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### Effect of potting media and bio-capsule on growth, yield, and quality of Strawberry cv. Winter Dawn under polyhouse cultivation

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#### Abstract

A research study entitled "Effect of Potting Media and Biocapsule on Growth, Yield, and Quality of Strawberry cv. Winter Dawn under Polyhouse Cultivation," was conducted at the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) between 2023 and 2024. The experiment comprises of twelve treatments and three replications involving various doses of garden soil, vermicompost, cocopeat, farmyard manure, biocapsule, and their combinations.

The main aim of this experiment was to find out the effect on growth, yield and quality of strawberry plants with the used of various soilless and soil media. The experiment was carried out according to Completely Randomized Block Design. According to the findings of this study, T11 {Cocopeat + FYM + Biocapsule (1:1:@500ppm)} was found to be the most effective treatment with overall well-being including growth, yield, fruit character, quality. Plant height of 18.22 cm in 120 DAP, number of leaves with 26.66 in 120 DAP, plant spread with 16.22 cm in 120DAP, survival percentage with 88.66%, days taken to flowering with58.55 and days taken to fruiting with 68.11, fruit polar diameter with 5.66 cm, fruit radial diameter with 3.83 cm, fruit weight with 31.22gm, no. of fruits with 14.55, total yield of 326.66gm, TSS of 11.89°B, titratable acidity with 0.60% were recorded on T11 as the best among the twelve treatments. This treatment also recorded the highest B: C ratio of 1.72.

Keywords: Garden soil; vermicompost; cocopeat; farmyard manure; bio-capsule; yield.

#### Introduction

Strawberry, an octaploid in nature having 2n=8x=56 chromosome number, is a herbaceous and perennial plant of family rosaceae, which gives the high return within shortest period as compared to other berry fruits.

The strawberry fruits are very nutritious with unique pleasant aroma and flavour and are consumed as dessert or processed as jam, syrup, Ice-cream and for canning purposes or quick freezing. This fruit have an excellent source of vitamin C, a good source of potassium and are low in calories.

It is one of the most globally appreciated fruits and it has attained a premier position in the fresh fruit market as well as processing industries of the world.

Strawberries (*Fragaria x ananassa Duch.*) are highly valued fruits both in temperate and subtropical regions for their fresh consumption and processing potential, boasting a global appeal. Their cultivation is rapidly expanding in North India due to a great deal of profit. In India, commercial cultivation of this plant primarily is successfully occurring in Mahabaleshwar (Maharashtra), Haryana, Punjab, Uttar Pradesh, Jammu and Kashmir, Uttarakhand and the lower hills of Himachal Pradesh, with limited presence in Dehradun, Udham Singh Nagar, and Nainital districts of Uttarakhand.

Strawberries comprises mostly water and are nutritionally rich in carbohydrates, with minimal fat content and low calorie count The flavor of the strawberry fruit is primarily influenced by sugars, acids, and aromatic compounds.

Processed products of strawberry like jam, syrup, candy, etc. are in great demand.

Organic fertilizers play a very essential role in maintaining health of the soil and preventing food

pollution. They improve the fertility of the soil, enzyme activity, enhance soil fertility, enzyme activity, microbial biomass, and nutrient availability. Studies have investigated the used of various organic amendments have impacted on strawberry growth parameters, productivity and quality of fruit, going along very well with the growing interest in organic agriculture driven by consumer health and environmental concerns.

One of the organic manures, i.e. vermicompost have significantly contributed to the plant growth and soil improvement. In simple word, vermicomposting is a biotechnological process utilizing earthworms, accelerating waste to covert into a product for nutrient-rich castings, fostering microbial activity and plant growth. Applications of vermicompost have demonstrated the benefits of it that resulted in increased of strawberry yield, improvement in quality of fruit, and reduction of physiological disorders and diseases like Botrytis rot.

In Northern India, farmyard manure (FYM) is widely recommended for sustainable nutrient supply. High-quality FYM work as a valuable source of organic matter and nutrients for various crops, enhancing soil fertility and crop marketability. Making use of vermicompost and FYM can reduce fruit drop, improve yield and quality,fruit physicochemical properties, giving satisfaction to consumer preferences and expanding market demand for best-quality fruits. Biocapsules are capsules that contains nitrogen fixing bacteria, P solubilizing bacteria and K solubilizing bacteria. It enhance the availability of nutrients and promoting plant growth.It acts as an effective fertilizer for organic farming. The presence of biocapsule may contribute in increase number of fruit per plant, fruit breadth ( cm), fruit length ( cm) and fruit weight (g).

Bio-capsule have started to be in great demand in this modern world since it is very handy and easy to used and that the capsule can be diluted in 100-200 litres of water for the required quantity of application. It involves encapsulation of the desired microorganisms in a gelatine capsule for its delivery to the crops for the enhanced soil nutrient solubilization, enhanced growth and yield. Microorganisms are immobilized and can be activated by dissolving the capsule in water. The microorganisms which can be applied through bio-capsule are *Rhizobium* (for Nitrogen fixation), Phosphorous Solubilizing Bacteria (PSB), Plant Growth Promoting *Rhizobacteria* (PGPR), *Trichoderma*, *Burkholderia*, *Bacillus*, *Pseudomonas* etc.

The soilless media like cocopeat also has the ability to absorb and retain water extremely well, very suitable for plants. Growing strawberries with coco peat will not require frequent watering and also eliminates the problem of water-logging (due to its excellent drainage). Coco peat will do an excellent job of keeping your plants healthy, due to its anti-fungal properties. It is also resistant to mould, which in turn will help protect your plants from disease and decay as they grow. Strawberries are perennials that need rich soil with lots of organic matter and a slightly acidic pH (between 5.5 and 6.5). Work in compost, rotted manure and some peat moss at planting time.

The essential nutrients along with favourable media are very much needed for the ideal production of strawberries. The present study sought to find out the effectiveness of growth parameters and fruit yield of strawberries in different media growing under polyhouse.

The treatment with combination of the various soil and soilless media i.e. vermicompost, garden soil, cocopeat, FYM, biocapsule, being the most effective on plant growth parameters, i.e. plant height, number of leaves, crown diameter, canopy spread, fresh weight and dry weight of plant, flowering parameters, i.e. number of days taken for 1st flower, number of flowers/plant, number of fruits/plant and including the components of strawberry, i.e. fruit polar diameter, fruit radial diameter, total number of fruits/plant, fruit weight and total yield , and fruit quality of strawberry like TSS, acidity, colour, taste and aroma. Re-circulation of nutrient solution in polyhouse growing systems promotes a lot of advantages, environmentally and economically. The disadvantages are the risk of spreading phytopathogens through the nutrient solution and too much of heat inside polyhouse are the disadvantages. Closed growing systems may lead to a greater source for water-borne plant pathogen dispersion as compared to open (run-to-waste) ones. Martínez et al. (2010) <sup>[42]</sup> demonstrated that *Phytophthora* cactorum propagules are removed by slow sand filtration and that disease severity is consequently reduced. In comparison to other methods, mechanical, chemical and biological properties may interact in slow sand filtration. The disadvantages are the large space requirements, the high cost of cleaning after clogging and the chances of clogging as a result of water turbidity.

For further development of biological control methods in soilless growing systems, it is necessary to understand the ecological and biological characteristics of indigenous.

Micro-organisms in such systems. In addition, they can utilize a wide range of substances, such as either carbon or nitrogen sources, and grow relatively faster than other microorganisms.

In recent years, protected horticulture has changed from soilgrown systems to soilless systems. Composts produced from different types of agricultural residues can be a suitable material for growth media or for use in field soils as amendment. The use of these composts in soilless growing systems (SGS) can improve sustainability.

Conclusively, it can be concluded that for maintaining quality in the fruit characters as well as meeting the increasing demand, strawberries can be cultivated by using various potting medias and biocapsule together in pots.

#### **Materials and Methods**

The present investigation entitled "Effect of Potting media and Biocapsule on growth, yield and quality of strawberry cv. Winter Dawn under polyhouse cultivation" was conducted inside the polyhouse on the Department of horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) during 2022-2024. The aim of the experiment was to study the effect of soilless media and soil media on growth, yield and quality of strawberry under polyhouse cultivation as well as to estimate the economic values of different treatments. Rectangular pots equipped with drainage holes were used for growing the strawberry plants and the experiment was laid out in a Completely Randomized Design with twelve treatments and three replication, thus making a total of 108 plants. The various growing medias used in this research includes Cocopeat, Garden soil, FYM, Vermicompost and Biocapsule. The details of the treatment are given in Table 1. The result of using various medias on all the twelve treatments on various growth, phenological and yield parameters of strawberry plants (plant height, plant spread, survival %, number of leaves per plant, days taken to flower, days taken to fruiting, number of fruits per plant, total yield per plant were measured in this experiment. The characters of fruit (i.e fruit weight, fruit polar diameter, fruit radial diameter) and quality parameter (i.e. TSS, Titratable Acidity, Organoleptic Test) were also measured during this research.

were analyzed statistically with the help of Windows-based computer package "OPSTAT".

SL. No.	Treatment symbol	Details of treatment combination	
1.	T1	Garden soil	
2.	T2	Garden soil + Farmyard manure (1:1)	
3.	Т3	Garden soil + FYM + vermicompost (1:1:1)	
4.	T4	Cocopeat	
5.	T5	Cocopeat + FYM (1:1)	
6.	T6	Cocopeat + FYM + Vermicompost (1:1:1)	
7.	Τ7	Garden soil (along with biocapsule@500ppm)	
8.	Т8	Garden soil + Farmyard manure {(1:1) along with biocapsule@500ppm}	
9	Т9	Garden soil + FYM + vermicompost(1:1:1) along with biocapsule@500ppm}	
10	T10	Cocopeat (along with biocapsule@500ppm)	
11	T11	{Cocopeat + FYM (1:1) along with biocapsule@500ppm}	
12	T12	{Cocopeat + FYM + Vermicompost(1:1:1) along with biocapsule@500ppm}	

Table 1: Treatment Details

#### **Results and Discussions**

### Effect of Potting media and Biocapsule on Physical Parameters:

The plant height at 30 days after transplanting was recorded the highest in T11{Cocopeat + FYM (1:1) along with biocapsule@500ppm} with 8.66 cm which was followed T12 {Cocopeat + FYM + Vermicompost (1:1:1) along with biocapsule@500ppm} with 7.77 cm while minimum value (4.11 cm) was recorded in treatment T4 (Garden Soil + Farmyard manure + Vermicompost) (1:1:1). The plant height at 60 days after transplanting was recorded the highest in T11{Cocopeat + FYM (1:1) along with biocapsule@500ppm} with 11.44 cm which was followed T12 {Cocopeat + FYM + Vermicompost (1:1:1) along with biocapsule@500ppm} with 10.44 cm while minimum value (5.11 cm) was recorded in treatment T4 (Garden Soil + Farmyard manure + Vermicompost) (1:1:1). The plant height at 90 days after transplanting was recorded the highest in T11{Cocopeat + FYM (1:1) along with biocapsule@500ppm} with 13.22 cm which was followed T12 {Cocopeat + FYM + Vermicompost (1:1:1) along with biocapsule@500ppm} with 11.44 cm while minimum value (9.77 cm) was recorded in treatment T4 (Garden Soil + Farmyard manure + Vermicompost) (1:1:1). The plant height at 120 days after transplanting was recorded the highest in T11{Cocopeat + FYM (1:1) along with biocapsule@500ppm} with 18.22 cm which was followed T12 {Cocopeat + FYM + Vermicompost(1:1:1) along with biocapsule@500 ppm} with 17.33 cm cm while minimum value (13.00 cm) was recorded in treatment T4 (Garden Soil + Farmyard manure + Vermicompost) (1:1:1). According to Rai et al., (2024) [48] in his research, the used of FYM and cocopeat along with biocapsule result in better physical parameter. Similar findings were reported by Singh et al.,  $(2022)^{[52]}$  in (Chrysanthemum × morifolium Ramat.) where used of Cocopeat by combining with other growing medias result in maximum plant height. The used of FYM and cocopeat might have improved the fertility of the soil and created an atmosphere that was ideal for the plant growth since they are rich in nutrients and advantageous microbes. Biocapsules also contained vital nutrients and chemicals to promote the plant growth resulting in increase of plant height. The increase in plant height might be due to the presence of nutrients and sufficient pore spaces in cocopeat having the properties of increased cation exchange capacity, better distribution of moisture, water retention capacity, and better holding capacity of water and nutrients (Firoozabadi et al., 2009; Por-Hossein et al., 2009)<sup>[35, 47]</sup>.

Table 2: Effect of Potting media and Biocapsule on plant height of strawberry under polyhouse cultivation

Treatment Details	30 Days	60 Days	90 Days	120 Days
T1 Garden soil	5.33	8.44	10.11	14.55
T2 (Garden Soil + Farmyard manure) (1:1)	6.00	8.89	10.22	15.22
T3 (Garden Soil + Farmyard manure + Vermicompost) (1:1:1)	5.11	6.22	10.33	15.44
T4 Cocopeat	4.11	5.11	9.77	13.00
T5 (Cocopeat + Farmyard manure) (1:1)	5.11	8.55	10.55	16.00
T6 (Cocopeat + Farmyard manure + Vermicompost) (1:1:1)	5.00	6.88	10.11	15.33
T7 (Garden Soil + Biocapsule@500ppm)	5.22	9.00	10.22	15.89
T8 (Garden Soil + FYM + Biocapsule (1:1: @500ppm)	5.44	9.66	10.22	15.33
T9 (Garden Soil + FYM + Vermicompost + Biocapsule)(1:1:1:@500ppm)	6.11	7.44	10.00	14.11
T10 (Cocopeat + Biocapsule @500ppm)	7.66	9.89	10.78	16.55
T11 (Cocopeat + FYM + Biocapsule)(1:1:@500ppm)	8.66	11.44	13.22	18.22
T12 (Cocopeat + FYM + Vermicompost + Biocapsule (1:1:1:@500ppm)	7.77	10.44	11.44	17.33
C.D. (5%)	1.38	1.28	1.10	2.53
SE(m)	0.47	0.43	0.37	0.86
SE(d)	0.66	0.62	0.53	1.22
C.V.	13.72	8.94	6.12	9.59

The data presented in Table 3 shows that under polyhouse, the number of leaves per plant for 30 DAP varied significantly in all the different treatments. For 60 days, maximum number of leaves per plant (8.77) was recorded in treatment T11 (Cocopeat

+ FYM + Biocapsule) (1:1:@500ppm) while minimum number of leaves per plant (2.77) was recorded in T4 (Cocopeat). Maximum number of leaves per plant for 60 days with (15.88) was recorded in treatment T11 (Cocopeat + FYM + Biocapsule) (1:1:@500ppm) while minimum number of leaves per plant (14.00) was recorded in T4 (Cocopeat). For 90 days, the maximum number of leaves per plant (19.55) was recorded in treatment T11 (Cocopeat + FYM + Biocapsule) (1:1:@500ppm) while minimum number of leaves per plant (16.33) was recorded in T4 (Cocopeat). For 120 days, the maximum number of leaves per plant (26.66) was recorded in treatment T11 (Cocopeat + FYM + Biocapsule) (1:1:@500ppm) while minimum number of leaves per plant (26.61) was recorded in treatment T11 (Cocopeat + FYM + Biocapsule) (1:1:@500ppm) while minimum number of leaves per plant (23.11) was recorded in T4 (Cocopeat).

The increase in number of leaves per plant might be due to the application of biocapsules along with other medias rich in nutrients on Strawberry. The used of cocopeat might have positive impact on the growth of plants as it can retain water and contains essential nutrients and as a result, it might have showed significant increased in number of leaves. FYM helps in improving soil structure and soil biomass (Dauda *et al.*, 2008) <sup>[18]</sup>. FYM helps the root to uptake more nutrients. Because of that, the number of leaves might have increased.

Table 3: Effect of Potting media and Biocapsule on number of leaves of strawberry under polyhouse cultivation

Treatment Details	30 Days	60 Days	90 Days	120 Days
T1 Garden soil	3.33	14.66	16.44	23.44
T2 (Garden Soil + Farmyard manure) (1:1)	4.00	15.11	17.88	23.89
T3 (Garden Soil + Farmyard manure + Vermicompost) (1:1:1)	5.33	14.89	16.66	24.00
T4 Cocopeat	2.77	14.00	16.33	23.11
T5 (Cocopeat + Farmyard manure) (1:1)	6.61	14.77	16.89	24.88
T6 (Cocopeat + Farmyard manure + Vermicompost) (1:1:1)	5.94	15.00	17.00	24.55
T7 (Garden Soil + Biocapsule@500ppm)	6.00	15.33	17.55	24.78
T8 (Garden Soil + FYM + Biocapsule (1:1: @500ppm)	7.66	15.22	17.44	23.66
T9 (Garden Soil + FYM + Vermicompost + Biocapsule)(1:1:1:@500ppm)	7.28	14.11	17.77	23.55
T10 (Cocopeat + Biocapsule @500ppm)	8.00	15.55	18.77	25.44
T11 (Cocopeat + FYM + Biocapsule)(1:1:@500ppm)	8.77	15.88	19.55	26.66
T12 (Cocopeat + FYM + Vermicompost + Biocapsule (1:1:1:@500ppm)	8.39	15.78	19.22	25.88
C.D. (5%)	0.48	0.82	0.78	1.36
SE(m)	0.16	0.28	0.26	0.46
SE(d)	0.23	0.39	0.37	0.65
C.V.	4.66	3.24	2.61	3.28

The data (Table 4) pertaining to the effect of different treatment on plant spread of strawberry cv. Winter Dawn under polyhouse. For 30 DAP, the maximum plant spread (6.44 cm) was recorded in treatment T11(Cocopeat + FYM + Biocapsule)(1:1:@500ppm) while the minimum plant spread (2.39 cm) was recorded at T4 (Cocopeat). The plant spread for 60 DAP, the maximum leaf area (9.33 cm) was recorded in treatment T11(Cocopeat + FYM + Biocapsule) (1:1:@500ppm) while the minimum plant spread (4.05 cm) was recorded at T4 (Cocopeat).

For 90 DAP the maximum leaf area (11.89 cm) was recorded in treatment T11(Cocopeat + FYM + Biocapsule) (1:1:@500ppm) while the minimum plant spread (7.16 cm) was recorded at T4 are in complete agreement with Umar *et al.*, (2009) <sup>[58]</sup> in

(Cocopeat). For 120 DAP, the maximum leaf area (16.22 cm) was recorded in treatment T11(Cocopeat + FYM + Biocapsule) (1:1:@500ppm) while the minimum plant spread (11.61 cm) was recorded at T4 (Cocopeat). These might be due to the fact higher micronutrients, macronutrients, that there are carbohydrates (%) and protein (%) contents as a result of using cocopeat, FYM and biocapsule as medias leading to balanced NPK. Godara et al., Sharma (2016) [36] experimented on effect of soilless growing media on container with strawberry cv. Sweet Charlie and conclude that maximum spread of plant was shown with the used of cocopeat. The plant spread increased with the application of organic and inorganic fertilizers at different levels. These findings strawberry.

Table 4: Effect of Potting media and Biocapsule on Plant Spread of strawberry under polyhouse cultivation

Treatment Details	30 Days	60 Days	90 Days	120 Days
T1 Garden soil	4.72	5.05	8.77	12.27
T2 (Garden Soil + Farmyard manure) (1:1)	6.89	7.05	9.94	13.11
T3 (Garden Soil + Farmyard manure + Vermicompost) (1:1:1)	4.90	6.33	9.44	14.11
T4 Cocopeat	2.39	4.05	7.16	11.61
T5 (Cocopeat + Farmyard manure) (1:1)	4.55	7.66	7.66	13.78
T6 (Cocopeat + Farmyard manure + Vermicompost) (1:1:1)	4.05	6.66	8.89	14.00
T7 (Garden Soil + Biocapsule@500ppm)	5.33	7.16	8.55	13.72
T8 (Garden Soil + FYM + Biocapsule (1:1: @500ppm)	4.50	6.73	8.00	13.00
T9 (Garden Soil + FYM + Vermicompost + Biocapsule)(1:1:1:@500ppm)	4.33	7.89	9.00	12.61
T10 (Cocopeat + Biocapsule @500ppm)	5.55	8.66	10.16	14.94
T11 (Cocopeat + FYM + Biocapsule) (1:1:@500ppm)	6.44	9.33	11.89	16.22
T12 (Cocopeat + FYM + Vermicompost + Biocapsule (1:1:1:@500ppm)	5.66	8.99	10.89	15.05
C.D. (5%)	0.61	0.82	1.36	0.90
SE(m)	0.21	0.28	0.46	0.30
SE(d)	0.29	0.39	0.65	0.43
C.V.	7.37	6.80	8.73	3.89

The survival percentage of the strawberry plant (Table 5) revealed that under polyhouse the highest survival % was

recorded in T11{(Cocopeat + FYM + Biocapsule) (1:1:@500ppm)} with 88.66%. While the minimum survival percentage was recorded in T4(Cocopeat) with 67.78. These result might be due to the presence of organic-rich media that support the absorption of nutrients and microbial activity resulting in strengthened root systems and overall vitality increasing the survival percentage used of FYM cocopeat and biocapsule. The provable reason of highest survival % can be that FYM, cocopeat and biocapsule content relatively high humus-like compounds, active micro-organisms, enzymes as well a physical and nutritional condition. Godara *et al.*, Sharma  $(2016)^{[36]}$  reported that among the different organic media, the used of Cocopeat and Vermicompost results in highest survival percentage in Strawberry (*Fragaria ananassa Duch.*).

Table 5: Effect of Potting m	edia and Biocapsule on	Survival Percentage of str	awberry fruit under	polyhouse cultivation
0	1	0		

Treatment Details	Survival Percentage (%)
T1 Garden soil	69.33
T2 (Garden Soil + Farmyard manure) (1:1)	79.89
T3 (Garden Soil + Farmyard manure + Vermicompost) (1:1:1)	73.77
T4 Cocopeat	67.78
T5 (Cocopeat + Farmyard manure) (1:1)	71.88
T6 (Cocopeat + Farmyard manure + Vermicompost) (1:1:1)	77.55
T7 (Garden Soil + Biocapsule@500ppm)	70.67
T8 (Garden Soil + FYM + Biocapsule (1:1: @500ppm)	68.55
T9 (Garden Soil + FYM + Vermicompost + Biocapsule)(1:1:1:@500ppm)	72.55
T10 (Cocopeat + Biocapsule @500ppm)	81.77
T11 (Cocopeat + FYM + Biocapsule) (1:1:@500ppm)	88.66
T12 (Cocopeat + FYM + Vermicompost + Biocapsule(1:1:1:@500ppm)	83.44
C.D. (5%)	0.56
SE(m)	0.19
SE(d)	0.27
C.V.	0.44

### Effect of Potting media and Biocapsule on Physical parameter

(Table 6) The treatment T4 (Cocopeat) was recorded the maximum number of days taken for flowering with 66.33 days whereas the minimum number of days taken for 1st flower appearance was recorded in treatment T11 {(Cocopeat + FYM + Biocapsule) (1:1:@500ppm)} with 58.55 days. The treatment T4 (Cocopeat) was recorded the maximum number of days taken for 1st fruit appearance with 83.22 days whereas the minimum number of days taken for 1st fruit appearance was recorded in treatment T11 {(Cocopeat + FYM + Biocapsule) (1:1:@500ppm)} with 68.11 days. These result could be due to the used of biocapsule. It may have enhanced essential nutrients to the plants that increases physical attributes of the fruit. (Singh et al., 2023)<sup>[9]</sup>. Odongo et al., (2008)<sup>[45]</sup> reported an increase in photosynthate production due to phosphorus contents in FYM which helped to break bud dormancy and increased flowering sites. The faster days taken for flowering and fruiting in T11 may be due to used Biocapsule, cocopeat and FYM. Biocapsule may have allows faster flowering and fruiting since it contained vital nutrients and chemicals that promote the growth of plants.

Used of cocopeat may also have resulted in faster flowering and fruiting due to high nutrient composition i.e. 1.32% (NPK) providing more aeration space allowing the root to uptake more nutrients.It also obtained optimum soil moisture levels promoting rapid root establishment and early flowering. The used of these three medias might have created a favourable growing environment that encourages the strawberries to reached maturity quicker resulting in shorter duration to the first fruit harvest in potted strawberry plants. Better flowering and berry set in artificial media compared to soil media may have resulted due to the improvement in root zone environment. These observations are supported by the findings of Nourizadeh (2003)<sup>[44]</sup> as well as Thakur and Shylla (2018)<sup>[56]</sup> who reported the increased number of flowers in plants due to suitable conditions in soilless substrate by way of better aeration and better water availability. However, these results are in contrast to the findings of Joshi (2003) [40] who obtained non-significant effect of soilless media on number of days to first flower and duration of flowering. Ali et al., (2003) <sup>[5]</sup> found that farm vard manure produced maximum number of flowers and fruits in cv. Chandler strawberry.

 Table 6: Effect of Potting media and Biocapsule on plant Physical Parameter of strawberry under polyhouse cultivation.

Treatment Details	Days taken to 1st Flowering	Days taken to 1st fruiting
T1 Garden soil	65.88	82.66
T2 (Garden Soil + Farmyard manure) (1:1)	64.00	73.22
T3 (Garden Soil + Farmyard manure + Vermicompost) (1:1:1)	61.22	74.55
T4 Cocopeat	66.33	83.22
T5 (Cocopeat + Farmyard manure) (1:1)	64.78	82.22
T6 (Cocopeat + Farmyard manure + Vermicompost) (1:1:1)	65.55	72.44
T7 (Garden Soil + Biocapsule@500ppm)	62.55	77.11
T8 (Garden Soil + FYM + Biocapsule (1:1: @500ppm)	63.00	76.22
T9 (Garden Soil + FYM + Vermicompost + Biocapsule )(1:1:1:@500ppm)	67.11	74.55
T10 (Cocopeat + Biocapsule @500ppm)	60.44	71.66
T11 (Cocopeat + FYM + Biocapsule) (1:1:@500ppm)	58.55	68.11
T12 (Cocopeat + FYM + Vermicompost + Biocapsule (1:1:1:@500ppm)	59.00	69.22
C.D. (5%)	3.64	1.90
SE(m)	1.24	0.64
SE(d)	1.75	0.91
C.V.	3.40	1.48

Effect of Potting media and Biocapsule on Fruit Characters As shown in Table 7, the maximum fruit weight (31.22g) was recorded in treatment T11 (Cocopeat + FYM + Biocapsule) (1:1:@500ppm) which was followed by T12 (Cocopeat + FYM + Vermicompost + Biocapsule (1:1:1:@500ppm) with (30.72g) while the minimum fruit weight (11.38g) was recorded on T4(Cocopeat). The maximum fruit polar diameter (5.66 cm) was recorded in treatment T11 (Cocopeat + FYM + Biocapsule) (1:1:@500ppm) while the minimum fruit polar diameter (3.05 cm) was recorded in T4 (Cocopeat). The maximum fruit radial diameter (3.83 cm) was recorded in treatment T11 (Cocopeat + FYM + Biocapsule) (1:1:@500ppm) while the minimum fruit radial diameter (2.55 cm) was recorded with T4 (Cocopeat). Raja *et al.*, (2018) carried out a study on influence of different medias on growth and its quality in soilless culture system (Strawberry cv. Chandler). The study revealed that the used of cocopeat along with other medias gave the maximum fruit weight, fruit polar diameter and fruit radial diameter.

Table 7: Effect of Potting media and Biocapsule on Fruit Character of strawberry cv. Winter Dawn under polyhouse cultivation.

Treatment Details	Fruit Length ( cm)	Fruit diameter ( cm)	Fruit weight (gm)
T1 Garden soil	4.72	3.00	12.77
T2 (Garden Soil + Farmyard manure) (1:1)	5.11	3.61	28.55
T3 (Garden Soil + Farmyard manure + Vermicompost) (1:1:1)	4.90	3.11	22.05
T4 Cocopeat	3.05	2.55	11.38
T5 (Cocopeat + Farmyard manure) (1:1)	4.39	3.28	27.50
T6 (Cocopeat + Farmyard manure + Vermicompost) (1:1:1)	4.05	3.38	24.00
T7 (Garden Soil + Biocapsule@500ppm)	5.33	3.16	26.88
T8 (Garden Soil + FYM + Biocapsule (1:1: @500ppm)	4.50	3.50	23.55
T9 (Garden Soil + FYM + Vermicompost + Biocapsule)(1:1:1:@500ppm)	4.33	3.55	25.77
T10 (Cocopeat + Biocapsule @500ppm)	5.50	3.66	29.66
T11 (Cocopeat + FYM + Biocapsule) (1:1:@500ppm)	5.66	3.83	31.22
T12 (Cocopeat + FYM + Vermicompost + Biocapsule (1:1:1:@500ppm)	5.55	3.72	30.72
C.D. (5%)	0.54	0.46	0.61
SE(m)	0.18	0.15	0.21
SE(d)	0.26	0.22	0.29
C.V.	6.79	8.15	1.48

Effect of Potting media and Biocapsule on Yield Parameters: Here, the observations on total number of fruits per plant for the three harvests were statistically analyzed and have been presented (Table 8). The table shows that the maximum total number of fruits per plant was recorded with (14.55) in the treatment T11(Cocopeat + FYM + Biocapsule) (1:1:@500ppm) followed by treatment T12 (Cocopeat + FYM + Vernicompost + Biocapsule (1:1:1:@500ppm) with (14.11) and the minimum total number of fruits per plant was recorded in T4 (Cocopeat ) with (7.11). These result may be due to the used of different dozes of organic manures and growing conditions. It may also be due to the used of cocopeat that results in accumulation of

starch, carbohydrates, thereby increasing the number of berries.

The suitable atmosphere in root zonal area in soilless substrate leads to variation in number of berries (Ebrahimi *et al.*, 2012)

<sup>[25]</sup>. They also revealed that the combination of different growing medias most probably provided a better atmosphere for root

growth and prevents tension in water and produced a greater number of berries. Herencia *et al.*, (2011) <sup>[38]</sup> investigated the effect of organic fertilized soils on flowering and fruiting in strawberry found that vegetative stages of strawberries completed earlier on FYM leading to early onset of reproductive stage. According to Singh *et al.*, (2020) <sup>[54]</sup>, in one of his research reported that max. number of fruits/ plant was found with the used of FYM in hybrid cucumber. Different combinations of media have also been reported to improve aeration resulting in the formation of better root system (Yuan *et al.*, 1996 <sup>[60]</sup> and Verdonck and Demeyer, 2001) <sup>[59]</sup> and resulting in higher yield (Albaho *et al.*, 2009) <sup>[3]</sup>. Various workers (Yuan *et al.* 1996; Verdonck and Demeyer, 2001; Jafarnia *et al.* 2010; Hassan *et al.* 2011) <sup>[60, 59, 5]</sup> have reported an improved aeration under soilless media combinations resulting in the formation of better root system, thereby resulting in higher yield (Du *et al.* 2007; Albaho *et al.* 2009) <sup>[3]</sup>.

Ali et al., (2003) <sup>[5]</sup> found that farm yard manure produced maximum number of flowers and fruits in cv. Chandler strawberry. Application of Cocopeat, FYM and Biocapsule brought about an increase in plant well.

Table 8: Effect of Potting media and Biocapsule on number of fruits in total harvest of strawberry under polyhouse cultivation

Treatment Details	No. of fruits from all the harvest
T1 Garden soil	8.22
T2 (Garden Soil + Farmyard manure) (1:1)	9.77
T3 (Garden Soil + Farmyard manure + Vermicompost) (1:1:1)	10.66
T4 Cocopeat	7.11
T5 (Cocopeat + Farmyard manure) (1:1)	12.00
T6 (Cocopeat + Farmyard manure + Vermicompost) (1:1:1)	12.33
T7 (Garden Soil + Biocapsule@500ppm)	13.00
T8 (Garden Soil + FYM + Biocapsule (1:1: @500ppm)	11.22
T9 (Garden Soil + FYM + Vermicompost + Biocapsule)(1:1:1:@500ppm)	11.00
T10 (Cocopeat + Biocapsule @500ppm)	13.66
T11 (Cocopeat + FYM + Biocapsule) (1:1:@500ppm)	14.55
T12 (Cocopeat + FYM + Vermicompost + Biocapsule (1:1:1:@500ppm)	14.11
C.D. (5%)	0.76
SE(m)	0.26
SE(d)	0.36
C.V.	3.93

Data recorded on total fruit yield (g) per plant under under polyhouse condition have been presented (Table 9). Maximum average yield (326.66g) was recorded in treatment T11 (Cocopeat + FYM + Biocapsule) (1:1:@500ppm) which was followed by T12 (Cocopeat + FYM + Vermicompost + Biocapsule (1:1:1:@500ppm) with (315.55g) and the total yield per plant was found lowest in T4 (Cocopeat) with a record of (200g). These result may be due to availability of essential nutrients along with favourable conditions in the media combination (i.e. FYM, cocopeat and biocapsule) which facilitated better aeration, adequate drainage and higher nutrient uptake ultimately affecting the yield Used of cocopeat will lower the electrical conductivity resulting in better adaptability of nutrients which have better effect on growth and yield of plants. Soilless culture systems are very effective and intensive to plant production. Moreover, it has higher water and nutrient used efficiencies and can produce higher yields.

Topno *et al.*, (2022) <sup>[57]</sup> reported similar finding in Chilli (*Capsicum annuum L.*) where the used Biocapsule results in maximum yield. Maximum total yield was reported with the combination of Biocapsule and other plant growth regulators by Deo *et al.*, (2022) <sup>[21]</sup>. Overall, the combination of Cocopeat, FYM, and Biocapsules can provide a balanced and supportive growing medium for strawberry plants, leading to improved yield, quality, and sustainability in cultivation practices.

Table 9: Effect of Potting media and	d Biocapsule on Total	Yield per plant of	strawberry fruit under	polyhouse cultivation
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Treatment Details	Total yield pet plant (g)
T1 Garden soil	202.22
T2 (Garden Soil + Farmyard manure) (1:1)	208.89
T3 (Garden Soil + Farmyard manure + Vermicompost) (1:1:1)	223.33
T4 (Cocopeat)	200.00
T5 (Cocopeat + Farmyard manure) (1:1)	206.66
T6 (Cocopeat + Farmyard manure + Vermicompost) (1:1:1)	224.44
T7 (Garden Soil + Biocapsule @500ppm)	263.33
T8 (Garden Soil + FYM + Biocapsule (1:1: @500ppm)	273.33
T9 (Garden Soil + FYM + Vermicompost + Biocapsule) (1:1:1:@500ppm)	280.00
T10 (Cocopeat + Biocapsule @500ppm)	300.00
T11 (Cocopeat + FYM + Biocapsule) (1:1:@500ppm)	326.66
T12 (Cocopeat + FYM + Vermicompost + Biocapsule (1:1:1:@500ppm)	315.55
C.D.	9.83
SE(m)	3.34
SE(d)	4.73
C.V.	2.30

About 5 - 55% of all women suffer from breast disorders in their lifetime. Benign disorders of the breast is usually seen in reproductive period of life, is thought to be largely hormone induced and there is a dramatic fall in the incidence, after menopause due to cessation of clinical ovarian stimulation. Benign breast disease is 4 -5 times more common than breast cancer <sup>[3]</sup>.

The concept of ANDI – Abberations of Normal Development and Involution is gaining acceptance <sup>[4]</sup>. Benign proliferation of the breast are often considered as aberrations of normal development and involution. The cyclical changes due to variations in estrogen and progesterone result in increased mitosis around days 22–24 of the menstrual cycle but apoptosis restores the balance across the cycle. ANDI, first proposed by Huges is now universally accepted. This concept allows conditions of the breast to be mapped between normality, through benign.

## Effect of Potting media and Biocapsule on Quality Parameter

Maximum T.S.S (11.890B) was recorded in treatment T11

(Cocopeat + FYM + Biocapsule) (1:1:@500ppm), which was followed by T12 (Cocopeat + FYM + Vermicompost + Biocapsule (1:1:1:@500ppm) with ((1.660B) while the minimum T.S.S (8.110B) was recorded in treatment T4 (Cocopeat). Maximum titratable acidity (0.60%) was obtained in T11 (Cocopeat + FYM + Biocapsule) (1:1:@500ppm) while the minimum titratable acidity (0.20%) was obtained in T4 (Cocopeat). These results might be due to the fact that cocopeat, FYM and biocapsule enhanced T.S.S and acidity in strawberries with the presence of macro and micro nutrients of media. The presence of potassium improves vegetative growth as well as promotes sugar accumulation which ultimately yield higher TSS. The highest in titratable acidity as shown in Table 10 might also be because of cocopeat application as media resulting in high moisture retention giving an impact in nutrient uptake and subsequently affecting titratable acidity. Kumar et al., (2015)<sup>[41]</sup> reported that used of FYM in Strawberry (Fragaria x ananassa Duch.) cv. Chandler results in highest TSS. Odongo et al., (2008) <sup>[45]</sup> reported that FYM significantly enhanced TSS contents of strawberry. Ali et al., (2003)<sup>[5]</sup> found an increased in TSS with the application of FYM.

Table 10: Quality parameter as affected by Potting media and Biocapsule on strawberry fruit cv. Winter Dawn under polyhouse cultivation

Treatment Details	Total Soluble Solids TSS (°Brix)	Titratable acidity (%)
T1 Garden soil	8.33	0.27
T2 (Garden Soil + Farmyard manure) (1:1)	9.77	0.32
T3 (Garden Soil + Farmyard manure + Vermicompost) (1:1:1)	10.66	0.42
T4 Cocopeat	8.11	0.20
T5 (Cocopeat + Farmyard manure) (1:1)	10.22	0.34
T6 (Cocopeat + Farmyard manure + Vermicompost) (1:1:1)	9.11	0.54

T7 (Garden Soil + Biocapsule @500ppm)	10.55	0.46
T8 (Garden Soil + FYM + Biocapsule (1:1: @500ppm)	10.22	0.25
T9 (Garden Soil + FYM + Vermicompost + Biocapsule)(1:1:1:@500ppm)	10.44	0.37
T10 (Cocopeat + Biocapsule @500ppm)	10.88	0.53
T11 (Cocopeat + FYM + Biocapsule) (1:1:@500ppm)	11.89	0.60
T12 (Cocopeat + FYM + Vermicompost + Biocapsule (1:1:1:@500ppm)	11.66	0.57
C.D. (5%)	0.71	0.07
SE(m)	0.24	0.02
SE(d)	0.34	0.03
C.V.	4.12	10.04

The results of Organoleptic Test are shown in Table 11. Based on Colour, T11 (Cocopeat + FYM + Biocapsule) (1:1:@500ppm) shows the highest with 8.66 while T4 (Cocopeat) shows the lowest with5.66. This result may be due to the used of biocapsule as it contain substances that influence the production of pigments responsible for fruit colour such as athocyanins in strawberry. The used of biocapsule and cocopeat might also be the reason as they can enhance the intensity and uniformity of strawberry colour by promoting healthy growth and ripening. Adequate nutrients and optimal growing conditions facilitated by cocopeat might also have contributed to vibrant fruit colouration.

Based on Taste, T11 (Cocopeat + FYM + Biocapsule) (1:1:@500ppm) shows the highest with 8.50 while T4 (Cocopeat) shows the lowest with 4.66. This might be due to the combination of the three medias as FYM enriches the soil with

organic matter and nutrients enhancing the synthesis of sugar and organic acids in strawberries. Cocopeat and bio-capsules also might have help in the improvement of soil structure and moisture management, ensuring consistent nutrient availability for flavor development.

Based on Aroma, T11 (Cocopeat + FYM + Biocapsule) (1:1:@500ppm) shows the highest with 8.33 while T4 (Cocopeat) shows the lowest with 5.66. The best result on aroma may be because of using cocopeat, FYM and biocapsule. Biocapsule contain compound that influence aroma formation during ripening process. FYM and Cocopeat contribute to healthy plant growth, which is essential for synthesis of volatile compounds responsible for aroma. Proper soil conditions provided by cocopeat might also have help in maintaining optimal microbial activity, which further enhances aroma development.

 Table 11: Result of Organoleptic test as effected by Potting media and Biocapsule on strawberry fruit under polyhouse cultivation based on colour, taste and aroma with a rating from 1-10

Treatment Details	Colour	Taste	Aroma
T1 Garden soil	6.33	5.66	6.00
T2 (Garden Soil + Farmyard manure) (1:1)	7.33	6.66	7.33
T3 (Garden Soil + Farmyard manure + Vermicompost) (1:1:1)	6.66	6.66	6.66
T4 Cocopeat	5.66	4.66	5.66
T5 (Cocopeat + Farmyard manure) (1:1)	7.33	6.66	7.33
T6 (Cocopeat + Farmyard manure + Vermicompost) (1:1:1)	7.66	6.33	6.66
T7 (Garden Soil + Biocapsule @500ppm)	8.00	6.33	6.66
T8 (Garden Soil + FYM + Biocapsule (1:1: @500ppm)	7.33	6.33	6.00
T9 (Garden Soil + FYM + Vermicompost + Biocapsule) (1:1:1:@500ppm)	7.33	6.66	6.00
T10 (Cocopeat + Biocapsule @500ppm)	8.00	7.33	7.33
T11 (Cocopeat + FYM + Biocapsule) (1:1:@500ppm)	8.66	8.50	8.33
T12 (Cocopeat + FYM + Vermicompost + Biocapsule (1:1:1:@500ppm)	8.33	7.66	8.00
C.D. (5%)	1.01	1.37	1.44
SE(m)	0.34	0.46	0.49
SE(d)	0.49	0.66	0.69
C.V.	8.13	12.26	12.43

#### Conclusion

Here, during the cultivation of strawberry cv. Winter Dawnt, the treatment that uses {(Cocopeat + FYM + Biocapsule) (1:1: @500ppm)} i.e.T11 as potting medias in rectangular plastic pots which was carried out inside the polyhouse shows the best result among all the twelve treatments. Based on the investigation's results, it can be concluded that using potting medias like Cocopeat, FYM and Biocapsule will provide the strawberry growers a significant benefits in terms of growth, quality, yield making it effective choice in the modern agriculture.

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