



Short communication

## Performance of coloured bell pepper in naturally-ventilated polyhouse under mid-hill conditions of Himachal Pradesh

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### ABSTRACT

Bell pepper is highly susceptible to water stagnation and excess moisture. Therefore, cultivation of this vegetable under protected structures can prove to be a boon, ensuring higher yields and quality produce. Farmers are mainly concentrating on cultivation of coloured varieties, viz., Orobelle and Bomby, under these structures. Therefore, on-farm trials were laid out during the year 2007 in farmers' fields, with six hybrids of bell pepper (Orobelle, Bomby, Mahabharath, Tanvi, Tanvi Plus and US-26) replicated thrice in RBD at four locations. The aim was to provide a suitable substitute for the existing varieties. On studies revealed that Tanvi (yellow-fruited) and Tanvi Plus (red-fruited) were the best yielders when compared to varieties being grown by the farmers. Average plant height ranged from 100 to 160cm, fruit weight ranged from 205 to 280g/fruit and number of marketable fruits per plant varied from 11 to 23. Yield and (Benefit:Cost) B:C ratio for the two best hybrids, i.e., Tanvi and Tanvi Plus were 140.5t & 127.3t ha<sup>-1</sup>, and 2.37 & 2.06, respectively.

**Key words:** Bell pepper, naturally-ventilated polyhouse, quality produce, yield

Capsicums (*Capsicum annuum* L.), commonly called sweet pepper or bell pepper is the Christmas ornamental of vegetable world with a beautifully shaped glossy exterior that comes in an array of vivid colors ranging from green, red, yellow, orange, purple, brown to black. Sweet peppers are plump, bell-shaped vegetables featuring three to four lobes. Bell pepper is a source of over 30 different members of the carotenoid nutrient family. Recent studies have shown that vitamin C content and carotenoid content in bell pepper increase with ripening. So does their total antioxidant capacity. Bell pepper is also a good source of the antioxidant Vitamin E. In addition to conventional antioxidant vitamins, bell pepper is also a good source of the antioxidant mineral, manganese.

Solan district of Himachal Pradesh is well-known for commercial cultivation of vegetables, mainly tomato, bell pepper, cauliflower and cabbage. Bell pepper is more susceptible to water stagnation and excess moisture. Therefore, cultivation of bell pepper under protected structures can prove to be a boon for ensuring higher yield and quality produce. Cultivation of sweet pepper under greenhouse would not only help realize higher productivity, but can also ensure better returns to the farming community (Singh and Asrey, 2005).

The present investigation was conducted in naturally-ventilated polyhouses of 225m<sup>2</sup> area, at the farmer's field, in the year 2007. Plants of six hybrids, viz., Orobelle, Bomby, Mahabharath, Tanvi, Tanvi Plus and US-26, were spaced 45 x 30cm apart in RBD, with four replications. The total plant population accommodated was 1400. Plants were transplanted in the first week of April, and the final harvest was made in October. Calcium ammonium nitrate (CAN), Single Super Phosphate (SSP) and Muriate of Potash (MOP) fertilizers were applied in the form of basal dose, and water-soluble fertilizer NPK 19:19:19 was applied through drip irrigation as per recommendations of Dr. Y.S. Parmar UHF, Nauni, Solan; but, mulching was not done. All the recommended agronomic and plant protection measures were followed by the farmers to ensure a healthy plant stand. Data were recorded on plant height, fruit weight, number of marketable fruits per plant, fruit length, fruit width, fruit shape, fruit colour and yield per unit area. Data were subjected to statistical analysis as per Gomez and Gomez (1984). Economics of production was also worked out to assess economic feasibility of the hybrids tested.

All the traits under study were significantly influenced by different hybrids/genotypes (Table 1). Maximum plant

**Table 1. Mean performance of bell pepper genotypes for various horticultural traits**

Genotype	Plant height (cm)	Fruit weight (g)	No. of fruits per plant	Fruit length (mm)	Fruit width (mm)	Yield per ha (t)	Fruitcolour	Fruitshape
Bomby	120	220	14	83.4	99.6	109.2	Red	Flat
Orobelle	120	230	17	79.3	79.9	116.7	Yellow	Square
Mahabharath	132	240	11	107.7	93.3	101.1	Red	Bell
Tanvi	100	280	19	93.3	82.6	140.5	Yellow	Bell
Tanvi Plus	160	215	23	106.2	78.6	127.3	Red	Bell
US-26	140	205	13	97.4	109.1	106.1	Yellow	Flat
CD ( $P=0.05$ )	25.4	41.2	3.2	14.22	18.37	20.6	-	-

**Table 2. Economics of bell pepper production under naturally-ventilated polyhouse (area = 225m<sup>2</sup>)**

Genotype	Cost of cultivation (Rs.)	Gross returns (Rs.)	Net returns (Rs.)	*B:C ratio
Bomby	56195	147420	91225	1.62
Orobelle	56195	157545	101350	1.80
Mahabharath	56195	136485	80290	1.43
Tanvi	56195	189675	133480	2.37
Tanvi Plus	56195	171855	115660	2.06
US-26	56195	143235	87040	1.55

\*B:C = Net returns / Cost of cultivation; Sale price of fruits: Rs.60 per kg

**Table 3. Cost of cultivation of coloured bell pepper in 225m<sup>2</sup> naturally-ventilated polyhouse**

Sl. No.	Cost head	Amount (Rs.)
1.	Cost of polyhouse (area 225m <sup>2</sup> )	175,000/-
1a.	Average life of polyhouse	5 years
1b.	Cost of polyhouse/ year	35,000/-
2.	Labour charges (70 mandays, @ Rs. 130/-)	9,100/-
2a.	Preparation of beds	10 man days
2b.	Transplanting and irrigation	10 man days
2c.	Intercultural operations (fertilizer application, weeding / hoeing, spraying, staking, etc.)	40 man days
2d.	Harvesting	10 man days
3.	Cost of seed material	900/-
4.	Cost of manure, fertilizer and pesticide	8,895/-
5.	Cost of staking material	1,000/-
6.	Transportation charges	1,300/-
	Total cost of cultivation	56,195/-

height (160cm) was recorded in the hybrid Tanvi Plus which was statistically at par with US-26 (140cm). However, difference in height of rest of the genotypes was non-significant. Hybrids US-26 and Mahabharath also showed significant differences in height compared to Tanvi, which attained a maximum height of 100cm. Significant differences seen among the hybrids may be attributed to the varied genetic constitution of the genotypes. However, Kanwar and Sharma (2010) have earlier observed non-significant differences for plant height among the genotypes tested in naturally ventilated-polyhouses under cold desert conditions of Ladakh (J&K).

Average fruit weight varied from 205g in US-26 to 280g in Tanvi. The highest average fruit weight recorded for Tanvi (280g) differed significantly from rest of the genotypes, except in Mahabharath (240g), which was at par with Tanvi. Differences for average weight were non-significant among the genotypes Bomby, Orobelle, Mahabharath, Tanvi Plus and US-26. Variation in fruit weight in bell pepper from 27.3g to 200g has been reported also by Luitel *et al* (2011).

Hybrid 'Tanvi Plus' produced maximum number of fruits per plant (23), with statistical superiority over the remaining genotypes/hybrids tested. This was followed by 'Tanvi'. 'Mahabharath' recorded minimum number of fruits per plant (11), and was at par with Bomby and US-26.

Maximum fruit length (107.7mm) was recorded in the hybrid Mahabharath and showed significant differences with Orobelle, Bomby and Tanvi; while, it should statistical similarity with rest of the genotypes. Shortest fruits were observed in the hybrid Orobelle (79.3mm). Fruit width ranged between 78.6 and 109.1mm. Widest fruits (109.1mm) were seen in the hybrid US-26, which was statistically superior to Orobelle, Tanvi Plus and Tanvi. Differences with the remaining hybrids were non-significant. On the basis of fruit length and fruit width, appropriate bell-shape (which is a characteristic trait of bell peppers) was observed in the genotypes Mahabharath, Tanvi and Tanvi Plus.

Highest yield (140.5t ha<sup>-1</sup>) was recorded for Tanvi, closely followed by Tanvi Plus (127.3t ha<sup>-1</sup>), while, differences with the remaining hybrids were significant. It was interesting to note that though Tanvi recorded less number of fruits per plant (19) compared to Tanvi Plus (23), higher yield per unit area in Tanvi resulted from higher average fruit weight. Fruit weight was significantly higher in Tanvi (280g) compared to Tanvi Plus (215g). It can, thus, be inferred that yield is directly related to fruit weight rather than number of fruits per plant. Singh and Asrey (2005) reported the yield of California Wonder, an open-pollinated variety, to be 76.4t ha<sup>-1</sup>. This supports the higher yields of

hybrid varieties obtained in the present study very well. Kanwar and Sharma (2010) also reported significant differences among hybrids for fruit weight, fruit length, fruit breadth and, ultimately, yield per unit area.

Economics of production was worked out upon taking into account variable and fixed costs. Benefit:cost ratio for the hybrids ranged from 1.43 to 2.37 (Table 2).

Hybrid 'Tanvi' proved to be the best in terms of yield per unit area ( $140.5\text{t ha}^{-1}$ ), and was closely followed by 'Tanvi Plus' ( $127.3\text{t ha}^{-1}$ ). Benefit:Cost ratio for the two best hybrids i.e. Tanvi and Tanvi Plus, was 2.37 and 2.06, respectively. Hybrids 'Mahabharath', 'Tanvi' and 'Tanvi Plus' exhibited an exact bell shape.

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(MS Received 03 December 2012, Revised 23 September 2013, Accepted 24 October 2013)