

## Short communication

### Performance of capsicum genotypes for horticultural traits and disease incidence under protected structure *vis-à-vis* open conditions

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Sweet pepper or bell pepper (*Capsicum annum* L.) occupies a prominent position among green vegetables due to its export value. The agro-climatic conditions of temperate/sub-temperate regions are well suited for its commercial production. Vegetable production technology in general is not popularized yet in Garhwal region, where there is a wide scope of expansion and production potential in the hills. In mid and high hills of Uttarakhand, capsicum is cultivated as off-season during June-October, when the crop does not grow well in the adjoining plains on account of unfavourable temperatures. Despite its economic importance, growers are not in a position to produce good quality capsicum due to adverse climate under open field conditions. Hence, to increase productivity of good quality produce and for production during off -season, there is need to cultivate capsicum under protected structures. Plastic low tunnels are flexible transparent coverings that are installed over the rows or individual row of transplanted vegetables to enhance plant growth by warming the air temperature around the plants. The crop is not only advanced but an increase in yield is also obtained due to extending in cropping period than their traditional method of crop production (Kumar *et al.*, 5). An attempt has been made to screen and evaluate commercially important cultivars/hybrids of capsicum under indigenously prepared parabola shaped polytunnels and field conditions for growth parameters and disease occurrence.

The studies were carried out during at VCSG College of Horticulture, G.B. Pant University of Agriculture and Technology, Bharsar situated at 2,100 m above mean sea level. Nine genotypes *viz.*, Bomby, Aishwarya, Bharath, Manhattan, Orobelle, Indira (hybrids); California Wonder, China Zohinger and Solan Bharpur (cultivars) were included in the present set of experiments. Six-week-old seedlings were planted in the beds at a spacing of 45 cm × 45 cm in the last week of April with planting density of 4.9 plants per square metre under polytunnels as well as field

conditions. The plants were arranged in such a manner accommodating 20 plants/tunnel in a randomized block design (RBD) with three replications.

A white polythene sheet of 200 gauze was used in the experiment for construction of polytunnels using local bamboo for providing shape to the tunnels. The recommended package of practices was followed to raise the healthy crop. The observations on horticultural traits (plant height, number of fruits per plant, average fruit weight, harvest duration and fruit yield) and appearance of disease(s) were taken at regular interval. Per cent disease incidence was worked out by counting the infected and total number of leaves on each seedling. The data pertaining to horticultural traits and disease incidence were first analysed in usual way for each year separately and then homogeneity of error variances was tested using F-test. The error variances were found to be homogeneous so the pooled analysis for 2005 and 2006 was carried out accordingly. The least significant difference was used to compare the values (Gomez and Gomez, 4). The date of first observation (last week of August) was taken as zero week for recording the disease incidence. Thereafter, observations were made at weekly interval.

It is evident from the data (Table 1) that plant growth and fruit yield of capsicum was significantly superior in polytunnels in comparison to the open field conditions. The varietal differences were prominent in both the situations. In general, hybrids performed better over open pollinated cultivars. In open field conditions among the tested genotypes, plant height varied from 31.40 to 45.50 cm with minimum plant height recorded in Aishwarya while maximum in Solan Bharpur. On the other hand, under polytunnels the plant height varied from 54.25 cm (Orobelle) to 67.25 cm (California Wonder). Fruit weight is an important quality parameters and the same was recorded higher under polytunnels than open field conditions. Minimum average fruit weight was recorded in Solan Bharpur under both the situations while maximum was recorded in Manhattan (59.7 g) under open field conditions and Orobelle (73.25 g) under polytunnels. Hybrid Bharath yielded highest (2.193 kg/m<sup>2</sup>) followed by California Wonder (2.050 kg/m<sup>2</sup>) and Orobelle (2.012 kg/m<sup>2</sup>),

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**Table 1.** Performance of capsicum genotypes in polytunnel *vis-à-vis* in open field conditions.

Hybrid/ cultivar	Polytunnel			Open field			Increase in yield over open field (%)
	Plant height (cm)	Av. fruit wt. (g)	Fruit yield/ m <sup>2</sup> (kg)	Plant height (cm)	Av. fruit wt. (g)	Fruit yield/ m <sup>2</sup> (kg)	
Bomby	57.50	65.50	1.907	36.20	54.20	1.706	11.78
Aishwarya	62.25	61.25	1.918	31.40	51.30	1.479	29.68
Bharath	66.50	65.40	2.193	40.50	55.40	1.797	22.04
Manhattan	66.00	68.75	1.830	40.20	59.70	1.617	13.17
Orobelle	54.25	73.25	2.012	34.60	53.80	1.594	26.22
Indira	63.25	60.25	1.676	33.75	50.80	1.456	15.11
California Wonder	67.25	63.05	2.050	42.75	58.30	1.589	29.01
China Zohinger	58.50	52.36	1.557	30.15	50.60	0.991	57.11
Solan Bharpur	56.50	51.25	1.615	45.50	45.30	1.444	11.84
CD <sub>0.05</sub>	3.45	4.14	0.148	4.35	2.16	0.279	

**Table 2.** Progress of *Cercospora* leaf spot disease on different capsicum genotypes.

Hybrid/ cultivar	Disease incidence (%) on week						Mean
	0	1	2	3	4	5	
Bomby	20.25	40.09	52.05	62.09	63.71	64.55	50.46
Aishwarya	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bharath	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manhattan	0.00	0.00	0.00	0.00	62.28	70.50	22.13
Orobelle	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Indira	10.15	31.56	43.14	68.95	71.00	75.60	50.07
California Wonder	4.21	18.18	18.75	60.00	66.86	71.45	29.24
China Zohinger	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Solan Bharpur	6.72	27.63	30.95	32.85	56.59	59.25	35.62
Mean	4.59	13.05	16.10	24.88	35.60	37.93	

CD<sub>0.05</sub> Genotype = 4.67; Interval = 2.14; Genotype × interval = 5.89

while lowest yield was recorded in China Zohinger (1.557 kg/m<sup>2</sup>) under polytunnels. On the other hand, under open field conditions Bharath (1.797 kg/m<sup>2</sup>) yielded highest followed by Bomby (1.706 kg/m<sup>2</sup>), while lowest yield was recorded in China Zohinger (0.991 kg/m<sup>2</sup>). Increase in yield over open field conditions varied from 11.78 to 57.11 per cent with maximum in China Zohinger and minimum in Bomby.

Evaluation of these genotypes was also done for *Cercospora* leaf spot disease (*Cercospora capsici* Heald & Wolf) under natural epiphytotic conditions and data is presented in Table 2. Disease was first recorded on Bomby in the last week of August. On the first date of observation, disease was recorded only

on four genotypes (Bomby, Indira, California Wonder and Solan Bharpur) with mean disease incidence of 4.59% while incidence varied from 4.21 to 20.25% which increased to 13.05% at the time of second observation. At the time of third observation only these four genotypes exhibited symptoms with mean disease incidence of 16.10% where incidence varied from 18.75 (California Wonder) to 52.05% (Bomby). At the time of fourth observation mean incidence increased to 24.88% and incidence ranged from 32.85 to 68.95%. At the time of fifth observation mean disease incidence increased to 35.60% with range of incidence from 56.59% (Solan Bharpur) to 71.00% (Indira). At this time disease also appeared on Manhattan

(62.28%). At the time of last observation, mean disease incidence increased to 37.93% and overall disease incidence varied from 59.25 to 75.60%. Irrespective of time interval, minimum disease incidence was recorded in Manhattan (22.13%), while maximum was recorded in Bomby (50.46%). Throughout the course of investigation, only these five genotypes developed disease, while Aishwarya, Bharath, Orobelle and China Zohinger remained disease-free.

These plastic low tunnels enhanced plant growth by warming the air temperature around plants (*i.e.*, microclimate) in open fields. The crop was advanced by 15-20 days and an increase in yield was recorded due to extending in cropping period (25-30 days) than the open field conditions. These studies are in agreement with earlier workers who have reported the earliness, productivity, fruiting span, fruiting quality and plant vigour of capsicum and hot pepper hybrids significantly better under low and high polytunnels as compared to open field conditions and found hybrid Bharath promising for cultivation under polytunnels (Singh and Dhillon, 7). Similarly, Singh and Kumar (6) studied the performance of summer squash varieties under plastic low tunnels and have reported varietal differences in days to first picking and total fruit yield. Performance of chilli genotypes was studied by Deb *et al.* (3) and they found differences in various horticultural traits. Thangam and Thamburaj (9) studied comparative performance of tomato varieties and hybrids under shade and open conditions and found that plants grown under shade exhibited better growth in terms of plant height and dry matter production compared to those in open field. Significant differences between shade and open conditions were observed in respect of biochemical constituents. Significant variation was observed among the chilli genotypes for number of fruits per plant and yield per plant under all levels of shade as well as between different shade levels. There was no significant difference for number of fruits per plant and yield per plant between open and 25% shade (Sreelathakumary and Rajamony, 8). No commercial variety of capsicum has been reported resistant to *Cercospora* leaf spot disease; however, in the present studies, Aishwarya, Bharath, Orobelle (hybrids) and China Zohinger (cultivar) were found disease-free which could be ascribed to variation in the genetic make up of these hybrid/cultivar. In general, fruit of Manhattan was attractive in terms of colour, size and shape and moreover, it infected late in the season and recorded minimum disease incidence. Small fruited varieties do possess resistance against the disease. Resistance to *Cercospora capsici* is recessive and controlled by three complementary genes, additive and dominance effects being important (Cheema and Cheema, 1; Cheema *et al.*, 2). This low cost technology

for off-season cultivation of capsicum is found highly suitable, simple and profitable for advancing crop and obtaining high yield by extending crop span and suits to the vegetable growers of hills.

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