The Pharma Innovation Journal 2019; 8(6): 791-794

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2019; 8(6): 791-794

www.thepharmajournal.com
Received: 01-04-2019
Accepted: 05-05-2019

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Influence of nutrients and mulching on fruiting and fruit characteristics of bell pepper (*Capsicum annum* L.)

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Abstract
The field experiment was conducted to study the effect of nutrients and mulching on fruiting and fruit characteristics of Bell pepper at Horticulture farm, Institute of Agriculture, Visva-Bharati, Sriniketan (West Bengal) during *rabi* season 2014-15. The experiment was laid out in Completely Randomized Block Design (CRBD) consisting of nine treatments. The treatment comprising of different combinations of nutrients and mulches *i.e.* Nitrogen (150Kg $ha^{-1}$and 200 Kg ha^{-1}), Phosphorous (80 Kg ha^{-1} and 120 Kg ha^{-1}) and mulches (Paddy straw and water hyacinth each @ 7t ha^{-1}) with three replications. The statistical analysis indicated that the fruiting and fruit characteristics of bell pepper were significantly influenced by nutrients and mulching. Highest number of fruits per plant (9.95), highest fruit weight (69.18g), maximum fruit length (9.95cm), diameter (7.37cm) and volume (97.07cm^3) were observed in the treatment T_6 with 200kg N ha^{-1} + 80kg P_2O_5 ha^{-1} + Paddy straw mulch @ 7 t/ha^{-1}. Control condition indicated significantly lowest result than all other treatments.

Keywords: Nutrients, mulching, bell pepper, fruiting, fruit characteristics

Introduction
Bell pepper also known as Bell pepper or Sweet pepper or Green pepper or Shimla mirch is one of the popular solanaceous vegetable crops cultivated in most parts of the world, especially in temperate regions of Central and South America and European countries, tropical and sub tropical regions of Asian continent mainly in India and China. India contributes one fourth of world production of Bell pepper with an average annual production of 0.9 million tons from an area of 0.885 million hectare with a productivity of 1266 kg per hectare from open as well as protected cultivation (Anonymous, 2005) [2]. It is extensively cultivated in hills of Himachal Pradesh, Uttar Pradesh, Jammu and Kashmir and Nilgiri hills during summer months. As an autumn crop, it extends up to winter months in Karnataka, Maharashtra, Tamil Nadu, Andhra Pradesh, Bihar, West Bengal and Madhya Pradesh (NHB, 2012-13).
Bell pepper can be consumed either by cooking or raw. The leaves are also consumed as salad, soups or eaten with rice (Love look, 1973) [8]. It was also used as folk medicine for black vomit, tome for gout and paralysis in Shimla hills. Nutritive value of sweet pepper is also very good as it is rich in vitamin A (3131IU), vitamin C (283 mg), protein (1.29 mg) and minerals like calcium (13.4mg), magnesium (14.9mg), phosphorus (28.3mg), potassium (263.0 mg) per 100 g of fresh weight. (Arya, P.S., 1999 and IIHR, 2000) [9].
Application of nutrients to support the crop plants for optimum production is well established through various research programmes, especially for the macronutrients like nitrogen, phosphorus and potassium. Crucial role of nitrogen for being main constituent of all amino acids in proteins and lipids, the structural compounds of cells and chloroplast made it the most essential macronutrient for good plant establishment and expected growth (Uddin and Khalequzzaman, 2003) [16]. Therefore, its deficiency shows negative impact on growth and development of plants which is ultimately reflected in reduced yield. Reports of various investigations indicated its significant role for application stimulating the plants for uptake of potassium and phosphorus through its synergistic effect (Qawasmi *et al*., 1999) [11]. Bell pepper requires heavy nitrogen application for higher yield as it imparts good vegetative growth necessary for good development of fruit.
Phosphorus (P) is another important macronutrient vital for plant growth as it is involved in several key plant cellular activities like energy transfer, photosynthesis,

transformation of sugars and starches and transfer of genetic characteristics from one generation to the next. It also promotes root proliferation that increases root volume and improves soil nutrient exploration.

Water is the critical factor for growth and development of any crop. Favorable water balance maintained through irrigations may result in better maintenance of cell turgidity, better translocation of photosynthates, greater availability of nutrients leading to better plant growth and yield (Ali and Kushwaha, 1987) [1]. Raising of crop during *rabi* season in laterite belt of West Bengal has been threatened by various factors like low and erratic rainfall, deep ground water table and scarcity of alternative water resources. Bell pepper is a high value crop and it is susceptible to moisture stress and drought. Therefore, better water management through water conservation practices are necessary to maintain adequate soil moisture during critical periods of growth and development of the plants. Among all water conservation methods mulching is an important one and easy to adopt which reduces evaporation and increases availability soil moisture and thus enhances availability of nutrients to plants which ultimately affects yield and quality (Vanlalhluana and Sahoo 2011) [17]. Among mulches, organic mulches are an attractive option to improve soil organic matter through their biodegradation and easy availability. It improves vegetative growth, blooming and number of fruit per plant which leads to early maturity and early harvest (Gomez *et al.,* 1997) [6]. Use of organic materials for mulching provide opportunities for growers to recycle on-farm agricultural by-products and thus these are eco-friendly and economic as well.

Materials and Methods

The field experiment on capsicum was conducted at the Horticultural farm, Palli-Siksha Bhavana (Institute of Agriculture), Visva-Bharati, Sriniketan, West Bengal during December, 2014 to March, 2015 to study the effect of nutrients and mulching on growth and yield of capsicum. The experimental field is in the red and lateritic belt of West Bengal, situated at about 23º 42′ N latitude and 87º 40′ 30″ E longitude with an average altitude of 40 m above mean sea level.

The soil of experimental field was sandy loam having pH 6.1. The main field was prepared by thoroughly ploughing and leveling and then divided into plots. The size of individual plots was 3m x 2m and the whole area was intercept by irrigation cum drainage channels of 0.5m wide. The bunds besides irrigation channel are 15 cm and border bunds & bunds in intra replication are 30 cm. Bell pepper cv. Bharat was taken for experiment. First seedling was raised in the nursery and then 35 days old healthy seedlings were planted at spacing of 60 X 40cm in the main field plot.

The experiment was laid out in a Randomized Block Design (RBD) with three replications of nine treatments. The treatment consisted 9 different combinations of nutrient levels and mulches *i.e.* T_1 -150kg N/ha + 80kg P_2O_5/ha + Rice chaff mulch @ 7t/ha, T_2-150kg N/ha + 80kg P_2O_5/ha+ Paddy straw mulch @7t/ha, T_3 - 150kg N/ha + 120 kg P_2O_5/ha + Rice chaff mulch @7t/ha, T_4 - 150kg N/ha + 120kg P_2O_5/ha + Paddy straw mulch @7t/ha, T_5 - 200kg N/ha + 80kg P_2O_5/ha + Rice chaff mulch @7t/ha, T_6 - 200kg N/ha + 80 kg P_2O_5/ha + Paddy straw mulch @7t/ ha, T_7 - 200kg N/ha + 120kg P_2O_5/ha + Rice chaff mulch @7t/ha, T_8 - 200kg N/ha + 120kg P_2O_5/ha + Paddy straw mulch @7t/ha, T_9 – Control. All the experimental plants were uniformly maintained and same cultured practices were provided *i.e.* Irrigation, manuring, fertilizer application, gap filling, earthing up, harvesting and plant protection measures during whole period of investigation. Data regarding fruiting and fruit characteristics were recorded and statistically analyzed.

Results findings and discussion

Number of fruit per plant

Marked variation was observed in number of fruits per plant with different treatments applied and its range varied from 5.00 to 9.95.Investigation of results showed an increasing trend in number of fruits per plant seemingly related with the increment in nutrient levels. The highest number of fruits per plant (9.95) was observed in the treatment T_8 (200kg N/ha + 120kg P_2O_5/ha + Paddy straw mulch @ 7 t/ha) which was closely followed by T_6(9.90) and T_7 (9.86) with the application of 200kg N/ha + 80kg/ha P_2O_5 + Paddy straw mulch @ 7 t/ha and 200kg N/ha + 120kg /ha P_2O_5 + Rice chaff mulch @ 7 t/ha, respectively. On the other hand, the lowest number of fruits per plant (5.00) was observed in T_9 with control condition.

Soil application of nutrients and their availability due to presence of sufficient soil moisture conserved through mulching in different treatments might have contributed positively for increased growth and development followed by good flowering. This was reflected in production of more number of fruits per plant. On the other hand, application of paddy straw mulch might have reduced water stress conditions in soil through better soil coverage and increased availability of nutrients to the plants leading to improved number fruit per plant. The results are in accordance with findings of Chaudhary *et al*., (2007) [4], Sarma *et al*., (2004) [13] in chilli.

Fruit weight (g)

Marked variation was observed in fruit weight and its range was identified from 46.25g to 69.18g among different treatments. Exploration of result clearly showed an increasing trend in fruit weight related with the increment of levels in nitrogen and phosphorous under paddy straw mulch. The highest fruit weight (69.18g) was observed in the treatment T_6(200kg N/ha + 80kg P_2O_5/ha + paddy straw mulch @ 7 t/ha) followed by T_8(68.38 g) comprising of 200kg N/ha, 120kg/ha P_2O_5 and paddy straw mulch @ 7 t/ha. On the other hand, the lowest fruit weight (46.25g) was observed in T_9 with control condition.

Application of nitrogen and phosphorous were found beneficial for fruit weight. This might be attributed to good growth and development of the plant due to increased photosynthesis and translocation of photosynthates from source (leaf) to sink (fruit).On the other hand, mulching improved the availability of applied nutrients through conservation of soil moisture and elimination of weed by smothering. Moreover, non- application of both nutrients and mulches in controlled plots was found to be detrimental for growth and development of the plants which resulted the production of fruits with reduced fruit weight. The results are in conformity with findings of Roy *et al.,* (2011) [12] Singegol *et al*., (2007) [14], Jan *et al*., (2006) [7], Srinivasan *et al.,* (1997) [15].

Fruit length (cm)

Statistical analysis of data indicated increase in fruit length of capsicum with the application of different levels of nitrogen

and phosphorous along with different mulches in comparison to control. The highest fruit length (9.95cm) was observed in the treatment T_8 (200kg N/ha + 80kg P_2O_5/ha + paddy straw mulch @ 7 t/ha) followed by T_7(9.90) and T_6 (9.86)with the application of200kg N/ha + 120kg P_2O_5/ha + rice chaff mulch @ 7t/ha and 200kg N/ha +120kg/ha P_2O_5 + paddy straw mulch @ 7 t/ha, respectively. On the other hand, the lowest fruit weight was observed in the treatment T_9 (5.00) where application of nutrients and mulching was not done.

Remarkable improvement in fruit length of capsicum was recorded with application of nitrogen and phosphorus which might be due to their positive role in growth and development through cell division and cell elongation. Whereas, mulching improved the availability of applied nutrients through conservation of soil moisture and smothering of weeds. These might have been reflected in this character with respect to various treatments applied. On the other hand, absence of the nutrients and mulching in controlled plots negatively affected the growth and development of fruits resulting in reduced fruit length. The experimental findings are in agreement with findings of Malik, *et al*., (2011) [9], Gare *et al*., (2001) [5], Manchanda *et al*., (1988) [10].

Fruit diameter (cm)

The highest fruit diameter (7.37 cm) was observed in the treatment T_6 (200kg N/ha + 80kg P_2O_5/ha + paddy straw mulch @ 7 t/ha) followed by T_8(7.16cm) and T_6 (7.13cm) with the application of 200kg N/ha + 120kg P_2O_5/ha + paddy straw mulch @ 7t/ha and 200kg N/ha +80kg/ha P_2O_5 + paddy straw mulch @ 7 t/ha, respectively. On the other hand, the lowest fruit diameter (5.26cm) was observed in T_9in control condition.

Analysis of results indicated the beneficial effect of applied nutrients and mulching on the fruit diameter of capsicum in comparison to non-application in control plots. The role of nitrogen and phosphorus in growth and development through cell division and cell development might have influence the fruit diameter. Moreover, mulching improved the availability of applied nutrients through conservation of soil moisture and smothering of weeds. On the other hand, non- application of both nutrients and mulches in controlled plots resulted reduction in fruit diameter. The experimental findings are in agreement with findings of Malik, *et al*., (2011) [9].

Volume (cm^3)

Volume is an important character while grading of vegetables for processing and it is also indicator for market value. It can predict the fruit growth and yield (Wilhelm *et al.*, 2005). The highest fruit volume (97.07cm^3)was observed in the treatment T_6(200kg N/ha + 80 kg P_2O_5 /ha + paddy straw mulch @ 7 t/ha) followed by T_8(94.81cm^3) and T_7(91.52cm^3) with the application of 200kg N/ha+120 kg P_2O_5 /ha + paddy straw mulch @ 7 t/ha and 200kg N/ha + 120kg /ha P_2O_5 + rice chaff mulch @ 7 t/ha, respectively. On the other hand the lowest fruit volume (62.45cm^3) is observed in T_9 in control condition.

Remarkable variation of volume of fruit with different treatment might be due to variable effect of treatments on growth and development of fruits especially with respect to their length and diameter. Increased fruit length and diameter had shown greater volume of fruit. On the other hand, absence of nutrients and mulches in control plots negatively affected growth and development of fruits which was reflected in reduced volume of fruit.

Table 1: Effect of Nutrients and Mulching on number of fruits per plant and fruit weight of Bell Pepper

Treatments	Number of fruits/ plant	Fruit weight (g)
T_1-150kg N/ha + 80kg P_2O_5/ha + Rice chaff mulch @ 7t/ha	6.57^{e}	58.75^{e}
T_2-150kg N/ha + 80kg P_2O_5/ha + Paddy straw mulch @ 7t/ha	6.97^{e}	60.93^{e}
T_3-150kg N/ha + 120 kg P_2O_5/ha + Rice chaff mulch @ 7t/ha	8.79^{d}	63.77^{d}
T_4-150kg N/ha + 120kg P_2O_5/ha + Paddy straw mulch @ 7t/ha	9.00^{cd}	65.11^{cd}
T_5-200kg N/ha + 80kg P_2O_5/ha + Rice chaff mulch @ 7t/ha	9.37^{bc}	66.35^{bcd}
T_6-200kg N/ha + 80kg P_2O_5/ha + Paddy straw mulch @ 7t/ha	9.90^{ab}	69.18^{a}
T_7-200kg N/ha + 120kg P_2O_5/ha + Rice chaff mulch @ 7t/ha	9.86^{ab}	67.35^{abc}
T_8-200kg N/ha + 120kg P_2O_5/ha + Paddy straw mulch @ 7t/ha	9.95^{a}	68.38^{ab}
T_9-Control	5.00^{f}	46.25^{f}
SEM(±)	0.16	0.97
CD (5%)	0.50	2.92
CV (%)	3.4	2.68

The superscript letter indicates that the treatment means with same letters are at par at 5% level of significance, while the means with different letters are significantly different at 5% level of significance. These letters have been affixed based on CD-value comparison of treatment means.

Table 2: Effect of Nutrients and Mulching on fruit characteristics of Bell Pepper

Treatments	Fruit length (cm)	Diameter (cm)	Volume (cm^3)
T_1-150kg N/ha + 80kg P_2O_5/ha + Rice chaff mulch @ 7t/ha	6.57^{e}	5.75^{de}	83.97^{c}
T_2-150kg N/ha + 80kg P_2O_5/ha + Paddy straw mulch @ 7t/ha	6.97^{e}	5.84^{b}	88.86^{bc}
T_3-150kg N/ha + 120 kg P_2O_5/ha + Rice chaff mulch @ 7t/ha	8.79^{d}	6.06^{b}	89.32^{bc}
T_4-150kg N/ha + 120kg P_2O_5/ha + Paddy straw mulch @ 7t/ha	9.00^{cd}	6.66^{b}	90.52^{b}
T_5-200kg N/ha + 80kg P_2O_5/ha + Rice chaff mulch @ 7t/ha	9.37^{bc}	6.83^{b}	90.68^{b}
T_6-200kg N/ha + 80kg P_2O_5/ha + Paddy straw mulch @ 7t/ha	9.86^{ab}	7.37^{a}	97.07^{a}
T_7-200kg N/ha + 120kg P_2O_5/ha + Rice chaff mulch @ 7t/ha	9.90^{ab}	7.13^{ab}	91.52^{ab}
T_8-200kg N/ha + 120kg P_2O_5/ha + Paddy straw mulch @ 7t/ha	9.95^{a}	7.16^{ab}	94.81^{ab}
T_9-Control	5.00^{f}	5.26^{e}	62.45^{d}
SEM(±)	0.16	0.22	1.97

CD (5%)	0.50	0.67	5.90
CV (%)	3.4	6.02	3.89

The superscript letter indicates that the treatment means with same letters are at par at 5% level of significance, while the means with different letters are significantly different at 5% level of significance. These letters have been affixed based on CD-value comparison of treatment means.

References

1. Ali M, Kushwaha BL. Cultivation of *rabi* rajmash in plains. Indian Farming. 1987; (2):20-23.
2. Anonymous. Chilly export touch all-time high, 2005. www.thehindubusiness.com.
3. Arya PS. Vegetable breeding and seed production. Kalyani Publishers, Ranjinder Nagar, Ludhiana, India, 1999.
4. Chaudhary AS, Sachan SK, Singh RL. Effect of spacing, nitrogen and phosphorus on growth and yield of capsicum hybrid. International Journal of Agricultural Sciences. 2007; 3(1):12-14.
5. Gare BN, More SM, Jadhav MG, Burli AV. Effect of spacing and fertilizer on yield of rainfed chilli in sub-montane zone of Maharashtra. Journal of Maharashtra Agricultural Universities. 2000-2001; 25(3):270-271.
6. Gómez O, Casanova A, Martínez L, Hernández JC, de Armas G, Santos R *et al*. Principales resultados científicos en Hortalizas y papa. Cultivo del tomate. Memorias 25 Aniversario Del Instituto de Investigaciones Hortícolas Liliana Dimitrova. Cuba, 1997, 11-19.
7. Jan NE, Khan IA, Ahmed S, Shafiullah, Khan R. Evaluation of optimum dose of fertilizer and plant spacing for sweet peppers cultivation in Northern Areas of Pakistan. Sarhad Journal of Agriculture. 2006; 22(4):601-606.
8. Love-look Y. Various herbs species and condiments. The Vegetable Book. New York, St. Martin Press, 1973, 343.
9. Malik AA, Chattoo MA, Sheemar G, Rashid R. Growth, yield and fruit quality of sweet pepper hybrid SH-SP-5 (*Capsicum annuum* L.) as affected by integration of inorganic fertilizers and organic manures (FYM). International Journal of Agricultural Technology. 2011; 7(4):1037-1048.
10. Manchanda AK, Bhopal S, Singh B. Effect of plant density on growth and fruit yield of bell pepper *(Capsicum annuum* L.) Indian Journal Agronomy. 1988; 33(4):445-447.
11. Qawasmi W, Munir JM, Najim H, Remon Q. Response of bell pepper grown inside plastic houses to nitrogen fertigation. J Commun. Soil Sciences Plant Annals. 1999; 30(17):2499-2509.
12. Roy SS, Khan MSI, Pall KK. Nitrogen and phosphorus efficiency on the fruit size and yield of capsicum. Journal of Experimental Sciences. 2011; 2(1):32-37.
13. Sarma UJ, Baruah JP, Suhrawardy J, Narzary BD, Chakravarty M. Effect of various NPK levels on yield and capsaicin content in direct seeded chilli (*Capsicum annuum*). Indian Journal of Hill Farming. 2004; 17(1-2):15-18.
14. Singegol HY, Patil HB, Patil DR. Growth and yield of green chilli (*Capsium annuum* L.) cv. Pusa Jwala as influenced by nitrogen and phosphorus. Asian Journal of Horticulture. 2007; 2(2):184-187.
15. Srinivasan K, Veeraragavathatham D, Kanthaswamy V, Thiruvudainambi S. Effect of nitrogen and phosphorous on the yield and economics of hybrid capsicum. Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore-641003, India. South Indian Horticulture. 1997; 47(1-6):57-60.
16. Uddin MK, Khalequzzaman KM. Yield and yield component of winter chilli (*capsicum annum*) as affected by different level of nitrogen and boron. Pakistan Journal Biological. Science. 2003; 6(6) 605-609.
17. Vanlalhluana PC, Sahoo UK. Growth and yield of maize under different agro forestry systems exposed to varying cultural treatments in Mizoram, India. Science Vista. 2011; 11(1):11-15.