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Effect of growing media and planting density on incidence of fruit borer (*Spodoptera litura*), fruit yield and cost benefit ratio of hybrid capsicum cv. Orobelle under naturally ventilated polyhouse

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Abstract
The field experiments were carried out for two years to know the effect of different growing media and plant density on the yield, benefit: cost ratio and incidence of fruit borer on capsicum cv Orobelle in the mid hills of Himachal Pradesh. The data of both the years on the effect of growing media and spacing showed that among the different growing media M_4 comprising of Soil +Coco peat + Vermicompost + FYM (2:1:0.5:0.5) gave positive effect on yield attributes, economics and incidence of fruit borer which was at par with M_3 comprising of Soil +Coco peat + Vermicompost (2:1:1), 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.

Keywords: Capsicum, Orobelle, *Spodoptera litura*, spacing, growing media

Introduction
Capsicum has attained a status of high value crop in India in recent years and occupies a pride of place among vegetables in Indian cuisine because of its delicacy and pleasant flavour coupled with rich content of ascorbic acid and other vitamins and minerals. Capsicum (Capsicum annuum L. var. grossum Sendt.), is an important vegetable worldwide belonging to the solanaceous family. It has both nutritional and medicinal values. When used as a primary ingredient it contributes to flavour texture and colour to dishes. In India, capsicum is extensively cultivated in Himachal Pradesh, hilly areas of Uttarakhand, Karnataka, Andhra Pradesh, Maharashtra and Tamil Nadu. In recent years capsicum has become one of the premier crops under polyhouse condition.

One of the important limiting factors in the cultivation of capsicum is damage caused by Tobacco caterpillar, *Spodoptera litura* (Satyagopal *et al.*, 2014) [16]. Capsicum has been attacked by number of diseases and insect pest. Besides different diseases fruit borers are the most common cause of losses to polyhouse grown capsicum as they affect both quantity and quality of the produce and are difficult to control. *Spodoptera litura* belongs to order Lepidoptera, family Noctuidae and subfamily Amphipyrinae. The caterpillars of the pest generally defoliate crops in vegetative stage (Ahmad *et al.*, 2005) [1] and attack the fruits in fruiting stage under open and protected environment (Sood, 2010) [19]. Leaf eating caterpillar, *S. litura* (Fab) (Lepidoptera: Noctuidae) is a polyphagous insect pest of national importance causing economic damage to a number of agricultural crops and about 40- 50% yield loss was reported by (Vijayalaxmi *et al.*, 2016) [21]. The young larvae of *S. litura* feed gregariously for few days on green material of leaf and skeletonize it, then disperse to feed individually. Larva feeds on leaves by making big holes. Fruits are also bored by this pest. They are voracious feeders and are reported to cause damage in all stages of crop growth (Sharma and Sharma, 2018) [17]. Fruit borer (Spodoptera) is the serious pest of capsicum. It causes serious damage during the fruit development stage. A total of 293 pest and insect species have been found affecting the production of the capsicum crop as well as in the process of storage also. The larva feeds on the pulp by making hole.

The infested fruit becomes unfit for consumption. The habit of larvae is to hide under the plants, cracks and crevices of soil debris during the day time and feeds during night hours. The life cycle completes on average of 25 days (Natikar and Balikai., 2017) [13].

Plant population play an important role in determining the damage caused by the insect pest. Hence, it is necessary to study the influence of various plant density affecting the population fluctuation of capsicum pests. The study on the influence of different growing media and plant density responsible for population fluctuation on a particular crop might help in the prediction of its incidence in the particular area and further, it will be helpful for successful pest management (Havanoor and Rafee, 2018) [8]. Therefore, the present experiment carried out to study relationship between the incidence of *S. litura* with different growing media and plant spacing under polyhouse condition for further increase in yield of the crop, economics and management of *S. litura* infestation.

Material and Methods

The present investigation 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". The experiment was laid 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*., (M1) Soil + Sand + FYM (2:1:1), (M2) Soil + Cocopeat + FYM (2:1:1), (M3) Soil + Cocopeat + Vermicompost (2:1:1), (M4) Soil + Cocopeat + Vermicompost + FYM (2:1:0.5:0.5) and three plant spacings with different plant density (S) *viz*., 45×30 cm (S1), 45×45 cm (S2), and 45×60 cm (S3). Twelve different Treatment combinations *viz*., M1S1, M1S2, M1S3, M2S1, M2S2, M2S3, M3S1, M3S2, M3S3, M4S1, M4S2, M4S3 were used. Seedlings were transplanted in the naturally ventilated polyhouse in three replications on 15th April, 2015 and 2016 in a plot having size of 1.62 m2.

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 the incidence of fruit borer was recorded in each treatment. Number of fruits per plant, average fruit weight (g), fruit yield (kg/plant and kg/m2), were recorded. The cumulative value of the yield per plant and per m2 was taken as and when the pickings progressed.

Incidence of fruit borer (Per cent)

The Insect incidence was recorded for both the years in different treatments which is compiled and presented in Table-1. Data revealed that during both the years the main effect of growing media and plant spacing found to have significantly influenced the incidence of fruit borer. Minimum incidence of fruit borer (13.26) during 2015 was recorded in M_4 comprising of Soil +Coco peat + Vermicompost + FYM (2:1:0.5:0.5) which was at par with M_3 (13.59) comprising of Soil +Coco peat + Vermicompost (2:1:1), whereas, maximum incidence of fruit borer (19.84) was recorded in M_1 comprising of Soil+Sand+FYM (2:1:1).

Table 1: Treatment details of the experiment along with symbols

Treatment combinations	Media	Spacing
M_1S_1	Soil + Sand + FYM (2:1:1)	45x30
M_1S_2	Soil + Sand + FYM (2:1:1)	45x45
M_1S_3	Soil + Sand + FYM (2:1:1)	45x60
M_2S_1	Soil + FYM + Vermicompost (2:1:1)	45x30
M_2S_2	Soil + FYM + Vermicompost (2:1:1)	45x45
M_2S_3	Soil + FYM + Vermicompost (2:1:1)	45x60
M_3S_1	Soil + Cocopeat + FYM (2:1:1)	45x30
M_3S_2	Soil + Cocopeat + FYM (2:1:1)	45x45
M_3S_3	Soil + Cocopeat + FYM (2:1:1)	45x60
M_4S_1	Soil + Cocopeat + Vermicompost + FYM (2:1:0.5:0.5)	45x30
M_4S_2	Soil + Cocopeat + Vermicompost + FYM (2:1:0.5:0.5)	45x45
M_4S_3	Soil + Cocopeat + Vermicompost + FYM (2:1:0.5:0.5)	45x60

In case of plant spacing minimum incidence of fruit borer (14.55) was recorded in the plant spacing S_3 (45 x 60 cm), which was statistically at par with plant spacing S_2 (15.03) comprising of 45 x 45 cm, whereas, maximum incidence of fruit borer (16.32) was recorded with the plant spacing S_1 comprising of 45 x 30 cm. The interaction effects of growing media and plant spacing found to be non significant. However, the minimum incidence of fruit borer was recorded with M_4S_3 (12.73), whereas M_1S_1 recorded the maximum incidence of fruit borer (21.62). In 2016, there was less incidence of fruit borer as compare to 2015. Minimum incidence of fruit borer (6.76) was recorded with M_4 comprising of Soil +Coco peat + Vermicompost + FYM (2:1:0.5:0.5) which was at par with M_3 (7.78) comprising of Soil +Coco peat + Vermicompost (2:1:1), whereas, maximum incidence of Fruit borer (12.52) was recorded with M_1 comprising of Soil+Sand+FYM (2:1:1).

Table 2: Main and interaction effect of growing media (M) and plant spacing (S) on incidence of fruit borer on Capsicum cv. Orobelle.

Treatments	Incidence of fruit borer (per cent)		
	2015	2016	Pooled
M_1	19.84(4.45)	12.52(3.53)	16.18(4.02)
M_2	14.50(3.80)	9.68(3.10)	12.09(3.47)
M_3	13.48(3.67)	7.78(2.78)	10.63(3.26)
M_4	13.37(3.66)	6.76(2.59)	10.07(3.17)
Mean	15.3(3.90)	9.18(3.00)	12.24(3.48)
$CD_{0.05}$	0.12	0.19	0.16
S_1	16.32(4.02)	10.21(3.17)	13.26(3.62)
S_2	15.02(3.86)	8.77(2.92)	11.89(3.43)
S_3	14.56(3.80)	8.57 (2.91)	11.57(3.39)
Mean	15.3(3.90)	9.18(3.00)	12.24(3.48)
$CD_{0.05}$	0.11	0.17	0.10
Interaction			
M_1S_1	21.62(4.65)	12.86(3.59)	17.24(4.15)
M_1S_2	19.10(4.37)	13.46(3.66)	16.28 (4.03)
M_1S_3	18.80(4.33)	11.23(3.35)	15.02 (3.87)
M_2S_1	15.38(3.92)	10.87(3.29)	13.13(3.62)
M_2S_2	14.66(3.83)	9.47(3.07)	11.67 (3.42)
M_2S_3	13.44(3.67)	8.69(2.94)	11.46 (3.38)
M_3S_1	14.31(3.78)	9.73 (3.12)	12.02(3.47)
M_3S_2	13.24(3.64)	6.64(2.57)	9.94(3.15)
M_3S_3	12.90(3.59)	6.98(2.64)	9.94(3.15)
M_4S_1	13.95(3.73)	7.39(2.70)	10.67(3.26)
M_4S_2	13.06(3.61)	6.30(2.51)	9.68(3.11)
M_4S_3	13.12(3.62)	6.59(2.56)	9.85 (3.14)
Mean	15.3(3.90)	9.18(3.00)	12.24(3.48)
$CD_{0.05}$	NS	NS	NS

Figures in parenthesis represent square root transformation

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+Coco peat+Vermicompost+FYM (2:1:0.5:0.5), S_1: (45 x 30), S_2: (45 x 45), S_3: (45 x 60)

In case of plant spacing minimum incidence of fruit borer (8.50) was recorded with the plant spacing S_3 (45 x 60 cm), which was statistically at par with the plant spacing S_2 (8.84) comprising of 45 x 60 cm, whereas, maximum incidence of fruit borer (10.21) was recorded with the plant spacing S_1 comprising of 45 x 30 cm. There was no significant difference in treatment combinations with respect to incidence of fruit borer. However, the minimum incidence of fruit borer was recorded with M_4S_3 (6.30), whereas M_1S_2 recorded the maximum incidence of fruit borer (13.46).

In the pooled data of both the years minimum incidence of fruit borer (10.07) was recorded in M_4 comprising of Soil +Coco peat + Vermicompost + FYM (2:1:0.5:0.5) which was at par with M_3 (10.63) comprising of Soil +Coco peat + Vermicompost (2:1:1), whereas, maximum incidence of fruit borer (16.18) was recorded with M_1 comprising of Soil+Sand+FYM (2:1:1).

Plant spacing also significantly affected the incidence of fruit borer. Minimum incidence of fruit borer (11.57) was recorded in the plant spacing S_3 comprising of 45 x 60 cm, which was followed by plant spacing S_2 (11.89) comprising of 45 x 45 cm, whereas, maximum incidence of fruit borer (13.26) was recorded in the plant spacing S_1 comprising of 45 x 30 cm. The interaction effects were found to be non-significant. However, the data revealed that minimum incidence of fruit borer was recorded with M_4S_3 (9.51), whereas M_1S_1 recorded the maximum incidence of fruit borer (17.24).

Spodoptera litura is one of the most common pest species that significantly affects the production of the crop, during major stages of flowering and fruiting phases. To protect these crops from the effects of insects and pest damage the farmers resort to indiscriminate application of pesticides on the crops. Spodoptera litura (Fabricius) feeds on the green plant-material, the feeding on complete plant parts can also be observed in cases of severe food shortage. This also leads to the transfer of the insects to various parts of the plants also (Rosenthal and Berenbaum, 1992; Simpson *et al.*, 2002) [15, 18]. The presence of plant metabolites also deters or attracts the pests towards it (Ehrlich and Murphy, 1988; Hill, 1975) [6, 9].

The incidence of the *S. litura* have been reported to be less in Soil +Coco peat + Vermicompost + FYM (2:1:0.5:0.5) and the wider plant spacing of 45 x 60 cm had less incidence of the fruit borer than the closer plant spacing. The maximum incidence of the fruit borer in closer spacing during the study indicates that close spacing of the sweet pepper encourages the build-up and subsequent infestation of the plants by the fruit borer. However moderate and wide sweet pepper spacing which had significant less incidence of the fruit borer indicate that wide spacing discourages the building up of the fruit borer. The less incidence of the fruit borer in the wider spacing shows that the larvae does not stay in the open canopy than closer or shaded areas. It also suggested that these larvae prefer to hide and breed under closed canopy, hence the large number of the larvae perpetuated under plants spaced closer. The lower incidence of the pest recorded under the plants spaced wider during the study period implies that the pest does not like staying and breeding under the opened space. This could be due to the general habit of insect avoiding open spaces and preferring hidden or shaded areas. This result agrees with the report of Chakraborti and Sarkar (2011) [4], Degri (2014) [5] and Ghosh and Senapati (2009) [7] indicating that closed spaced crops suffer serious infestation by pests than some wide spaced crops in the tropics and subtropics. The crops need to be spaced correctly as recommended otherwise their infestations, growth and yield performance will be hampered. (Onekuku and Omolaye, 2012) [14].

Fruit Yield

The yield was significantly influenced by different growing media and plant spacings. Yield per plant increased significantly with the incorporation of cocopeat and vermicompost together in M3 media. The media consisting of cocopeat, vermicompost and FYM which was followed by M4. M3 recorded the highest number of fruits per plant (14.86).

The media M4 recorded the maximum average fruit weight (192.91 g), fruit yield (2.81 kg/plant), whereas M1 gave the lowest yield parameters during both the years. The treatments combination of 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 the treatments found significantly better than the M1. This result is in agreement of the findings of Llaven *et al.*, (2008) [11] in bell pepper, Uma Maheshwari and Haripriya (2007) [20] in hot pepper.

Table 3: Main and interaction effect of growing media (M) and plant spacing (S) on no. of fruits per plant and average fruit weight (g) of Capsicum cv. Orobelle

Treatments	No. of fruits per plant			Average fruit weight (g)		
	2015	2016	Pooled	2015	2016	Pooled
M_1	12.02	11.60	11.81	149.48	148.46	148.97
M_2	13.91	13.01	13.46	163.93	157.20	160.57
M_3	15.41	14.32	14.86	180.54	190.00	185.27
M_4	15.00	13.96	14.48	188.72	197.10	192.91
Mean	14.08	13.22	13.65	171.67	173.19	171.86
$CD_{0.05}$	0.69	0.63	0.66	9.09	10.74	9.95
S_1	13.42	12.52	12.97	121.62	120.94	121.09
S_2	13.95	13.25	13.60	165.84	169.16	167.50
S_3	14.88	13.90	14.39	224.54	229.47	227.00
Mean	14.08	13.22	13.65	171.67	173.19	171.86
$CD_{0.05}$	0.57	0.54	0.57	7.87	9.30	8.61
Interaction						
M_1S_1	10.67	10.25	10.46	117.49	115.97	116.73
M_1S_2	12.50	12.25	12.38	135.31	136.73	136.02
M_1S_3	12.90	12.30	12.60	195.64	192.67	194.16
M_2S_1	13.00	11.98	12.49	120.32	117.55	118.94
M_2S_2	13.32	12.64	12.98	165.27	156.02	160.65
M_2S_3	15.42	14.41	14.91	206.21	198.03	202.12
M_3S_1	15.27	14.26	14.77	121.22	122.02	121.62
M_3S_2	15.32	14.39	14.85	173.52	183.36	178.44
M_3S_3	15.63	14.30	14.97	246.86	264.62	255.74
M_4S_1	14.75	13.57	14.16	127.45	128.21	127.83
M_4S_2	14.67	13.73	14.20	189.25	200.53	194.89
M_4S_3	15.58	14.59	15.09	249.44	262.57	256.01
Mean	14.08	13.22	13.65	171.67	173.19	171.86
$CD_{0.05}$	1.14	1.08	1.14	15.74	18.60	17.23

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+Coco peat+Vermicompost+FYM (2:1:0.5:0.5), S_1: (45 x 30), S_2: (45 x 45), S_3: (45 x 60)

Table 4: Main and interaction effect of growing media (M) and plant spacing (S) on Fruit yield, kg/plant and kg/m^2 of Capsicum cv. Orobelle

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

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+Coco peat+Vermicompost+FYM (2:1:0.5:0.5), S_1: (45 x 30), S_2: (45 x 45), S_3: (45 x 60)

The vermicompost based M3 and M4 media again proved to be better to others as it produced maximum yield parameters followed by M2 and M1 growing media.

Wider spacing produced significantly a greater number of fruits per plant (14.39), 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) [12]. The interaction of the M4 growing media with wider spacing of 45 x 60 cm2 proved to be superior to the other treatment combinations.

The comparison between M4S3 and M4S2 revealed that although the M4S3 enhanced the growth and yield characters, the yield per m2 was higher at the M4S2 (16.50 kg). This was probably due to the increase in the number of plants per unit area in 45 x 45 cm2 plant spacing, which might contribute to the extra yield per unit area leading to the high yield (Law-Ogboma and Egharevba, 2009) [10].

The less incidence of fruit borer in wider plant spacing led to less damage of fruits and the wider plant spacing not only suppressed the incidence of fruit borer but also augmented the fruit yield of the capsicum therefore significantly higher yield was obtained from this treatment which ultimately found to be more economic. The relevant data is presented in Table 3 and 4.

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 economic analysis of various treatment combination of growing media and plant spacing the gross return, net return and B: C ratio have been studied. In the present investigation, maximum B: C ratio of 2.23:1 was obtained with combination M4S2 (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 M4S3 (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 M1S1 (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 cm2 and 45 x 45 cm2 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 and less incidence of fruit borer giving superior results and made the cultivation of capsicum in polyhouse less tedious and more economical as well.

Table 5: Cost of cultivation of Capsicum cv. Orobelle 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

Conclusion

In the treatments obtained from the combinations it is well observed that the pest incidence and population in wider spacing was comparatively lower with the closer spacing that was observed in the case of *Spodoptera litura* (Fabricius). The pests usually prefer the plants with closer spacing and hence higher pest population was found in such places. Also, the site with closer spacing were also found to be of higher preference for breeding. Hence, spacing played a critical role in the overall management of the pest. The overall naturally ventilated conditions in the case of a polyhouse with an ideal spacing was also found to be significant in the case of control and management practices for the pest. The selection of the growing media and also the spacing helped in the maintenance of better soil structure created by organic growing media. Apart from this, the proper spacing led to the healthy competition amongst the plants and less incidence of fruit borer giving superior results and made the cultivation of capsicum in polyhouse less tedious and more economical as well. This had a positive impact on the yield and which ultimately helped to get high Benefit: Cost ratio, 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 yield of capsicum cv. Orobelle and found to be most economic. The selection of wider spacing and also the selection of growing media had a direct impact on the population parameter index of the pest, wherein less pest incidence was observed in the case of increased spacing and also the variation of the growing media.

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