

## Performance of Capsicum (*Capsicum annuum* L.) Varieties in Naturally Ventilated Polyhouse Condition

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### ABSTRACT

An experiment was conducted for performance of capsicum varieties in naturally ventilated polyhouse Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Science, Prayagraj (UP) in the month of October to March during *rabi* season 2021-2022 for studying Performance of Capsicum Varieties (*Capsicum annuum* L.) in Naturally Ventilated Polyhouse Condition. The experiment was laid out in Randomized Block Design (RBD) with 3 replications. This study consists of nine different varieties of capsicum to find out their influence on growth, yield and fruit quality parameters of capsicum. The

study revealed that, among nine different varieties evaluated, the variety Krishna recorded maximum no of fruits per plant (7.8), fruit yield per plant (1.27 kg), fruit yield per meter square (4.01 kg) and also with respect to qualitative parameters maximum shelf life (7.31 days), The maximum TSS (6.92 Brix) and vitamin – C content (160.61/100g) was found. The maximum plant height (86.96 cm), fruit length (7.74 cm) and fruit diameter (7.28 cm) were recorded by red queen. The maximum BC ratio (2.59) was recorded in Krishna.

**Keywords** Capsicum, Naturally ventilated polyhouse, protected cultivation.

### INTRODUCTION

Capsicum commonly known as sweet pepper belongs to the family Solanaceae and is believed to be native of Tropical South America (Shoemaker and Teskey 1995). It is one of the most popular vegetables in India. It is rich in vitamin A, vitamin C, and minerals such as calcium, magnesium, and potassium. In India, capsicum is widely 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 hectares with a production of about 53.01 thousand tons (Anonymous 2015).

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Its cultivation under protected conditions is becoming popular in recent years due to increased productivity and high-quality produce. For protected cultivation, different structures are being used depending upon the local environmental conditions. There are several indeterminate capsicum hybrids, which are much suited for protected cultivation and the plant spatial arrangement is one of the crop managements practices that have been used to increase yield of sweet pepper per unit area in greenhouse (Cebula 1995). The cultivation of capsicum under different protected structures like polyhouse, net house, walk-in-tunnels, plastic low tunnels are the most suitable solutions to the challenging environmental factors as it prevents spreading of insect, pest, and viral diseases. Capsicum can be successfully grown under open field conditions and in protected structures, i.e., net house, polyhouse, walk-in-tunnels, plastic low tunnels. (Singh and Sirohi 2006) but its cultivation under open condition is not successful which might be due to poor adoptability. 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.

## MATERIALS AND METHODS

An experiment was conducted for performance of capsicum varieties in naturally ventilated polyhouse Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Science, Prayagraj (UP) in the month of October to March during *rabi* season 2021-2022 for studying performance of capsicum varieties (*Capsicum annuum* L.). In Naturally Ventilated Polyhouse Condition The results of the investigation, regarding the performance of the 9 different variety of capsicum i.e., F1 Purple, Indra, Andhra, Indam Bharat, Krishna, 35-160-RZ, Red Queen, Delisha, Yellow Wonder. Source from different private companies. The experiment was laid out in Randomized Block Design

with 9 treatments and three replications. The crop was grown in naturally ventilated polyhouse. 35 days old seedlings were used for transplanting. November was the first week that transplants were performed at 45 cm × 45 cm spacing in zigzag planting method on the raised bed. The planting density was 4 plants per m<sup>2</sup> in polyhouse. The plants were trained along a plastic thread tied to GI wire stretched over headlong beds. The necessary recommended cultural practices like fertilizer application, irrigation, weeding. The four plants from each treatment were randomly selected for recording observations on plant height, first flower initiation, individual fruit weight, and number of fruits per plant and per m<sup>2</sup>, fruit yield per plant and fruit yield m<sup>2</sup> and per 250 m<sup>2</sup>.

## Statistical analysis

The data recorded during the course of investigation were subjected to statistical analysis as per method of analysis of variance Fisher (1950). The significance and non-significance of the treatment effect were judged with the help of 'f' value (variance ratio) was compared with the table value at 5% level of significance. If calculated value exceeded then the value, the effect of considered to be significant. The significant difference between the means was tested against the critical difference at 5% level of significance.

## RESULTS AND DISCUSSION

Observations were recorded on following growth parameters which are plant height and first flower initiation, and yield parameter Number of fruit per plant, Number of fruit/ m<sup>2</sup>, Fruit yield per plant (kg), Fruit yield kg/ m<sup>2</sup>, Individual fruit weight (g), Fruit length (cm), Fruit Diameter (cm), Number of fruit 250/ m<sup>2</sup>, Fruit yield kg/250 m<sup>2</sup> and quality parameters Self life (days), TSS (Brix), Vitamin-c (mg/100g).

### Plant height

The maximum plant height was recorded in Red Queen (43.17 cm) at 30 DAT which was significantly superior over the other varieties and followed by Delisha (42.00cm), Andhra (41.0cm), Indam Bharat (40.01cm), Yellow Wonder (38.63cm), 35-160-RZ

**Table 1.** Performance of various capsicum Varieties in terms of plant height, first flower initiation in naturally ventilated polyhouse condition..

	Name of variety	Plant height (cm)				First flower initiation (days)
		30 DAT	60 DAT	90 DAT	120 DAT	
V <sub>1</sub>	F1 Purple	32.08	48.67	53.83	58.03	32.83
V <sub>2</sub>	Indra	29.42	44.29	48.92	56.01	34.25
V <sub>3</sub>	Andhra	41.04	61.08	64.92	69.13	31.67
V <sub>4</sub>	Indam Bharat	40.17	55.42	60.25	67.47	33.67
V <sub>5</sub>	Krishna	32.75	49.08	55.42	60.01	27.42
V <sub>6</sub>	35-160-RZ	34.17	50.83	57.25	63.39	35.50
V <sub>7</sub>	Red Queen	43.17	65.50	74.63	86.96	38.25
V <sub>8</sub>	Delisha	42.00	63.67	71.17	74.00	35.42
V <sub>9</sub>	Yellow wonder	38.63	53.08	58.17	65.76	38.58
	F-test	S	S	S	S	S
	SEd (±)	2.6	2.47	2.6	2.8	1.5
	CD @ 5%	7.9	5.19	7.9	8.4	4.51
	CV %	12.3	10.23	12.3	8.9	4.3

(34.17cm) and the minimum plant height was recorded in Indra (29.42cm). At 60, 90 and 120 days after planting Red Queen recorded the maximum plant height(65.50 cm, 74.63 cm and 86.96 cm, respectively) which was significantly superior over the other varieties and the minimum plant height (44.29 cm, 48.92 cm and 56.01 cm, respectively) was recorded by Capsicum Indra (Table 1). This might be due to the genetic constitution of the varieties. The differential response of vegetative growth of the different may be due to differences in genetic constituents of the varieties (Bergefurd *et al.* 2011).

#### First flower initiation

The minimum days to first flower initiation was recorded in Krishna (27.42 days) followed by Andhra (31.76 days), F1 Purple (32.83 days), Indam Bharat (33.67 days), Indra (34.25 days), 35-160-RZ (35.50 days) and maximum was recorded in yellow wonder (38.12 days) are given in (Table 1). May be due occurrence of early flowering is basically a genetic character of each variety. However, favorable temperature regime in protected conditions for longer period showed great impact on the genetic constitution of plant to express its full genetic potential. Better environmental conditions and available nutrients seems to have brought quick changes in plant growth and development.

#### Fruit yield per plant (kg)

The maximum fruit yield per plant (kg) was recorded in Krishna (1.27 kg) followed by Indra (1.19 kg), 35-160-RZ (1.11 kg), Delisha (1.06 kg) Andhra (1 kg), Red Queen (0.96 kg) and the minimum fruit yield per plant was recorded in F1 Purple (0.89 kg) are given in (Table 2). It might be due to higher number of flowers per plant, fruits per plant, more pollination, lesser flower drop, maximum percent fruit set, maximum mean fruit weight and fruit volume. Similar findings were obtained by Manoj and Venugopal (2018).

#### No. of fruit per plant

The maximum number of fruit fruits per plant was recorded in Krishna (8.78) followed by Indra (7.21), Delisha (6.78), 35-160-RZ (6.87), Andhra (6.37), Indam Bharat (5.78) and the minimum number of fruit fruits per plant was recorded in F1 Purple (5.20) are given in (Table 2). This might be due to the favorable climatic conditions, sufficient accumulation of photosynthesis in the polyhouse condition. Similar result was reported by Farooq *et al.* (2015).

#### Fruit yield per m<sup>2</sup> (kg)

The maximum fruit yield per m<sup>2</sup> (kg) was recorded in Krishna (4.01kg) followed by Indra (26.7), Delisha (25), 35-160-RZ (24.7), Andhra (24.7), Indam Bharat

**Table 2.** Performance of various capsicum varieties in terms of, yield and quality parameter in naturally ventilated polyhouse condition..

Name of variety		Fruit yield per plant (kg)	No. of fruit per plant	Fruit yield per m <sup>2</sup> (kg)	No. of fruits per m <sup>2</sup>	Individual fruit weight (g)	Fruit diameter (cm)
V <sub>1</sub>	F1 Purple	0.89	5.20	2.50	20.7	127.57	5.67
V <sub>2</sub>	Indra	1.19	7.20	3.60	26.7	142.96	6.49
V <sub>3</sub>	Andhra	1.00	6.37	3.03	24.7	120.17	6.59
V <sub>4</sub>	Indam Bharat	0.93	5.78	2.72	21.7	121.04	6.58
V <sub>5</sub>	Krishna	1.27	8.78	4.01	31.0	134.80	6.45
V <sub>6</sub>	35-160-RZ	1.11	6.87	3.40	24.7	131.64	6.79
V <sub>7</sub>	Red Queen	0.96	5.45	2.93	22.7	139.19	7.28
V <sub>8</sub>	Delisha	1.06	6.78	3.22	25.0	122.18	6.47
V <sub>9</sub>	Yellow wonder	0.91	4.62	2.78	16.3	241.58	7.16
	F-test	S	S	S	S	S	S
	SEd (±)	0.06	0.3	0.16	1.2	2.6	0.1
	CD @ 5%	0.13	1.02	0.49	3.50	8.27	0.38
	CV %	7.0	9.3	9.03	8.5	3.3	3.2

**Table 2.** Continued.

Name of variety		Fruit length (cm)	Fruit yield per 250 m <sup>2</sup> (q)	Shelf-life (days)	TSS (°Brix)	Vitamin-C (mg/100 g)
V <sub>1</sub>	F1 Purple	5.38	9.24	5.58	5.08	148.23
V <sub>2</sub>	Indra	6.98	11.91	7.25	6.42	136.33
V <sub>3</sub>	Andhra	6.93	9.96	6.42	5.50	131.43
V <sub>4</sub>	Indam Bharat	5.53	9.28	7.08	6.07	126.79
V <sub>5</sub>	Krishna	5.69	12.83	7.33	4.58	122.88
V <sub>6</sub>	35-160-RZ	7.20	11.14	6.17	6.75	135.28
V <sub>7</sub>	Red Queen	7.74	9.69	7.17	6.17	160.64
V <sub>8</sub>	Delisha	7.48	10.57	6.50	6.92	142.25
V <sub>9</sub>	Yellow wonder	7.53	9.40	6.17	6.17	154.56
	F-test	S	S	S	S	S
	SEd (±)	0.2	0.40	0.2	0.2	1.3
	CD @ 5%	0.49	1.20	0.61	0.57	3.76
	CV%	4.1	6.65	5.3	5.5	1.5

(21.7) where's the minimum number of fruits per m<sup>2</sup> was recorded in F1 Purple (20.7) are given in (Table 2). This might be due to the favorable climatic conditions, sufficient accumulation of photosynthesis in the polyhouse condition this investigation was also supported by Singh *et al.* (2011) and Farooq *et al.* (2015).

#### Individual fruit weight (g)

The maximum individual weight was recorded in Yellow Wonder (241.58g) followed by Indra (142.96g), Red Queen (139.19g), Krishna (134.80g), 35-160-RZ (131.64g), F1 Purple (127.57g) and the minimum was recorded in Andhra (120.17g) are given in

(Table 2). Increased fruit weight may be attributed to the favorable microclimate that prevailed in the polyhouse compared to other structures similar result was reported by Singh *et al.* (2011) and Haque *et al.* (2011).

#### Fruit diameter (cm)

The maximum fruit diameter was recorded in Red Queen (7.28cm) followed by Yellow Wonder (7.16 cm), 35-160-RZ (6.79 cm), Andhra (6.59 cm), Indam Bharat (6.58 cm), Delisha (6.47 cm) and the minimum was recorded in F1 Purple (5.67cm) are given in (Table 2). Increased fruit size attributed in different hybrids might be due to enhanced photosynthesis,

accumulation of carbohydrates and favorable effect on vegetative growth which increased the fruit variety besides increasing the fruit size. Similar result for maximum fruit diameter under plastic tunnel has also been observed by Farooq *et al.* (2015).

#### **Fruit length (cm)**

The maximum fruit length was recorded in Red Queen (7.74 cm) followed by Yellow Wonder (7.73 cm), Delisha (7.48 cm), 35-160- RZ (7.20 cm), Indra (6.98 cm), Andhra (6.93cm) and the minimum was recorded in F1 Purple (5.38 cm) are given in (Table 2). Increased fruit size in different hybrids, might be due to enhanced photosynthesis accumulation of carbohydrates and favorable effect on vegetative growth which increased the fruit variety besides increasing fruit size. Similar result for maximum fruit length under naturally ventilated polyhouse has also been observed by Sharma and Shukla (2013) and Farooq *et al.* (2015).

#### **Fruit yield per 250 m<sup>2</sup> (q)**

The maximum fruit yield per 250 m<sup>2</sup> (q) was recorded in Krishna (12.83q) followed by Indra (9.36q), 35-160-RZ (11.14q), Delisha (10.57q) Andhra (9.96q), Red Queen (9.69q) and the minimum was recorded in F1 Purple (11.91q) are given in (Table 2). The higher fruit yield under this condition may be attributed to the favorable climatic conditions that prevailed under polyhouse and also due to its protective ability against major a biotic stress, which reduces the effect of the excess rainfall, water logging, and provide controlled environment to the crop similarly higher fruit yield was also reported by Singh and Kumar (2003), Singh *et al.* (2007), Buoczkowska (1990) and Lone (2014).

#### **Shelf-life (days)**

The maximum self-life was recorded in Krishna (7.33 days) followed by Indra (7.25 days), Red Queen (7.17 days), Indam bhara (7.08 days), Delisha (6.50), Andhra (6.42 days) and the minimum was recorded in F1 Purple (5.58 days) are given in (Table 2). It may be due to differences in genetic constituents of the varieties and microclimate condition similar result was reported by Manoj and Venugopal (2018).

#### **TSS (°Brix)**

The maximum TSS was recorded in Delisha (6.92 °Brix) followed by 35-160-RZ (6.75 °Brix), Indra (6.42 °Brix), Red Queen (6.17 °Brix), Yellow Wonder (6.17 °Brix) and minimum was recorded in Krishna (4.58 °Brix) are given in (Table 2). TSS is an important quality attribute of capsicum fruit. Increase in this parameter improves the flavor and increases the palatability. Since capsicum is used for salad making, fruits with high TSS are highly preferred. The obtained results are in accordance with the earlier findings of Narayana *et al.* (2015).

#### **Vitamin-C (mg/100g)**

The maximum Vitamin-C was recorded in Red Queen (160.61 mg/100g) followed by Yellow Wonder (154.56 mg/100g), F1 Purple (148.2356 mg/100g), Delisha (142.2556 mg/100g), Indra (136.3356 mg/100g) and minimum was recorded in Krishna (122.88 mg/100g) are given in (Table 2). Generally, the higher ascorbic acid content would increase the nutritive value of capsicum, which would help better retention of color and flavor. Capsicum varieties and hybrids possessing high ascorbic acid content are of great demand in export markets it may be due to differences in genetic constituents of the varieties and microclimate condition similar result was reported by Manoj and Venugopal (2018).

#### **Economics**

The maximum benefit cost ratio was recorded in Krishna (2.59) followed by Indra (2.40), 35-160-RZ (2:25), Delisha (2:13), Andhra (2:01), Red Queen (1:96) and the minimum benefit cost ratio was recorded in F1 purple (1:86). Varieties (V<sub>5</sub>) Krishna was superior over all other varieties followed by Indra V<sub>3</sub> in relation to cost benefit ratio. Similar finding was also reported by Sharma and Shukla (2013).

#### **CONCLUSION**

According to the present investigation, the cultivation of different capsicum varieties in poly house is very advantageous Red Queen is superior capsicum variety in terms of growth parameters and Krishna was found

superior in terms of yield and quality parameters as well as B:C ratio. For common farmers, the practice of growing capsicum variety Krishna under naturally ventilated polyhouse will be more profitable.

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