



## Effect of soilless growing media and fertigation on capsicum production under naturally ventilated polyhouse in cold desert region of Himachal Pradesh

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### ABSTRACT

An experiment on effect of soilless growing media and fertigation on capsicum production under naturally ventilated polyhouse was conducted at Regional Horticulture Research Sub-Station, Dr Y.S. Parmar University of Horticulture and Forestry Tabo, Spiti during year 2015 and 2016. Significant individual effect of growing media and fertigation was found on parameters like harvest duration, plant height, number of fruits per plant, fruit yield per plant, fruit yield per m<sup>2</sup> and fruit yield per ha during both the years. Interaction effect of growing media and fertigation was found significant for harvest duration, number of fruits per plant, fruit yield per plant, fruit yield per m<sup>2</sup> and fruit yield per ha. Soilless growing media comprising of vermicompost: sand (2:1) and fertigation @ 250 kg NPK/ha recorded the maximum harvest duration (52 days), fruit yield per plant (621.31 & 585.85 g), fruit yield per m<sup>2</sup> (4.60 & 4.33 kg) and fruit yield per ha (46.02 & 43.40 MT) during year 2015 and 2016, respectively.

**Key words:** Bell pepper, cold desert, fertigation, polyhouse, vermicompost.

### INTRODUCTION

Capsicum is one of the most important nutritious and highly remunerative vegetable crops grown for its fruits. It is not possible to obtain higher yields of good quality fruits under open conditions in cold desert regions of Himachal Pradesh and therefore protected cultivation offers good scope for production of capsicum in this region. One of the most important cultural inputs involved in greenhouse crop production, perhaps the most important is the type of growing media used. It is well known that soilless culture offers an alternative to soil culture when serious soil and water problems (i.e., soil borne pests, soil and water salinity, chemical residues in soil, lack of fertile soil, water shortage), create difficulties in traditional soil based production. The main advantages of soilless culture are the most accurate control over the supply of water, nutrients, pH, root temperature, etc., increase productivity due to easier and more accurate control of production factors, reduction of labour requirement, no need for soil sterilization and more crops per year Tuzel *et al.* (10).

Soilless culture is widely used to grow plants in greenhouse in many countries at present. Monoculture results in a lot of problems when soil is used as growing media Sevgican (8). Another important component of protected cultivation, which

influences productivity and quality of the produce, is application of fertilizers with irrigation water called fertigation. Fertigation also provides opportunity to control the concentration of individual nutrients in the form of soluble fertilizers to meet the crop need slowly according to its stage of development and reduce leaching of nutrient. Therefore, an experiment was conducted to investigate the productivity potential of soil based and soil less growing media along with fertigation treatment for capsicum production under naturally ventilated plastic greenhouses for yield and quality traits.

### MATERIALS AND METHODS

The experiment was conducted in a plastic greenhouse with natural ventilation at Regional Horticulture Research Sub Station, Dr YSPUH&F, Tabo Spiti, for two consecutive years. The seeds of capsicum var. Solan Bharpur were sown in polytunnels for healthy seedling production. Further, the seedlings were transplanted in three different growing media (soil: vermicompost: sand; 2:1:1 (M<sub>1</sub>), 1:2:1 (v/v) (M<sub>2</sub>) and vermicompost: sand, 2:1 (v/v) (M<sub>3</sub>)). Three levels of fertigation, i.e. 150 kg NPK/ha (F<sub>1</sub>), 200 kg NPK/ha (F<sub>2</sub>) and 250 kg NPK/ha (F<sub>3</sub>) with water soluble fertilizers 19:19:19 NPK were tested. Fertigation treatment started after three weeks of transplantation and given twice a week. It was stopped 2 weeks prior to expected final harvest. The irrigation regime was kept at 20 kpa with the help of tentimeter. The

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observations were recorded on days to marketable maturity, harvest duration, plant height (cm), number of fruits per plant, fruit length (mm), fruit breadth (mm), average fruit weight (g), fruit yield per plant (g), fruit yield per m<sup>2</sup> (kg) and fruit yield per ha (MT). Plant spacing was 45 cm × 30 cm. All the parameters were recorded through standard procedure and fruit yield per ha (MT) was calculated on the estimation basis of fruit yield per m<sup>2</sup> (kg). The experimental design was two factors completely randomized design with three replications. Data were subjected to analysis of variance (ANOVA) to compare the effects of growing media and fertigation. The differences between the means were compared using the least significant difference test (LSD, p<0.05).

### RESULTS AND DISCUSSION

Days to first picking was earliest with the lowest level of fertigation F1 (101.77 and 100.78 days) during both the years (Tables 1, 3). Higher dose of fertilizer may lead to more vegetative growth which may delay in early maturity. Maximum harvest duration of 50.00 and 48.67 days was recorded in highest level of fertigation F3 during year 2015 and 2016, respectively. It may be due to higher nutrient availability for plants from maximum dose. Highest fertigation dose also recorded maximum values for number of fruits per plant, fruit yield per plant, fruit yield per m<sup>2</sup> and fruit yield per ha. Similar results of higher yield under fertigation were also reported by Contreras *et al.* (4), Bassiony *et al.* (2) and Brahma *et al.* (3). Among growing media, soilless media comprising of vermicompost: sand (2:1) (M<sub>3</sub>) found promising for most of the traits. Maximum harvest duration (47.00 & 48.67 days), fruit length (75.56 & 77.31 mm) and number of fruits per plant (11.16 & 11.83) were recorded in M<sub>1</sub> soilless growing media during both the years, respectively. Vermicompost 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 vermicompost treatments. These results may be attributed to the role of macro and micro-nutrients, as well as the improved growing conditions due to vermicompost application, which 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 (5) in capsicum, Natarajan *et al.* (7) in tomato, Bairwa *et al.* (1) in Okra. Same growing media also recorded the highest value for fruit yield per plant, fruit yield per m<sup>2</sup> and fruit

**Table 1.** Effect of growing medium and fertigation on capsicum production under protected conditions during year 2015.

Treatment	Days to 50% flowering	Days to first picking	Harvest duration	Plant height (cm)	Fruit length (mm)	Fruit breadth (mm)	Pericarp thickness (mm)	Av. fruit wt. (g)	No of fruits per plant	Fruit yield per plant (g)	Fruit yield per m <sup>2</sup> (kg)	Fruit yield per ha (MT)
<b>Fertigation</b>												
F1	82.33	101.77	42.33	47.70	70.03	45.62	3.22	35.30	8.55	302.46	2.24	22.40
F2	87.88	116.11	43.77	48.32	73.12	46.69	3.18	41.49	9.80	406.48	3.01	30.11
F3	85.11	109.55	50.00	58.39	71.83	46.97	3.29	39.17	11.25	448.30	3.32	33.21
CD <sub>(0.05)</sub>	NS	7.59	1.04	3.57	NS	NS	NS	NS	0.32	43.05	0.32	3.19
<b>Growing medium</b>												
M1	83.11	105.55	47.00	58.26	75.56	47.49	3.33	41.31	11.16	466.52	3.45	34.56
M2	85.22	109.33	45.33	50.50	70.56	47.73	3.31	39.60	9.48	376.14	2.78	27.86
M3	87.00	112.55	43.77	45.66	68.86	44.05	3.15	35.05	8.95	314.59	2.33	23.30
CD <sub>(0.05)</sub>	NS	NS	1.04	3.57	2.70	NS	NS	NS	0.32	43.05	0.32	3.19

**Table 2.** Interaction effect of growing medium and fertigation on capsicum production under protected conditions during year 2015.

Treatment combination	Days to 50% flowering	Days to first picking	Harvest duration	Plant height (cm)	Fruit length (mm)	Fruit breadth (mm)	Pericarp thickness (mm)	Average fruit weight (g)	No of fruits per plant	Fruit yield per plant (g)	Fruit yield per m <sup>2</sup> (kg)	Fruit yield per ha (MT)
M1F1	80.00	98.33	42.00	59.67	71.81	48.22	3.47	38.39	9.08	348.99	2.58	25.85
M2F1	83.00	103.00	43.00	44.00	69.51	45.63	3.44	35.29	8.37	294.46	2.18	21.81
M3F1	84.00	104.00	42.00	39.44	68.80	43.02	3.06	32.24	8.20	263.92	1.95	19.55
M1F2	85.00	108.00	47.00	52.33	77.87	48.77	3.00	41.06	10.47	429.25	3.18	31.80
M2F2	87.67	119.33	43.00	49.31	71.52	47.60	3.25	45.24	9.63	435.13	2.22	32.23
M3F2	91.00	121.00	41.33	43.33	69.99	43.72	3.29	38.18	9.30	355.07	2.63	26.30
M1F3	84.33	110.33	52.00	62.78	77.02	45.50	3.52	44.49	13.94	621.31	4.60	46.02
M2F3	85.00	105.66	50.00	58.18	70.66	49.98	3.26	38.27	10.43	398.84	2.95	29.54
M3F3	86.00	112.66	48.00	54.22	67.81	45.44	3.10	34.75	9.37	324.77	2.40	24.06
CD <sub>(0.05)</sub>	NS	NS	1.80	NS	NS	NS	NS	NS	0.56	74.57	0.55	5.52

**Table 3.** Effect of growing medium and fertigation on capsicum production under protected conditions during year 2016.

Treatment	Days to 50% flowering	Days to first Picking	Harvest duration	Plant height (cm)	Fruit length (mm)	Fruit breadth (mm)	Pericarp thickness (mm)	Av. fruit wt. (g)	No of fruits per plant	Fruit yield per plant (g)	Fruit yield per m <sup>2</sup> (kg)	Fruit yield per ha (MT)
<b>Fertigation</b>												
F1	80.67	100.78	43.00	46.37	70.95	45.87	3.19	36.15	8.55	309.79	2.29	22.95
F2	83.11	105.33	45.44	49.29	75.04	48.29	3.46	42.27	12.31	520.41	3.85	38.55
F3	87.22	115.56	48.67	53.58	74.32	46.28	3.45	40.85	10.52	435.79	3.22	32.28
CD <sub>(0.05)</sub>	1.73	1.82	1.57	1.82	2.27	NS	0.15	1.59	0.27	19.27	0.14	1.43
<b>Growing medium</b>												
M1	81.89	104.55	48.67	55.07	77.31	48.57	3.59	42.38	11.83	504.67	3.73	37.38
M2	83.44	107.67	45.67	47.39	71.88	47.76	3.38	40.57	9.97	410.19	3.03	30.39
M3	85.67	109.44	42.78	46.78	71.11	44.11	3.13	36.31	9.59	351.13	2.60	26.01
CD <sub>(0.05)</sub>	1.73	1.82	1.57	1.82	2.27	2.46	0.15	1.59	0.27	19.27	0.14	1.43

**Table 4.** Interaction effect of growing medium and fertigation on capsicum production under protected conditions during year 2016.

Treatment combination	Days to 50% flowering	Days to first picking	Harvest duration (days)	Plant height (cm)	Fruit length (mm)	Fruit breadth (mm)	Pericarp thickness (mm)	Av. fruit wt. (g)	No of fruits per plant	Fruit yield per plant (g)	Fruit yield per m <sup>2</sup> (kg)	Fruit yield per ha (MT)
M1F1	79.00	98.00	43.00	53.67	73.51	49.11	3.40	39.19	9.08	355.79	2.63	26.35
M2F1	81.00	101.33	43.67	43.33	70.07	46.17	3.25	36.15	8.37	302.43	2.24	22.40
M3F1	82.00	103.00	42.33	42.11	69.27	42.32	2.95	33.12	8.20	271.17	2.01	20.08
M1F2	82.00	103.67	51.00	55.56	79.80	50.30	3.76	41.57	13.78	572.37	4.23	42.40
M2F2	82.33	105.33	43.67	48.12	73.42	48.94	3.39	46.07	11.90	547.56	4.05	40.56
M3F2	85.00	107.00	41.67	44.00	71.89	45.62	3.24	39.17	11.27	441.29	3.27	32.69
M1F3	84.67	112.00	52.00	56.00	78.63	46.30	3.64	46.39	12.63	585.85	4.33	43.40
M2F3	87.00	116.33	49.67	50.52	72.16	48.18	3.50	39.51	9.63	380.60	2.82	28.19
M3F3	90.00	118.33	44.33	54.22	72.17	44.37	3.21	36.65	9.30	340.92	2.52	25.26
CD <sub>(0.05)</sub>	NS	NS	2.71	3.16	NS	NS	NS	2.76	0.48	33.37	0.14	1.43

yield per ha. Increase in yield in vermicompost rich medium is also reported by Llaven *et al.* (6) in bell pepper, Sumita Roy *et al.* (9) Uma Maheshwari and Haripriya (11) in hot pepper. Combined effect of soilless growing media and highest level of fertigation (Tables 2, 4) recorded significantly higher values for harvest duration, number of fruits per plant, fruit yield per plant (g), fruit yield per m<sup>2</sup> and fruit yield per ha.

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