

## Performance of Capsicum Cultivars (*Capsicum annum* L.) Grown under Shade Net and Open Field in Arid Ecosystem of Rajasthan

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**Abstract** The field experiment was conducted during three successive growing seasons (2010-2013). The experiment was laid out in factorial randomized block design with three replications and 12 treatment combinations, two growing conditions viz., shade net house and open field conditions and six capsicum varieties viz., Orobelle, Bombay, Natasha Red, Swarna, Indra and california wonder. Results revealed that shade net house gave significantly higher growth characters viz., plant height (59.49 cm), No. of branches/plant (29.90) and No. of leaves /plant (60.91) as compared to open field condition. Similarly, higher yield attributes viz., length of fruits (7.74

cm), diameter of fruits (6.76 cm), fresh weight of fruit (98.9 g), dry weight (12.6 g), moisture content (91.8%), No. of fruits/plant (11.34) and yield/plant (1.07 kg) and yield/ha (477.06 kg) as compared to open field condition. Maximum net return (Rs 45922/1000m<sup>2</sup>) and B : C ratio (2.79) was also noticed under shade net house. High TSS (4.58 °Brix) and ascorbic acid (188.96 mg/100g) were also observed under shade net. Among six capsicum cultivars, Indra proved its dominance over other cultivars regarding growth, yield attributes and yield (361.26 kg/ha). Maximum net return (Rs 33148/ha) and B : C ratio (2.35) was also fetched in cultivar of Indra. As regards to quality parameters, high TSS (4.49 °Brix) and ascorbic acid (180.59 mg/100g) was observed in the cultivar of Indra. On the basis of this investigation it is concluded that Indra variety is best suited for shade net cultivation in arid region of Rajasthan.

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**Key words** Capsicum, cultivars, Shade net, TSS, Yield attributes.

### Introduction

Capsicum (*Capsicum annum* L.) also known as 'simlamirch' or bell pepper is a cool season tropical crop and lacks adaptability to varied environmen-

tal conditions. It is reported to be the native of tropical America. Capsicums are used as vegetable as well as condiment. The mature fruits (green, red and yellow) of capsicum are eaten raw (salads) or widely used in stuffings, bakings, pizza and burger preparations due to its mild pungency and taste. Capsicum is rich source of vitamin A and C and consumed by almost every Indian (1). The average annual production of capsicum in India is 1.60 lakh MT from an area of 12,000 ha [2].

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 factors (flower and fruit drop). Hence, to obtain a good quality produce and production during off season, there is a need to cultivate capsicum under protected conditions such as green houses or polyhouses or shadenet houses [3]. Shade net can be commercially exploited for successful year round cultivation of high value thermo sensitive vegetable sweet pepper. Cultivation of capsicums are widely grown in shade net due to higher productivity and economic feasibility. Through there are number of varieties and hybrids available for cultivation, the information relating to performance of different colored capsicum varieties and hybrids for quality attributes under protected environment is scanty. Hence, the present study was conducted to assess the performance of different cultivars of capsicum in terms growth, yield and quality parameters under shade net and open field condition.

### Materials and Methods

The experiment was carried out in a designed shade net at Precision Farming Development Center, Agriculture Research Station, S. K. Rajasthan Agricultural University, Bikaner during three successive growing seasons (2010—2013). The experimental soil was loamy sand (85.21% sand, 7.35% silt and 7.95% clay) with PH (8.30) and EC ( $0.16 \text{ dS}^{-1}$ ). The available N, P and K of experimental soil were 83.15, 18.6 and 179.3 kg/ha, respectively. The experiment was laid out in factorial randomized block design with three rep-

lications. The experiment consisted twelve treatment combinations comprised of two shade net viz., shade net house and open field condition and six cultivars of capsicum viz., Orobelle, Bombay, Natasha Red, Swarna, Indra and California wonder. The raised beds of 80 cm width were formed with furrow of 40 cm between two beds. One month age healthy seedlings were transplanted at the spacing of 50 cm between rows and 45 cm between plants on the raised beds and irrigated through drip irrigation. The recommended package of practices were followed. The capsicum fruits were harvested periodically. Observations were recorded on growth characters (plant height, No. of branches/plant and No. of leaves/plant), yield attributes viz., length of fruits (cm), diameter of fruits (cm), fresh weight of fruit (g), dry weight (g), moisture content (%), No. of fruits/plant, yield/plant (kg) yield (kg/ha), ascorbic acid (mg/100g) and TSS ( $^{\circ}\text{Brix}$ ). The observations were recorded from five randomly selected plants from each treatment. The ascorbic acid content in the fruit was estimated by volumetric method as proposed earlier [4] using 2, 6-dichloro phenol-indophenol dye and total soluble solids (TSS  $^{\circ}\text{Brix}$ ) with the help of a digital refractometer. Fruit wall thickness was measured with the help of vernier calipers. The data was subjected to statistical analysis as per the methods outlined earlier [5].

### Results and Discussion

#### Effect of shade net house

Data showed (Tables 1 and 2) that shade net house significantly influenced the growth, yield attributes and yield of capsicum. Tallest plants (59.49 cm), No. of branches/plant (60.91) and no. of leaves/plant (23.90) were recorded higher under shade net house as compared to open field condition. This might be due to improved photosynthesis and respiration due to the favorable climatic conditions in the shade net house. Shade net protect the crop from adverse climate. Similar results were reported by [6] in tomato and [7]. Similarly, higher yield attributes viz., length of fruits (7.74 cm), diameter of fruits (6.76 cm), fresh weight of fruit (98.9 g/plant), dry weight (12.6 g/plant), moisture content (91.8%) and No. of fruits/plant (11.34) were observed in shade net house and

**Table 1.** Effect of growing condition and cultivars on growth and yield attributes of capsicum (pooled data of 3 years).

Treatments	Plant height (cm)	No. of leaves/plant	No. of branches/plant	Length of fruit (cm)	Diameter of fruit (cm)	Fresh weight of fruit/plant (g)	Dry weight of fruit/plant (g)	Moisture content in fruit (%)	No. of fruits/plant
Growing condition									
Shade net house	59.49	23.90	60.91	7.74	6.76	98.9	12.6	91.8	11.34
Open field condition	24.32	12.24	29.33	3.94	3.22	50.5	7.4	86.1	4.26
SEM $\pm$	0.20	0.15	0.29	0.09	0.03	0.85	0.18	1.15	0.19
CD ( $p=0.05$ )	0.58	0.45	0.85	0.26	0.08	2.49	0.52	3.36	0.56
Cultivars									
Orobelle	42.21	18.49	46.12	6.08	5.17	74.7	10.1	87.5	7.96
Bombey	40.42	16.54	44.59	5.24	4.42	74.7	8.9	89.7	7.40
Natasha Red	44.00	19.68	46.72	6.38	5.45	75.7	12.3	88.7	8.58
Swarna	38.54	15.20	42.08	4.83	4.17	69.6	7.4	90.4	6.47
Indra	46.35	21.23	48.70	6.80	5.84	81.4	12.9	87.5	9.41
Callifornia wonder	39.91	17.28	42.49	5.68	4.88	72.3	8.2	90.1	6.98
SEM $\pm$	0.34	0.26	0.50	0.15	0.05	1.47	0.31	1.99	0.33
CD ( $p=0.05$ )	1.01	0.78	1.47	0.45	0.15	4.31	0.91	NS	0.98

significantly superior over open field condition. The highest yield/plant (0.81 kg) and yield/ha (477.08 kg) produced under shade net house and higher by 0.86 kg/plant and 384.23 kg/ha over open field condition. The cultivation of vegetables in net house can play a better role in improving quality, advancing maturity as well as increasing fruiting span and productivity. This might be due to light intensity in the shade net was lower than in the open field [8]. The performance of tomato and sweet pepper under unheated green house. The production of tomato and sweet pepper under medium cost green house was found top the tune of 93.2 and 76.4 t/ha, respectively [9]. Similar results were also reported in sweet pepper [11].

Further, Table 2 reveals that shade net house showed superiority over open field condition in respect to net return and B : C ratio. Maximum net return (Rs 45922/1000 m<sup>2</sup>) and B : C ratio (2.74) was observed under shade net house, whereas, the lowest net return (Rs 2713/1000m<sup>2</sup>) and B C ratio (0.84) in open field conditions. Similarly, higher TSS (4.58 Brix) and ascorbic acid (188.96 mg/100 g) were recorded under shade net house which was sig-

nificantly superior over open field condition. These results are in conformity with the findings capsicum [3, 10].

#### Effect of cultivars

A considerable change in various growth, yield attributes and yields was noticed due to effect of different capsicum cultivars (Tables 1 and 2). Among the six varieties, significantly higher plant height (43.35 cm), No. of branches/plant (48.70) and No. of leaves/plant (21.23) were recorded in Indra followed by with Natash red cultivars. Similarly, Indra has produced significantly higher length of fruits (6.80 cm), diameter of fruits (5.84 cm), fresh weight of fruit (81.4 g/plant), dry weight (12.9g/plant) and No. of fruits/plant (9.41) followed by in Natasha red. The genetic character of a variety plays an important role in the development of fruit size and weight. High values of fruit length and width was the probably due to higher fruit volume as reported early in capsicum [11]. significantly higher fruit yield/plant was recorded in Indra (0.81 kg) followed by Natasha red (0.71 kg). Similarly, with respect to yield/ha significantly higher yield of 477.08 kg was recorded in Indra which was followed

**Table 2.** Effect of growing condition and cultivars on yield, economics and quality of capsicum (pooled data of 3 years).

Treatments	Yield/ plant (kg)	Yield (q/ha)	Net return (Rs./1000m <sup>2</sup> )	B : C ratio	TSS (°Brix)	Ascorbic Acid (mg/100g)
Growing condition						
Shade net house	1.07	477.08	45922	2.79	4.58	188.96
Open field condition	0.21	92.85	2713	0.84	2.98	151.10
SEm±	0.02	7.81	1171	0.05	0.02	0.74
CD ( <i>p</i> =0.05)	0.05	22.91	3436	0.14	0.07	2.16
Cultivars						
Orobelle	0.65	288.27	22020	1.82	3.84	171.73
Bombey	0.59	263.62	18323	0.66	3.44	162.95
Natasha Red	0.71	315.58	26167	2.02	4.15	174.32
Swarna	0.51	228.62	13324	1.44	3.13	160.82
Indra	0.81	361.26	33148	2.35	4.49	180.59
Callifornia wonder	0.57	252.43	16645	1.59	3.64	169.76
SEm ±	0.03	13.53	2029	0.08	0.04	1.27
CD ( <i>p</i> =0.05)	0.09	13.68	5951	0.25	0.12	3.73

by Natasha red (315.58 kg/ha) and lowest yield was in California wonder (252.43 kg/ha). This could be higher values of fruit length, width and wall thickness contributed for maximum fruit weight in the cultivar Indra and Natasha red. The difference in the yielding ability of a variety may be due to the genetic potential of that variety. Patel and Patel [12] conducted a study on cultivation of capsicum in net house, greenhouse and open field. The production of crop was recorded highest in greenhouse, but due to huge consumption of electric energy in greenhouse the cultivation of crop was not found profitable. Net house is another alternative structure for cultivation of capsicum.

Table 2 shows that maximum net return (Rs 33148/1000m<sup>2</sup>) and B : C ratio (2.35) was noticed under Indra followed by Natasha red (Rs 26167/1000m<sup>2</sup>) and B : C ratio 2.02, respectively. Similar results were also reported earlier. [1]

The cultivars of capsicum differed significantly for TSS and ascorbic acid content (Table 2). High TSS and (4.49 °Brix) ascorbic acid content (180.59 mg/100g) was recorded in the Indra followed by the Natash red (4.15 °Brix) and 174.32 mg/100 g, respectively. The low TSS (3.13 °Brix) and ascorbic acid (160.82mg/100 g) was recorded in Swarna. The

higher ascorbic acid content and TSS would increase the nutritive values of capsicum, which would help good retention of color and flavor. Capsicum cultivars possessing high ascorbic acid content are of great demand in export markets as reported earlier [10,13].

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