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Growth, yield and economic analysis of strawberry under nutrient film technique of hydroponic system

Monica Rani*[1], Saket Mishra*[1], Shashi Kant Ekka*[2] and Himanshu Mishra*[2]

Department of Horticulture, NAI, SHUATS, Prayagraj, U.P., India

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ABSTRACT

An experiment entitled "Growth, yield and economic analysis of strawberry c.v. WinterDawn under close Hydroponics system" was conducted in Naini Agricultural Institute, SHUATS, Prayagraj, Uttar Pradesh. A Randomized Block Design was adopted as a method for analysis. The experiment included 9 treatments with 3 replication,which included 20 plants of strawberry in each treatment. The quantity of nutrients varies in each treatment from T_1- $T_9$with respect to the timing of flow and amount of water used. The timing of flow of nutrients in each replication was 24hr./day, 18 hr./day, 12hr./day respectively . Out of all the treatments T_1 turned out to the best combination for the growth due to suitable amount of nutrients and appropriate timing for strawberry in hydroponics setup. The yield was also more in the treatment T_1 as compared to other treatments. The benefit cost ratio was recorded best in T_1 set up, i.e. 1:1.229.

Key word: *Hydroponics, Strawberry, NFT, Growth, Yield.*

Introduction

Strawberries are low-growing herbaceous plants, a widely grown hybrid species of genes fragaria. The winter dawn var. is across of FL 93-103(seed plant) and FL 95-316 (pollen grain) (Weber *et al.,* 2020). The strawberry cultivars (genotype) originated at Dover, fla. Winterdown can be grown in subtropical zone and in winter climate. It is short day cultivators. It is resistance to *collectotrichum* crown rot caused by *C. gloeosporiodes..* In subtropical region plant can be transplanted in November through February yield (Urena-Padilla *et al.,* 2001). Most hydroponic systems operate automatically to control the amount of water, nutrients and photoperiod based on the requirements of different plants (Resh, 2013). To address the food shortage in the near future caused by a decrease in arable land or increase in world population, green house horticultures, especially hydroponic technique practices without soil are becoming more important nowadays, soilless growing in protected environment are in trend for cultivation of strawberry (Gruda, 2021). When the cultivation in carried out in the setup above ground level. There in lesser chance or reduction in occurrence of any leaf disease. Furthermore, this is an improvement in fruit quality, both sensory and form the point of view of chemicals and microbiological contaminated (Brazillian Agricultural Research Corporation, 2005). Strawberry, hydroponically in green houses which are considered best for off season production (Khan, 2018).

Materials and Method

Experimental site: The experiment was laid out at Research Farm, Department of Horticulture, Sam Higginbottom University of Agriculture and Science, Prayagraj. The experimental site is situated on left side of Allahabad-Rewa Road, near the river

([1]Master Student, [2]Assistant Professor)

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Climate condition: The annual mean temperature is approx. 26.1°C (79.0°F); monthly mean temperatures are 18-29°C (64-84°F).

Plant selection

Plants were selectively brought from National Bureau of Plant Genetic Resources (ICAR) Regional Station, Bhovali, Nanital, Uttarakhand, India. 220 plants of variety Winter Dawn were brought for laying out experiment on 12 November 2020 and the plantation was done on 13 November 2021.

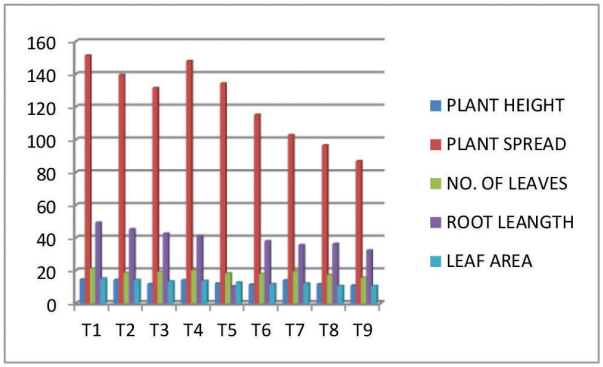
Treatment Details

Total of 9 treatments were given with respect to nutrient concentration and time duration of running water. From, Treatment T_1-T_3 was supplied with nutrients and 24 hours of continuous flow of water, Treatment T_4-T_6 was supplied with nutrients and 18 hours of continuous flow of water and Treatment T_7-T_9 was supplied with nutrients and 12 hours of continuous flow of water. The design of experiment carried out was in R.B.D. Total no. of plants taken in experiment were 180 followed in 36 no. of rows. Each row has 5 plants with spacing of 15*15 cm.

Results and Discussion

The treatment shows significant differences during experimental investigation, observations on various parameters, flowering parameters, yield parameters, and economics parameter were taken. The results of the experiment, to find out the suitable dosage of GROW, MICRO and BLOOM on growth and yield of strawberry in hydroponic system are presented in Tables, wherever required.

The treatment showed significant effect of plant nutrients viz. (grow, micro, bloom) on vegetative growth parameters at 140 DAT, as shown in Table 1 that progressive increase in plant height (14.6 cm) recorded in T_1 with 24 hr. of continuous flow of water, followed by T_2(14.3 cm) as observed in graph 1 with 24hr. of continuous flow of water, whereas the minimum plant height (10.90 cm) was recorded in T_9 with 12 hr. of continuous flow of water. The progressive increase in plant spread (151.52 cm) was recorded inT_1 with 24 hr. of continuous flow of water as mentioned in Table 1, followed by T_4 (148.12 cm) with 18hr. of continuous flow of water, whereas the minimum plant spread (86.937 cm) was recorded in T_9 with 12 hr as observed in Graph 1. of continuous flow of water. The progressive increase in no. of leaves (21.333 cm) was recorded in table no. 1 and graph 1, followed by T_4(20.333 cm) with 18hr. of continuous flow of water, whereas the minimum plant spread (15.667 cm) was recorded in T_9 with 12hr. of continuous flow of water. The progressive increase in root length (49.33 cm) recorded in T_1



Graph 1. Effect of different treatments on vegetative parameters of strawberry.

Table 1. Effect of nutrients on plant vegetative growth of strawberry

Treatments	Vegetative Parameters				
	Plant height	Plant spread	No. of Leaves	Root leangth	Leaf area
T_1	14.6	151.52	21.333	49.33	15.167
T_2	14.3	139.617	18.667	45.333	14.203
T_3	11.833	131.603	19.333	42.667	13.373
T_4	14.1	148.12	20.333	41.333	13.717
T_5	12.133	134.4	18.333	10.33	12.733
T_6	11.467	115.243	18	38	11.8
T_7	14	102.91	19.667	35.667	12.17
T_8	11.7	96.577	17.33	36.333	10.633
T_9	10.903	86.937	15.667	32.333	10.64
C.D.(5%)	0.475	7.505	0.764	1.904	0.662

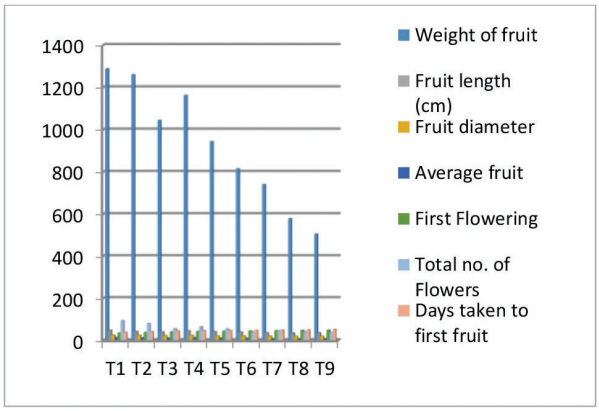
with 24hr. of continuous flow of water, followed by T_2 (14.203 cm) with 24hr. of continuous flow of water as recorded in Table 1 and Graph 1, whereas the minimum root length (32.333 cm) was recorded in T_9 with 12hr. of continuous flow of water. The progressive increase in leaf area (15.167 cm) recorded in T_1 with 24hr. of continuous flow of water as mentioned in Table 1 and Graph 1, followed by T_2 (14.203 cm) with 24 hr. of continuous flow of water, whereas the minimum leaf area (10.64 cm) was recorded in T_9 with 12 hr. of continuous flow of water.

The amount of nutrient viz.(grow, micro bloom) were used during investigation, varied from each other on the behavior of plant intake of water with differentamount of nutrients presented in Table 2 below.

Table 2. Amount of nutrients and water used in setup of strawberry

Treatments	Nutrient Used	Water Used
T_1	1414.6	147
T_2	1256.1	147
T_3	1098.697	147
T_4	1282.4	133
T_5	1139.9	133
T_6	996.9	133
T_7	1145.5	119
T_8	1022.297	119
T_9	895.7	119

The treatment showed significant effect of plant nutrients viz. (grow, micro, bloom) on flowering and yield parameters at 140 DAT, progressive increase in weight of fruits (1289.03 g) recorded in T_1 with 24hr. of continuous flow of water as recorded in Table 3 and Graph 2, followed by T_2 (1260.997g) with 24hr. of continuous flow of water, whereas the minimum weight of fruits (506 g) was recorded in T_9 with 12hr. of continuous flow of water. Progressive increase in number of fruits (103.997) recorded in T_1 with 24hr. of continuous flow of water as recorded in Table 3 and Graph 2, followed by T_2(95) with 24hr. of continuous flow of water, whereas the minimum number of fruits (53.003) was recorded in T_9 with 12hr. of continuous flow of water. The progressive increase in fruit length (49.667 cm) recorded in T_1 with 24hr. of continuous flow of water as observed in Table 3 and Graph 2, followed by T_4 (46cm) with 18hr. of continuous flow of water, whereas the minimum fruit length (35.667 cm) was recorded in T_8 with 12hr. of continuous flow of water.The progressive increase in fruit diameter (26 cm) recorded in T_1 with 24hr. of continuous flow of water, followed by T_4 (25 cm) with 18hr. of continuous flow of water, as observed in Table 3 and Graph 2 whereas the minimum fruit diameter (19.333cm) was recorded in T_8 with 12 hr. of continuous flow of water. The first flowering was recorded on 35th DAT in treatment T_1 with 24 hr. of continuous flow of wa-



Graph 2. Variations in effect of nutrients on flowering stage and yield of strawberry

Table 3. Effect of nutrients on flowering stage and yield of strawberry

Treatments	Weight of fruit	Number of fruit	Fruit length (cm)	Fruit diameter	Average fruit	First Flowering	Total no. of Flowers	Days taken to first fruit
T_1	1289.003	103.997	49.667	26	14.367	35	95.33	38.333
T_2	1260.997	95	43.333	25.33	12.667	37.997	80.667	42.667
T_3	1045.003	68	41	22.997	11.743	40.67	55.667	46
T_4	1163	85.003	46	25	13.793	42.383	65.003	46.333
T_5	945	62	42.33	21.333	11.003	44.663	56	47.667
T_6	816.003	54.997	40	21.667	10.583	45.667	41.333	48.003
T_7	742	57.997	37	20.663	8.397	47	46.333	49.333
T_8	580	57.003	35.667	19.333	7.103	48.333	41	51
T_9	506	53.003	36.997	19.667	7.5	49.67	38.667	52.667

Fig 1. Flowering and fruiting of strawberry under NFT system .

Table 4. Benefit cost ratio of strawberry

Treatments	Fruit yield (q/ha)	Selling price (Rs/q)	Gross return (Rs/q)	Cost of cultivation	Net return (Rs/ha)	Benefit cost ratio
T_1	155.129	50000	7756450	6306561.579	1449888.421	1.229
T_2	146.34	50000	7317000	6101183.941	1215816.059	1.199
T_3	120.918	50000	6045900	5894111.123	151788.877	1.025
T_4	134.773	50000	6738650	5682276.512	1056373.488	1.185
T_5	110.259	50000	5512950	5496458.649	16491.451	1.003
T_6	94.667	50000	4733350	5309988.794	-576638.794	0.891
T_7	85.681	50000	4284050	5281053.817	-997003.817	0.811
T_8	65.892	50000	3294600	5120533.263	-1825933.263	0.643
T_9	56.819	50000	2840950	4955448.762	-2114490.762	0.573

ter as observed in Table 3 and Graph 2 followed by T_2 (37.997 DAT) whereas treatment T_9 (49.67 DAT) took maximum days in first flowering. The progressive increase in total no. of flowers (95.33) was recorded in T_1 with 24 hr. of continuous flow of water, followed by T_2 (80.667) with 18hr. of continuous flow of water, whereas the total no. of flowers (38.667) was recorded in T_9 with 12hr. of continuous flow of water as observed in Table 3 and Graph 2. The progressive increase in plant with minimum days taken to first fruiting (38.333 DAT) was recorded in T_1 with 24hr. of continuous flow of water, followed by T_4 (42.667 DAT) with 18hr. of continuous flow of water, whereas the maximum days taken to first fruit (52.667 DAT) was recorded in T_8 with 12hr. of continuous flow of water.

The treatment showed significant effect of plant nutrients viz. (grow, micro, bloom) on plant at 140 DAT, with good quantity of fruits in smaller area. After the investigation economic parameter showed that the treatment $T_1$with a benefit cost ratio of 1.229 with a net return of Rs. 1449888.421 was significantly superior as observed in Table 4.

Conclusion

On the basis of investigation result, it was concluded that treatment T_1 (with a total of 443 ml Grow, 556.4ml micro and 415.2 ml bloom) found to be best in terms of plant height, plant spread, number of leaves formed, root length, leaf area, amounts of water and nutrients used, first flower formation, first fruit set, maximum number of flowers, fruit yield, fruit diameter, fruit length, average fruit weightand cost benefit ratio. The continuous flow of nutrients for a circulation of 24 hours was found best as under T_1. The cost benefit ratio was found to be best under T_1 (1.229)as mentioned in Table 4 and

was followed by T2 (1.199). T_1 was followed by T_2 that also showed good plant characters and gave a good yield.

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