Effect on Vegetative Growth and developmentof strawberry (*Fragariaananassa*) in potting mixture systemunder shade net conditions cv. Winter Dawn

ABSTRACT

InPrayagrajagro climatic conditions strawberry is produced with high-technology, but there is littleresearch on the productivity of strawberry in Potting media mixture under shade net conditions. The presentstudy was conducted to compare single potting media for the strawberry. The conventional method was used for the comparison study. In this method, uniform runners of the strawberry cultivar Winter Dawn were grown in pots with growing medium consisting of goat manure, vermiculite, and peat moss in various ratios on a volume-to-volume basis. Additionally, Ponic green's 3-part Nute hydroponic nutrient set was applied to the plants via foliar spray at fortnightly intervals. In order to meet the nutritional requirements of each individual plant and ensure that the uppermost layer of the pots remained adequately moist, the irrigation process was carefully monitored. Based on both years2021- 22research trail findings of this study. It was determined to have the greatest growth traits for every growth, flowering and fruit weight criteria.

Keywords: *Fragaria* × *ananassa*winter Dawn, Potting mixture, irrigation process,highest growth

INTRODUCTION

Strawberry (*Fragariaananassa*Duch.) is a member of the Rosaceae family and Fragaria genus. Essentially, it is a little perennial herbaceous plant. Strawberry is a monoeciousoctoploid(2n = 56) hybrid of two dioeciousoctoploidspecies, namely *Fragariachiloensis*Duch. and*Fragariavirginiana*Duch**(Bowling, 2000).**strawberry production and area have increased exponentially due to the fact that the majority of the crop is now grown in greenhouses **(Thakur and Shylla 2018)**. China produces roughly 3.7 million metric tons (MT) of strawberries, followed by the United States, which produces approximately 1.45 million MT **(Anonymous, 2019)**. In India, it is cultivated on 3000 hectares with an annual output of 14,000 MT **(NHB 2021)**, with Haryana being the largest producer (1,650 MT), followed by Mizoram (1,080 MT), Meghalaya, Maharashtra, and Himachal Pradesh **(Anonymous, 2019)**.The majority of this crop is produced in open field circumstances, with soil as the growth medium. This, in turn, results to low-quality planting material and, ultimately, low-quality fruits due to the prevalence of soil-borne pests, diseases, nematodes, and other soil-limiting factors. Therefore, the use of soilless production technology is of utmost importance and is growing in popularity because it generally eliminates soil borne diseases, pests, and nematodes **(Tehranifar*et al.*, 2007; Shylla*et al.*, 2018)**, leading to better vegetative growth parameters, number of fruits, and yield of good quality strawberry fruits **(Adak and Gubbuk, 2015)**.

Peat moss, rockwool, perlite, goat dung, cocopeat, vermiculite, and many more soilless media are used in various regions of the globe as soil substitutes**(De-Rijck and Schrevens, 1998)**.In addition to boosting the nutritional supply, goat manure application has a high water-holding capability. It comprises 0.63-0.95% nitrogen, 0.35-0.51% phosphorus oxide, and 1.0-1.2% potassium oxide **(Rastiyanto*et al.*, 2013)**. When goat manure is treated as a solid mixture, its durability may be increased (briquettes or pellets).On the other hand, Peat moss, an organic substance with a pH of 3.0 to 4.0, is found in bogs at high latitudes **(Margenot*et al.*, 2018;**

Kingston *et al.*, 2017). Water can be retained in the organic medium roughly 10 times as much as the norm for dry weight because of the microsporespresents in the media **(Kim *et al.*, 2011; Shin *et al.*, 2012).** It contains 1% N, 0.1% P_2O_5 AND 0.1% K_2O. Because of its potential to increase both air permeability and water retention, peat moss has seen extensive usage in modern agriculture **(Kim *et al.*, 2010).** Another potting material called vermiculite is also very popular, Vermiculite is a hydrated magnesium aluminum silicate clay with a high cation exchange capacity (CEC), often between 50 and 150 meq/100 g due to its huge chemically active surface area **(Marwa*et al.*, 2012)**. Vermiculite has a great capacity to absorb cations, lowering the amount of cations lost to leaching because of its high CEC. It is utilised as potting material for seedlings because to its high-water holding capacity (WHC) **(Li *et al.*, 2017)**

MATERIAL AND METHODS

The experiment titled "Effect on Vegetative Growth, flowering and fruiting attributes of strawberry (*Fragariaananassa*) in potting mixture system under shade net conditions cv. Winter Dawn " was conducted at the Department of Horticulture, Naini Agricultural Institute, SHUATS, Prayagraj during the years 2020-21and 2021-22.Prayagraj is located in a climatic zone which experiences hot summer and fairly cold winter. During the winter months, especially December and January the temperature falls as low as 2°C- 5°C or even low while during the summer months (May-June) it reaches as high as 49°C.The average rainfall is about 850-1100 mm, mainly concentrated in the months of July to September. The conventional method was used for the comparison study. In this method, uniform runners of the strawberry cultivar Winter Dawn were grown in pots with growing medium consisting of goat manure, vermiculite, and peat moss in various ratios on a volume-to-volume basis. Additionally, Ponic green's 3-part Nute hydroponic nutrient set was applied to the plants via foliar spray at fortnightly intervals. In order to meet the nutritional requirements of each individual plant and ensure that the uppermost layer of the pots remained adequately moist, the irrigation process was carefully monitored. Growing strawberries required the use of pots measuring 6 × 6 inches that were filled with various growing materials. Date of transplanting in pots was 17th of August, 2020 and 2021 during 1st and 2ndtrailrespectively.

The treatment Combination

Substrate or Pot Media

- P_1. Goat Manure + Vermiculite + Peat Moss (25:35:40)
- P_2. Goat Manure + Vermiculite + Peat Moss (30:40:30)
- P_3. Goat Manure + Vermiculite + Peat Moss (35:25:40)

Nutrient Doses (ml)/15 litres of water used

(1) Nute Micro (M)
(2) Nute Bloom (B)
(3) Nute Grow (G)

Stage of plant growth at which treatments were applied

(1) S_1- Seeding,
(2) S_2- Vegetative Growth,
(3) S_3- Transition,
(4) S_4- Bloom and Ripening

Chart 1: Treatment Combination of Experiment

Treatments Notation	Nutrient Doses ml/15Liters of water															
	P_1 (Substrate or Pot Media)				P_2 (Substrate or Pot Media)				P_3 (Substrate or Pot Media)							
	S_1	S_2	S_3	S_4	S_1	S_2	S_3	S_4	S_1	S_2	S_3	S_4				
	G M B	G M B	G M B	G M B	G M B	G M B	G M B	G M B	G M B	G M B	G M B	G M B	G M B	G M B	G M B	G M B
T_0	0	0	0	0	0	0	0	0	0	0	0	0				
T_1	6,6,6	09,09,06	06,11,11	06,13,13	7,7,7	09,09,07	07,11,11	07,13,13	8,8,8	10,10,08	08,12,12	08,14,14				
T_2	9,9,9	11,11,09	06,13,13	09,15,15	10,10,10	12,12,10	10,14,14	10,16,16	11,11,11	13,13,11	11,15,15	11,17,17				
T_3	12,12,12	14,14,11	12,16,16	12,18,18	13,13,13	15,15,13	13,17,17	15,19,19	14,14,14	16,16,14	14,18,18	14,20,20				
T_4	15,15,15	17,17,15	15,19,19	15,21,21	16,16,16	18,18,16	18,22,22	16,24,24	17,17,17	19,19,17	17,21,21,	17,23,23				
T_5	18,18,18	20,20,18	18,22,22	18,24,24	19,19,19	21,21,18	21,25,25	19,27,27	20,20,20	22,22,20	22,24,24	20,26,26				
T_6	21,21,21	23,23,21	21,25,25	21,27,27	22,22,22	24,24,22	24,26,26	22,28,28	23,23,23	25,25,23	25,27,27	23,29,29				
T_7	24,24,24	26,26,24	24,28,28	24,30,30	25,25,25	27,27,25	27,29,29	25,31,31	26,26,26	28,28,26	28,30,30	26,32,32				
T_8	27,27,27	29,29,27	27,31,31	27,33,33	28,28,28	30,30,28	30,32,32	28,34,34	29,29,29	31,31,29	31,33,33	29,35,35				
T_9	30,30,30	32,32,30	30,34,34	30,36,36	31,31,31	33,33,31	33,35,35	31,37,37	32,32,32	34,34,35	34,34,32	32,36,36				

RESULTS AND DISCUSSION

Plant height (cm)

The data regarding plant height (cm) of strawberry (*Fragariaananassa*) cv. Winter Dawn presented in table 1.was found significantly affected by different treatments and potting media mixture. It was found that Treatment T_6 (96,104,102)of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] recorded the maximum plant height [18.01cm (2021-22), 19.61cm (2022-23) and 18.58 (Pooled)] cm over all other treatments during both the years of study as well as pooled analysis. It was followed by Treatment T_7(108,116,114)of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] which recorded the 2nd best plant height [17.54 (2021-22)&19.00 (2022-23)] cm where-as according to pooled analysed data treatment T_9 (132,136,135)of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)]recorded the 2nd best treatment with 18.23 cm of plant height. It was also found that treatment T_7 (108.116, 114), T_8 (120,128,126)& T_9 (132,136,135) were found at par with treatment T_6 (96,104,102) of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)]. The minimum height of plant [10.86 (2021-22), 11.76 (2022-23) and 11.31 (Pooled)] cm was recorded in treatment T_1 (27, 39, 36) of potting mixture combination P_1 [Goat Manure + Vermiculite + Peat Moss (25:35:40)] during both the years of study as well as pooled analysis. It was also found that treatment T_2 (35,48,46), T_3 (50,60,57) and T_4 (62,72,70) were found at par with treatment T_1 (27,39,36) of potting mixture combination P_1 [Goat Manure + Vermiculite + Peat Moss (25:35:40)] during both the years of study where-as according to pooled analyzed data T_2 (35,48,46), T_3 (50,60,57),

T_4(62,72,70) & T_5 (74,84,82) were found at par with treatment T_1 (27,39,36) of potting mixture combination P_1 [Goat Manure + Vermiculite + Peat Moss (25:35:40)].

The Treatment T_6 (96,104,102)of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] recorded highest plant height. This may be attributed to optimum availability of macronutrients and Micronutrients for better plant growth. This increased plant height may be attributed to the excellent nutrient and moisture retention ability of the vermiculite and peat moss (**Martinussen*et al*., 2021)**. The pot which had highest quantity of goat manure, vermiculite and peat moss showed the highest plant growth. The vermiculite and peat moss lead to a better aeration capacity for roots and increased ability to absorb nutrients; as a result, the plant efficiently assimilated the nutrients and resulted in better plant growth (**Falah*et al*., 2022**). The addition of goat manure also increased the nitrogen availability for plants which also led to better plant growth. Similar reports were reported by **Majdi*et al*. (2012)** while working on strawberry.

Plant spread (cm)

The data regarding plant spread (cm) of strawberry (*Fragariaananassa*) cv. Winter Dawn presented in table 2.was found significantly affected by different treatments and potting media mixture. It was found that Treatment T_6 (96,104,102)of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] recorded the maximum plant spread [24.52 (2021-22), 25.88 (2022-23) and 25.2 (Pooled)] cm over all other treatments during both the years of study as well as pooled analysis. It was followed by Treatment T_9(132,136,135)of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] recorded the 2nd best plant spread [24.49 (2021-22), 24.89 (2022-23) and 24.69 (Pooled)] cm during both the years and pooled analyzed data. It was also found that treatment T_9(132,136,135)was found at par with treatment T_6 (96,104,102)of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] during the year 2021 and according to pooled data. The minimum spread of plant during 2021-22 i.e., 20.14 cm was recorded in treatment T_3 (50, 60, 57) of potting mixture combination P_1 [Goat Manure + Vermiculite + Peat Moss (25:35:40)] where-as during 2022-23 the minimum spread of 21.29 cm was found under treatment T_2 (35, 48, 46) of potting mixture combination P_1 [Goat Manure + Vermiculite + Peat Moss (25:35:40)]. According to pooled analysed data the minimum spread of the plant 20.72 cm was found under treatment T_3 (50,60,57)of potting mixture combination P_1 [Goat Manure + Vermiculite + Peat Moss (25:35:40)]. It was also found that treatment T_1 (27, 39, 36), T_2 (35, 48, 46), T_4 (62,72,70) and T_9 (122,132,130) were found at par with treatment T_3 (50,60,57) of potting mixture combination P_1 [Goat Manure + Vermiculite + Peat Moss (25:35:40)] during 2021-22. But during 2022-23, T_3 (50,60,57), T_4 (62,72,70) and T_5 (74,84,82) were found at par with treatment T_2 (35,48,46) of potting mixture combination P_1 [Goat Manure + Vermiculite + Peat Moss (25:35:40)] where-as according to pooled analyzed data, T_1 (27,39,36), T_2 (35,48,46), T_4 (62,72,70) and T_5 (74,84,82) were found at par with treatment T_3 (50,60,57)of potting mixture combination P_1 [Goat Manure + Vermiculite + Peat Moss (25:35:40)].

The Treatment T_6 containing Nute grow, Nute Micro and Nute bloom @ 96ml, 104ml and 102 ml respectively in 15l of water and potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] recorded highest plant spread at all stages of growth. The excellent water holding, aeration, bulk density and cationexchange capacity lead to higher fixation of Nitrogen and other elements. This leads to optimum availability of nitrogen to the plants, which is directly responsible for increase in plant biomass. The increase in biomass is due

to optimal production of growth regulators. These growth regulators lead to profuse branching and more production of leaves which then increases plant spread. Similar results were reported by **Hasan*et al*. (2021)** while working on strawberry.

No. of Leaves (cm)

The data regarding the number of leaves of strawberry (*Fragariaananassa*) cv. Winter Dawn presented in table 2.was found significantly affected by different treatments and potting media mixture. It was found that Treatment T_6 (96,104,102)of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] recorded the maximum number of leaves [24.89 (2021-22)&26.25 (2022-23)] over all other treatments during both the years of study where-as according to pooled data, treatment T_7(108,116,114) of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] recorded the maximum number of leaves i.e., 25.49. It was followed by Treatment T_7(108,116,114)of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] recorded the 2ndbestnumber of leaves [24.49 (2021-22)&26.09 (2022-23)] during both the years. According to pooled data treatment T_6 (96,104,102) of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] was found 2nd best treatment with 25.16 number of leaves. It was also observed that treatment T_5 (74,84,82), T_7(108,116,114) &T_9 (132,136,135) were found at par with treatment T_6 (96,104,102)of potting mixture combination P_3[Goat Manure + Vermiculite + Peat Moss (35:25:40)] during the both the years of study where-as according to pooled data, T_6 (96,104,102), T_8 (120,128,126) &T_9(132,136,135) were found at par with treatment T_7(108,116,114)of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)]. The minimum number of leaves was found under treatment T_2 (35,48,46) of potting mixture combination P_1 [Goat Manure + Vermiculite + Peat Moss (25:35:40)] with [13.65 (2021-22), 14.78 (2022-23) & 14.22 (Pooled)] number of leaves.

The Treatment T_6 containing Nute grow, Nute Micro and Nute bloom @ 96ml, 104ml and 102 ml respectively in 15l of water with potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] recorded highest number of leaves in strawberry plants in pot culture experiment. The use of vermiculite and peat moss led to improved moisture retention and aeration conditions, which led to the formation of a larger root system. Additionally, these amendments encouraged the uptake of nutrition by the shoots, bolstered activities that captured more light, and as a consequence, increased vegetative growth (**Tariq *et al*., 2013**). The use of Nute grow, Nute Micro, and Nute bloom provided the micronutrients and macronutrients such as nitrogen, phosphorus, and potassium, which are essential for metabolic processes such as the protein synthesis, nucleic acids synthesis, synthesis of secondary metabolism products, enzyme activation, regulation of osmosis, energy transfer, respiration, and photosynthesis, amongst many other significant processes (**Castellanos-Morales, 2010**; **Taiz&Zeiger, 2013**). Because of this, applying these nutrients to a plant result in a considerable increase in the plant's growth and development, which in this instance is measured by the number of leaves. Similar results were also reported by **Ors and Anapali (2010)** and **Khalid *et al.* (2013)**

No. of flowers

The data regarding the number of flowers of strawberry (*Fragariaananassa*) cv. Winter Dawn presented in table 2.was found significantly affected by different treatments and potting media mixture. It was found that Treatment T_6 (96,104,102)of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)]recorded the maximum Number of flowers

per plant[44.42 (2021-22),45.78 (2022-23)& 44.11 (Pooled)]over all other treatments during both the years of study as well as pooled data. It was followed by Treatment T_7(108,116,114)of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] which recorded the 2nd besttreatment with [42.44 (2021-22), 44.04 (2022-23)& 41.45 (Pooled)]Number of flowers per plant during both the years of study and pooled data. The minimum Number of flowers per plant [26.38 (2021-22), 27.21(2022-23)& 26.8 (Pooled)]was recorded in treatment T_2(35,48,46)of potting mixture combination P_1[Goat Manure + Vermiculite + Peat Moss (25:35:40)] during both theyears of study and pooled analysis data. It was also observed that treatment T_3 (50, 60, 57) was found at par with T_2(35,48,46)of potting mixture combination P_1 [Goat Manure + Vermiculite + Peat Moss (25:35:40)] during both the years of study and pooled data.

The Treatment T_6 containing Nute grow, Nute Micro and Nute bloom @ 96ml, 104ml and 102 ml respectively in 15l of water with potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] recorded highest number of flowers per plant. The Goat manure along with Nute grow, Nute Micro and Nute bloom provided the essential nutrients to the plants for optimum growth. Vermiculite along with peat moss help in retention of moisture and nutrients along with maintaining porosity in the potting media. These nutrients uptake in plant led to biosynthesis of different growth regulators like Auxin which promote flowering in the plants. Similar results were observed by **Hassan *et al*. (2021)** while working on strawberry and **Kumar *et al*. (2022)** while working on calendula.

Average no of fruit

The data regarding the number of fruits per plantof strawberry (*Fragariaananassa*) cv. Winter Dawn presented in table 3.was found significantly affected by different treatments and potting media mixture. It was found that Treatment T_6 (96,704,102)of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] recorded the maximum Number of fruits per plant [17.54 (2021-22),81.46 (2022-23)& 17.48 (Pooled)]over all other treatments during both the years of study as well as pooled data. It was followed by Treatment T_7(108,116,114)of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] which recorded the 2nd best treatment with [16.28 (2021-22)&17.44 (2022-23)] number of fruits per plant during both the years of study where-as according to pooled data, treatment T_8 (120,128,126) of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] was found 2nd best with 17.1number of fruit per plant. It was also observed that treatment T_7(108,116,114) was found at par with T_6 (96,104,102)of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)]during both the years of study where-as according to pooled data, T_7(108,116,114) and T_8 (120,128,126) were found at par with T_6 (96,704,102)of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)]. The minimum number of fruits per plant [10.08 (2021-22),10.48(2022-23)& 10.28 (Pooled)]was recorded in treatment T_1(27,39,36)of potting mixture combination P_1 [Goat Manure + Vermiculite + Peat Moss (25:35:40)]during both theyears of study and pooled analysis data.

The Treatment T_6 containing Nute grow, Nute Micro and Nute bloom @ 96ml, 104ml and 102 ml respectively in 15l of water with potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] recorded maximumnumber of fruits per plant. Substantial increase in the number of soil microorganisms may be responsible for strawberry fruit set. These bacteria may be responsible for the generation of hormones that function as plant growth

regulators and encourage the development of reproductive structures. The optimal water and oxygen holding capacity is achieved by using the organic substrate (goat manure, vermiculite, and peat moss) in conjunction with the three Nutes in the amounts that are specified. In addition to this, it promotes aeration, which in turn leads to the construction of healthier root systems, which in turn allows for greater nutrient uptake, which is necessary for appropriate growth and production of strawberries (**Arancon*et al.*, 2003**). Similar results were observed by **Gowda (2016)** and **Rodriguez *et al*. (2022)** while working on tomatoes.

Average fruit weight (gm)

The data regarding the average fruit weight (g) of strawberry (*Fragariaananassa*) cv. Winter Dawn presented in table 3.was found significantly affected by different treatments and potting media mixture. It was found that Treatment T_6 (96,104,102)of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] recorded the maximum average fruit weight (g)[49.66 (2021-22)&50.32 (2022-23)] g over all other treatments during both the years of study where-as according to pooled data, treatment T_8 (120,128,126) was found significantly best with 49.67 g average fruit weight. It was followed by Treatment T_8 (120,128,126)of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] which recorded the 2nd best treatment with [49.07 (2021-22)&49.67 (2022-23)] g average fruit weight during both the years of study where-as according to pooled data, treatment T_6 (96,104,102) of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] was found 2nd best with 48.69 gaverage fruit weight. It was also observed that treatment T_5 (84,92,90)&T_8 (120,128,126) were found at par with T_6 (96,104,102)of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)]during both the years of study where-as according to pooled data, T_5 (84,92,90), T_6 (96,704,102), T_7 (108,116,114) and T_9 (132,136,135) were found at par with T_8 (120,128,126)of potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)]. The minimum average fruit weight [38.92 (2021-22),39.82(2022-23)&39.37 (Pooled)]gwas recorded in treatment T_1(27,39,36)of potting mixture combination P_1 [Goat Manure + Vermiculite + Peat Moss (25:35:40)] during both theyears of study and pooled analysis data.

The Treatment T_7 containing Nute grow, Nute Micro and Nute bloom @ 108ml, 116ml and 114 ml respectively in 15l of water with potting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss (35:25:40)] recorded maximum average fruit weight (g). It is probable that an increased microbial population is responsible for the increased fruit weight per plant seen across a spectrum of strawberry plant densities and medium combinations. The combination of vermiculite and peat moss improves the substrate's cation exchange capacity and its ability to retain moisture, and the beneficial effects of goat manure on better plant growth and yield were not solely attributable to the nutrient status of the goat manure; rather, they were attributable to the availability of plant growth-influencing materials, such as plant growth regulators and humic acids, which may have assisted in achieving lush vegetative growth **(Lim *et al.*, 2015**). In working with strawberry, **Cantlifee*et al.* (2007)** and **Singh *et al.* (2019)** also observed comparable outcomes.

CONCLUSION

Based on the research findings Grow, Micro, and Bloom hasmaximizedoverall growth in addition to showing the highest vegetative growth, flowering, and fruiting attributes. Based on the results of the current experiment, concluded that in the pot culture system Treatment T_6 (96,104,102) withpotting mixture combination P_3 [Goat Manure + Vermiculite + Peat Moss

(35:25:40)] has increased the vegetative growth, early flowering, Maximum no. of flowers and maximum no. of Strawberryfruits.

Due to the increased yields and indicating its advantages in the changing agricultural domain in order to meet the demand for fresh vegetables in cities and other metropolitan areas, the outcomes of the study may be useful for urban farmers and city dwellers who wish to implement the technology in their confined backdrop.

References

Adak, N. and Gubbuk, H. 2015. Influence of different soilless substrates to morph physiological characteristics and yield relations in strawberries. *Erwerbs-Obstbau* 60: 341-348.

Arancon, N. Q., Edwards, C. A., Bierman, P., Metzger, J. D., Lee, S. and Welch, C., 2003. Effects of vermicomposts on growth and marketable fruits of field-grown tomatoes, peppers and strawberries: the 7th international symposium on earthworm ecology· Cardiff· Wales· 2002. *Pedobiologia*, *47*(5-6), pp.731-735.

Anonymous.2019a. Food and Agriculture Organization of the United Nations, Rome.http://www.fao.org [11.08pm, 10th June, 2019].

Anonymous.2019b. Indian Production of Strawberry (HSCODE-1060). http://apeda.in/agriexchange [11.08pm, 10th June, 2019]

Bowling, B. L. 2000. The berry grower's companion. Timber Press Inc., Portland, Oregon, USA.

Burgel, L., Hartung, J. and Graeff-Hönninger, S., 2020. Impact of different growing substrates on growth, yield and cannabinoid content of two Cannabis sativa L. genotypes in a pot culture. *Horticulturae*, *6*(4), p.62.

Cantliffe, D. J., Castellanos, J. Z., &Paranjpe, A. V. 2007. Yield and quality of greenhouse-grown strawberries as affected by nitrogen level in coco coir and pine bark media. In *Proceedings of the Florida State Horticultural Society* (Vol. 120, pp. 157-161).

Castellanos Morales, V., Villegas-Moreno, J., Vierheilig, H., & Cárdenas-Navarro, R. 2012. Nitrogen availability drives the effect of Glomusintraradices on the growth of strawberry (*Fragaria x ananassa*Duch.) plants. *Journal of the Science of Food and Agriculture*, *92*(11), 2260-2264.

Falah, M. A. F., Ulfiyati, N., Waras, B., Afrianti, V. and Ushada, M., 2022, March. Destructive and non-destructive quality measurements of strawberry (*Fragaria*× *ananassa* cv. Tristar) cultivated using soilless culture in tropical greenhouse. In *2nd International Conference on Smart and Innovative Agriculture (ICoSIA 2021)* (pp. 130-137).Atlantis Press.

Gowda, B. M., 2016. Evaluation of different genotypes for growth, yield and quality of strawberry (*Fragaria*x *ananasa*Duch.) under naturally ventilated polyhouse in hill zone of Karnataka. *M.Sc*. *thesis*, Univ. Agric. Hortic. Sci., Shivamogga Karnataka (India), pp. 46.

Hassan, A., El-Salehein, A., El Hamady, M. and Sobh, M., 2021. Effect of Different Substrate Media and Irrigation on Flowering and production of Strawberry (*Fragaria*spp). *Journal of Productivity and Development*, *26*(4), pp.1053-1069.

Jensen M. H, Collins W. L, 1985.Hydroponic vegetables production.Horticultural Reviews, 7: 483- 570.

Khalid, S., Qureshi, K. M., Hafiz, I. A., Khan, K. S., &Qureshi, U. S. 2013. Effect of organic amendments on vegetative growth, fruit and yield quality of strawberry. *Pakistan Journal of Agricultural Research, 26*(2).

Kumar, A., Pandey, S. D., Rai, R. R., and Vishal, N. 2022.Evaluation of alternate potting media mixtures for raising quality-planting material of litchi in polybags.*The Bioscan*, **9**(1): 381- 384.

Lim, S. L., Wu, T. Y., Lim, P. N. and Shak, K. P. Y., 2015. The use of vermicompost in organic farming: overview, effects on soil and economics. *Journal of the Science of Food and Agriculture*, *95*(6), pp.1143-1156.

Majdi, Y., Ahmadizadeh, M. and Ebrahimi, R., 2012. Effect of different substrates on growth indices and yield of green peppers at hydroponic cultivate. *Current Research Journal of Biological Sciences*, *4*(4), pp.496-499.

Martinussen, I., Avetisyan, A., Hokhanyan, M., Herdt, K., Lund, L., Hykkerud, A. L. and Jaakola, L., 2021.Effect of organic fertilizer on growth of strawberry cultivar'Sonata'. In *IX International Strawberry Symposium 1309* (pp. 629-634).

McNeill D. B., Blom T. J., Hughes J., 1983. Soilless Mixes.Ontario Ministry of Agriculture and Food Factsheet.AGDEX 296/510.3 pages.

National Horticulture Board. 2021. State wise Area and Production estimates of Horticultural crops. Ministry of Agriculture.Government of India.

Ors, S. and Anapali, O., 2010. *Effect of soil addition on physical properties of perlite based media and strawberry cv. Camarosa plant growth. J. Sci. Res. Essays., **5**(22): 3430-3433.*

Rodriguez, M. H., Schmidt, U., Büttner, C. and Bandte, M., 2022. *Electrolytic Disinfection of Irrigation Water for Intensive Crop Production in Greenhouses as Demonstrated on Tomatoes (Solanumlycopersicum Mill). Horticulturae, 8(5), p.414.*

Shylla, B., Sharma A, Thakur M and Handa A. 2018. Perlite: An Effective Soilless Substrate for Producing Strawberry Plants Free from Nematode Transmitted Viruses. *The International Journal of Current Microbiology and Applied Sciences* 7:2319-7706.

Singh, N., Mishra, S. and Bahadur, V., 2019. Production of strawberry through closed hydroponics system under NFT (Nutrient Film technique). *Journal of Pharmacognosy and Phytochemistry*, *8*(4), pp.2958-2960.

Sinclair, G., Charest, C., Dalpé, Y. and Khanizadeh, S., 2014. Influence of colonization by arbuscularmycorrhizal fungi on three strawberry cultivars under salty conditions. *Agricultural and food science*, *23*(2), pp.146-158.

Tariq, R., Qureshi, K. M., Hassan, I., Rasheed, M. and Qureshi, U. S., 2013. Effect of planting density and growing media on growth and yield of strawberry. *Pakistan Journal of Agricultural Research, 26*(2).

Tehranifar, A., Poostchi, M., Arooei, H. and Nematti, H. 2007.Effects of seven substrates on qualitative and quantitative characteristics of three strawberry cultivars under soilless culture.*ActaHorticulturae* 761:485-488.

Thakur, M. and Shylla, B. 2018. Influence of different growing media on plant growth and fruit yield of strawberry (*Fragaria* × *ananassa*Duch.) cv. Chandler grown under protected conditions. *International Journal of Current Microbiology Applied Sciences* 7:2724-2730

Table 1: Effect of Different Treatments and potting media on Plant height (cm) and Plant Spread (cm)at 120 days after planting (DAP) of strawberry (*Fragariaananassa*)in Pot culture under shade net condition cv. Winter Dawn during 2021-22

	Plant hight (cm) at 120 days after planting									Plant Spread (cm) at 120 days after planting								
	2021			2022			Pooled			2021			2022			Pooled		
	P_1	P_2	P_3	P_1	P_2	P_3	P_1	P_2	P_3	P_1	P_2	P_3	P_1	P_2	P_3	P_1	P_2	P_3
T_0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_1	10.86	13.74	14.41	11.76	14.64	15.31	11.31	14.19	14.86	20.49	21.9	22.57	23.39	21.8	23.47	21.94	21.85	23.02
T_2	11.45	14.12	14.79	12.58	15.25	15.92	12.02	14.69	15.36	20.16	20.96	21.63	21.29	22.09	22.76	20.73	21.53	22.2
T_3	11.71	14.33	15	12.87	15.49	16.16	12.16	14.81	15.48	20.14	21.71	22.38	21.3	22.87	23.54	20.72	22.29	22.96
T_4	11.83	14.47	15.14	13.03	15.67	16.34	12.37	15	15.67	20.31	20.82	21.49	21.51	22.02	22.69	20.91	21.42	22.09
T_5	12.95	15.75	16.42	13.31	16.11	16.78	12.57	15.29	15.96	21.61	22.1	22.77	21.97	22.46	23.13	21.79	22.28	22.95
T_6	14.51	17.34	18.01	16.11	18.94	19.61	15.11	17.91	18.58	23.48	23.85	24.52	24.84	25.21	25.88	24.16	24.53	25.2
T_7	14.1	16.87	17.54	15.56	18.33	19	14.75	17.52	18.19	21.75	21.9	22.57	23.35	23.5	24.17	22.55	22.7	23.37
T_8	13.94	16.7	17.37	15.3	18.06	18.73	14.13	16.91	17.58	21.68	21.57	22.24	23.14	23.03	23.7	22.41	22.3	22.97
T_9	14.51	16.78	16.97	15.83	18.18	18.45	15.17	17.76	18.23	20.64	21.82	24.49	23.04	23.22	24.89	21.84	22.52	24.69
	SE(m)	**C.D. at 5%**	**F-test**	**SE(m)**	**C.D. at**	**F-test**	**SE(m)**	**C.D.**	**F-test**	**SE(m)**	**C.D. at 5%**	**F-test**	**SE(m)**	**C.D. at 5%**	**F-test**	**SE(m)**	**C.D. at 5%**	**F-test**
Pot Media	**0.313**	**0.646**	*****	**0.313**	**0.645**	*****	**0.248**	**0.511**	*****	**0.324**	**0.668**	*****	**0.291**	**0.601**	*****	**0.283**	**0.584**	*****
Treatments	**0.626**	**1.291**	*****	**0.625**	**1.29**	*****	**0.496**	**1.023**	*****	**0.648**	**1.337**	*****	**0.582**	**1.201**	*****	**0.565**	**1.167**	*****

Table 2 :Effect of Different Treatments and potting media on Number of leaves (cm) and Number of flowers per plant at 120 days after planting (DAP) of strawberry (*Fragariaananassa*)in Pot culture under shade net condition cv. Winter Dawn during 2021-22

	Number of leaves at 120 days after planting									Number of flowers per plant								
	2021			2022			Pooled			2021			2022			Pooled		
	P_1	P_2	P_3	P_1	P_2	P_3	P_1	P_2	P_3	P_1	P_2	P_3	P_1	P_2	P_3	P_1	P_2	P_3
T_0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_1	18.97	19.67	19.97	19.53	20.57	21.24	19.25	20.12	20.61	30.63	36.88	37.55	31.53	37.78	38.45	31.08	37.33	38
T_2	13.65	16.64	17.31	14.78	17.77	18.44	14.22	17.21	17.88	26.38	30.77	31.44	27.21	31.9	32.57	26.8	31.34	32.01
T_3	17.34	20.75	21.42	18.5	21.91	22.58	16.08	19.28	19.95	27.34	32.15	32.82	28.5	33.31	33.98	27.44	32.04	32.71
T_4	17.33	20.74	21.41	18.53	21.94	22.61	17.94	21.35	22.02	29.33	34.42	35.09	30.53	35.62	36.29	28.94	33.89	34.56
T_5	19.65	23.39	24.06	20.01	23.75	24.42	18.67	22.25	22.92	35.31	41.23	41.9	35.67	41.59	42.26	32.5	38.01	38.68
T_6	20.61	24.22	24.89	21.97	25.58	26.25	20.81	24.49	25.16	37.94	43.75	44.42	39.3	45.11	45.78	37.74	43.44	44.11
T_7	20.25	23.82	24.49	21.85	25.42	26.09	21.23	24.82	25.49	36.18	41.77	42.44	37.78	43.37	44.04	35.39	40.78	41.45
T_8	19	22.39	23.06	20.46	23.85	24.52	20.36	23.84	24.51	33	38.18	38.85	34.46	39.64	40.31	34.89	40.44	41.11
T_9	18.73	22.08	22.75	20.69	23.48	23.91	19.85	22.94	23.49	30.73	35.61	36.28	32.13	37.01	37.68	35.04	40.38	41.05
	SE(m)	**C.D. at 5%**	**F-test**	**SE(m)**	**C.D. at 5%**	**F-test**	**SE(m)**	**C.D. at 5%**	**F-test**	**SE(m)**	**C.D. at 5%**	**F-test**	**SE(m)**	**C.D. at 5%**	**F-test**	**SE(m)**	**C.D. at 5%**	**F-test**
Pot Media	**0.516**	**1.066**	*****	**0.291**	**0.602**	*****	**0.331**	**0.683**	*****	**0.404**	**0.833**	*****	**0.402**	**0.831**	*****	**0.398**	**0.822**	*****
Treatments	**1.033**	**2.132**	*****	**0.583**	**1.203**	*****	**0.662**	**1.366**	*****	**0.808**	**1.667**	*****	**0.805**	**1.661**	*****	**0.797**	**1.644**	*****

Table 3: Effect of Different Treatments and potting media on Number of flowers per plant and Average fruit weight (g) in Pot Cultureof strawberry (*Fragariaananassa*)in Pot culture under shade net condition cv. Winter Dawn during 2020-21 and 2021-22

	Number of fruits per plant									Average fruit weight (g)								
	2021			2022			Pooled			2021			2022			Pooled		
	P_1	P_2	P_3	P_1	P_2	P_3	P_1	P_2	P_3	P_1	P_2	P_3	P_1	P_2	P_3	P_1	P_2	P_3
T_0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T_1	10.08	10.23	11	10.48	10.43	11.1	10.28	10.33	11.05	38.92	41.1	41.77	39.82	42	42.67	39.37	41.55	42.22
T_2	14.08	14.63	15.3	14.18	16.23	16.9	14.13	15.43	16.1	40.92	43.2	43.87	42.35	44.33	45	41.64	43.77	44.44
T_3	14.41	15.23	15.9	14.11	16.43	17.1	14.1	15.53	16.2	41.49	43.78	44.45	42.65	44.94	45.61	41.79	44.07	44.74
T_4	14.41	15.23	15.9	13.27	15.59	16.26	13.84	15.41	16.08	43.91	46.55	47.22	45.11	47.75	48.42	43.3	45.77	46.44
T_5	13.75	14.26	14.93	13.71	15.72	16.39	14.06	15.48	16.15	44.86	47.63	48.3	45.22	47.99	48.66	44.57	47.27	47.94
T_6	15.75	16.87	17.54	15.58	18	18.67	15.17	16.81	17.48	46.22	48.99	49.66	47.58	49.55	50.32	45.75	47.97	48.69
T_7	14.75	15.61	16.28	14.41	16.77	17.44	14.08	15.52	16.19	43.91	46.39	47.06	45.37	47.85	48.52	45.12	47.74	48.41
T_8	14.08	14.63	15.3	13.94	15.99	16.66	14.85	16.43	17.1	45.7	48.4	49.07	47.3	49.2	49.67	46.76	49.1	49.67
T_9	13.41	13.88	14.55	13.31	15.28	15.95	13.7	14.96	15.63	43.79	46.25	46.92	45.19	47.65	48.32	45.45	48.03	48.7
	SE(m)	**C.D. at 5%**	**F-test**	**SE(m)**	**C.D. at 5%**	**F-test**	**SE(m)**	**C.D. at 5%**	**F-test**	**SE(m)**	**C.D. at 5%**	**F-test**	**SE(m)**	**C.D. at 5%**	**F-test**	**SE(m)**	**C.D. at 5%**	**F-test**
Pot Media	**0.319**	**0.659**	*	**0.383**	**0.79**	*	**0.218**	**0.451**	*	**0.41**	**0.846**	*	**0.194**	**0.4**	*	**0.311**	**0.643**	*
Treatments	**0.638**	**1.317**	*	**0.765**	**1.579**	*	**0.437**	**0.902**	*	**0.819**	**1.691**	*	**0.387**	**0.8**	*	**0.623**	**1.285**	*