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# Growth and Yield Characteristics of Capsicum (*Capsicum annuum* L.) cv. Orobelle in Response to Different Growing Media and Plant Spacing under Protected Conditions

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**A B S T R A C T**

An experiment was conducted during 2015 and 2016 to study the effect of growing media and plant spacing on growth and yield of capsicum cv. Orobelle in the mid hills of Himalayas. The media consisting of Soil + Cocopeat + Vermicompost + FYM (2:1:0.5:0.5) proved to be statistically superior over rest of the growing media for almost all the aspects under investigation. All the attributes were better or at par when the plants were spaced at the wider plant spacing (45 x 60 cm). Therefore it can be inferred that incorporation of Cocopeat, Vermicompost, and FYM led to the better soil properties and nutrient supply to plants, whereas appropriate crop spacing created suitable micro environment for proper plant competition.

## Introduction

Varied agro ecological conditions offer vast scope for production of vegetables, fruits and other horticultural commodities in Himalayan regions. In general, profits are higher in off season vegetable crops provided climatic constraints are overcome by adopting protected cultivation technologies (Bisht 2012). The purpose of growing crops under greenhouse conditions is to extend cropping season and to protect them from adverse environmental conditions (Sharma *et al.*, 2010, Jaipaul *et al.*, 2011). In India, protected cultivation is gaining momentum in expansion of area and productivity of horticultural crops in a faster rate. Among various vegetable crops, capsicum fits best in summer seasons as offseason crop. Capsicum is an important commercial vegetable crop of mid and high Himalayan region and gives maximum profit to farmers during early and off-season. It is considered to be an export potential commodity. Generally, crop requires warm temperature ranging from 20 to 25ºC for its growth and development. Especially high hills and mid areas are not considered suitable for open field cultivation. In natural ventilated conditions, capsicum can be cultivated throughout the year except 2-3 months in winters. However, inclement weather accompanied by fluctuating temperature, which is a common feature in hilly regions during rainy season, affects the productivity

and quality of the produce of this crop when grown under open field conditions and finally reduces the profit margin of the producers. Under such conditions, greenhouse cultivation of capsicum (Sweet pepper) can play an important role in producing and sustaining higher yield and better quality of fruits than the open field cultivation. Greenhouse technology for vegetable production, especially at high altitudes needs to be further exploited and expanded for commercial cultivation of high quality vegetables. Greenhouse provides protection against biotic and abiotic stresses and ensures high quality produce.

The consistent and discriminate use of inorganic fertilizers have caused serious damage to soil health, ecology and caused decline in vitamin and mineral content of fresh fruits and vegetables. The addition of farm organic wastes, manures, cocopeat and vermicompost etc. are extremely important to maintain the fertility and productivity of the agricultural system. Organically grown greenhouse crops in general, have higher nutrient demands than field grown crops and therefore, in order to optimize production it is essential to focus on the growing media studies.

## Materials and Methods

The experiment was carried out in naturally ventilated polyhouse at Vegetable Research Farm of Department of Vegetable Science, Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh. Planting of capsicum cv. "Orobelle" was done in Randomized Block Design (Factorial) with three replications during the February 2015 and 2016 inside a naturally ventilated polyhouse. The different growing media in combination with different plant spacings were allotted randomly to the plots. The treatments comprised of four different growing media (M) *viz*., ($M_1$) Soil + Sand + FYM (2:1:1), ($M_2$) Soil + Cocopeat + FYM (2:1:1), ($M_3$) Soil + Cocopeat + Vermicompost (2:1:1), ($M_4$) Soil + Cocopeat + Vermicompost + FYM (2:1:0.5:0.5) and three plant spacings with different population (S) *viz*., 45×30 cm ($S_1$), 45×45 cm ($S_2$), and 45×60 cm ($S_3$). Twelve different Treatment combinations *viz*., $M_1S_1$, $M_1S_2$, $M_1S_3$, $M_2S_1$, $M_2S_2$, $M_2S_3$, $M_3S_1$, $M_3S_2$, $M_3S_3$, $M_4S_1$, $M_4S_2$, $M_4S_3$ were transplanted in the polyhouse in three replications on 15$^{th}$ April, 2015 and 2016 in a plot having size of 1.62 m$^2$. All the standard recommended cultural practices were followed to raise a successful crop during the course of investigation. Treatment details are given in the Table 1.

Data for growth and yield attributes were recorded on five randomly chosen plants in each treatment. Then the average was calculated. All the growth characters such as Days to 50 per cent flowering, days to marketable maturity, harvest duration (days), and plant height (cm), number of fruits per plant, fruit length (cm), fruit breadth (cm), average fruit weight (g), fruit yield (kg/plant and kg/m$^2$), were recorded. The cumulative value of the yield per plant and per m$^2$ was taken as and when the pickings progressed.

## Results and Discussion

### Growth parameters

The data in general revealed that the media consisting of cocopeat, vermicompost and FYM recorded the maximum growth among all the treatments. Perusal of the Table 2 and 3 showed that the minimum values for Days to 50 per cent flowering (41.89) and days to marketable maturity (71.56), whereas, maximum values for harvest duration (85.67), and plant height (154.46 cm) were recorded in $M_4$ over other growing media during both the years of experimentation. The media $M_3$

performed closely behind it and gave the second best results and many times was statistically at par to the highest readings. These results are in accordance to the studies of Roy *et al.,* (2011). They had inferred that vermicompost alone and admixed with FYM and green manure, were found to be effective in improving various plant growth parameters in capsicum. Organic material can be broken down and fragmented rapidly by earthworm, resulting in a stable nontoxic material with appropriative structure which has potentially high economic value as a soil conditioner for plant growth (Hala *et al.,* 2003). Organic growing media have a property of good water holding capacity and are also able to drain excess water to come to field capacity which creates congenial root environment. Considering the results, it is noticed that growth characters of capsicum were increased with application of cocopeat, vermicompost and FYM. These results may be attributed to the role of macro and micro-nutrients, as well as the improved soil conditions due to vermicompost application, which conduced to stimulate metabolic processes and encourage growth, synthesis and accumulation of more metabolites in plant tissues. Several investigators mentioned similar results on different plants such as Kumar and Kohli (2005) in capsicum, Natarajan (2005) in tomato, Bairwa *et al.,* (2009) in Okra. Plant spacing had a significant influence on growth characters of capsicum during both the years. Capsicum raised at 45 x 60 cm ($S_3$) obtained minimum days to 50 per cent flowering, minimum (42.29) days to marketable maturity (71.50), taller plants (151.66) and maximum harvest duration (82.71), which was statistically at par with 45 x 45 cm ($S_2$). Taller plants might be due to competition of light under $S_1$ (45 x 30 cm) with closer plant to plant space for want of light. Wider plant spacing had minimum days to 50 per cent flowering, days to marketable maturity, taller plants and highest harvest duration due to better availability of resources. Wider space availability between the plants might have increased the root spread which eventually utilized the resources such as water, nutrients, space and light very effectively. Similar results were reported by Ganjare *et al.,* (2013), Malik *et al.,* (2011), Roy *et al.,* (2011), and Kumar (2011).

## Yield parameters

It is evident from Table 4 that the yield per plant increased significantly with the incorporation of cocopeat and vermicompost together in $M_3$ media. The media consisting of cocopeat, vermicompost and FYM which was followed by $M_4$. $M_3$ recorded the highest number of fruits per plant (14.86) and fruit breadth (9.80 cm). The media $M_4$ recorded the maximum fruit length (10.25 cm), average fruit weight (192.91 g), fruit yield (2.81 kg/plant), whereas $M_1$ gave the poorest yield parameters during both the years. The treatments combining both cocopeat, vermicompost and FYM showed highest yields, while the yields of treatments using cocopeat and vermicompost were also comparable but were significantly lesser than the former. Both performed significantly better than the $M_1$. This result is in agreement of the findings of Llaven *et al.,* (2008) in bell pepper, Uma Maheshwari and Haripriya (2007) in hot pepper. The vermicompost based $M_3$ and $M_4$ media again proved to be better to others as it produced maximum yield parameters followed by $M_2$ and $M_1$ growing media. Wider spacing produced significantly more number of fruits per plant (14.39), fruit length (9.84 cm), fruit breadth (9.48 cm), average fruit weight (227.00 g), fruit yield (3.28 kg/plant) during both the years. The wider spacing leads to more growing area and better competition among plants and subsequently better growth which in turn had a positive effect on yield attributes. Similar results were recorded by Mantur *et al.,* (2005).

**Table.1** Treatment details of the experiment along with symbols

| Treatment No. | Media | Spacing | Symbol |
|---|---|---|---|
| 1. | Soil + Sand + FYM (2:1:1) | 45x30 | $M_1$ $S_1$ |
| 2. | Soil + Sand + FYM (2:1:1) | 45x45 | $M_1$ $S_2$ |
| 3. | Soil + Sand + FYM (2:1:1) | 45x60 | $M_1$ $S_3$ |
| 4. | Soil + Cocopeat + FYM (2:1:1) | 45x30 | $M_2$ $S_1$ |
| 5. | Soil + Cocopeat + FYM (2:1:1) | 45x45 | $M_2$ $S_2$ |
| 6. | Soil + Cocopeat + FYM (2:1:1) | 45x60 | $M_2$ $S_3$ |
| 7. | Soil + Cocopeat + Vermicompost (2:1:1) | 45x30 | $M_3$ $S_1$ |
| 8. | Soil + Cocopeat + Vermicompost (2:1:1) | 45x45 | $M_3$ $S_2$ |
| 9. | Soil + Cocopeat + Vermicompost (2:1:1) | 45x60 | $M_3$ $S_3$ |
| 10. | Soil + Cocopeat + Vermicompost + FYM (2:1:0.5:0.5) | 45x30 | $M_4$ $S_1$ |
| 11. | Soil + Cocopeat + Vermicompost + FYM (2:1:0.5:0.5) | 45x45 | $M_4$ $S_2$ |
| 12. | Soil + Cocopeat + Vermicompost + FYM (2:1:0.5:0.5) | 45x60 | $M_4$ $S_3$ |

**Table.2** Days to 50 per cent flowering, days to marketable maturity, harvest duration and plant height, as influenced by growing media, plant spacing and their interaction

| Treatments | Days to 50 per cent flowering | | | Days to marketable maturity | | | Harvest duration (days) | | | Plant height (cm) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2015 | 2016 | 2015 | 2016 | 2015 | 2016 | 2015 | 2016 | Pooled | 2015 | 2016 | Pooled |
| **$M_1$** | 43.00 | 46.44 | 43.00 | 46.44 | 43.00 | 46.44 | 73.00 | 69.44 | 71.22 | 145.07 | 122.14 | 133.61 |
| **$M_2$** | 41.67 | 44.56 | 41.67 | 44.56 | 41.67 | 44.56 | 82.00 | 73.67 | 77.83 | 150.24 | 138.13 | 144.19 |
| **$M_3$** | 42.00 | 43.22 | 42.00 | 43.22 | 42.00 | 43.22 | 89.11 | 82.00 | 85.56 | 156.19 | 149.51 | 150.89 |
| **$M_4$** | 41.44 | 42.33 | 41.44 | 42.33 | 41.44 | 42.33 | 90.11 | 81.22 | 85.67 | 158.76 | 150.17 | 154.46 |
| **Mean** | **42.03** | **44.14** | **42.03** | **44.14** | **42.03** | **44.14** | **83.55** | **76.58** | **80.07** | **152.57** | **139.99** | **146.79** |
| **$CD_{0.05}$** | **0.81** | **1.24** | **0.81** | **1.24** | **0.81** | **1.24** | **1.60** | **1.01** | **1.34** | **3.47** | **5.11** | **4.37** |
| **$S_1$** | 42.25 | 44.92 | 42.25 | 44.92 | 42.25 | 44.92 | 79.08 | 72.00 | 75.54 | 142.28 | 132.48 | 137.38 |
| **$S_2$** | 42.42 | 44.25 | 42.42 | 44.25 | 42.42 | 44.25 | 85.25 | 78.67 | 81.96 | 157.42 | 142.17 | 148.33 |
| **$S_3$** | 41.42 | 43.25 | 41.42 | 43.25 | 41.42 | 43.25 | 86.33 | 79.08 | 82.71 | 158.00 | 145.31 | 151.66 |
| **Mean** | **42.03** | **44.14** | **42.03** | **44.14** | **42.03** | **44.14** | **83.55** | **76.58** | **80.07** | **152.57** | **139.99** | **146.79** |
| **$CD_{0.05}$** | **0.71** | **1.07** | **0.71** | **1.07** | **0.71** | **1.07** | **1.39** | **0.87** | **1.16** | **3.00** | **4.43** | **3.78** |
| **Interaction :** | | | | | | | | | | | | |
| **$M_1S_1$** | 43.00 | 48.33 | 45.67 | 72.67 | 74.67 | 73.67 | 70.00 | 65.00 | 67.50 | 132.40 | 115.00 | 123.70 |
| **$M_1S_2$** | 44.00 | 45.67 | 44.83 | 72.33 | 74.00 | 73.17 | 77.00 | 72.33 | 74.67 | 154.67 | 122.17 | 138.42 |
| **$M_1S_3$** | 42.00 | 45.33 | 43.67 | 72.00 | 73.67 | 72.83 | 72.00 | 71.00 | 71.50 | 148.15 | 129.27 | 138.71 |
| **$M_2S_1$** | 42.33 | 44.33 | 43.33 | 72.33 | 73.67 | 73.00 | 72.00 | 67.33 | 69.67 | 136.40 | 122.32 | 129.36 |
| **$M_2S_2$** | 41.00 | 45.00 | 43.00 | 71.00 | 72.33 | 71.67 | 85.00 | 75.33 | 80.17 | 156.67 | 143.35 | 150.01 |
| **$M_2S_3$** | 41.67 | 44.33 | 43.00 | 70.67 | 72.00 | 71.33 | 89.00 | 78.33 | 83.67 | 157.67 | 148.72 | 153.19 |
| **$M_3S_1$** | 42.33 | 44.00 | 43.17 | 71.67 | 73.33 | 72.50 | 86.33 | 80.00 | 83.17 | 150.13 | 146.85 | 148.49 |
| **$M_3S_2$** | 42.67 | 43.67 | 43.17 | 71.33 | 72.67 | 72.00 | 89.00 | 82.33 | 85.67 | 157.59 | 150.75 | 148.29 |
| **$M_3S_3$** | 41.00 | 42.00 | 41.33 | 70.67 | 71.67 | 71.17 | 92.00 | 83.67 | 87.83 | 160.84 | 150.94 | 155.89 |
| **$M_4S_1$** | 41.33 | 43.00 | 42.17 | 72.00 | 73.33 | 72.67 | 88.00 | 75.67 | 81.83 | 150.17 | 145.75 | 147.96 |
| **$M_4S_2$** | 42.00 | 42.67 | 42.33 | 71.00 | 71.67 | 71.33 | 90.00 | 84.67 | 87.33 | 160.77 | 152.42 | 156.59 |
| **$M_4S_3$** | 41.00 | 41.33 | 41.17 | 70.00 | 71.33 | 70.67 | 92.33 | 83.33 | 87.83 | 165.34 | 152.33 | 158.83 |
| **Mean** | **42.03** | **44.14** | **43.07** | **71.47** | **72.86** | **72.17** | **83.55** | **76.58** | **80.07** | **152.57** | **139.99** | **146.79** |
| **$CD_{0.05}$** | **NS** | **NS** | **NS** | **NS** | **NS** | **NS** | **2.78** | **1.74** | **2.32** | **6.00** | **8.85** | **7.56** |

**Table.3** No. of fruits per plant, average fruit weight, fruit length, fruit breadth as influenced by growing media, plant spacing and their interaction

| Treatments | No. of fruits per plant | | | Average fruit weight (g) | | | Fruit length (cm) | | | Fruit breadth (cm) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2015 | 2016 | Pooled | 2015 | 2016 | Pooled | 2015 | 2016 | Pooled | 2015 | 2016 | Pooled |
| $M_1$ | 12.02 | 11.60 | 11.81 | 149.48 | 148.46 | 148.97 | 8.62 | 8.33 | 8.48 | 7.86 | 7.96 | 7.91 |
| $M_2$ | 13.91 | 13.01 | 13.46 | 163.93 | 157.20 | 160.57 | 9.53 | 8.93 | 9.23 | 9.04 | 8.58 | 8.81 |
| $M_3$ | 15.41 | 14.32 | 14.86 | 180.54 | 190.00 | 185.27 | 10.13 | 10.18 | 10.15 | 9.73 | 9.87 | 9.80 |
| $M_4$ | 15.00 | 13.96 | 14.48 | 188.72 | 197.10 | 192.91 | 10.28 | 10.21 | 10.25 | 9.77 | 9.66 | 9.72 |
| **Mean** | **14.08** | **13.22** | **13.65** | **171.67** | **173.19** | **171.86** | **9.63** | **9.41** | **9.53** | **9.11** | **9.02** | **9.06** |
| $CD_{0.05}$ | **0.69** | **0.63** | **0.66** | **9.09** | **10.74** | **9.95** | **0.29** | **0.15** | **0.23** | **0.28** | **0.17** | **0.23** |
| $S_1$ | 13.42 | 12.52 | 12.97 | 121.62 | 120.94 | 121.09 | 9.07 | 8.78 | 8.93 | 8.41 | 8.20 | 8.30 |
| $S_2$ | 13.95 | 13.25 | 13.60 | 165.84 | 169.16 | 167.50 | 9.89 | 9.72 | 9.81 | 9.38 | 9.42 | 9.40 |
| $S_3$ | 14.88 | 13.90 | 14.39 | 224.54 | 229.47 | 227.00 | 9.94 | 9.74 | 9.84 | 9.53 | 9.43 | 9.48 |
| **Mean** | **14.08** | **13.22** | **13.65** | **171.67** | **173.19** | **171.86** | **9.63** | **9.41** | **9.53** | **9.11** | **9.02** | **9.06** |
| $CD_{0.05}$ | **0.57** | **0.54** | **0.57** | **7.87** | **9.30** | **8.61** | **0.25** | **0.13** | **0.20** | **0.25** | **0.15** | **0.20** |
| **Interaction** | | | | | | | | | | | | |
| $M_1S_1$ | 10.67 | 10.25 | 10.46 | 117.49 | 115.97 | 116.73 | 8.40 | 8.00 | 8.20 | 7.43 | 7.52 | 7.47 |
| $M_1S_2$ | 12.50 | 12.25 | 12.38 | 135.31 | 136.73 | 136.02 | 8.71 | 8.75 | 8.73 | 8.32 | 8.50 | 8.41 |
| $M_1S_3$ | 12.90 | 12.30 | 12.60 | 195.64 | 192.67 | 194.16 | 8.74 | 8.25 | 8.50 | 7.84 | 7.87 | 7.86 |
| $M_2S_1$ | 13.00 | 11.98 | 12.49 | 120.32 | 117.55 | 118.94 | 8.76 | 8.25 | 8.51 | 8.34 | 7.77 | 8.06 |
| $M_2S_2$ | 13.32 | 12.64 | 12.98 | 165.27 | 156.02 | 160.65 | 9.92 | 9.03 | 9.48 | 9.58 | 8.75 | 9.17 |
| $M_2S_3$ | 15.42 | 14.41 | 14.91 | 206.21 | 198.03 | 202.12 | 9.90 | 9.50 | 9.70 | 9.20 | 9.22 | 9.21 |
| $M_3S_1$ | 15.27 | 14.26 | 14.77 | 121.22 | 122.02 | 121.62 | 9.43 | 9.45 | 9.44 | 9.03 | 9.15 | 9.09 |
| $M_3S_2$ | 15.32 | 14.39 | 14.85 | 173.52 | 183.36 | 178.44 | 10.42 | 10.50 | 10.46 | 9.83 | 10.20 | 10.02 |
| $M_3S_3$ | 15.63 | 14.30 | 14.97 | 246.86 | 264.62 | 255.74 | 10.53 | 10.58 | 10.56 | 10.34 | 10.25 | 10.30 |
| $M_4S_1$ | 14.75 | 13.57 | 14.16 | 127.45 | 128.21 | 127.83 | 9.70 | 9.43 | 9.57 | 8.84 | 8.36 | 8.60 |
| $M_4S_2$ | 14.67 | 13.73 | 14.20 | 189.25 | 200.53 | 194.89 | 10.53 | 10.59 | 10.56 | 9.77 | 10.22 | 9.99 |
| $M_4S_3$ | 15.58 | 14.59 | 15.09 | 249.44 | 262.57 | 256.01 | 10.60 | 10.62 | 10.61 | 10.72 | 10.40 | 10.56 |
| **Mean** | **14.08** | **13.22** | **13.65** | **171.67** | **173.19** | **171.86** | **9.63** | **9.41** | **9.53** | **9.11** | **9.02** | **9.06** |
| $CD_{0.05}$ | **1.14** | **1.08** | **1.14** | **15.74** | **18.60** | **17.23** | **NS** | **0.26** | **0.40** | **0.49** | **0.29** | **0.40** |

**Table.4** Yield of sweet pepper as influenced by growing media, plant spacing and their interaction

| Treatments | Fruit yield (kg/plant) | | | Fruit yield (kg/m$^2$) | | |
|---|---|---|---|---|---|---|
| | 2015 | 2016 | Pooled | 2015 | 2016 | Pooled |
| $M_1$ | 1.82 | 1.74 | 1.78 | 10.07 | 9.66 | 9.86 |
| $M_2$ | 2.31 | 2.07 | 2.19 | 12.78 | 11.47 | 12.13 |
| $M_3$ | 2.79 | 2.72 | 2.75 | 15.38 | 14.94 | 15.16 |
| $M_4$ | 2.85 | 2.77 | 2.81 | 15.74 | 15.24 | 15.49 |
| **Mean** | **2.44** | **2.33** | **2.38** | **13.49** | **12.83** | **13.16** |
| **$CD_{0.05}$** | **0.09** | **0.09** | **0.09** | **0.59** | **0.49** | **0.54** |
| $S_1$ | 1.64 | 1.52 | 1.58 | 13.08 | 12.11 | 12.59 |
| $S_2$ | 2.33 | 2.26 | 2.29 | 13.97 | 13.54 | 13.75 |
| $S_3$ | 3.36 | 3.21 | 3.28 | 13.43 | 12.83 | 13.13 |
| **Mean** | **2.44** | **2.33** | **2.38** | **13.49** | **12.83** | **13.16** |
| **$CD_{0.05}$** | **0.08** | **0.08** | **0.08** | **0.51** | **0.43** | **0.47** |
| **Interaction :** | | | | | | |
| $M_1S_1$ | 1.25 | 1.18 | 1.22 | 10.03 | 9.43 | 9.75 |
| $M_1S_2$ | 1.69 | 1.67 | 1.68 | 10.12 | 10.01 | 10.07 |
| $M_1S_3$ | 2.52 | 2.37 | 2.44 | 10.07 | 9.46 | 9.77 |
| $M_2S_1$ | 1.56 | 1.40 | 1.48 | 12.48 | 11.20 | 11.84 |
| $M_2S_2$ | 2.19 | 1.97 | 2.08 | 13.15 | 11.82 | 12.49 |
| $M_2S_3$ | 3.18 | 2.85 | 3.01 | 12.70 | 11.40 | 12.05 |
| $M_3S_1$ | 1.85 | 1.74 | 1.79 | 14.77 | 13.89 | 14.33 |
| $M_3S_2$ | 2.66 | 2.64 | 2.65 | 15.93 | 15.80 | 15.88 |
| $M_3S_3$ | 3.85 | 3.78 | 3.82 | 15.41 | 15.12 | 15.27 |
| $M_4S_1$ | 1.88 | 1.74 | 1.81 | 15.04 | 13.91 | 14.48 |
| $M_4S_2$ | 2.77 | 2.75 | 2.76 | 16.64 | 16.50 | 16.57 |
| $M_4S_3$ | 3.89 | 3.83 | 3.86 | 15.55 | 15.30 | 15.43 |
| **Mean** | **2.44** | **2.33** | **2.38** | **13.49** | **12.83** | **13.16** |
| **$CD_{0.05}$** | **1.15** | **0.16** | **0.16** | **NS** | **0.86** | **0.94** |

**Table.5** Cost of cultivation of capsicum production as affected by different treatments

| Sr. No. | Treatment | Fruit yield (kg/m$^2$) | Gross returns (Rs./m$^2$) | Cost of cultivation/ treatment | Net returns (Rs. /m$^2$) | Benefit-cost ratio |
|---|---|---|---|---|---|---|
| 1. | $M_1S_1$ | 9.75 | 585.00 | 260.45 | 324.55 | 1.25 |
| 2. | $M_1S_2$ | 10.07 | 604.20 | 258.45 | 345.75 | 1.34 |
| 3. | $M_1S_3$ | 9.77 | 586.20 | 256.45 | 329.75 | 1.29 |
| 4. | $M_2S_1$ | 11.84 | 710.40 | 276.42 | 433.98 | 1.57 |
| 5. | $M_2S_2$ | 12.49 | 749.40 | 274.42 | 474.98 | 1.73 |
| 6. | $M_2S_3$ | 12.05 | 723.00 | 272.42 | 450.58 | 1.65 |
| 7. | $M_3S_1$ | 14.33 | 859.80 | 343.14 | 516.66 | 1.51 |
| 8. | $M_3S_2$ | 15.88 | 952.80 | 341.14 | 611.66 | 1.79 |
| 9. | $M_3S_3$ | 15.27 | 916.20 | 339.14 | 577.06 | 1.70 |
| 10. | $M_4S_1$ | 14.48 | 868.80 | 309.78 | 559.02 | 1.80 |
| 11. | $M_4S_2$ | 16.57 | 994.20 | 307.78 | 686.42 | 2.23 |
| 12. | $M_4S_3$ | 15.43 | 925.80 | 305.78 | 620.02 | 2.03 |

A significant interaction between both the factors was recorded for yield per plant in $M_4S_3$ and $M_4S_2$ during both the years. The interaction of the $M_4$ growing media with wider spacing of 45 x 60 $cm^2$ proved to be superior over the other treatment combinations. The comparison between $M_4S_3$ and $M_4S_2$ revealed that although the $M_4S_3$ enhanced the growth and yield characters, the yield per $m^2$ was higher at the $M_4S_2$ (16.50 kg). This was probably due to the increase in the number of plants per unit area in 45 x 45 $cm^2$ plant spacing, which might contribute to the extra yield per unit area leading to the high yield (Law-Ogboma and Egharevba, 2009).

## Benefit: Cost ratio

The impact of growing media and plant spacing on benefit: cost ratio in capsicum cv. Orobelle under protected conditions has been worked. Therefore, for the economical analysis of various treatment combination of growing media and plant spacing the gross return, net return and B: C ratio have been studied. The relevant data is presented in Table 5. In the present investigation, maximum B: C ratio of 2.23:1 was obtained with combination $M_4S_2$ (Soil + Cocopeat + Vermicompost + FYM (2:1:0.5:0.5) with plant spacing 45 x 45 cm), which was very close with the treatment combination $M_4S_3$ (Soil + Cocopeat + Vermicompost + FYM (2:1:0.5:0.5) with plant spacing 45 x 60 cm) which obtained the B: C ratio of 2.03:1, whereas, minimum B: C ratio (1.25:1) was resulted from the treatment $M_1S_1$ (Soil + Sand + FYM (2:1:1) with plant spacing 45 x 30) cm.

The result of this investigation showed that the growing media Soil + Cocopeat + Vermicompost + FYM (2:1:0.5:0.5) at a plant spacing 45 x 60 $cm^2$ and 45 x 45 $cm^2$ gave highest growth and yield characters of capsicum cv. Orobelle. It can be attributed to the better soil structure created by organic growing media, both physically and biologically, along with the constant and steady nutrient supply to the plants. Apart from this, the proper spacing led to the healthy competition amongst the plants giving superior results and made the cultivation of capsicum in polyhouse less tedious and more economical as well.

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