

Efficacy of column hydroponic system for increasing growth and yield of pak-choy (*Brassica rapa* L.) per unit area

ABSTRACT

Increasing the domestic production of Brassica vegetables is important to sustain the local food supply, maintain the healthy diets of the population, reduce the country's foreign exchange, and improve the local economy. In this study, a column hydroponic system (CHS) of 1.2 m L × 1.2 m W × 1.5 m H was built and tested to increase Brassica vegetable production per unit area. There were 16 rectangular polyvinyl chloride tubes (10.2 cm L × 5.1 cm W × 1.5 m H) positioned upright (PVC columns) at 30.0 cm apart in four rows. Each column had 36 planting cups (4 lines × 9 levels). The seeds of curly dwarf Pak-choy were germinated on mop yarns in the cups. The nutrient solution was supplied using a 0.5HP non-submersible pump. Data were recorded on day 37 by measuring the vegetable yield, development, growth, and quality. The data were analyzed using Microsoft Excel®2019 by performing one- and two-way ANOVAs, followed by posthoc tests ($\alpha = 0.05$). The vegetable yield/area of the CHS (12.7 kg/m² , or 400 plants/m²) was 60% higher than that of a raft hydroponic system (5.1 kg/m² , or 63 plants/m²), but the mean weight/plant was 62% lower than that of the latter system (31.3 g/plant vs. 82.1 g/plant). There were statistically significant ($P < 0.05$) effects of column horizontal position (CHP) or vegetable vertical location (VVL) on the parameters studied. However, the effects of CHP × VVL was statistically significant only on yield and leaf area. Pak-choy in outer columns facing the morning and afternoon sunlight directly or at the top were heavier (39.2 - 71.7 g/plant) than those in inner columns or at the bottom (8.8 - 20.3 g/plant). The CHS can be used effectively to increase Brassica vegetable production/area, but its full potential is yet to be achieved. Research is recommended to determine the ideal column spacing to achieve the best balance between plant/area and weight/plant to increase further the system's growth, yield, and quality of vegetables.