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RESEARCH NOTE

Evaluation of capsicum hybrids under protected condition

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An experiment was conducted for evaluation of capsicum hybrids under protected condition at Hi-tech Horticulture Unit, Saidapur Farm, MARS, University of Agricultural Sciences, Dharwad, Karnataka during the summer 2015-16 under protected cultivation. This study consists of fourteen different hybrids to find out their influence on growth, yield and fruit quality parameters of capsicum.The study revealed that, among fourteen hybrids evaluated, the hybrid Bachata recorded maximum fruits per plant (18.13), percent fruit set (47.61%), fruit yield per plant (2.41 kg), fruit yield per meter square (14.44 kg) and fruit yield per hectare(100.5 t) and alsowith respect to qualitative parameters maximum shelf life (7.83 days), higher pericarp thickness (0.82 cm) and maximum dietary fibre content (1.98 g/ 100 g of fruit) was found.The maximum vitamin – C content (167.50 mg/ 100 g)was recorded by Orobelle. The minimum moisture content was recorded by Bachata, Inspiration, Sympatty and Orobelle.

Key words: Capsicum, Protected cultivation, Hybrids

The genus capsicum belongs to family Solanaceae, a widely distributed and cultivated one in tropical regions of the world (Dapgan and Kazym, 2002).The capsicum (*Capsicum annuum* L.var. *grossum,* 2n= 24) is commonly known as bell pepper or green pepper or sweet pepper. In India, capsicum is extensively cultivated in Andhra Pradesh, Karnataka, Maharashtra, Tamil Nadu, Himachal Pradesh and hilly areas of Uttar Pradesh. Karnataka stands first with an area of about 3.89 thousand hectare with a production of about 53.01 thousand tons (Anon., 2015).

The traditionally grown green capsicum, depending upon variety and season, usually yields 20-40 tons per hectare in about 4-5 months. In greenhouse, the crop duration of green and coloured capsicums is about 7 -10 months and yields about 80-100 t ha^{-1}. Despite its economic importance, growers are not in a position to produce good quality capsicum with high productivity due to various biotic (pest and diseases), abiotic (rainfall, temperature, relative humidity and light intensity) and crop factor (flower and fruit drop), which ultimately affects the crop productivity adversely (Ochigbo and Harris, 1989). Growing of capsicum under polyhouse has been reported to give high productivity of good quality produce in developed countries and several hybrids have been developed recently. Hence, there is a need to evaluate their performance under naturally ventilated polyhouse conditions for getting higher productivity of excellent quality under Indian conditions. Capsicum is one such vegetable which befits into cultivation under protection to increase the production and yield. There are several capsicum varieties and hybrids available and being cultivated by farmers on commercial scale under open field condition. Hence, there is a need to evaluate various commercial capsicum hybrids for recommending its cultivation under greenhouse condition.

Present investigation was carried out during 2015-16 to evaluate capsicum hybrids under protected condition. Fourteen capsicum genotypes from different private companies collected and used for experiment under protected structure at Hi-tech Horticulture Unit, Saidapur Farm, Main Agricultural Research Station, University of Agricultural Sciences, Dharwad which is situated in the Northern Transition Zone (Zone 8) in Karnataka state. The location corresponds to $15^0$26' N latitude and 75^0 07' East longitude with an altitude of 730 m above the mean sea level (MSL).The experiment was laid out in randomized completely block design with 14 treatments and three replications.The crop was grown in naturally ventilated polyhouse by adopting the recommended package of practices (Capsicum Technical Bulletin, Hi-Tech Horticultural Unit, University of Agricultural Sciences, Dharwad).Anon., (2009). The Polyhouse used for experimentation is with height of 6 m from the floor area, gutter height is 4 m from floor area and the ventilation is (20 %) of floor area. Width and length of polyhouse is about 18m × 28 m, respectively.GI pipes were used to construct polyhouse. Transparent UV stabilized polyethylene film of 200 micron thickness was used for covering the polyhouse roof. It was provided with retractable or movable shade nets, at about 11 feet height just below the structures from ground level. The sides of the polyhouse were covered with 200 micron thick polyethylene film to a height of 3 feet from the ground level, to have better protection from rain splash. Remaining height of side wall was covered with 40 micron white coloured insect proof net from all the four sides. Fourteen different hybrids from different sources as detailed below were used for the experimental study with an objective to identify the better

Capsicum genotypes used for evaluation with source are given below

Name of the hybrid	Colour of fruit	Company
Bachata	Yellow	RijkZwaan India seeds Pvt. Ltd.
Bomby	Red	Syngenta India Ltd.
Doctor Wonder	Green	Doctor seeds Pvt. Ltd.
Green Wonder	Green	Biocarve seeds
Indra Green	Syngenta India Ltd.	
Inspiration	Red	RijkZwaan India seeds Pvt. Ltd.
Krishna	Green	Pahuja seeds Pvt. Ltd.
Mahabharath	Green	Indo-American hybrid seeds (India) Pvt. Ltd.
Orange Wonder	Orange	Biocarve seeds
Orobelle	Yellow	Syngenta India Ltd.
Purple	Purple	Biocarve seeds
Red Queen	Red	Biocarve seeds
Sympatty	Orange	Rijk Zwaan India seeds Pvt. Ltd.
Yellow Wonder	Yellow	Biocarve seeds

hybrid for growth, yield and quality. The hybrid Indra was used as a control.

The observations of growth parameters taken at 30, 60, 90 and 120 days after transplanting and the yield parameters are taken at harvesting stage. Economics of capsicum production under polyhouse was worked out by considering the present price of input and produce. The quality parameters Vitamin- C, dietary fibre, moisture content and total soluble solids were estimated at Department of Horticulture (Lab work). Harvesting of capsicum fruits was started from 70 days after transplanting and continued until 180 days after transplanting.

The hybrid Krishna recorded maximum plant height (36.87 cm) at 30 DAT which was significantly superior over the other hybrids and on par with Indra (35.93 cm) and Mahabharath (35.91 cm). The least plant height (29.51 cm) was recorded by Red Queen. At 60, 90 and 120 days after planting Indra recorded the maximum plant height(77.22 cm, 107.50 cm and 139.5 cm, respectively) which was significantly superior over the other hybrids and the least plant height (64.85 cm, 88.92 cm and 110.59 cm, respectively) was recorded by Capsicum Purple (Table 1).

At 30 DAT, among the fourteen hybrids, Mahabharath recorded the maximum number of leaves per plant (31.47) which was on par with Orobelle (30.47), Bomby (31.27), Krishna (31.07) and Indra (30.40). The hybrid Orobelle recorded maximum number of leaves (57.73, 74.00 and 103.13, respectively) at 60, 90 and 120 days after planting (Table 1). This might be due to the genetic constitution of the hybrid. The differential response of vegetative growth of the different hybrids may be due to differences in genetic constituents of the varieties and microclimate condition (Bergefurd *et al.,* 2011).

Table 1. Plant height and number of leaves per plant of capsicum hybrids at different stages of crop growth under polyhouse condition

Treatments	Plant height (cm) at				Number of leaves at			
	30 DAT	60 DAT	90 DAT	120 DAT	30 DAT	60 DAT	90DAT	120 DAT
T_1- Orobelle	33.53	75.39	104.79	134.89	30.47	57.73	74.00	103.13
T_2- Bomby	34.90	70.52	102.64	131.17	31.27	53.40	70.00	98.47
T_3- Bachata	30.05	70.24	100.82	125.78	28.27	52.93	70.44	100.33
T_4- Inspiration	31.78	73.22	101.80	129.07	29.33	54.00	68.33	97.33
T_5–Sympatty	31.20	72.01	101.93	127.20	29.20	55.07	69.44	97.93
T_6- Mahabharath	35.91	70.13	101.63	126.53	31.47	54.80	72.33	99.00
T_7- Krishna	36.87	73.95	100.34	124.34	31.07	54.27	72.89	96.13
T_8- Doctor Wonder	30.79	68.32	97.58	120.60	27.07	53.20	68.11	97.20
T_9- Green Wonder	31.90	68.20	95.66	117.39	27.13	51.67	65.22	95.27
T_{10}- Yellow Wonder	30.42	70.32	99.40	125.14	27.33	50.93	64.00	91.60
T_{11}- Orange Wonder	30.88	68.13	98.02	122.41	28.13	57.00	75.78	100.27
T_{12}- Capsicum Purple	30.39	64.85	88.92	110.59	26.53	55.20	63.33	90.93
T_{13}- Red Queen	29.51	66.08	95.03	118.29	26.27	50.33	67.44	95.80
T_{14}- Indra (control)	35.93	77.22	107.50	139.25	30.40	58.27	71.00	101.20
S.Em ±	0.35	0.57	0.56	0.80	0.57	0.83	0.99	0.58
C.D. at 5%	1.02	1.67	1.64	2.32	1.65	2.42	2.89	1.70

Table 2. Yield and related quality parameters of capsicum hybrids grown under pohyhouse condition

Treatments	Shelf life (days)	Pericarp thickness(cm)	Vitamin– c (mg/100g)	Moisture content (%)	Dietary fibre (g/ 100 g of fruit)	Yield per plant (kg)	Yield per hectare (t)
T_1 - Orobelle	7.00	0.72	167.50	90.41	1.37	2.23	93.12
T_2 - Bomby	7.17	0.77	141.53	91.50	1.65	1.98	82.82
T_3 - Bachata	7.83	0.82	145.73	90.23	1.98	2.41	100.50
T_4 - Inspiration	7.50	0.79	151.60	91.10	1.68	2.33	97.16
T_5 - Sympatty	7.17	0.76	155.13	90.69	1.53	2.17	90.62
T_6 - Mahabharath	7.17	0.78	131.27	91.63	1.48	1.74	72.52
T_7 - Krishna	5.33	0.68	121.87	93.79	1.39	1.59	66.54
T_8 - Doctor Wonder	6.83	0.70	128.47	93.99	1.42	1.60	66.68
T_9 - Green Wonder	6.50	0.71	152.97	92.35	1.46	1.61	67.37
T_{10} - Yellow Wonder	7.17	0.70	158.77	91.26	1.33	1.70	70.85
T_{11} - Orange Wonder	5.67	0.70	121.10	92.38	1.27	1.52	63.34
T_{12} - Capsicum Purple	5.33	0.67	89.27	94.07	1.35	1.48	61.94
T_{13} - Red Queen	5.67	0.68	160.63	92.78	1.31	1.43	59.72
T_{14} - Indra (control)	7.67	0.81	135.20	92.00	1.46	2.01	84.08
S.Em±	0.31	0.01	1.84	0.37	0.03	0.038	1.28
C.D. at 5%	0.90	0.029	5.34	1.07	0.09	0.089	3.74

Table 2 indicated that hybrid Bachata recorded maximum pericarp thickness (0.82 cm), which was on par with Indra (0.81 cm) and superior over the other hybrids. Least pericarp thickness (0.67 cm) was recorded by Capsicum Purple. The maximum shelf life (7.83 days) was recorded in hybrid Bhachata (T_3) which was superior over other varieties. Lesser shelf life was recorded by Krishna (5.33 days) and Capsicum Purple (5.33 days).The shelf life of capsicum hybrids is an important quality parameter because it directly influences the time that can be taken before marketing the produce. Increased shelf life is directly related to the pericarp thickness (Table 2) The hybrid Bachata recorded higher shelf life which is because of thicker pericarp (0.82 cm) which prevented the moisture loss and shrinkage. Similar results were recorded by Rai *et al.* (1992) in capsicum who reported maximum shelf life of 16 days in Arun F_1 grown in polyhouse compared to open.

The hybrid Bachata recorded minimum moisture content (90.23 %) which was on par with Orobelle (90.41 %), Sympatty (90.69 %) and Inspiration (91.10 %) and superior over the other hybrids and maximum moisture content (94.07 %) was recorded by Capsicum Purple and also Bachata recorded maximum dietary fibre content (1.98 g/100 g) which was significantly superior over other hybrids and least dietary fibre content (1.27 g/100 g) was recorded by Orange Wonder. Minimum moisture content and maximum dietary fibre is due to the firmness or brittleness of the hybrid. Similar findings were recorded by Wahundeniya *et al.* (2002) in tomato.

Higher Vitamin-C content was recorded in Orobelle (167.50 mg/100g) hybrid which was superior over all hybrids evaluated and least vitamin-C content (89.27 mg/100g) was recorded by Capsicum Purple.Generally, the higher ascorbic acid content would increase the nutritive value of capsicum, which would help better retention of colour and flavour. Capsicum varieties and hybrids possessing high ascorbic acid content are of great demand in export markets as opined by Sweta Rani (2003), Banaras *et al.* (2005) and Choudhary *et al.* (2011) in capsicum.

Bachata recorded maximum yield per plant (2.41 kg/plant) which was significantly superior over the other hybrids and also recorded higher yield per hectare (100.50 t/ha) which was on par with Inspiration (97.16 t/ha). Least yield per plant (1.43 kg/plant) and least yield (55.96 t/ha) was recorded by Red Queen (Table 2). Bachata and Inspiration hybrids are significantly superior over other hybrids. It might be due to higher number of flowers per plant, fruits per plant, more pollination, lesser flower drop, maximum per cent fruit set,maximum mean fruit weight and fruit volume. Similar findings were obtained by Granges and Leger (1989), Fontes *et al.* (1997), Pitam Chandra *et al.* (2000), Nagendra Prasad (2001), Kavita *et al.* (2008) and Kurubetta and Patil (2008) in capsicum.

The hybrid Bachata (Yellow) was found to be superior for reproductive and quality parameters which showed maximum pericarp thickness, vitamin C, good shelf life and suitable for long distance transport. These characteristics make it suitable for export and better price realization. The next best was Orobelle (Yellow) in all the yield and quality parameters including B:C ratio followed by Indra (Green) which is also a preference by local consumers.

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