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Effect of different level of training on fruit quality of Capsicum (*Capsicum annuum* L) hybrid buffalo under natural ventilated polyhouse

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Abstract

The bell pepper, (*Capsicum annuum* L), is an important off-season cash crop among the solanaceous vegetables cultivated in the Indian states of Himachal Pradesh, Uttar Pradesh, some parts of Gujarat, Uttarakhand, Jammu and Kashmir, West Bengal, Maharashtra, Karnataka and Bihar. An experiment was carried out to study the Effect of different level of training on fruit quality of Capsicum (*Capsicum annuum* L) hybrid buffalo under natural ventilated polyhouse during September, 2016 to February, 2017 at Hi-Tech Horticulture, Dr. R.P.C.A.U Pusa, Samastipur, Bihar. There were three levels of training level viz. P1 (two shoots), P2 (three shoots) and P3 ((four shoots). The experiment was laid out in factorial randomized block design with three replications. Among the different training level the maximum fruit length, fruit breadth, volume of fruit, rind thickness, self- life, A⁺ grade %, A grade %, B grade % was recorded under P1(two shoots) rest of treatments while C grade % fruit and B : C ratio was recorded under P3 (Four shoots) rest of treatments.

Keywords: *Capsicum annuum* L, hybrid buffalo, natural ventilated polyhouse

Introduction

The bell pepper, (*Capsicum annuum* L), is an important off-season cash crop among the solanaceous vegetables cultivated in the Indian states of Himachal Pradesh, Uttar Pradesh, parts of Gujarat, Uttarakhand, Jammu and Kashmir, West Bengal, Maharashtra, and Karnataka (Chadha 2005) ^[1]. During the summer and rainy seasons, Himachal Pradesh is a major supplier of bell pepper fruits to the plains, making it a strong source of higher prices due to offseason cultivation. Greenhouse, the recent term in Indian agriculture, is a method of growing plants in a regulated or partially controlled climate, resulting in higher yields than would be possible in open conditions (Navale *et al.* 2003) ^[4]. The main focus in greenhouse cultivation is on acceptable cultural practices such as plant densities and training systems in order to increase yield per unit area by maximizing available space and resources. A successful training system will not only allow for better management and uniform lighting of the plants, but it will also allow for closer planting, earlier fruit ripening, higher yields of larger fruits, and higher yields of high-quality seeds. Different plant densities and growth habits require different training programs. For fresh vegetable production, agro-techniques such as adequate planting density and plant training have been used in India and other countries, but these agro-techniques have not been used on a large scale for seed production under protected conditions. Cultural practices such as proper plant spacing and training level have a significant impact on capsicum growth, yield, and quality. In light of the above, the current research was designed to determine the best planting density and training method for bell pepper seed production under protected conditions. Except for number of flowers plant⁻¹ and days to first picking, which were better under control (i.e. on plants not trained at all), the two-stem training method in capsicum was found to be the best for most traits (Singh *et al.* 2017) ^[6].

Materials and Methods

The present investigation was carried out at Hi-Tech Horticulture, R.P.C.A.U PUSA, Samastipur, Bihar during 2017, Effect of different level of training on fruit quality of Capsicum (*Capsicum annuum* L) hybrid buffalo under natural ventilated polyhouse. Capsicum hybrid buffalo seedlings were planted in two rows on a one-meter-wide bed with a 50-centimeter path between them, with three training levels: P1 (two shoots per plant), P2 (three

shoots per plant), and P3 (four shoots per plant). Plastic thread tied to galvanized iron wire stretched over head along the bed was used to train the plants. The experiment was set up in a three-replication with factorial randomized block design. Irrigation and fertilizer were applied according to the instructions. Misting was done with an over head mister as required to bring the temperature and relative humidity in the polyhouse up to optimum levels. The polyhouse was heated at night to keep a constant temperature of 16 °C. During the cultivation season, maximum temperatures (daytime) inside the polyhouse ranged from 20 to 34 °C depending on outside air temperatures. For irrigation and fertilization, a drip irrigation device was used. Five plants were tagged randomly in each treatment for recording the fruit length from the stem end of the fruit to the distal end of the fruit using vernier caliper and mean calculated and recorded in centimeters. Using a vernier caliper, the breadth of five fruits from each treatment was calculated at the point of maximum breadth, and the mean was determined and recorded in centimeters. The volume of fruit was measured using the water displacement method on five randomly selected fruits. The fruits were dipped into a jar of water, the displaced water was estimated by the measuring cylinder, and the mean was recorded and expressed in cubic centimeters (cc). With the aid of a vernier caliper, the selected fruits were sliced at the equatorial plane to calculate the rind thickness, and the mean was calculated and reported in centimeter. On the basis of light green color development of 25, 50, 75, and 100 percent, five fruits per treatment were chosen. These fruits were stored at room temperature until they were still fresh and of acceptable quality. To express the shelf life in days, the number of days was calculated and registered. The capsicum fruits are harvested from the labeled plants from each treatment were divided into four parts of the grades (ie. A⁺, A, B & C) and recorded in grams. "A⁺" grade fruit consider > 200 g. "A" grade fruit consider 150-200 g with four lobes. "B" grade fruit consider 100-150 g. "C" grade fruit consider < 100 g.

Results and Discussion

The fruit length at different training levels, the highest fruit length (9.30 cm) was recorded in P1 (two shoots) training levels, which was statistically at par with P2 (9.01 cm) and significantly superior over P3 (8.81 cm) training levels. Which could be due to the higher source to sink ratio. A sufficient amount of assimilates was available for young fruits in training level P1, but the reverse situation was observed under training level P3, where the sink to source ratio was high. So, due to the more sink assimilates availability was low and it has directly affected on length and breadth of fruit. The highest number of fruit breadth (7.03 cm) was recorded in P1 (two shoots) training levels which was statistically at par with P2 (7.01 cm) and P3 (6.90 cm) training levels. It may be due to the higher source to sink ratio. A sufficient amount of assimilates was available for young fruits in training level P1, but the reverse situation was observed under training level P3, where the sink to source ratio was high. So, due to the more sink assimilates availability was low and it has directly affected on length and breadth of fruit. Among different training levels, the highest number of fruit volume (309.80 cc/fruits) was obtained in P1 (two shoots) training levels which was significantly superior over P2 (293.03 cc/fruits) training levels. This could be due to the increased uptake of

more nutrients and buildup of sufficient photosynthates enabling the increase in size of fruits (length and breadth), ultimately resulted in the increased fruit weight and volume. Similar findings were reported by Joshi *et al.* (1980) [3] in tomato, Harminder Singh *et al.* (1997) [2] in brinjal and Prasad (2001) [5] in capsicum. With regard to different training levels, the highest rind thickness (0.73cm) was observed under P1 (two shoots) training levels which was significantly superior over P2 (0.64 cm) training levels. Which might be due to bigger size of fruits under naturally ventilated Polyhouse, spacing S3 and training level P1. The rind thickness of fruit was positively correlated with fruit size, which is similar to the observation of Stevens *et al.* (1977). Significantly higher (7.11 days) shelf life was noticed under P1 (two shoots), which was statistically at par with P2 (6.59 days) and significantly superior over P3 (6.14 days) training levels. This is mainly because of bigger size fruits having thicker pericarp. Among different training levels, the highest number of 'A⁺' (5.70 fruits) and 'A' (23.08 fruits) grade was recorded under P1 (two shoots) training levels which was statistically at par with P2 (5.18 fruits) and (21.36 fruits) respectively training levels and significantly superior over P3 (4.73 fruits). This might be due to availability of more space to spread, more moisture and nutrients and solar radiation compared to other spacing S1 and S2. With regard to the different training levels of 'B' grade fruits, the highest number of 'B' grade fruit was noticed under P1 (47.78 fruits) training levels which was significantly superior over P2 (43.38 fruits) training levels. Among different training levels, the highest number 'C' grade fruit (36.41 fruits) was noticed in P3 (four shoots) training levels which was significantly superior over P2 (30.06 fruits) training levels. With regards to training levels, the training level P1 observed the maximum (47.78%) extent of B grade fruits and the training level P3 was observed the maximum (36.41%) extent of C grade fruits as compare to other training levels. This might be due to not availability of more space to spread, more moisture and nutrients and solar radiation compared to other spacing S3 and S2. Among different training levels, the highest B: C ratio (6.21) was recorded under P3 (four shoots) training levels which was significantly superior over P2 (4.91) training levels. It may due to better quality and higher yield obtained than other treatments.

The grades are accepted by retail outlet of India

Sl. No.	Grade	Fruit weight
1	A ⁺	> 200 g
2	A	150-200 g with four lobes
3	B	100-150 g
4	C	< 100 g

Table 1: Effect of different level of training on fruit length, fruit breadth, volume of fruit, rind thickness and self- life of Capsicum (*Capsicum annuum* L) hybrid buffalo under natural ventilated polyhouse

Treatment	Fruit Length	Fruit Breadth	Volume of Fruit	Rind Thickness	Self-Life
P1 (Two shoots)	9.30	7.03	309.80	0.73	7.11
P2 (Three shoots)	9.01	7.01	293.03	0.64	6.59
P3 (Four shoots)	8.81	6.90	287.21	0.59	6.14
S.Em(±)	0.11	0.07	3.55	0.02	0.24
LSD(0.05)	0.34	0.22	10.65	0.07	0.71
CV%	3.80	3.15	3.59	11.05	10.60

Table 2: Effect of different level of training on extend of fruit grade (%) and B: C ratio of capsicum hybrid buffalo

Treatment	A ⁺ grade %	A grade %	B grade %	C grade %	B : C ratio
P1 (Two shoots)	5.70	23.08	47.78	23.43	4.02
P2 (Three shoots)	5.18	21.36	43.38	30.06	4.91
P3 (Four shoots)	4.73	19.96	39.13	36.41	6.21
S.Em(±)	0.24	0.60	1.45	0.96	0.15
LSD(0.05)	0.71	1.79	4.33	2.87	0.46
CV%	13.59	8.34	9.99	9.60	10.09

Conclusion

Whenever it comes to various types of characters like; fruit length, fruit breadth, volume of fruit, rind thickness, self- life, A⁺ grade %, A grade %, B grade % was recorded under P1 while highest C grade % fruit and B : C ratio was recorded under P3.

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