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"Food and nutrition security and its resilience to global crises"

Increasing Nutrition Security with Vertical Gardens – Testing Different Systems for Vegetable Production

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Abstract

Vertical garden systems have been a largely urban phenomenon, used to cultivate food crops as well as ornamental species in areas that would not normally be suitable for plant growth. Vegetables grown in vertical garden systems can provide an important dietary supplement to households. However not much research has been done concerning systems' or varieties' production efficiency. We aimed to construct vertical garden systems that are low-cost, low-labour, and simple to make with materials available to all. The developed systems were tested for their (i) water holding capacity; (ii) produced biomass and yield; and (iii) which vegetable plant families could be suitable.

The three systems designed and constructed were: the Second Wall, Planting Tower, and Bucket System, using three irrigation systems, i.e. cotton cloth, plastic tubes, and drip irrigation. The crops used in the systems represented four vegetable families: field peas (*Pisum sativum* L.; Fabaceae), African spinach (*Beta vulgaris* spp.; Amaranthaceae), black nightshade (*Solanum nigrum* L.; *Solanaceae*) and sukuma (*Brassica oleraceae* L.; Brassicaceae). Soil temperature and moisture were measured through implanted sensors, and yield was recorded. Six systems were constructed at three sites (2 system types per site) in schools located in Kapchorwa, Uganda. The systems and vegetables were compared using a mixed model.

The Planting Tower had the highest and most constant water holding capacity, followed by the Second Wall. The soil temperatures of all three systems remained very constant, varying slightly between 18–23°C. The Planting Tower showed the highest yields for all cultivated species, followed by the Second Wall. The Bucket System produced the lowest yield for all vegetables. Both African spinach ($p = 0.020$) and black nightshade ($p = 0.049$) showed significant differences in yield depending on their placement in the system (at the top or the bottom), making them more sensitive to water content than sukuma and field peas. Overall, the systems performed well to produce a mix of nutrient-dense vegetables under different conditions in the field. We consider vertical gardens a promising option to increase surface area to produce a higher amount of diverse vegetables for the household, hence improving their food and nutrition security.

Keywords: Food and nutrition security, home garden, vegetables, vertical garden

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