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## To study effect of organic sources and pruning patterns on growth and yield of sweet pepper (*Capsicum annuum* var. *Grossum*) cv. Shalimar hybrid-2 under protected conditions

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**Abstract**

An investigation was conducted in the plastic greenhouse at experimental field of the Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir (SKUAST-Kashmir) during *Kharif* season 2013-14 to find out the most suitable organic source and pruning pattern for optimum growth, yield and quality of sweet pepper in Kashmir valley against four different nutrient treatments (S<sub>1</sub>: Farmyard manure @ 2.5 kg m<sup>-2</sup>, S<sub>2</sub>: Vermicompost @ 0.5 kg m<sup>-2</sup>, S<sub>3</sub>: Sheep manure @ 1.65 kg m<sup>-2</sup> and S<sub>4</sub>: Recommended fertilizer dose (20 t FYM + NPK @ 120:90:60 kg ha<sup>-1</sup>) under two pruning levels P<sub>1</sub>: One shoot and P<sub>2</sub>: three shoot. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. Data with regards to main effect revealed that organic manures through vermicompost (S<sub>2</sub>) resulted in maximum plant height (117.18 cm). In case of pruning the maximum plant height (119.18 cm) were obtained with plants pruned to one shoot (P<sub>1</sub>). Most of the yield parameters also recorded higher values due to vermicompost (S<sub>2</sub>) e.g., total fruit yield (10.25 kg m<sup>-2</sup>) while in case of pruning the maximum total fruit yield (8.92 kg m<sup>-2</sup>) was observed in plants pruned to three shoots..

**Keywords:** Sweet pepper, growth, organic manures, pruning, yield and protected condition

**Introduction**

*Capsicum* also known as sweet pepper, belongs to the family Solanaceae. India contributes one fourth of world production of sweet pepper with an average annual production of 4.51 million tons from an area of 0.885 million hectare, with a productivity of 50.9 ha<sup>-1</sup> (Anonymous, 2013)<sup>[3]</sup>. In Kashmir, sweet pepper is grown as minor crop and the area under this crop in Kashmir is 300 ha, with a production of 1223 tonnes (Anonymous, 2014)<sup>[4]</sup>. Growing of vegetables under poly house improves quality of produce this in turn is helpful in getting higher price that becomes remunerative to grower. Its yield in open field condition ranges from 30-40 t ha<sup>-1</sup> where as in greenhouse it is 100-120 t ha<sup>-1</sup> (Prabhakara *et al.*, 2004)<sup>[16]</sup>. Pruning facilitates light penetration for early ripening of fruits and getting higher yields. Application of organic manures increase yield and influence quality attributes in vegetables (Worthington, 2001)<sup>[25]</sup>. Keeping in view the above considerations, the study was undertaken to assess the effect of different organic manures and pruning patterns on growth, yield and quality of capsicum under protected conditions.

**Materials and Methods**

The investigation entitled "Effect of organic sources and pruning patterns on growth, yield and quality of sweet pepper (*Capsicum annuum* var. *grossum* L.) cv. Shalimar hybrid-2 under protected conditions" in Kashmir valley was carried out during *kharif* 2013-14 at Vegetable Experiment Farm, Division of Vegetable Science, SKUAST-Kashmir, Shalimar. The experiment was laid out in randomized Block Design (RBD), the total number of treatments were eight with three replications. The eight treatments combinations comprising of S<sub>1</sub>P<sub>1</sub> (Farm yard manure @ 2.5 kg m<sup>-2</sup> + one shoot), S<sub>1</sub>P<sub>2</sub> (Farm yard manure @ 2.5 kg m<sup>-2</sup> + Three shoots), S<sub>2</sub>P<sub>1</sub> (Vermicompost @ 0.5 kg m<sup>-2</sup> + one shoot), S<sub>2</sub>P<sub>2</sub> (Vermicompost @ 0.5 kg m<sup>-2</sup> + Three shoots), S<sub>3</sub>P<sub>1</sub> (Sheep manure @ 1.65 kg m<sup>-2</sup> + One shoot), S<sub>3</sub>P<sub>2</sub> (Sheep manure @ 1.65 kg m<sup>-2</sup> + Three shoots), S<sub>4</sub>P<sub>1</sub> (Recommended fertilizer dose\* + One shoots) and

S<sub>4</sub>P<sub>2</sub> (Recommended fertilizer dose\* + three shoots \*(20 t FYM + NPK @ 120:90:60 kg ha<sup>-1</sup>). The recommended dose of fertilizer for capsicum *i.e.*, 120: 90: 60 NPK kg ha<sup>-1</sup>, whole of phosphorus and potassium along with half dose of Nitrogen was applied at the time of sowing to plots in which recommended dose of fertilizer was to be applied. Remaining half dose of nitrogen was applied as spilt dose to plots of recommended dose of fertilizer, 25 per cent was applied 45 days after transplanting and remaining half dose of nitrogen was applied 90 days after transplanting. Full dose of FYM, full dose of vermicompost and full dose of sheep manure was applied 15 days before transplanting to plots.

## Results and Discussion

**Effect on Growth attributes:** The growth attributes were significantly affected by different sources of organic sources and pruning patterns. Data have shown significant improvement in the plant height while non-significant improvement in leaf area index of capsicum due to influence of organic sources and pruning patterns. Significantly highest plant height (117.18 cm) was recorded with Vermicompost @ 0.5 kg m<sup>-2</sup> (Table-1). Was effected by organic manures significantly (Table-1). This can be attributed to the fact that vermicompost is a rich source of macro and micro nutrients which are released into the soil slowly over a period of time, enabling the plants to consume these nutrients throughout

their life cycle. Vermicompost also contains all beneficial soil bacteria (Sinha *et al.*, 2010) [22] so, its dominating role over FYM and sheep manure is obvious. The results are in conformity with the finding of Fung *et al.* (1994) [8], Corrales *et al.* (1991) [7], Abd-El-Aty (1997) [1] Sunitha (2000) [23] and Anitha *et al.* (2003) [2]. The Capsicum Shalimar hybrid-2 was also significantly influenced by the pruning with respect to plant height and leaf area index. Plants pruned to one shoot (P<sub>1</sub>) recorded maximum plant height (119.18 cm). However plants with three shoots (P<sub>2</sub>) recorded more leaf area index (3.39). Increase in height of plants pruned to one shoot may be attributed to the phenomenon of apical dominance and diversion of nutrients to the growing point that resulted in more plant height. Reason for high leaf area index in case of plants pruned to three shoots might be due to increased number of leaves in plants with three shoots. The results are in agreement with the findings of Paksoy and Umesh *et al.* (2008) [24]. Data revealed that among various treatments days to first flower, first fruit set and days to first fruit harvest was recorded to be maximum when Vermicompost @ 0.5 kg m<sup>-2</sup> (37.55, 45.92 days and 60.53 days) was used as organic source. Similar results have been reported by Naidu *et al.* (2002) [10]. Significantly maximum number of days to first, flower, fruit set and days to first fruit harvest was recorded with plants pruned to three shoots. The results corroborate with the findings of Umesh, *et al.* (2008) [24].

**Table 1:** Effect of organic manures and pruning patterns on growth parameters of sweet pepper cv. Shalimar hybrid-2.

Source	Plant height (cm)	Leaf area index	Days to first flower	Days to first fruit set	Days to first fruit harvest	Duration of picking (days)
<b>Organic manure</b>						
S <sub>1</sub>	113.71	3.25	36.33	43.40	59.25	119.16
S <sub>2</sub>	117.18	3.49	37.88	45.92	60.53	122.00
S <sub>3</sub>	115.81	3.41	37.55	44.55	59.86	120.66
S <sub>4</sub>	111.95	3.03	34.56	41.78	57.58	101.50
S.E(m)±	1.03	0.12	0.73	0.75	0.46	2.76
C.D (p≥0.05)	3.14	N.S	2.19	2.27	1.39	8.24
<b>Pruning</b>						
P <sub>1</sub>	119.18	3.07	34.52	45.14	55.40	116.75
P <sub>2</sub>	108.65	3.39	38.53	47.76	63.22	114.92
S.E(m)±	1.15	0.08	.56	0.53	0.32	0.62
C.D (p≥0.05)	3.49	0.25	1.55	1.60	0.98	1.86

**Effect on yield attributes and yield:** Maximum fruit length (7.65 cm), width (7.02 cm), and average fruit weight (119.66 g) was obtained with Sheep manure @ 1.65 kg m<sup>-2</sup> as depicted in table-2. This increase may be due to better organic matter build up, more translocation of nutrients to aerial parts for synthesis of protoplasmic protein and other compounds (Singh *et al.*, 2000) [20]. Plants pruned to one shoot recorded maximum fruit width (7.34 cm), fruit length (7.89cm) and average fruit weight (127.20 g). The improved characteristics were expressed due to better exposure of plants to light because of pruning of plants to one shoot, assimilation of more carbohydrates and proteins due to less competition between shoots and translocation of more photosynthates from source to sink. Enhanced cell division and cell enlargement might have attributed to increased fruit size. The results are in line with those of Lim and Chen (1988) [9], Olson (1989) [14], Saen and Pathom (1998) [18]. Data revealed that significantly highest flowers plant<sup>-1</sup> (42.95), fruits plant<sup>-1</sup> (22.45), fruit yield of 2.55 kg plant<sup>-1</sup> and total fruit yield (9.42kg m<sup>-2</sup>) was recorded with vermicompost @ 0.5 kg m<sup>-2</sup>, similarly plants pruned to three shoots recorded maximum fruit yield (2.44 kg plant<sup>-1</sup>). Vermicompost producing more

flower number might be due to presence of more phosphorus as compared to other two sources of organic manures, increased availability of native soil phosphorus and biological activity (Singh and Srivastava, 1970) [21]. These findings are in consonance with those of Umesh *et al.* (2008) [24] and Cebula (1995) [5]. The results showed that the interaction between organic manures and pruning level were significant and are depicted in table-3. Vermicompost and plants with three shoots recorded highest number of flowers plant<sup>-1</sup> (48.33) and fruit number per plant. This may be due to complementary effect between vermicompost and pruning pattern P<sub>2</sub> *i.e.* plants with three shoots. The interaction effect was significant with highest average fruit weight in case of average fruit weight between organic manures and pruning pattern were found significant. The highest average fruit weight (132.60 g) recorded with the application of sheep manure @ 1.65 kg m<sup>-2</sup> and plants with one shoot. Data revealed that organic manures had significant effect on duration of picking. Longest duration (122 days) of picking in capsicum plants was recorded with Vermicompost @ 0.5 kg m<sup>-2</sup>. Significantly highest duration of picking was observed in plants pruned with one shoot (P<sub>1</sub>) *i.e.* 116.75 days.

**Table 2:** Effect of organic manures and pruning patterns on growth and yield parameters of sweet pepper cv. Shalimar hybrid-2

Source	Plant height (cm)	Leaf area index	Days to first flower	Days to first fruit set	Days to first fruit harvest	Duration of picking (days)
<b>Organic manure</b>						
S <sub>1</sub>	113.71	3.25	36.33	43.40	59.25	119.16
S <sub>2</sub>	117.18	3.49	37.88	45.92	60.53	122.00
S <sub>3</sub>	115.81	3.41	37.55	44.55	59.86	120.66
S <sub>4</sub>	111.95	3.03	34.56	41.78	57.58	101.50
S.E(m)±	1.03	0.12	0.73	0.75	0.46	2.76
C.D (p≥0.05)	3.14	N.S	2.19	2.27	1.39	8.24
<b>Pruning</b>						
P <sub>1</sub>	119.18	3.07	34.52	45.14	55.40	116.75
P <sub>2</sub>	108.65	3.39	38.53	47.76	63.22	114.92
S.E(m)±	1.15	0.08	.56	0.53	0.32	0.62
C.D (p≥0.05)	3.49	0.25	1.55	1.60	0.98	1.86

**Table 3:** Interaction effect of organic manures and pruning patterns on Flower number plant<sup>-1</sup>, fruit number plant<sup>-1</sup>, Average fruit weight (g) and Fruit yield plant<sup>-1</sup> (kg) of sweet pepper cv. Shalimar hybrid-2.

Treatment	Pruning levels											
	Flower number plant <sup>-1</sup>			Fruit number plant <sup>-1</sup>			Average fruit weight (g)			Fruit yield plant <sup>-1</sup> (kg)		
Organic manure	P <sub>1</sub>	P <sub>2</sub>	Mean (x̄)	P <sub>1</sub>	P <sub>2</sub>	Mean (x̄)	P <sub>1</sub>	P <sub>2</sub>	Mean (x̄)	P <sub>1</sub>	P <sub>2</sub>	Mean (x̄)
S <sub>1</sub>	33.50	43.13	38.31	16.60	21.43	18.80	122.86	106.93	114.89	2.03	2.29	2.17
S <sub>2</sub>	37.57	48.33	42.95	18.37	24.53	21.45	129.76	107.26	118.51	2.38	2.71	2.55
S <sub>3</sub>	35.60	45.53	40.56	17.60	23.17	20.38	132.60	106.73	119.66	2.25	2.63	2.44
S <sub>4</sub>	33.20	40.00	36.60	16.17	19.77	18.18	121.56	103.43	112.66	1.98	2.11	2.04
Mean (x̄)	34.47	43.58	39.14	17.18	22.22	19.70	127.19	108.34	118.77	2.18	2.44	2.30
S.E(m)±	0.84			0.47			1.93			0.03		
C.D (p≥0.05)	2.52			1.44			5.88			0.09		

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