using hydroponic systems or protected agriculture structures. Univ. of Fla., IFAS, Gainesville. HS1240.https://edis.ifas.ufl.edu/pdf/HS/HS1240/HS1240-15328772.pdf

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