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Comparision of cut chrysanthemum performance in conventional and Aeroponics system on Physio-chemical characters

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Abstract
The purpose of this study was to see if aeroponics farming might be used as an alternative to greenhouse soil-based production in temperate India. In the aeroponics system, most photosynthetic parameters had higher values, resulting in a better yield per plant for the system. Crop quality improved as well under the aeroponics system, as evidenced by higher values of quality parameters such as chlorophyll, protein content, catalase, and peroxidase activity. The study's findings validated aeroponics chrysanthemum production as a viable and long-term alternative to traditional soil-based chrysanthemum production.

Keywords: Conventional, aeroponics, chrysanthemum, physiological, biochemical

Introduction
Traditional soil-based agriculture is facing significant challenges, including decreased per capita land availability, diminished soil productivity in cultivable areas, and inadequate soil fertility due to continuous cultivation over time (Lambin, 2012, Lal, 2015, Lehman *et al*., 2015) [2, 1, 4]. Traditional soil-based agricultural practices must be supplemented with more productive and environmentally sustainable modern agricultural practices (Lambin and Meyfroidt, 2011) [3]. Aeroponics is a specialised technique that involves growing plants without soil and suspending their roots in air. Aeroponics is a method of producing plants that employs a soil-free growing system and a nutrient solution that is designed to give the calculated resources required for plant growth and development (Savvas, 2003) [5]. The goal of the study was to see how well aeroponicsally grown cut chrysanthemum compared to soil-based lettuce under controlled settings.

Materials and Methods
This experiment was conducted in Department of Agricultural Microbiology, Tamil Nadu Agricultural University, Madurai. In both conventional and aeroponics system, five different varieties were transplanted.

Name of the varieties with colour

Variety
Larenzo (Green colour – pompon type)
Danta pink (Peach colour – standard type)
Artiqueen (White colour – standard type)
Champagne yellow (Yellow colour – Spray type)
Dark Red (Red colour – Spray type)

Setup of planting board under aeroponics cultivation
A typical aeroponics unit consists of a closed Styrofoam chamber in which plant shoots are inoculated in holes made on Styrofoam sheet, and emerging roots remain dangled in the air. The chamber might be lined with a black sheet in order to assist in the maintenance of optimum humidity and darkness in the chamber. Plants cuttings in aeroponics are misted through the nozzles, which are evenly spaced and fixed into PVC pipes for the supply of nutrient solution.

The pipeline is connected to the motor which pumps the nutrient solution at high pressure. To regulate the nutrient spraying for a set time interval, a digital timer is connected to the pump. Space between nozzles and their pressure, the spacing of Styrofoam holes, pumping capacity of the motor, duration of nutrient spraying, and the time gap between two subsequent sprays may vary according to the scale of aeroponics unit setup and cultivated plants. Nutrient solution dribbling from the suspended roots in the tank is pumped back to the water tank and recycled (Udit Sharma *et al*., 2018)

Area of the grow room was 300 sq. m area, which accommodates 40 crop modules, each module with the height of 4 ft, single row 7-layer board on both sides. Two sides of the module has 6-hole boards. The dimension of the board was with the length of 0.52 m, width of about 0.62 m and height of about 0.97 m.

Results and discussion

PeC (2.59) has the highest chlorophyll 'a' content and the lowest chlorophyll 'a' content was recorded in RC (1.09) under aeroponics system. The highest chlorophyll 'b' content was observed in GC (1.572) under aeroponics growing system and the lowest chlorophyll 'b' content was recorded in RC (0.90) with conventional. WC has the highest total chlorophyll contents with conventional (3.96). The lowest total chlorophyll contents was recorded in RC (2.432) under aeroponics shown in Table 1. This better quality can be linked to precise control of nutrient availability through nutrient solution management while maintaining optimum growing conditions when compared to conventional and aeroponics grown cut chrysanthemum.

The highest catalase activity was recorded in PeC (49.13) under conventional and the lowest catalase activity was observed in GC (17) under aeroponics system of growing. The highest soluble protein was recorded in PeC (65.28) under conventional and the lowest soluble protein was observed in YC (49.92) under aeroponics.

The peroxidase activity was highest unde aeroponics with variety PeC (0.82) (Table 2). Under stress condition, the ROS production in plant cell is increased. The plants grown under aeroponics system exhibits higher ROS scavenginig enzyme production like peroxidase to succcumb the ROS synthesized in plant cells than the plants grown under conventional system. Literature data is deficient and inconclusive regarding the qualitative response of cut chrysanthemum crop grown under aeroponics cultivation.

Table 1: Comparision of chlorophyll content in both conventional and aeroponics system

	Total chlorophyll		Chlorophyll a		Chlorophyll b	
	Aeroponics	**Conventional**	**Aeroponics**	**Conventional**	**Aeroponics**	**Conventional**
GC	3.00	3.55	1.43	2.42	1.57	1.12
PeC	3.69	3.86	2.59	2.38	1.10	1.48
WC	3.71	3.89	2.51	2.36	1.20	1.53
YC	3.17	3.96	2.23	2.46	0.94	1.50
RC	2.43	2.50	1.09	1.60	1.35	0.90
Mean	3.20	3.55	1.97	2.24	1.23	1.31
S.Ed.	0.049	0.77	0.028	0.044	0.028	0.040
C.D (p=0.05)	0.111	0.175	0.063	0.099	0.064	0.089

Table 2: Comparision of soluble protein content, catalase and peroxidase activity in both conventional and aeroponics system

	Soluble protein		Catalase		Peroxidase	
	Aeroponics	**Conventional**	**Aeroponics**	**Conventional**	**Aeroponics**	**Conventional**
GC	60.96	56.16	17.00	33.32	0.22	0.54
PeC	64.32	65.28	20.57	49.13	0.82	0.57
WC	59.04	57.60	24.48	38.25	0.57	0.36
YC	49.92	50.40	21.57	33.32	0.46	0.64
RC	64.80	58.08	38.25	43.52	0.36	0.22
Mean	59.81	57.50	24.37	39.51	0.49	0.47
S.Ed.	1.176	1.134	0.620	1.093	0.011	0.012
C.D (p=0.05)	2.655	2.560	1.398	2.468	0.025	0.026

Conclusion

The results of the comparison research showed that the aeroponics systems investigated were suitable for chrysanthemum production in India's temperate climate. When compared to the protected soil-based production system, aeroponics techniques produced nutritionally superior and higher yields. The entire performance of the aeroponics system was effectively assessed in this study. Because of its simplicity, ease of operation, decreased crop duration, economic feasibility, and high yield of excellent quality, the aeroponics system is proposed as a possible growing system for cultivating chrysanthemum and other crops.

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