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STANDARDISATION OF ORGANIC SOURCES AND PRUNING PATTERNS ON GRADING AND QUALITY 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 greenhouse at experimental field of the Division of Vegetable Science, SKUAST-K during *Kharif* season 2013-14 to find out the most suitable organic source and pruning pattern for optimum grading and quality of sweet pepper against four different nutrient treatments (S_1:Farmyard manure @ 2.5 kg m^{-2}, S_2: Vermi compost @ 0.5 kg m^{-2}, S_3: Sheep manure @ 1.65 kg m^{-2} and S_4: Recommended fertilizer dose (20 t FYM + NPK @ 120:90:60 kg ha^{-1}) under two pruning levels P_1 : One shoot and P_2: three shoot. Data with regards to main effect revealed that organic manures through vermi compost (S_2) in combination P_1 treatment resulted in maximum of "A" (24.01 %) and "B" grade (56.02 %) while, minimum was recorded under R.D.F in combination with P_2 treatment (16.28 % and 36.13 %) .The results revealed that among various organic sources, S_2 recorded highest vitamin C (244.67mg 100^{-1}g) and dry matter 7.80 (%) as compared to control (233.07 mg 100^{-1}g and 6.38 %).Therefore it may be concluded that vermicompost along with plants pruned to one shoot resulted in better graded and quality fruits.

INTRODUCTION

Capsicum also known as sweet pepper belongs to the family Solanaceae. Sweet pepper is believed to be native of Tropical South America (Shoemaker and Teskey, 1995). Chromosome number of sweet pepper is 2n = 24. Country 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^{-1} (Anonymous, 2013). 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). Sweet pepper has attained a status of high value crop in India in recent years and occupies a pride position among vegetables in Indian cuisine because of its delicacy and pleasant flavor. Sweet pepper is a cool season tropical crop and lacks adaptability to varied environmental conditions (Yoon *et al*., 1989). Due to erratic behaviour of weather, the crops grown in open field are often exposed to fluctuating levels of temperature, humidity, wind flow *etc*. which ultimately affect the crop productivity adversely (Ochigbo and Harris, 1989). To obtain good quality produce and production during off season there is need to cultivate capsicum under protected conditions such as greenhouse or polyhouses especially under Kashmir valley, were the growing season is shorter. Growing of vegetables under poly house improves quality of produce this in turn is helpful in getting higher price that becomes remunerative to grower (Navel *et al*., 2003). Its yield in open field condition ranges from 30-40 t ha^{-1} where as in green house it is 100-120 t ha^{-1} (Prabhakara *et al*., 2004).The most important operation performed under greenhouse for production of high quality capsicum is pruning. Pruning facilitates light penetration for early ripening of fruits and getting higher yields. Due to the heavy vegetative growth and fruit load on the colored pepper plants (Shaw and Cantliffe, 2002), shoot pruning is important factor in proper utilization of production area (Maniutiu *et al*., 2010). Pruning of capsicum plants to one branch increases flesh thickness and vitamin C (Alsadon, 2013). Pruning of plants to 2, 3 or 4 shoots was also reported to be effective in increasing quality (Cebula, 1995). Pruning is prerequisite for better quality of fruits because it increases the quality attributes viz., TSS, Ascorbic Acid etc., (Kumar *et al*., 2014). Organic manures is the key to improve the sustainability of agricultural farming system and soil productivity and also the organic treated plants produces optimum vegetative growth (Dalal, 2012). Application of organic manures increase yield and influence quality attributes in vegetables (Worthington, 2001) in addition organic manures improve soil nutrient status and enhance the biological activity of the soil (Bano and Kale *et al*., 1987). Application of farm yard manure as organic manure

significantly increases the dry matter content of sweet pepper (Shehata, 1992). Organic fertilization produces fruits with high quantity vitamin C content (Dumas *et al*., 2003). Vermicompost being rich NPK and other essential nutrients can be used as a substitute for chemical fertilizer (Jeyabal and Kuppuswamy, 2001). Application of vermicompost also increases chlorophyll, carbohydrate and protein content of capsicum plants (Adhikary and Gantayet, 2012). Vermicompost treatment plants were showed 43.58%, 41.26%, 42.46% increase of chlorophyll, carbohydrate and protein contents respectively over control. Keeping in view the above considerations, the study was undertaken to assess the effect of different organic manures and pruning patterns on grading and quality of capsicum under protected conditions.

MATERIALS AND METHODS

The investigation entitled "Effect of organic sources and pruning patterns on quality and soil parameters 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 Complete Block Design (RCBD), the total number of treatments were eight with three replications. The eight treatments combinations comprising of S_1P_1 (Farm yard manure @ 2.5 kg m^{-2} + one shoot), S_1P_2 (Farm yard manure @ 2.5 kg m^{-2} + Three shoots), S_2P_1 (Vermicompost @ 0.5 kg m^{-2} + one shoot), S_2P_2 (Vermicompost @ 0.5 kg m^{-2} + Three shoots), S_3P_1 (Sheep manure @ 1.65 kg m^{-2} + One shoot), S_3P_2 (Sheep manure @ 1.65 kg m^{-2} + Three shoots), S_4P_1 (Recommended fertilizer dose* + One shoots) and S_4P_2 (Recommended fertilizer dose* + Three shoots *(20 t FYM + NPK @ 120:90:60 kg ha^{-1}). The recommended dose of fertilizer for capsicum *i.e.,* 120: 90: 60 NPK kg ha^{-1}, 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. The number of fruits of different grades were counted and totaled separately plant wise of five randomly selected plants (Umesh *et al.,* 2008). Vitamin C (Ascorbic acid) was worked out by selecting fresh green fruits preferably of uniform size from the selected plants; the fruits were cut into small pieces. 100g of chopped fresh green fruits from each treatment were then used for the estimation of Vitamin C content in the laboratory following 2,6 dichlorophenol indophenols visual titration method (A.O.A.C., 1975). Dry matter content of 100 g of fresh green fruit from each of the replication was weighed, and sun dried to remove the moisture content. The sundried samples were again put in the incubator for complete drying at 60-65ºC, after complete drying the samples were again weighed (g). The dry matter content was worked out as percent. The estimation of chlorophyll content in fresh fruit was carried out following the procedure outlined by Arnon (1949). Fruits from selected plants were cut across the equatorial plane for measuring the pericarp thickness in millimeters with the help of a digital vernier caliper and then average was worked out.

RESULTS AND DISCUSSION

Grading

Maximum number of grade A (21.23 %) and grade B (49.45 %) fruits was obtained under S_2 treatment (Vermicompost (@ 0.5 kg m^{-}) which was significantly at par to S_3 treatment (sheep manure @1.65 kg m^{-2}) viz., 19.91 as depicted in Table-1. 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). Similar results were also obtained by (Singh and Chauan, 2014) in potato and (Singh *et al.,* 2003) conducted same result in potato .With regards to pruning patterns, the maximum 21.36 and 53.17 per cent of A and B grade fruits was recorded under pruning treatment P_1 (plants with one shoot) which were significantly superior to P_2 (plants with three shoots) viz., 17.39 and 21.36 per cent. The improved characteristics were expressed may be 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 Saen and Pathom (1998), Naryan (2010) and Naryan *et al.* (2013) Alsadon *et al.* (2014).The interaction between vermicompost and plants with one shoot produced highest percentage of "A" and "B" grade fruits i.e. S_2P_1 (vermicompost@.5 kg m^{-2} + plants with one shoot) viz., 24.01 and 56.02 per cent, which was significantly superior over all the treatment combinations but was at par with S_3P_1 treatment combination as depicted in table-2. This may be due to cumulative effect of both vermicompost and pruning of plants to one shoot.

Quality

Quality parameters were found effected significantly by organic manures but the effect of pruning patterns were non-significant except in case of dry matter % of fruit as depicted in Table 3. In addition to this an interaction effect was found

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

Source	Grading (%)		
	Grade "A"	Grade "B"	Grade "C"
Organic manure			
S_1	18.39	46.72	36.02
S_2	21.23	49.45	30.21
S_3	19.91	48.13	32.52
S_4	17.97	45.25	37.32
S.E(m) ±	0.61	0.64	0.61
C.D (pe≥0.05)	1.81	1.92	1.73
Pruning			
P_1	21.36	53.17	25.81
P_2	17.39	39.6	44.1
S.E(m) ±	0 .74	1.81	2.35
C.D (pe≥0.05)	2.18	5.44	7.45

Table 2: Interaction effect of organic manures and pruning patterns on grading of sweet pepper cv. Shalimar hybrid-2

PruningOrganic manures	Grade (%) Grade A		Grade B		Grade C	
	P_1	P_2	P_1	P_2	P_1	P_2
S_1	19.90	16.89	52.31	40.13	28.30	44.74
S_2	24.01	18.47	56.02	40.23	19.97	43.57
S_3	22.90	17.92	54.03	42.90	23.20	42.84
S_4	19.67	16.28	50.36	36.13	30.20	47.45
S.E(m)±	0.44		0.69		1.63	
C.D (pe³0.05)	1.36		2.07		4.89	

Table 3: Effect of organic manures and pruning patterns on quality parameters of sweet pepper cv. Shalimar hybrid-2.

Source Organic manure	Vitamin C (mg 100^{-1}g)	Dry matter (%)	Pericarp thickness (mm)	Total chlorophyll (mg $100g^{-1}$)
S_1	235.67	6.72	1.15	0.45
S_2	244.67	7.8	1.25	0.48
S_3	241.65	7.23	1.22	0.5
S_4	233.07	6.38	1.1	0.44
S.E(m)±	1.71	0.12	0.03	0.005
C.D (pe³0.05)	5.24	0.38	0.09	0.02
Pruning				
P_1	241.21	6.74	1.26	0.47
P_2	236.32	7.33	1.11	0.46
S.E(m)±	2.23	0.18	0.02	0.01
C.D (pe³0.05)	N.S	0.52	NS	N.S

Table 4:Interaction effect of organic manures and pruning patterns on dry matter (%) of sweet pepper cv. Shalimar hybrid-2

Organic manure	Pruning	
	P_1	P_2
S_1	6.48	6.95
S_2	7.73	7.87
S_3	6.69	7.76
S_4	6.04	6.73
S.E(m)±	0.08	
C.D (pe≥0.05)	0.25	

significant in case of dry matter % of fruit. The fruits produced from S_2 treatment recorded maximum vitamin C (244.67 mg $100g^{-1}$), dry matter (7.80 %) and pericarp thickness (1.25 mm). More dry matter in specific treatments may be attributed to better production and translocation of photosynthates to the fruits. The results are in conformity with findings of Narayan *et al*. (2013) and Caturano *et al*. (2008). The study also showed that two different pruning treatments were found significantly different in respect of dry matter production of fruits. The plants pruned to three shoots, produced fruits possessing more dry matter (7.33 %) as compared to one shoot system. It might be due to better foliage which led to more synthesis of dry matter constituents. Similar results were also obtained by Umesh *et al*. (2008) and Ambroszczyk *et al*. (2007). Data generated on interaction effects of organic manures and pruning on dry matter percent of Capsicum revealed that dry matter percent was significantly effected by interaction of different variables. The fruits from S_3 treatment (sheep manure @1.65 kg m^{-2}) recorded highest total chlorophyll content (0.50 mg g^{-1}) which was significantly at par to S_2. The results can be attributed to the fact that organic manures particularly sheep manure and vermicompost contains all essential micronutrients including magnesium, an important constituent of chlorophyll molecule, present in centre of pyroll ring. The results are in conformity to those of Melton *et al*. (1991) and Akhilesh and Soumana (2015). The data also showed that pruning had non significant influence on total chlorophyll content of sweet pepper cv. Shalimar hybrid-2 as depicted in Table 4.

REFERENCES

Adhikary, S. P. and Gantayet, P. K. 2012. Studies on the influence of organic fertilizers on the growth and some biochemical parameters of chilli (*Capsicum annum*). *The Bioscan*. **7:** 255-258.

Akhilesh, J. and Soumana, D. 2015. Effect of Various Organic Manures on Chlorophyll Content. *Indian J. Agric Biochem*. **28:** 183-186.

Alsadon, A., Wahb, M. A., Razzak, S. A. and Ibrahim, A. 2013. Effects of pruning systems on growth, fruit yield and quality traits of three greenhouse-grown bell pepper (*Capsicum annuum* L.) cultivars. *Australian J. Crop Science*. **7:** 1309-1316.

Ambroszczyk, A. M., Cebula, S. and Sekara, A. 2007. The effect of plant pruning on yield and fruit quality of eggplant in greenhouse cultivation *Hort. Environ Biotech*. **48:** 277-285.

Anonymous 2013. Published by National Horticulture Board, Gurgaon. *Indian Horticulture Data Base*.

Anonymous 2014. Information Status of Vegetables, Spices, and Mushroom of Kashmir Division. *Agriculture Department Jammu and Kashmir*.

A. O. A. C. 1975. *Official Methods of Analysis* (12th Edition.), William Sterwetzled, Published by A.O.A.C., Washington DC, pp. 506-508.

Arnon, D. I. 1949. Copper enzymes in isolated chloroplasts. Polyphenoloxidase in Beta vulgaris. *Plant Physiology*. **24:** 1-15.

Bano, K. and Kale, R. P. 1987. Vermicompost: A rural technology. *Agriculture Technology*. **5:** 33-37.

Caturano, E., Canali, S. and Leonardi, A. 2008. Organic vegetable

production in Southern Italy. *International Society of Organic Agriculture Research.* **1:** 228-231.

Cebula, S.1996. Optimization of plant and shoot spacing in greenhouse production of sweet pepper. *Acta Hort.* **412:** 321-329.

Dalal, L. P. 2012. Effect of Biofertilizer and NPK on okra in relation to fruit yield and quality. *The Bioscan.* **2:** 309-311.

Dumas, Y. M., Dadomo, G., Lucca, D. and Grolier, P. 2003. Effects of environmental factors and agricultural techniques on antioxidant content of tomatoes. *J. the Science of Food and Agriculture.* **83:** 369-382.

Jeyabal, A. and Kuppuswamy, G. 2001. Recycling of organic wastes for the production of vermicompost and its response in rice-legume cropping system and soil fertility. *European J. Agronomy.* **15(3):** 153-170.

Kumar, H., Katiyar, P. N. and Rajkumar, B. V. 2014. Effects of different pruning severity on physicochemical properties of ber (*Zizyphus mauritiana*).*The Bioscan.* **8:** 203-206.

Maniutiu, D., Sima, R., Apahide, A. S., Apahidean, M. and Ficior, D. 2010. The influence of plant density and shoot pruning on yield of bell pepper cultivated in plastic tunnel. *Bull UASVM Hort.* **67(1):** 259-263.

Melton, H., Galli, F. and Hussain, U. 1991. Effect of organic manures on Plastid structure, chlorophyll concentration and free amino acid of *capsicum. J. Applied Science.* **21:** 457-462.

Narayan, S. 2010. Effect of integrated nutrient management and planting dates on growth, yield and quality attributes of Potato (*Solanum tuberosum* L.,). *Ph.d thesis* submitted to SKUAST-Kashmir.

Narayan, S., Kanth, R. H., Narayan, R., Khan, F. A., Singh, P. and Rehman, S. U. 2013. Effect of integrated nutrient management practices on yield of Potato. *Potato J.* **40:** 84-86.

Navale, A. V., Nandagude, S. B., Pawar, A. G., Ghodke, H. M. and Bhosale, A. D. 2003. Comparative study of skirting and top covering effect in low cost greenhouse. *Procespects of All India on Seminar Potential and Prospects for Protective Cultivation*, organized by the Institute of Engineers, Ahmednagar, December 12-13, 2003, p.97.

Ochigbu, A. A. and Harris, G. P. 1989. Effect of film plastic cover on the growth and yield of bush tomato grown in a bed system. *J. Horticulture Science.* **64:** 300-302.

Prabhakara, B. S., Prabhakar, M., Hebbar, S. S., Krishna, N. K., Moorthy, P. N., Girija, G., Sreenivasa, M. D., Srinivas, V., Eswara, S. G. and Anjula, N. 2004. Greenhouse production of Capsicum. *Technical Bulletin of Indian Institute of Horticulture Research.* Bangalore. **22:** 88-92.

Saen, K. and Pathom, N. 1998. Effect of pruning on yield and quality of sweet pepper. *Hort.Technology.* **7:** 36-39.

Shaw, N. L. and Cantliffe, D. J. 2002. Brightly colored pepper cultivars for greenhouse production in Florida. *Proc. Fla. State Hort. Sci.* **115:** 236-241.

Shehata, A. M. 1992. The effect of manuring on soil moisture and the reflection on plant growth. *M.Sc. Thesis* Faculty of Agriculture. Menoufiya University, Egypt, pp. 66-79.

Shoemaker, J. S. and Taskey, B. J. E. 1995. Effect of pruning on earliness and growth of capsicum. *Practical Horticulture.* **3:** 1097-1118.

Singh, D. N., Sahu, A. and Parida, A. K. 2000. Organic farming technology for sustainable vegetable production in Himachal Pradesh. *Himachal J. Agricultural Research.* **26:** 69-73.

Singh, S. B. and Chaun, S. K. 2014. Impact of organic manures on yield of potato (Solanum tuberosum L.) in semiarid condition of Western U.P. *The J. Rural and Agricultural Research.* **14:** 45- 46.

Singh, S. K. and Lal, S. S. 2003. Integrated nutrient management in potato vegetable crop sequence under rainfed hilly condition of Meghalaya. *J. the Indian potato Association.* **29:** 147-151.

Umesh, M. Z., Mathad, J. C., Patil, A. A. and Koti, R. V. 2008. Investigation on production techniques in capsicum under protected cultivation. *M.Sc. Agriculture Thesis,* University of Agriculture Science, Dharwad (India), pp. 37-41.

Worthington, V. 2001. Nutritional quality of organic versus conventional fruits, vegetables, and grains. *The J. Alternative and Complementary Medicine.* **7:** 161-173.

Yoon, J. Y., Green, S. K., Tschanz, A. T., Tsou, S. C. S. and Changa, L. C. 1989. Pepper improvement for tropics-problems and the AVRDC approach in tomato and pepper production in the tropics. *International Symposium on Integrated Management Practices*. pp. 86-98.