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CAPSICUM CV. SOLAN BHARPUR GROWTH UNDER SHADE NET CONDITIONS: MORPHOLOGICAL, FRUIT YIELD AND QUALITY RESPONSES

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Abstract: The present investigation was conducted at Horticultural Research Station, Anantharajupeta, Dr. Y.S.R Horticultural University, Andhra Pradesh during 2014-2015. The trail was carried out in capsicum cv. Solan Bharpur consisting of 11 treatments, replicated thrice with Randomized Block Design. The results revealed that, capsicum plants applied with 10 t/ha of well rotten farm yard manure (T_{10}) recorded significantly taller plant (87.30 cm), number of leaves (163.77), stem girth (4.85 cm), leaf length (19.04 cm), leaf width (11.33 cm). However, higher number of fruits (25.66), fruit length (8.83 cm), fresh fruit weight (58.83 g), weight of 10 fruits (663.72 g), yield (16.32 t/ha), pericarp thickness at the blossom end (1.33 cm), number of seeds per fruit (140.05), dry weight of 100 seeds (0.71 g), fruit diameter (18.25 cm) and pericarp thickness at the centre of the fruit (0.81 cm) were registered with the application of vermicompost (2.50 t/ha) (T_9).

Keywords: Capsicum, Solan Bharpur, micronutrients, FYM, vermicompost, growth, flowering and quality.

INTRODUCTION

Sweet pepper (*Capsicum annum* L.) is a member of family solanaceae and genus capsicum. Tropical South America, especially Brazil is thought to be the original home of pepper. It is now widely cultivated in Central and South America, Peru, Bolivia, Costa Rica, Mexico, in almost all the European countries, Hong Kong and India. In India it is cultivated commercially in Tamil Nadu, Karnataka, Andhra Pradesh, Maharashtra and Himachal Pradesh and in some parts of Uttar Pradesh. Organic fertilizer is the key to improve the sustainability of agricultural farming system and soil productivity. It has been proved that indiscriminate use of inorganic fertilizers results in decrease in soil fertility and increase in soil acidity with depletion of organic humus content in addition to poor crop quality. Use of organic manures to meet the nutrient requirements of crop would be an inevitable practice in the years to come for sustainable agriculture since organic manures not only improve the soil physical, chemical and biological properties (Heitkamp *et al.,* 2011) but also improves the

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moisture holding capacity of soil, thus resulting in enhanced crop productivity along with better quality of crop produce (Premsekhar and Rajashree, 2009). Micronutrients play vital roles in the growth and development of plants, due to their stimulatory and catalytic effects on metabolic processes and ultimately on flower yield (Lahijie, 2012) and quality (Khosa *et al.,* 2011).

Vermicompost is a rich source of vitamins, hormones, enzymes, macro and micronutrients which when applied to plants help in efficient growth (Prabhakaran, 2005). The growth rate is fast due to increased uptake of macro and micronutrients present in the vermicompost, which results in increased shoot length and number of leaves in vermicompost applied plants. Vermicompost being rich in NPK and other nutrients can be used as a substitute for chemical fertilizer (Jeyabal and Kuppuswamy, 2001). Application of micronutrients *viz.,* zinc, boron, magnesium and organics *viz*., vermicompost and FYM bring profound changes in various metabolic processes within the plant system thereby influence the yield considerably. In recent years, the roles of these micronutrients are gaining more importance particularly in capsicum to boost not only the productivity but also to improve the quality. Organic matter has beneficial effects on soil chemical and physical characteristics, biological activity and soil structure including pH stabilization and faster water infiltration rate due to enhancing soil aggregation, increasing soil organic matter content. In addition, organic matter protects crops against pathogens and saprophytic through increasing parasitism and antibiosis (Jamir *et al*., 2017). Sporadic research works on nutrient management on capsicum were done where N, P, K, and S fertilizers were considered for recommendation. However, no systematic research work has been done so for to find out the response of capsicum to zinc and boron fertilization. Hence, an investigation on the effect of micronutrients and organics on growth and quality of capsicum under shade net conditions was initiated.

MATERIALS AND METHODS

A field experiment entitled “Capsicum cv. Solan Bharpur growth under shade net conditions: Morphological, fruit yield and quality responses” was conducted during rabi season of 2014-15. The experiment was carried out at Horticultural Research Station, Anantharahjupeta, Y.S.R Kadapa Dist. Andhra Pradesh. The experimental field was laid out in Randomized Block Design with 11 treatments with three replications. The details of experimental treatment plan employed in the present investigation was carried out as follows: T_1-$ZnSO_4$ (25 kg/ha), T_2-$ZnSO_4$ (0.2%), T_3-Borax (10 kg/ha), T_4-Borax (0.2%), T_5-$MgSO_4$ (10 kg/ha),

T_6-$MgSO_4$ (0.2%), T_7-$FeSO_4$ (10 kg/ha), T_8-$FeSO_4$ (0.2%), T_9-Vermicompost (2.50 t/ha), T_{10}-FYM (10 t/ha) and T_{11}-Control (No application of any nutrients).

After ploughing and digging, the land was brought to fine tilth under shade net house. All weeds were completely removed from the field. All the stubbles of previous crop were removed from the field and burnt. The trial was conducted in red loam soil with a spacing of 60 x 60 cm and planting was done with 45 days old healthy seedlings during November, 2014. The experimental plots were of size 2.50 × 2.50 m and each plot consisted of size ridges with 20 cm spacing. The soil of the experimental field was red loam in texture with pH 7.2. Necessary plant protection measures were followed to prevent pest and disease incidence. Well decomposed farmyard manure @ 10 t/ ha and vermicompost @ 2.50 t/ ha was applied uniformly as per the treatment and mixed well. The manures were incorporated in the respective plots 20 days before planting when applied as basal. Recommended micronutrients *viz*., Zn, Bo, Mg and Fe are applied as basal dose as per treatment and foliar feeding for two times once at fruit setting and again at fruit development stage. Intercultural operations and plant protection measures were done to keep the plant healthy. At initial stage of growth, spinosod @ 0.2 ml l^{-1} was sprayed to manage sucking pests and *Spodoptera litura,* while no disease incidence was noticed during the investigation period. For recording observations, five plants were selected per each plot at random and were labelled properly by indicating treatments. The data were analysed using the procedure outlined by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

An information made available in Table 1 clearly indicated that plant height (87.30 cm), number of leaves (163.77), stem girth (4.85 cm), leaf length (19.04 cm) and leaf width (11.33 cm) recorded was maximum with the application of FYM @ 10 t/ ha. Number of branches per plant was not significantly influenced by treatments. The above findings are in agreement with the reports of Sahoo *et al.* (2017) in sweet pepper and Reddy *et al.* (2017) in chilli. The good plant growth, number of leaves and higher leaf length and width may be due to application of FYM which might have acted as a source of additional nutrients and moisture supply. The earlier study made by Patil *et al.* (2014), Singh *et al.* (2014), Omogoya and Adewale (2015) also reported that application of FYM and other organic manures significantly influence the growth and development of capsicum. Natesh *et al.* (2010) stated the organic fertilizer influenced significantly the growth parameter. This might be due to the improvement in soil physical condition for the plant growth along with increased availability

of N, P and K at the early stage of crop growth (Patil *et al*., 2004). Nitrogen, phosphorus and potassium contained in FYM had great effects in plant growth and development. Plant need high concentration of these primary nutrients as any deficiency of these essential nutrients will prevent good plant growth (Gholizadeh *et al*., 2009). Thus, sufficient nitrogen, phosphorus and potassium supplied by organic fertilizer help in producing sturdy and taller plant. On the other hand, FYM treatment produced highest number of leaves. Abid *et al.* (2014) stated the mineral nutrients had a good effect on growth of red chillies. As nitrogen is an essential part of chlorophyll, helps in protein synthesis. Increase in leaves number per plant may be due to sufficient amount of nitrogen provided an ideal environment and balanced nutrition to plants, which increased number of leaves. The results are to some extent in agreement with the findings of Deore *et al*. (2010) who obtained maximum number of leaves per plant with increasing nitrogen containing in liquid organic fertilizer. Gopal *et al.* (2010) states that the leaf area is large when nutrients content in organic manure was increased. This is due to availability of dry matter in organic manure that contain rich nutrients and higher light interception resulted in increased leaf area and high photosynthetic activity leads to an increase in the plant growth (Balraj, 2014).

Data presented in Table 2 and 3 shows that higher number of fruits (25.66), fruit length (8.83 cm), fruit diameter (18.25 cm), fresh fruit weight (58.83 g), weight of 10 fruits (663.72 g), yield (16.32 t/ha), pericarp thickness at the blossom end (1.33 cm), number of seeds per fruit (140.05), dry weight of 100 seeds (0.713 g) and pericarp thickness at the centre of the fruit (0.81 cm) were recorded with the application of vermicompost (2.50 t/ha). Vermicompost used is known to enhance microbial activity, which may have improved availability of macro and micro nutrients to the plants. It also acts as a chelating agent and regulates availability of metabolic micro nutrients to plants and, thus helps increase yield attributing traits by providing nutrients in their available form.

Besides, vermicompost also contains significant quantities of nutrients, a large amount of beneficial microbial populations and biologically active metabolites particularly gibberellins, cytokinins, auxins and vitamins (Bhavalkar, 1991) all of which have a beneficial effect on photosynthesis and translocation. Results of the present findings are in conformity with findings of several earlier workers *viz.* Jeevansab (2000), Salas and Ramirez (2001), Basavaraja *et al,* (2003) and Ganiger *et al.* (2012) in capsicum (bell pepper). Organic manures increases the availability of nutrients, especially protein synthesis further it was suggested that significantly increase in number of fruits and fresh, dry weight of fruit might

have accelerated the mobility of photosynthetic from source to the sink which was influenced by the growth hormones which released from Vermicompost, the organic sources. Similar findings also were reported by Dileep and Sasikala (2009), Deshpande *et al.* (2010), Singh *et al.* (2014), Jayanti *et al.* (2014), Mudiganti *et al.* (2015) in chilli and Jamir *et al.* (2017) in sweet pepper. Congenial environment prevail under shade net house might also favours for good growth and yield of capsicum cv. Solan Bharpur. Application of nutrients like Vermicompost and FYM has a significant and vital effect on growth, yield and quality attributes of capsicum. The supply of various plant nutrients at an optimum level sustains the desired crop productivity by optimizing the benefit from all sources in an integrated manner. The inference drawn from the present investigation clearly stated that organics are effective alternatives as a source of macro- and micronutrients and have a potential to improve yield, and thus avoid costly chemical fertilizers. The bio-organic technology is based on eco-biotechnological approaches utilizing the bio-transformation of energy rich and complex organic substances into bio-stabilized composed products.

Conclusion

From the overall results, treatment supplemented with vermicompost gave positive effect in number of fruits produced, weight of fruit, length of fruit, diameter of fruit, seed number of fruit and other seed quality attributes. Thus, it may be concluded that application of organic manures had significantly affect the growth, yield, and quality of capsicum plant.

Table 1. Growth response of capsicum cv. Solan Bharpur to micronutrients and organics under shade net condition

Treatments	Plant height (cm)	Number of leaves per plant	Number of branches per plant	Stem girth (cm)	Leaf length (cm)	Leaf width (cm)
T_1	63.30	127.44	11.77	4.04	17.28	7.77
T_2	62.40	141.22	10.44	4.36	17.26	8.17
T_3	66.33	127.88	10.11	4.07	17.33	7.93
T_4	67.40	133.44	10.00	4.03	16.94	8.01
T_5	68.28	128.11	11.55	3.96	16.30	8.53
T_6	68.95	123.77	11.00	4.04	17.37	8.26
T_7	61.38	142.77	9.88	4.06	17.01	8.03
T_8	57.07	150.22	11.22	3.95	17.91	8.32
T_9	71.12	159.77	13.00	4.44	18.00	8.88
T_{10}	87.30	163.77	14.00	4.85	19.04	11.33
T_{11}	56.32	122.88	9.77	3.46	15.33	7.25
CD (*P*=0.05)	11.87	24.56	N.S	0.47	1.72	0.88
S.Em.±	3.99	8.27	1.05	0.16	0.58	0.29
C.V%	10.43	10.35	16.43	6.65	5.83	6.11

Table 2. Fruit trait response of capsicum cv. Solan Bharpur to micronutrients and organics under shade net condition

Treatments	Number of fruits per plant	Fruit length (cm)	Fruit breadth (cm)	Fruit diameter (cm)	Fresh fruit weight (g)	Weight of 10 fruits (g)
T_1	17.44	6.91	5.32	12.29	46.55	540.63
T_2	20.88	6.55	5.40	13.00	55.53	624.77
T_3	18.88	7.56	5.15	11.00	52.45	616.27
T_4	17.88	7.18	5.36	14.63	49.83	561.12
T_5	20.77	6.32	5.11	15.55	40.38	464.21
T_6	16.33	6.65	5.53	11.35	51.11	533.33
T_7	17.00	7.05	5.66	10.00	50.84	597.54
T_8	15.77	6.78	5.18	9.33	44.33	548.14
T_9	25.66	8.83	5.77	18.25	58.83	663.72
T_{10}	15.77	7.14	5.38	16.00	49.94	581.90
T_{11}	14.22	6.04	4.86	6.78	35.50	440.37
CD (P=0.05)	2.25	0.93	NS	1.45	8.97	45.32
S.Em.±	0.76	0.31	0.25	0.48	3.02	15.25
C.V%	7.22	7.76	8.08	6.72	10.74	4.71

Table 3. Response of seed and quality parameters of capsicum cv. Solan Bharpur to micronutrients and organics under shade net condition

Treatments	Yield (t/ha)	Pericarp thickness at the blossom end (cm)	Pericarp thickness at the centre of the fruit (cm)	Number of seeds per fruit	Seed weight/ fruit (g)	Dry weight of 100 seeds (g)
T_1	15.14	1.26	0.71	135.21	1.190	0.700
T_2	16.13	1.27	0.68	127.74	1.220	0.697
T_3	15.12	1.24	0.59	122.80	1.160	0.690
T_4	14.53	1.21	0.62	115.01	1.140	0.707
T_5	14.28	1.23	0.64	133.89	1.223	0.690
T_6	15.50	1.26	0.70	120.23	1.203	0.677
T_7	14.85	1.29	0.66	124.84	1.177	0.643
T_8	14.60	1.24	0.63	130.98	1.120	0.637
T_9	16.32	1.33	0.81	140.05	1.300	0.713
T_{10}	14.69	1.16	0.49	113.74	1.210	0.663
T_{11}	12.88	1.13	0.48	104.62	1.160	0.627
CD (P=0.05)	0.38	0.08	0.11	7.61	N.S	0.046
S.Em.±	0.12	0.02	0.03	2.56	0.06	0.015
C.V%	1.48	3.78	10.14	3.56	8.65	3.950

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