Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(4): 2958-2960
Received: 19-05-2019
Accepted: 21-06-2019

Nikhil Singh
M.Sc. Ag. (Horticulture)
Department of Horticulture,
Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj,
Uttar Pradesh, India

Saket Mishra
Assistant Professor,
Department of Horticulture,
Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj,
Uttar Pradesh, India

Vijay Bahadur
Associate Professor and head,
Department of Horticulture,
Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj,
Uttar Pradesh, India

Correspondence
Nikhil Singh
M.Sc. Ag. (Horticulture)
Department of Horticulture,
Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj,
Uttar Pradesh, India

Production of strawberry through closed hydroponics system under NFT (Nutrient Film technique)

Nikhil Singh, Saket Mishra and Vijay Bahadur

Abstract
Application of liquid nutrients at different concentrations were used resulting in various changes in plant heath and yield. The nutrient circulation was kept at different intervals ranging from 24, 18 and 12 hours. The plants with a 24-hour continuous nutrient circulation sowed the best results giving a plant height of 14.6 cm and yield of 1462 grams with an average weight of 15.103 grams. Hence gross return (8217000 INR), net return (1910438.422 INR) and B:C ratio (1.3029) was also recorded in the aforesaid treatment.

Keywords: Nutrient film technique, hydroponics, liquid nutrients

Introduction
The modern cultivated strawberry (*Fragaria* × *ananassa* Duchene) is one of the most delicious, attractive, luscious, nutritious, refreshing soft fruits of the world. One cup of sliced, fresh strawberries, or 166 g is rich in Calories: 53 kcal, Protein: 1.11 g, Carbohydrates: 12.75 g, Dietary fiber: 3.30 g, Calcium: 27 mg, Iron: 0.68 mg, Magnesium: 22 mg, Phosphorus: 40 mg, Potassium: 254 mg, Vitamin C: 97.60 mg, Folate: 40 micrograms (mcg), Vitamin A: 28 international units (IU) World- wide it is the most widely distributed fruit-crop due to its genotypic diversity, highly heterozygous nature and broad range of environmental adaptations [1]. Its plant is cherished in gardens and in commercial fields for its beautiful, red fruit that has a tantalizing aroma [2]. Being the rich source of vitamins and minerals coupled with delicate flavor, strawberry has now become an important table-fruit of millions of people around the globe. It is among the few fruit crops, which give quicker and very high returns per unit area on capital investment, as the crop is ready for harvesting within 6 months of planting. And now due to several technological advances in cultivation, strawberries remain available as fresh fruit throughout the year [3].

At present strawberry is grown in wide climatic zones, extending to temperate, Mediterranean, sub-tropical and taiga zones. Its cultivation is influenced by the specific regional adaptations due to critical photoperiod and temperature requirements, and thus its cultural systems are highly variable [4]. Due to constant efforts of strawberry breeders, the world-wide interest for strawberry cultivation has boosted its production tremendously, which has resulted in widespread popularity of strawberry in the last 50 years.

Hydroponically grown strawberries are quick to grow and give a good yield with about no soil related diseases, nutrient deficiency symptoms, minimum insect pest and disease infestation, can be grown all year round, and is very efficient in water saving. Soilless growing systems in protected environments are said to be the trend for cultivation of the strawberry. A yield of 300 g/plant is considered as being the threshold for economic viability for strawberries grown in the soil [5] When cultivation is carried out on benches above ground level, the job is easier and less unhealthy, the use of fumigant soil products is eliminated and there is a reduction in the occurrence of leaf diseases and consequently in the application of pesticides.

To address the food shortages in the near future caused by a decrease in arable land or increase in the world population, greenhouse horticultures, especially hydroponic cultures without soil, are becoming more important. While one advantage of a hydroponic culture is that plants can be cultivated under optimally controlled conditions for nutrients regardless of the soil conditions, a large amount of water is required to grow crops with nutrient solution. New hydroponic systems that enable stable crop production while saving water have been anticipated in recent years. Aeroponics is a water-saving hydroponic technique without rooting media [6]

There are limitations when cultivating strawberries in the soil related to the prohibition of chemical fumigants for the control of phytopathogens and to the ergonomic difficulties of

cultivating the plants on the ground surface, both of which have hampered the recruitment of manpower [7]. Hydroponics is a good way to deal with soil erosion, saline and alkaline soils, acidic soils, soils with less organic carbon, soils having nutrient imbalance, contaminated soils (because of pollution) and soil sealing and capping.

Under mid-hills of Sikkim Himalayas, 'Chandler' produced the 9-maximum number of flower trusses per plant under open conditions (13.6), followed in plastic tunnel (12.7). However, the maximum number of fruits per inflorescence was found in Ofra (7.12). The day neutral cv. 'Fern' took minimum number of days to flower under West Bengal conditions [8].

Strawberry when grown under hydroponics requires more labor hours, a proper chilling, correct pH and EC. Keeping above point in view the present experiment entitled "Closed hydroponic Strawberry (*fragaria× ananassa* Duch.) production through NFT (Nutrient Film Technique)" was under taken at Department of Horticulture of Naini Agricultural Institute, SHUATS during 2018-2019.

Materials and Methods

The experiment was conducted during November 2018 to April 2019 at Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj. The Research Farm is situated at 250 57' N latitude, 870 19' E longitudes and at an altitude of 98 m above mean sea level. Treatments include different concentrations of GROW, MICRO and BLOOM at different plant growth stages stated as seedling stage, vegetative growth, Transition and bloom and bloom and ripening. The nutrient concentration giving best result. The treatments included T_1 (1388.1 ml with 24 hours nutrient flow), T_2 (1230.6 ml with 24 hours flow) T_3 (1071.8 ml with 24 hours flow), T_4 (1255.9 ml with 18 hours flow), T_5 (1113.4 ml with 18 hours flow), T_6 (970 ml with 18 hours flow), T_7 (1118.9 ml with 12 hours flow), T_8 (995.8 ml with 12 hours), T_9 (869.2 ml with 12 hours flow).

There were 10 treatments each replicated thrice followed by a change of nutrients and water after every 20 days. The experiment was laid out in Randomized Block Design. Pre-harvest observation viz. Plant height, plant spread, root length and leaf area were recorded. Post- harvest observation viz. days to first flowering, yield of strawberry, fruit length and diameter and average fruit weight were recorded to find out the best treatment combination.

Result and Discussion

The result of the experiment entitled "Closed hydroponic Strawberry (*fragaria× ananassa* Duch.) production through NFT (Nutrient Film Technique)" was carried out during November 2018 to April 2019 the, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology & Sciences Prayagraj, to study the performance of strawberry under varying levels of GROW, MICRO and BLOOM. The results of the investigation regarding the Growth and yield of strawberry as influence by different levels of GROW, MICRO and BLOOM on growth and yield of strawberry have been presented in tables and figures, wherever required. Maximum plant height (14.6 cm), maximum plant spread (154.62 cm), maximum root length (50.333) and maximum leaf area (15.427), minimum days to first flowering (42), maximum yield of strawberry (1462 grams), fruit length (50.333 mm) and diameter (27 mm) and maximum average fruit weight (15.103).

Table 1: Effect of liquid nutrients on plant height and plant spread of strawberry

	Treatment	Plant height						Plant spread					
		20 days	60 days	100 days	140 days	C.D.	SE(d)	20 days	60 days	100 days	140 days	C.D.	SE(d)
1.	T1 (1388.1 ml +24 hours flow)	3.333	8.8	13.467	14.6	0.504	0.233	51.27	103.02	127.09	154.62	6.806	3.143
2.	T2 (1230.6 ml+24 hours flow)	2.867	9.567	13	14.1	0.345	0.159	47.47	87.697	121.447	141.36	6.026	2.783
3.	T3 (1071.8 ml +24 hours flow)	3.1	7.1	10.543	11.833	1.211	0.599	44.103	88.733	114.627	134.92	3.733	1.724
4.	T4 (1255.9 ml +18 hours flow)	3.133	8.867	13.133	14.1	1.201	0.554	47.547	87.513	126.053	151.12	4.489	2.073
5.	T5 (1113.4 ml +18 hours flow)	3.433	6.833	10.833	12.133	0.783	0.361	47.43	83.67	118.397	137.707	3.506	1.619
6.	T6 (970 ml +18 hours flow)	3.333	6.867	9.97	11.467	0.932	0.43	44.283	74.207	96.71	116.91	5.384	2.486
7.	T7 (1118.9 ml +12 hours flow)	3.567	8.567	13	14	0.749	0.346	40.93	65.243	89.177	104.58	5.653	2.61
8.	T8 (995.8 ml + 12 hours)	3.367	6.6	9.433	11.7	0.765	0.353	37.837	62.267	82.357	98.833	7.897	3.647
9.	T9 (869.2 ml +12 hours flow)	3.167	6.267	8.903	10.903	0.73	0.337	33.947	53.697	71.947	86.427	8.535	3.941
10.	T0 (0 ml +24 hours flow)	2						24.2					

Table 2: Effect of liquid nutrients on root length and leaf area of strawberry

	Treatment	Root length						Leaf area					
		20 days	60 days	100 days	140 days	C.D.	SE(d)	20 days	60 days	100 days	140 days	C.D.	SE(d)
1.	T1 (1388.1 ml +24 hours flow)	13	25	39	50.333	3.4	1.57	6.033	9.067	12.167	15.427	0.809	0.374
2.	T2 (1230.6 ml+24 hours flow)	13.667	24.333	36.333	46.333	2.331	1.076	6.367	8.733	12.133	14.033	0.632	0.292
3.	T3 (1071.8 ml +24 hours flow)	12.333	23.333	34	43.667	1.228	0.567	5.933	8.37	11.433	13.2	0.88	0.406
4.	T4 (1255.9 ml +18 hours flow)	12.333	22	31.667	42.333	2.144	0.99	5.967	8.767	11.733	13.74	0.852	0.394
5.	T5 (1113.4 ml +18 hours flow)	12.667	22.333	31.667	40.333	1.815	0.593	5.467	7.933	10.967	12.767	0.901	0.416
6.	T6 (970 ml +18 hours flow)	12	20.333	30.333	39	1.418	0.655	5.4	7.6	9.433	11.8	0.874	0.403
7.	T7 (1118.9 ml +12 hours flow)	11.667	19	28	36.333	2.631	1.215	6.033	8.333	10.2	12.633	0.571	0.264
8.	T8 (995.8 ml + 12 hours)	12	19.667	28.333	37	0.915	0.423	5.2	7.567	9.1	10.867	0.693	0.32
9.	T9 (869.2 ml +12 hours flow)	11.333	19.333	27	33.667	1.272	0.588	5.067	6.9	8.767	10.5	0.502	0.232
10.	T0 (0 ml +24 hours flow)	7						5.1					

Table 3: Effect of liquid nutrients on days to flowering, fruit yield, fruit diameter, fruit length and average fruit weight.

	Treatment	Days to first flowering	Fruit yield (g)	Fruit diameter (mm)	Fruit length (mm)	Average fruit weight (g)
1.	T1 (1388.1 ml +24 hours flow)	42	1462	27	50.333	15.103
2.	T2 (1230.6 ml+24 hours flow)	44	1380	26.333	44.333	13.743
3.	T3 (1071.8 ml +24 hours flow)	44.333	1090	24	42	12.667
4.	T4 (1255.9 ml +18 hours flow)	42.667	1218	26	48	14.58
5.	T5 (1113.4 ml +18 hours flow)	45.667	1021	22.333	43.333	12.793
6.	T6 (970 ml +18 hours flow)	47	860	22.667	41	11.003
7.	T7 (1118.9 ml +12 hours flow)	47.667	780	21.667	38	8.8
8.	T8 (995.8 ml + 12 hours)	49.333	630	20.333	37.667	7.367
9.	T9 (869.2 ml +12 hours flow)	51.667	515	20.667	38	7.8
10.	T0 (0 ml +24 hours flow)	0	0	0	0	0
	C.D.	1.406	--	2.283	3.566	1.374
	SE (d)	0.465	--	1.078	1.684	0.649

Table 6: Economics of strawberry grown under hydroponic conditions

Treatment (total of GROW MICRO BLOOM)	Gross return (Rs/q)	Cost of cultivation	Net return (Rs/ha)	Benefit cost ratio
T_0	0	4496500	-4496500	0
T_1 (1388.1 ml)	8217000	6306561.579	1910438.422	1.302929
T_2 (1230.6 ml)	7756450	6101183.941	1655266.059	1.271302
T_3 (1071.8 ml)	6112950	5894111.123	218838.877	1.037128
T_4 (1255.9 ml)	6845900	5682276.512	1163623.489	1.204781
T_5 (1113.4 ml)	5738650	5496458.649	242191.351	1.044063
T_6 (970.4 ml)	4833700	5309988.794	-476288.794	0.910303
T_7 (1118.9 ml)	4384050	5281053.817	-897003.8165	0.830147
T_8 (995.8 ml)	3540950	5120533.263	-1579583.263	0.69152
T_9 (869.2 ml)	2894600	4955448.762	-2060848.762	0.584125

Summary and Conclusion

Summary

Application of 1388.1 ml liquid nutrients including GROW, MICRO and BLOOM followed by 24 hours of continuous nutrient circulation recorded maximum plant height, plant spread, root length and leaf area. Also, minimum days to first flowering, maximum yield, fruit length, fruit diameter and average fruit weight was also recorded in the aforesaid treatment. The same treatment also recorded highest gross return, net return and benefit cost ratio.

Conclusion

Application of 1388.1 ml liquid nutrients including GROW, MICRO and BLOOM followed by 24 hours of continuous nutrient circulation recorded maximum growth in plant, maximum plant height (14.6 mm), plant spread (154.62) root length (50.333 cm) leaf area (15.427 cm^2) higher yield attributes namely fruit yield (1462 g) average weight of berries (15.103 grams), minimum days to flowering (42), fruit length (50.333 mm), fruit diameter (27 mm).

References

1. Childers NF, Morris JR, Sibbett GS. Modern fruit Science. Horticulture Publication, Gainesville, Florida, USA, 1995
2. Sharma RM, Yamdagni R. Modern strawberry cultivation. Ludhiana, India, Kalyani Pub. 2000; 37(1):163-165
3. Pathak RK, Singh R. Effect of some external factors on growth and fruiting of strawberry II. Effect of GA3, growth retardants and colchicine on flowering and yield. Progressive Horticulture. 1971; 3:53-63.
4. Oliveira RP, Scivittaro WB. Productive performance of strawberry cultivars, 2011; 12(2):69-074.
5. Ritter E, Angulo B, Riga P, Herran C, Relloso J, San JM. Comparison of hydroponics and aeroponics cultivation systems for the production of potato minitubers. Potato Res. 2001; 44:127-1
6. Godoi. Rodrigo dos Santos. Production and quality of strawberry in closed systems of cultivation without soil using substrates. Cienc. Rural [online]. 2009; 39(4):1039-1044. Apr 03, 2009. ISSN 0103-8478.
7. Kumar A, Avasthe RK, Pandey BK, Ramesh DR, Rahman H. Varietal Screening of Strawberry (Fragaria x ananassa Duch.) under Organic Production System for Fruit Quality and yield in Mid-Hills of Sikkim Himalayas, Indian J Plant Genetic Resources. 2011; 24(2):243-245.