THE INFLUENCE OF CONTAINER TYPES AND POTTING MEDIA ON THE BIOMETRIC, PHENOLOGICAL AND YIELD PARAMETERS OF STRAWBERRY *cv*. WINTER DAWN

ABSTRACT

Strawberry being an annual herbaceous plant with delicious fruit can be easily grown in a container filled with a potting media and suitable for growing in terrace garden or rooftop gardening in urban areas where the area for cultivation is less. This intends to augment the farmer's income and increase the overall production of strawberry. The study was conducted in the experimental field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology, and Sciences, Prayagraj (U.P.) during 2023-2024. The aim of the experiment was to determine the effect of container types and potting media on the biometric, phenological and yield parameters of strawberry *cv*. Winter Dawn. The experiment was laid out according to a factorial completely randomized block design. Observations on the biometric, phenological, and yield parameters of each plant were recorded during the study. The result of the statistical analysis revealed that among all the combinations of potting media, the combination of cocopeat, perlite and vermicompost in the ratio of 1:1:2 was found to be superior. Better biometric, phenological, and yield parameters were observed in plants grown in earthen pots. Based on the interaction effect, plants raised in PVC pots with a growing media ratio of 1:1:2 cocopeat + perlite + vermicompost (C2M1) result in maximum plant height (18.10 cm), plant spread (16.10 cm), number of leaves (26.67), number of fruits per plant (15.91) and total yield per plant (341.00 g). The study revealed that the minimum days to initiate first flower (47.10), flowering to harvest duration (27.67) and days to first fruiting (68.13) was reported in C2M1: PVC pots {(cocopeat + Perlite + Vermicompost) (1:1:2)}. Thus, strawberry production using cocopeat + perlite + vermicompost in 1:1:2 ratio in PVC Pots will ensure greater success in plant establishment and produce healthy and disease-free strawberries.

Key word: Strawberry; cocopeat; perlite; vermicompost; FYM; container ; biometric; phenological; yield

INTRODUCTION

Strawberry (*Fragaria* × *ananassa* Duch.) are classified as a stoloniferous, perennial, and short-day forb that grows predominantly in the temperate climate and belongs to the family Rosaceae. Temperatures of (22°C to 25°C) during the day and (7°C to 13°C) at night are suitable for its successful growth [7]. The cultivated strawberry, with its diploid chromosome number of 2n=56 having a basic chromosome number of x=7, is a hybrid between two octoploid species, *Fragaria chiloensis* Duch. and *Fragaria virginiana* Duch. [5] [10] and [33]. According to botanical theory, the strawberry is non-climacteric fruit that ripens solely on the plant. It is an aggregate fruit with soft texture having seeds on the surface of the red fleshy receptacle called achenes [6] and [18]. Strawberry is commercially propagated by runners. Its fruits contain 95 % of water and 5 % of

dry matter. It is also a rich source of vitamins and minerals with a tasty and delicious flavor constituting vitamin C (94 mg/150 g), vitamin A (45 IU/150 g) and proteins (1.0 g/150 g). It also contains higher amounts of other components like flavonoids and phenolics. Strawberry is known for its pleasant aroma, and its fruit is used in various commercial food product industries because of its flavor, sugars, lipid content, minerals, natural source of antioxidants, and high fibre content.

Soilless cultivation is an artificial means of providing plants with support and a reservoir for nutrients and water [26]. The growing popularity of soilless media is due to the fact that they are free from soil-borne pests, diseases, and nematodes and also address the problems of poor drainage, structure, soil fumigation, and salt accumulation, thereby resulting in good vegetative growth characteristics, the number of fruits, and the yield of better-quality strawberries [35], [1] and [36]. Cocopeat is a commonly used substrate in India and has a high water holding and cation exchange capacity, whereas, perlite provides the required porosity to the media [22]. Vermicompost contains accessible forms of nutrients, in addition to micronutrients elements such as nitrogen, exchangeable phosphorus, potassium, calcium, and magnesium [9], [36] and [20. Application of vermicompost in soilless culture boosted strawberry growth and yields [4] and [18]. According to Lakshmikanth et al [19] the pot culture with various media combinations produces the ideal growing conditions with an adequate supply of water, macronutrients, micronutrients, and other necessary hormones. Thus, strawberries being a shallow-rooted and small-statured plant can be cultivated in containers to meet the increasing demand for strawberries throughout the year as well as the nutritional security of people living in urban and peri-urban areas [30].

MATERIALS AND METHODS

The present investigation was conducted at the experimental field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology, and Sciences, Prayagraj (U.P.) during 2023-2024. The aim of the experiment was to determine the effect of container types and potting media on the biometric, phenological and yield parameters of strawberry *cv*. Winter Dawn The experiment was laid out according to a completely randomized block design with two factors, *viz*. media and container types: - each combination was replicated thrice with three plants in each replication. Factor 1 consists of different potting media, i.e. cocopeat, perlite, and vermicompost in a ratio of 1:1:2, 1:2:1, 2:1:1 and soil, sand, and FYM in a ratio of 1:1:1 and Factor 2 consist of three types of containers design i.e. earthen pot, PVC pot and thermoform pot. The details of differences containers types and potting media used along with the specific notation are given in **Table 1**. The various growth, phenological and yield parameters of strawberry plants such as plant height, plant spread, number of leaves per plant, days taken to first flower, flower to harvest duration, days taken to first fruiting, number of fruits per plant, and total yield per plant, were measured in this experiment (Plate 1,2). With the help of a measuring scale, the plant height and, plant spread, were measured. The number of leaves and fruits was counted at the end of the growing season, and an average number was worked out. The number of days taken to flower from the date of planting was measured, and the mean number of days required to first flower was worked out. The overall significance of the difference among the treatments was tested, using critical differences (C.D.) at a 5% level of significance. The results were statistically analyzed with the help of the Windows -based computer package OPSTAT [31]. The plants of the strawberry cultivar Winter Dawn were planted under natural light conditions in the evening during the last

week of October. Holes were made at the bottom of each container to allow the drainage of excess water. The prepared mixture of various potting media was filled in containers and kept in open field conditions. Before planting, half of the containers were filled with mixtures, and the other half were filled after the strawberry plant was placed in the middle. The plants were then watered right away until water emerged from the drainage holes. During the first phases, the plants were irrigated every one to two days. Later, mild irrigation was used to keep the potting media moist. All plants were given uniform cultural practices during the course of the investigation.

Table 1: Details of different container types and potting media used in the experiment

SL. No	Media Code	Potting media used	Ratio	Container Code	Container types
1	M1	Cocopeat + Perlite + Vermicompost	1:1:2	C1	Earthen Pots
2	M2	Cocopeat + Perlite + Vermicompost	1:2:1	C2	PVC Pots
3	M3	Cocopeat + Perlite + Vermicompost	2:1:1	C3	Thermoform Pots
4	M4	Sand + Soil + FYM	1:1:1		

Plate 1: Crop at reproductive Stage

Plate 2: Crop at fruit bearing Stage

RESULT AND DISCUSSION

Effect of container types and potting media on biometric parameters. The results of the statistical analysis of the data recorded on growth parameters are shown in **Table 2** and **Table 3**. It has been discovered that there is a noticeable interaction effect between the container types and the potting media on the various growth parameters of strawberry plants. As per the developed protocol in the present study, it was found that among the different media used, M1: cocopeat + perlite + vermicompost (1:1:2) resulted in the highest plant height of 16.46 cm, followed by M2: cocopeat + perlite + vermicompost (1:2:1) (14.91 cm) and the lowest plant height of 14.22 cm was noted in M3: cocopeat + perlite + vermicompost (2:1:1). Amongst the different containers used, the plants grown in earthen pots (C1) had the tallest plants (15.80 cm) which was followed by PVC pots (C2) (15.61 cm) and the shortest plant height of 13.74 cm was observed in thermoform pots (C3). It is evident from the data that, the interaction between container types and potting media resulted in a significant effect and that the maximum plant height (18.10 cm) was obtained in C2M1: PVC pot {cocopeat + perlite + vermicompost, (1:1:2)} followed by C1M1: Earthen pots {cocopeat + perlite + vermicompost, (1:1:2)} of 17.16 cm whereas, the minimum plant height (13.41 cm) was found in C3M4: Thermoform pot {soil+ sand+ FYM (1:1:1}. The increased height of the plants may be attributed to the presence of nutrients and enough pore spaces in perlite and cocopeat, both of which have improved moisture distribution, cation exchange capacity, water retention capacity, and nutrient and water holding capacity [11] and [24] The influence of perlite and vermicompost on the plant height of strawberries may be attributed to the activity of microbes present in vermicompost, which helps in providing the availability of macronutrients as well as micronutrients. According to Tabatabaei et al [34] the media consisted of perlite, which increased plant height in strawberries. A similar result was reported by Hassan et al [14] that utilizing coconut husk resulted in the largest plant height in strawberry, whereas soil cultivation produced the lowest. Kumar et al [17] indicates that highest plant height, was significantly recorded in Winter Dawn than Sweet Charlie in the potting substrates which consist of soil, vermicompost and cocopeat. Similar result was reported by Sharma et al [30] that highest plant height was recorded in the plant grown in PVC pots with a growing media of cocopeat, perlite and vermicompost in the ratio of 2:1:1. These results were similar to the earlier findings of [28], [26] and [36].

As evident from **Table 2**, among the different media, M1: cocopeat + perlite + vermicompost (1:1:2) resulted in a maximum plant spread of 14.46 cm, followed by M2: cocopeat + perlite + vermicompost (1:2:1) with 12.91 cm, and the minimum plant spread of 12.22 cm was noted in M3: cocopeat + perlite + vermicompost (2:1:1). Amongst the different containers used, the plants grown in earthen pots (C1) had a maximum plant spread of 13.80 cm, which was followed by PVC pots (C2) (13.61 cm) and minimum plant spread of 11.74 cm was observed in thermoform pots (C3). It is evident from the data that the interaction effect of C2M1: PVC pots {cocopeat +perlite + vermicompost (1:1:2)} resulted in maximum plant spread of 16.10 cm. It was followed by C1M1: Earthen pots {cocopeat +perlite + vermicompost (1:1:2)} with a plant spread of 15.17 cm whereas, the minimum plant spread of 11.41 cm was found in C3M4: Thermoform pots {soil + sand + FYM (1:1:1)}. Hesami et al [15] concluded that the treatment with the combination of soilless substrate i.e. perlite + cocopeat recorded the highest plant spread in strawberries. Lakshmikanth et al [19] revealed that the treatment with the combination of soil + cocopeat + vermiculite + vermicompost in 1:1:1:1 ratio gave the highest plant spread of 31.27 cm in the North-South and 30.21 cm in the East-West direction in the strawberry plant. Similar result was obtained by Ameri et al [3], they found that the maximum plant spread was observed in 50% cocopeat + 50% perlite and 5% vermicompost + 45% perlite + 50% cocopeat in strawberry *cv.* Camarosa. Similar result was reported by [30] and [12].

Table 2: Effect of container types and potting media on plant height and plant spread of strawberry *cv*. Winter Dawn

	Plant Height (cm)					Plant Spread (cm)				
	M1	M2	M3	M4	MEAN	M1	M2	M3	M4	MEAN
C1	17.16	16.63	14.42	15.00	15.80	15.17	14.63	12.42	13.00	13.80
C2	18.10	14.25	14.63	15.47	15.61	16.10	12.25	12.63	13.47	13.61
C3	14.12	13.86	13.60	13.41	13.74	12.12	11.85	11.60	11.41	11.74
Mean	16.46	14.91	14.22	14.62		14.46	12.91	12.22	12.62	

Factor	C.D(5%)	SE(d)	SE(m)	CV	C.D(5%)	SE(d)	SE(m)	CV
Factor C	0.27	0.13	0.09	0.49	0.32	0.15	0.11	0.57
Factor M	0.32	0.15	0.11	0.57	0.37	0.18	0.12	0.68
Factor C x M	0.55	0.26	0.19	0.99	0.63	0.30	0.22	1.14

C1 - Earthen Pot C2 - PVC Pot C3 – Thermoform Pot

M1- Cocopeat+ Perlite + Vermicompost (1:1:2) M2- Cocopeat+ Perlite + Vermicompost (1:2:1)

M3- Cocopeat+ Perlite + Vermicompost (2:1:1) M4- Soil + Sand + FYM (1:1:1)

The highest number of leaves per plant (23.55) was produced by potting media M1: cocopeat + perlite + vermicompost (1:1:2) followed by M2: Cocopeat + perlite + vermicompost (1:2:1) with 20.23 number of leaves per plant, whereas minimum number of leaves per plant (17.88) was observed in M4: Soil+ Sand + FYM (1:1:1). In the case of different containers, the maximum number of leaves per plant (22.46) was reported in earthen pots (C1) followed by PVC pots (C2) having 22.30 leaves whereas, the minimum number of leaves per plant (15.12) was found in thermoform pots (C3). Also, significant results were obtained as an outcome of the interaction effect of container types and potting media. The result of the statistical analysis of the interaction effect revealed that the maximum number of leaves per plant (26.67) was produced by C2M1: PVC pots {cocopeat + perlite + vermicompost (1:1:2)}. It was followed by C1M1: earthen pots {cocopeat + perlite + vermicompost (1:1:2) which had 25.50 leaves per plant, whereas, the minimum number of leaves per plant of 10.00 was noted in C3M4: thermoform pots {soil + sand + FYM (1:1:1)}. Hassan et al [14] found that utilizing coconut husk resulted in the largest number of leaves in strawberry whereas, soil cultivation produced the lowest. According, to Selda and Anapali [27] the number of leaves decreased as the soil amount increased in the media. Hesami et al [15] also reported that the treatment with the combination of soilless substrate i.e. perlite + cocopeat, recorded the highest number of leaves. Thakur and Shylla [36] also concluded that the maximum number of leaves were produced when strawberry *cv.* Chandler was grown under protected conditions and perlite was used as a potting media as compared to the control (soil). These results were similar to those of [16], [32] and [30].

Table 3: Effect of container types and potting media on number of leaves per plant of strawberry *cv.* Winter Dawn

	Number of leaves per plant				
	M1	M2	M3	M4	MEAN
C1	25.50	24.50	19.50	20.33	22.46
C2	26.67	19.20	20.00	23.33	22.30
C3	18.50	17.00	15.00	10.00	15.12
Mean	23.55	20.23	18.17	17.88	
Factor	C.D(5%)	SE(d)	SE(m)	*CV.*	

Factor C	0.35	0.17	0.12	0.65
Factor M	0.41	0.20	0.14	0.76
Factor C x M	0.70	0.34	0.24	1.29

C1 - Earthen Pot C2- PVC Pot C3- Thermoform Pot

M1- Cocopeat+ Perlite + Vermicompost (1:1:2) M2- Cocopeat+ Perlite + Vermicompost (1:2:1)

M3- Cocopeat+ Perlite + Vermicompost (2:1:1) M4- Soil + Sand + FYM (1:1:1)

Effect of container types and potting media on phenological parameters: The results of the statistical analysis of various phenological parameters observed in the present experiment are depicted in **Table 4** and **Table 5**. From the data, it is evident that among the different media M1: cocopeat + perlite + vermicompost (1:1:2) took a minimum of 52.70 days for the first flowering which was followed by M4: soil + sand + FYM (1:1:1) which took 56.89 days. The maximum of 58.82 days for first flowering was observed under M3: cocopeat + perlite + vermicompost (2:1:1). In containers, the minimum of 53.86 days taken to first flower was recorded in earthen pots (C1) followed by PVC pots (C2) which had first flower appearance in 54.37 days. The maximum of days 61.38 taken to initiate the first flower was observed in thermoform pots (C3). Similar result reported by Sharma and Godara [28] that the earliest flowering was in S2 (cocopeat + perlite + vermicompost, 3:1:1) plants grown in earthen pots. From the interaction, the minimum days taken to initiate the first flower (47.10) were recorded in C2M1: PVC pots {cocopeat + perlite + vermicompost (1:1:2)} which was followed by C1M1: Earthen pots {cocopeat + perlite + vermicompost (1:1:2)} with 49.34 days whereas, the maximum days taken to initiate the first flower (62.17) were noted in C3M4: Thermoform pots {soil + sand + FYM (1:1:1)}.This is because vermicompost leads to the early onset of reproductive stage, resulting in the increase in photosynthates production due to the presence of phosphorous [23]. The flowering was affected by potting media and it was observed that flowers bloomed earlier in soilless media as compared to soil-based cultivation system which was reported by Albaho et al [2]. Similar result was obtained by Sharma et al [30].

The data as shown in **Table 5** revealed that the potting media M1: cocopeat+ perlite+ vermicompost (1:1:2) resulted in a minimum day (29.03) from the emergence of the flower to the day of harvest, followed by M2: cocopeat + perlite + vermicompost (1:2:1) which took 32.09 days from flower emergence to harvest. The maximum of 34.27 days, was observed in M4: soil + sand + FYM (1:1:1). Amongst the different containers used, the plants grown in PVC pots (C2) had a minimum of 31.29 days from flowering to harvest followed by

earthen pots (C1) which took 32.27 days and maximum days of 32.89 was observed in thermoform pots (C3). It is evident from the data that the interaction between container types and potting media resulted in a significant effect on flowering to harvest duration. It was reported that the minimum of 27.67 days was obtained by C2M1: PVC pot {cocopeat + perlite + vermicompost, (1:1:2)} which was followed by C1M1: Earthen pot {cocopeat + perlite + vermicompost, (1:1:2)} with 28.75 days. Maximum days (35.56) was found in C3M4 in the interaction between thermoform pot using soil+ sand + FYM (1:1:1) as the media. Albaho et al [2] reported that flowers in soilless media blossomed earlier than those in soil-based growth systems. According to Prasad [25] bud dormancy is broken and flowering is enhanced when vermicompost and perlite are combined. Sharma et al [30] revealed that the minimum days from flowering to harvest duration was obtained by plant grown in PVC pot consisting of cocopeat, perlite and vermicompost in the ratio of 2:1:1 as a growing media. Therefore, growing strawberry in PVC Pot using cocopeat + perlite + vermicompost in 1:1:2 ratio provides the perfect growing conditions that can shorten the strawberry crop's blossom to harvest time, making the production cycle faster and more effective

As seen from **Table 5**, the results of the statistical analysis for days to first fruiting shows as significant different among the various media combination employed in the present experiment. It was recorded from the data that potting media M1: cocopeat + perlite + vermicompost (1:1:2) resulted in minimum days (72.53) taken from the day of planting to the day of first appearance of the fruit followed by M2: cocopeat + perlite + vermicompost (1:2:1) (78.05 days) and maximum days (79.31) were observed in M3: cocopeat + perlite + vermicompost (2:1:1).

The results of the statistical analysis, as shown in **Table 5,** exhibited a significant difference among the various container types analyzed for days to first fruiting. Amongst the different containers used, the plants grown in earthen pots (C1) had minimum days of 74.36 for first fruiting followed by PVC pots (C2) which had first fruiting in 75.02 days, and maximum days (81.83) were observed in thermoform pots (C3). It is evident from the data that the interaction between container types and potting media resulted in the minimum days (68.13) was obtained by C2M1: PVC pot {cocopeat + perlite + vermicompost, (1:1:2)} which was followed by C1M1: Earthen pot {cocopeat + perlite + vermicompost, (1:1:2)} of 69.07 days. The maximum days (83.61) for first fruiting were found in C3M4: Thermoform pots {soil+ sand + FYM (1:1:1)}. Growing strawberries using cocopeat keeps the soil at the ideal moisture content, which encourages quick root development and early flowering. Perlite guarantees that the roots receive enough oxygen, which promotes strong development and early fruiting. Vermicompost adds vital nutrients to the soil, which speeds up plant growth and encourages fruit and flowering. When combined, they produce a growing environment that is conducive to strawberries reaching maturity more quickly, which shortens the time taken for potted strawberry plants to reach the harvesting stage.

Table 4: Effect of container types and potting media on days to first flowering of strawberry *cv*.

Winter Dawn

Day to first flowering					
	M1	M2	M3	M4	MEAN
C1	49.34	53.39	58.06	54.67	53.86
C2	47.10	59.00	56.67	53.83	54.37
C3	60.78	60.83	61.74	62.17	61.38
Mean	52.70	57.74	58.82	56.89	
Factor	C.D(5%)	SE(d)	SE(m)	*CV.*	
Factor C	0.64	0.31	0.22	1.78	
Factor M	0.74	0.36	0.25	1.37	
Factor C x M	1.28	0.62	0.44	2.36	

C1 - Earthen Pot C2- PVC Pot C3- Thermoform Pot

M1- Cocopeat+ Perlite + Vermicompost (1:1:2) M2- Cocopeat+ Perlite + Vermicompost (1:2:1)

M3- Cocopeat+ Perlite + Vermicompost (2:1:1) M4- Soil + Sand + FYM (1:1:1)

Table 5: Effect of container types and potting media on flower to harvest duration and days taken to first fruiting of strawberry *cv*. Winter Dawn

	Flower to harvest duration					Days taken to first fruiting				
	M1	M2	M3	M4	MEAN	M1	M2	M3	M4	MEAN
C1	28.75	34.51	32.33	33.50	32.27	69.07	73.50	78.11	76.78	74.36
C2	27.67	31.17	32.58	33.75	31.29	68.13	79.39	77.78	74.78	75.02
C3	30.68	30.58	34.75	35.56	32.89	80.39	81.28	82.05	83.61	81.83
Mean	29.03	32.09	33.22	34.27		72.53	78.05	79.31	78.39	
Factor	C.D(5%)	SE(d)	SE(m)	*CV.*		C.D(5%)	SE(d)	SE(m)	*CV.*	
Factor C	0.47	0.23	0.16	0.87		0.55	0.26	0.19	0.99	
Factor M	0.54	0.26	0.19	0.99		0.63	0.30	0.22	1.14	
Factor C x M	0.94	0.45	0.32	1.71		1.09	0.53	0.37	2.01	

C1 - Earthen Pot C2 - PVC Pot C3 - Thermoform Pot

M1- Cocopeat+ Perlite + Vermicompost (1:1:2) M2- Cocopeat+ Perlite + Vermicompost (1:2:1)

M3- Cocopeat+ Perlite + Vermicompost (2:1:1) M4- Soil + Sand + FYM (1:1:1)

Effect of container types and potting media on yield parameters: The results of the statistical analysis of the yield parameters are shown in **Table 6** and depicted graphically in **Fig 1**. It was found that among the different combination of potting media used, M1: cocopeat + perlite + vermicompost (1:1:2) resulted in

maximum number of fruits per plant (13.78) followed by M2: cocopeat + perlite + vermicompost (1:2:1) which had 11.70 fruits per plant. The minimum number of fruits per plant (10.82) was observed in M3 which consist of cocopeat + perlite + vermicompost in the ratio 2:1:1. Amongst the different containers used, the plants grown in earthen pots (C1) had a maximum number of fruits per plant of 13.56 followed by PVC pots (C2) which had 13.48 fruits per plant. The minimum number of fruits per plant (8.78) was observed in thermoform pots (C3). It is evident from the data that the interaction between container types and potting media resulted in a significant difference for number of fruits per plant. The maximum number of fruits per plant (15.91) was obtained in C2M1 in which strawberry plant were grown in PVC pots with potting media of cocopeat + perlite + vermicompost in a ratio of 1:1:2 which was found to be at par with C1M1: Earthen pot {cocopeat, perlite and vermicompost (1:1:2)}, which had 15.33 number of fruits per plant. The minimum number of fruits per plant (7.08) was found in C3M4: Thermoform Pots {soil+ sand + FYM (1:1:1)}. The suitable atmosphere in the root zonal area in soilless substrates leads to variation in number of berries [8]. Godwa [13] revealed that the accumulation of starch, carbohydrates, and photosynthates provided by vermicompost and perlite leads to an increase in fruit set and thereby increasing the number of berries. Similar finding had reported by Thakur et al [36].

It is evident from the data shown in **Table 6** that the maximum yield of 305.82 g per plant was observed under M1: cocopeat + perlite + vermicompost (1:1:2) followed by M2: cocopeat + perlite + vermicompost (1:2:1) which had 268.12 g per plant. However, the minimum yield per plant (254.86 g) was recorded under M3: cocopeat + perlite + vermicompost (2:1:1). The earthen pot (C1) produced the maximum yield per plant (306.93 g), followed by PVC pots (C2) which had a yield of 300.69 g per plant. The minimum yield per plant (210.90 g) was observed in thermoform pots (C3). Further, the interaction between the container types and potting media was found to be significant and data revealed that the maximum yield per plant (341.00 g) was recorded in C2M1: PVC pots {cocopeat + perlite + vermicompost (1:1:2)} which is on par with C1M1: Earthen pots {cocopeat + perlite + vermicompost (1:1:2)} with a yield of 331.10 g per plant. The minimum yield per plant (183.78 g) was observed in C3M4 where strawberry plant grown in thermoform pots with a potting media of soil+ sand + FYM in the ratio of 1:1:1. As similar result was reported by Hesami et al [15] that the yield of strawberries significantly varied by soilless potting media composed of different ratios of cocopeat, perlite, pumice, vermicompost, sawdust, and zeolite. Maher et al [20] revealed that perlite (75 %) + cocopeat (25 %) + jeevambrit resulted in a maximum fruit yield per plant. Similar findings have been reported by **[19], [17] and [30]**

Table 6: Effect of Container types and potting media on number of fruits per plant and total yield per of strawberry *cv.* Winter Dawn

	Number of fruits per plant					Total yield per plant (g)				
	M1	M2	M3	M4	MEAN	M1	M2	M3	M4	MEAN
C1	15.33	14.25	11.58	13.07	13.56	331.10	319.63	274.17	301.91	306.93
C2	15.91	11.34	12.43	14.25	13.48	341.00	259.72	300.07	301.95	300.69
C3	10.09	9.50	8.45	7.08	8.78	244.47	225.02	190.33	183.78	210.90
Mean	13.78	11.70	10.82	11.46		305.82	268.12	254.86	262.54	
Factor	C.D(5%)	SE(d)	SE(m)	CV		C.D(5%)	SE(d)	SE(m)	CV	
Factor C	0.44	0.21	0.15	0.80		13.61	6.56	4.64	24.93	
Factor M	0.50	0.24	0.17	0.91		15.72	7.57	5.35	28.77	
Factor C x M	0.87	0.42	0.30	1.60		27.22	13.11	9.27	49.82	

C1 – Earthen Pot C2- PVC Pot C3- Thermoform Pot

M1- Cocopeat+ Perlite + Vermicompost (1:1:2) M2- Cocopeat+ Perlite + Vermicompost (1:2:1)

M3- Cocopeat+ Perlite + Vermicompost (2:1:1) M4- Soil + Sand + FYM (1:1:1)

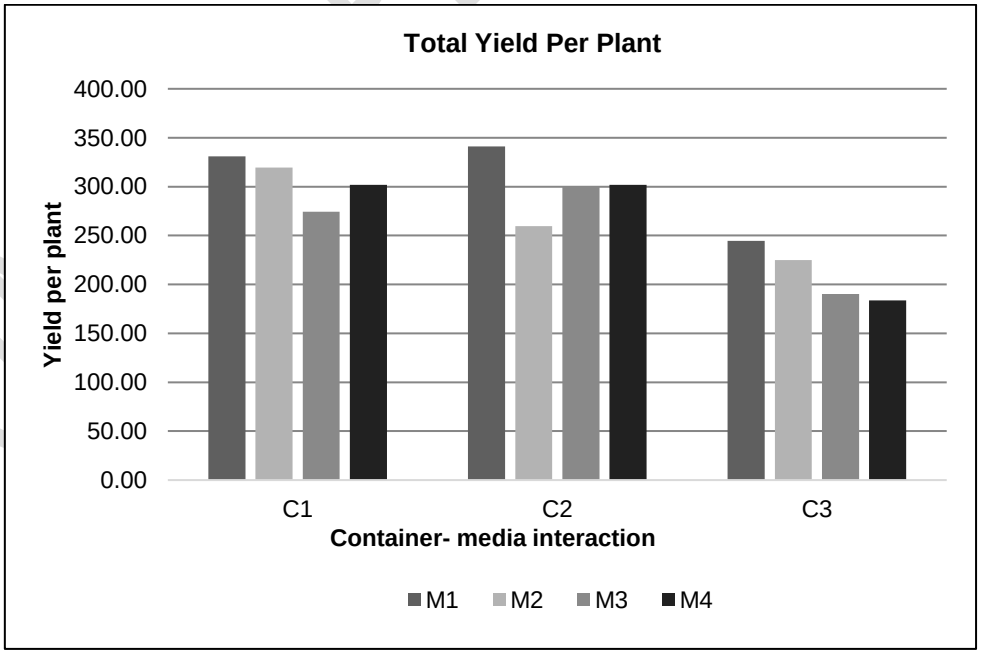

Fig 1: Total Yield per plant

Manole et al [21] also reported the significant influence of container type on the substrate biological activity and growth parameters of plants. In the present study, among the containers, plants grown in earthen pots had superior growth and yield characters whereas less growth was recorded in Thermoform pots. This might be due to the natural cooling effect attributed to the porous nature of clay. Godara and Sharma [12] also reported that from the different containers used, the maximum growth parameter was in earthen pots followed by PVC pots.

From the interaction between the container types and potting media the plants grown in PVC pots in cocopeat+ perlite+ vermicompost in the ratio of 1:1:2 significantly increased all the biometric observations recorded like the plant height, plant spread, number of leaves, etc. The enhanced vegetative growth might have contributed to the superior yield in strawberry plants grown in PVC pots using cocopeat+ perlite+ vermicompost in the ratio of 1:1:2. As similar finding was reported by Sharma et al [29]. He found that the plant grown in PVC pots with a combination of potting media (cocopeat + perlite + vermicompost, 3:1:1) had superior growth parameters like the maximum number of leaves (10.45 and 15.42), plant spread (27.43 cm and 30.24 cm) and crown diameter (17.44 mm and 18.10 mm). Sharma et al [29] concluded that strawberries show best performance when grown in PVC pots. The higher temperature of root media resulted in better root and shoot growth for the plant in the winter season which might be due to the elevated temperature of the rooting media in PVC pots due to absence of evaporative cooling, which is related to the findings in this research. Similar results were obtained by Sharma et al [30]. They revealed that from among all the treatments the plant raised in PVC pots with a potting media ratio of 3:1:1 cocopeat, perlite and vermicompost had significantly higher height, higher growth, maximum flowering and fruiting characters.

CONCLUSION

Growing strawberries in pots or growbags filled with potting substrate is an easy way to meet the year-round demand for strawberries and to ensure the nutritional security of people living in urban and peri-urban areas. As per the present investigation, the combination of potting media using cocopeat, perlite, vermicompost in the ratio of 1:1:2 was found to be superior among all other combination studied. Among the different containers evaluated the performance of strawberry plants grown in earthen pots showed enhanced biometric, phenological and yield characters. The findings of the study enable us to conclude that the container types and potting media directly influence the biometric, phenological and yield parameters of strawberry *cv.* Winter Dawn. Therefore, cultivating strawberries by utilizing PVC pots filled with cocopeat, perlite, and vermicompost media in a ratio of 1:1:2 can increase the overall production of strawberry by utilizing the unallocated spaces (like balconies, rooftops etc.). This experiment can also be an effective method for production of disease- free strawberries and to augment the farmer's income.

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COMPETING INTERESTS

The authors have declared that there are no competing interests regarding the publication of the research paper.

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