



Effect of Compost, Vermicompost, Trichocompost and NPKS Fertilizers on the Growth, Yield and Yield Components of Capsicum (*Capsicum annum* L.)

Mehedi Hashan Sohel^{1*}, Mithun Kumar Ghosh²

¹Department of Soil Science, EXIM Bank Agricultural University Bangladesh, Chapainawabganj-6300, Bangladesh

²Department of Agricultural Extension & Rural Development, EXIM Bank Agricultural University Bangladesh, Chapainawabganj-6300, Bangladesh

ARTICLE INFO	ABSTRACT
Received date: Sept. 19, 2020 Accepted date: Dec. 12, 2020	The experiment was conducted to evaluate the effect of organic (Compost, Vermicompost and Trichocompost) and inorganic fertilizers (NPKS) on the growth, yield and quality of capsicum. The experiment was carried out in pot where replication was thrice with nine treatments viz. T₁= Control, T₂ = 100% Recommended Fertilizer Dose, T₃ = Compost (3t/ha), T₄ = Vermicompost (3t/ha), T₅ = Trichocompost (3t/ha), T₆ = Compost (3t/ha) + NPKS fertilizers, T₇ = Vermicompost (3t/ha) + NPKS fertilizers, T₈ = Trichocompost (3t/ha) + NPKS fertilizers, T₉ = 1/3 Compost + 1/3 Vermicompost + 1/3 Trichocompost + NPKS fertilizers (N@120 kg/ha, P@65kg/ha, K@100kg/ha and S@20kg/ha). The result revealed that combined application of inorganic fertilizer (recommended doses of NPKS fertilizers) and organic fertilizer (Compost + Vermicompost + Trichocompost) in T₉ significantly enhanced the growth of crop at different stages as expressed in terms of numbers of flower, number of fruit/plant, fruit length (cm), diameter of fruit (cm), individual fruit weight (gm), yield per plant (gm), yield (t/ha). The combination of organic and inorganic fertilizer was more sustainable and more fruiting than other treatments. The physical and chemical properties of soil significantly improved by the application of organic manure.

Key words: Compost, Inorganic, Organic, Sustainable, Trichocompost, Vermicompost

CORRESPONDENCE

* mehedibau113@gmail.com

Senior Lecturer, Department of Soil Science, EXIM Bank Agricultural University Bangladesh, Chapainawabganj-6300, Bangladesh

1. INTRODUCTION

Capsicum or sweet pepper (*Capsicum annum* L.) belongs to the family Solanaceae, is eaten as cooked or raw food as in salad. Sweet peppers are chosen because of their high nutritive value and are rich source of vitamin C, bioflavonoid and 6-carotene. Peppers are rich in capsaicin that is performed against inflammation and have powerful antioxidant properties. Capsicum is used either green or red,

come in a variety of different colors- range from green to yellow, red, orange, purple, and black. Red bell peppers are fully ripened with a milder, sweeter flavor. Other sweet peppers include the red, heart-shaped; the pale green, slender and curved bull's horn, which range in color from yellow to red and the sweet banana pepper which is yellow and banana shaped (Michael, 1999).

Capsicum is considered an excellent source of bioactive nutrients. Main antioxidant compounds found in sweet

To Cite: Sohel, M. H. & Ghosh, M. K. (2021). Effect of compost, vermicompost, trichocompost and NPKS fertilizers on the growth, yield and yield components of capsicum (*Capsicum annum* L.). *EBAUB J.*, 3, 29-35.

pepper are ascorbic acid (vitamin C), carotenoids and phenolic compounds (Marin et al., 2004). The levels of vitamin C, carotenoids and phenolic compounds in vegetables varied based on several factors, including cultivar, agricultural management practices, Physiological maturity and storage duration (Lee & Kader, 2000).

Capsicum is considered a popular vegetable crop in Bangladesh, and its production statistics is not available. Small scale cultivation is found in peri-urban areas, primarily for the supply to some city markets in Bangladesh (Islam, 2006). Economically, it is the second most important vegetable crop in Bulgaria and is thought to be the original home of sweet pepper. It is now widely cultivated in America, Europe and some countries of the Asia-Pacific. It has great demand in Japan, Thailand, Philippines, Taiwan, Egypt and other countries even in Bangladesh.

Intensive synthetic fertilizer usage in agriculture creates so many health problems and environmental pollutions. To reduce and eliminate the adverse effects of synthetic fertilizers and pesticides on human health and the environment, new agricultural practices were developed in the organic agriculture, ecological agriculture or sustainable agriculture (Malgorzata & Georgios, 2008).

Organic farming products are becoming very necessary in today's world to manage ecosystem health and to impart related human health benefits, world over there is growing demand for organic products. The organic areas in the whole world reached to 37.5 million hectares.

The application of organic resources is essential for the balance of soil fertility status and crop productivity in agricultural systems. Imbalance use of chemical fertilizer in vegetable and other crop production is a common practice in Bangladesh. In Bangladesh, most of the cultivated soils have less than 1.5% organic matter, while a good agricultural soil should contain at least 2% organic matter. In continuous cropping area, organic matter supply to the crop field through different manuring practices is made only to a minimum extent. Under these imbalanced conditions various beneficial soil microorganisms are being adversely affected (Chandini et al., 2019; Chowdhury, 2004).

The organic fertilizers provide the nutritional requirements of plants. Additionally, they increase the microbial activity in soil, anion and cation exchange capacity, organic matter and carbon-content of soil. Organic fertilizers produce the yield and quality of agricultural crops in ways similar to inorganic fertilizers (Heeb et al., 2006; Tonfack et al., 2009).

Organic agriculture is one of the broad spectrums of production methods that are supportive of the environment. The demand for organic food is steadily increasing both in developed and developing countries with an annual growth rate of 20-25 per cent (Ramesh et al., 2005). Organic cultivation which is responsible for material circulation in agricultural ecosystem and enhanced crop production with a minimal environmental load in keeping ecological balance contains the holistic approach for production and management system for enhancing the health of agricultural ecosystems. Organic systems avoid the use of synthetic

fertilizers, pesticides and growth regulators. Instead they rely on crop residues, animal manures, legumes, green manures, off – farm wastes, mechanical cultivation and biological pest control to maintain soil health, supply of plant nutrients and minimize insects, weeds and other inputs. Organic culture helps in improvement of crop quality and reduces environmental pollution. It brightens the prospects of export of organic food items. Now there are signs of change across the agriculture landscape of the country towards organic farming (Aguoru et al., 2015).

Sustainability in crop yield and soil health could be achieved by the application of mineral fertilizers along with organic manures. Benefits of organic manures like compost, vermi compost and trichocompost are well known but the availability is reducing day by day. These organic manures are not only good sources of nutrients but also improve the physical structure of the soil. Apart from containing NPKS these also contain small amounts of trace elements especially boron, copper, iron, sulphur, zinc and with fair quantity of growth promoting substances. Integrated nutrient management involving both the organic and inorganic source is essential to realize higher yield potential (Shahein et al., 2015).

Capsicum as a new and promising crop in Bangladesh, production technology like, the use of cow dung are not yet standardized to compare the inorganic fertilizer. Considering the above facts, the present study was undertaken to investigate the organic cultivation of capsicum or sweet pepper by using compost, vermicompost and trichocompost (Alam et al., 2016; Islam et al., 2017).

The present study was undertaken with the following objective- To evaluate the effect of organic (compost, vermicompost and trichocompost) and inorganic fertilizers (NPKS) on the growth, yield and yield components of capsicum.

2. MATERIALS AND METHODS

2.1. Experimental Site

The soil was collected from the AEZ (Agro Ecological Zone) 10-Active Ganges Floodplain and AEZ 11-High Ganges River Floodplain.



Fig. 1 Study area of the present study.

2.2. Geographical Location

Chapai Nawabganj is the most western district of Bangladesh. Rajshahi and Naogaon is on the east, Malda of West Bengal, India is on the north. Chapai Nawabganj is situated between the latitude 24°22 to 24°57 and longitude 87°23 to 88°23.

2.3. Climatic Condition of Experimental Site

Chapai Nawabganj has a tropical wet and dry climate. The climate of Nawabganj is generally marked with monsoons, high temperature, considerable humidity and moderate rainfall. The hot season commences early in March and continues till the middle of July is about 32°C to 39°C and the minimum temperature recorded in January is about 7 to 16 °C (45 to 61 °F). The highest rainfall is observed during the months of monsoon. The annual rainfall in the district is about 1,448 millimetres.

2.4. Layout and Treatments

The experiment was laid out in the Randomized Complete Block Design (RCBD) with three replications and consisted of 9 treatments (T) and the total numbers of pots were 27.

T₁ = Control

T₂ = 100% RFD

T₃ = Compost (3t/ha)

T₄ = Vermicompost (3t/ha)

T₅ = Trichocompost (3t/ha)

T₆ = Compost (3t/ha) + NPKS fertilizer

T₇ = Vermicompost (3t/ha) + NPKS fertilizer

T₈ = Trichocompost (3t/ha) + NPKS fertilizer

T₉ = 1/3 Compost + 1/3 Vermicompost + 1/3 Trichocompost + NPKS fertilizer

2.5. Collection of Seedlings

Seedlings of 20-25 days old were collected from the horticulture centre at Chapainawabganj. Variety was BARI Mistimorich 1.

2.6. Intercultural Operations

Intercultural operations (Irrigation, weeding, mulching, pest management, fertilizer management) were done for ensuring and maintaining the normal growth of plants.

2.7. Fertilization

The dosages of fertilizers were recommended according to Fertilizer Recommendation Guide (BARC, 2012). All the recommended fertilizers were applied with proper doses. Recommended NPKS was applied using Urea, Triple Super phosphate, Murate of potash and Gypsum N@120 kg/ha, P@65kg/ha, K@100kg/ha and S@20kg/ha respectively.

2.8. Morphological Characteristics of the Experimental Soil

Morphology	Characteristics
Land type	Medium high land
Topography	Fairly level
Flood level	Above flood level
Soil color	Dark grey
Drainage	Moderately well drained
Vegetation	Rice crop grown year round

2.9. Procedure of Recording Plant Data

2.9.1. Plant Height (cm)

Plant height was measured in centimeter from the ground level to tip of the longest stem and mean value was calculated. Plant height was recorded at 30 DAT, 60 DAT, 90 DAT and 120 DAT (at final harvest).

2.9.2. Leaf Length (cm)

Measurement was done from basal node of the rachis to apex of each plant.

2.9.3. Number of Leaves Per Plant

The number of leaves per plant was counted from 8 randomly selected plants at 30, 60, 90 and 120 days DAT and their average was taken as the number of total leaves per plant.

2.9.4. Number of Branches Per Plant

The number of branch per plant was counted from 8 randomly selected plants at harvest and their average was taken as the number of total branch per plant.

2.9.5. Number of Fruits Per Plant

The number of branch per plant was counted from time to time.

2.9.6. Fruit Length (cm).

The length of all the marketable fruits were measured with a slide calipers from the neck of the fruits to the bottom of the fruits from each plot. Fruit weight above 50 g was considered as marketable fruits.

2.9.7. Fruit Diameter (cm)

Diameter of all the marketable fruits from each plot was measured at the middle portion with a slide calipers.

2.9.8. Weight of Individual Fruit (gm)

Individual fruit weight was measured for the average fruit weight of all the marketable fruits under each plot.

2.9.9. Weight of Fruit Per Plant (gm)

Weight of per plant fruit was recorded in gram (g) by measuring the weight of all fruits per plant and the marketable fruits per plant.

3. RESULTS AND DISCUSSION

3.1. Soil Sample Analysis

The physicochemical properties of soil were tested in two stages, i) Pre sowing period and ii) Post-harvest period. The depth of soil sample collection was 0-20 cm for the further analysis. The physicochemical properties of initial soil presented in Table 1. The analysis of soil was accomplished following the standard methods (Olsen et al., 1954; Page et al., 1982).

Soil physical properties are the stable factors of soil. Soil density, especially, the Bulk density (BD) of surface soil decreased with the depth and organic matter present in soil and varied from 1.00 to 1.50 g/cm³. The highest bulk density (1.75 g/cm³) was observed in T₁ (after harvesting) due to compaction of the soil (Table 1a) as compared to initial values (before planting) and the lowest bulk density was observed in T₉ due to high organic matter content of the soil (Table 1a).

The highest field capacity (40 %) and porosity (48 %) were observed in T₉ and the lowest field capacity (25 %) and porosity (24 %) in T₁ (Figure 1a). The other physical properties (particle density, infiltration rate, textural class) of the soil were not significantly changed (Table 1a).

The nutrient management practices showed significant effect on fertility status of the experimental soil, it had very significant effect on soil pH. Application of only chemical fertilizers did not help much on improving pH and fertility status of the experimental soil; rather, it marginally reduced the pH of the soil.

Integrated use of chemical fertilizers and organic manure (MOC) with biofertilizer negated the acidifying effect of chemical fertilizers and showed an increasing tendency of soil pH (Table 1b). After the end of experiment, INM with compost + vermicompost + trichocompost and chemical fertilizers significantly increased organic matter available N, P, K and S contents in soil over their initial values. The highest organic matter and available N, P, K and S contents in soil were recorded from the pot having compost + vermicompost + trichocompost and chemical fertilizers (T₉) under the study. The electrical conductivity (EC), Calcium, Magnesium, Zinc, Iron, and Boron content of soil were not significantly changed (Table 1b).

The organic manuring increased the nutrient holding capacity of the soil by enhancing the soil organic matter and thus had great advantage over other fertility treatments not only on increasing the growth and productivity of the crop but also on improving the available nutrient contents in soil necessary for sustaining crop productivity (Marimuthu et al., 2014).

Sinha (2009) reported that earthworm's vermicompost is a powerful crop nutrient over the conventional compost and protective soil conditioner against the destructive chemical fertilizers for food safety and security. Biofertilizer application enhances the microbial activities in soil and thereby increases the nutrient availability (Wu & Ma, 2015).

3.2. Plant Data Analysis

3.2.1. Plant Height (cm)

Plant height at different days after transplanting (DAT) and different doses of manures showed significant variation (Table 2).

At 30 DAT, plant height ranged from 18.49 to 21.71 cm. The maximum plant height (21.71 cm) was found from the treatment T₉ and the minimum was observed from T₁ (20.43 cm).

At 60 DAT, plant height varied from 31.42 cm to 35.08 cm, the maximum 35.08 cm recorded from T₉ and the minimum 31.42 cm plant height were recorded from treatment T₈.

At 90 DAT, plant height varied from 48.49 cm to 55.65 cm. The highest (55.65 cm) plant height was recorded from T₉ and the lowest 48.49 cm plant height was found from T₁.

At 120 DAT, plant height ranged from 52.36 cm to 61.98 cm. The highest (61.98 cm) plant height was recorded from T₉ (1/3 Compost + 1/3 Vermicompost + 1/3 Trichocompost + NPKS fertilizer) and the lowest (52.36 cm) was observed from T₁ (Control).

3.2.2. Number of Leaves per Plant

The number of leaves per plant at different stages of growth showed significant variation (Table 2) among the different doses of manures and fertilizer.

At 30 DAT, number of leaves per plant varied from 22.50 to 25.76. The highest (25.76) number of leaves per plant at 30 DAT was found from T₉ treatment and the lowest (22.50) was in T₁.

At 60 DAT, it ranged from 93.34 to 115.23. The highest number 115.23 was recorded from T₉ and the lowest (93.34) number was observed in T₁.

At 90 DAT, the maximum number (144.66) of leaves was recorded from treatment of T₉ and the lowest 139.33 was found from T₁ treatment.

At 120 DAT, the maximum (157.95) number of leaves per plant was observed in T₄ treatment and the minimum number (169.33) leaves per plant was recorded in T₁ treatment.

3.2.3. Number of Branch per Plant

Number of branch per plant was statistically influenced by integrated nutrient management (Table 2). The maximum number of branch per plant (10.85) was produced from T₉, which was statistically dissimilar with T₁ to T₈ treatment. The minimum number of branch per plant (6.67) was produced from T₁ (control) treatment.

3.2.4. Number of Fruit per Plant

From the table 3 it was observed that there was a statistical variation in number of fruit per plant due to different treatment variation. Results showed that highest number of fruit per plant was obtained (13.33) from T₉ treatment, which was very close with T₂ treatment. The lowest number of fruit per plant (5.33) was found from control treatment.

Table 1 Nutrient status of soil before planting and after harvesting

a) Soil physical properties

Treatments	Parameters	Bulk density (g/cm ³)	Particle density (g/cm ³)	Porosity (%)	Infiltration (mm/hr)	Field Capacity (%)	Textural class
T ₁	Before planting	1.50	2.00	24	6.50	25	Silty Clay Loam
	After harvesting	1.75	1.90	26	6.25	27	
T ₂	Before planting	1.45	2.20	38	7.00	33	
	After harvesting	1.68	2.10	35	6.80	30	
T ₃	Before planting	1.24	2.30	42	8.20	35	
	After harvesting	1.55	2.10	36	8.15	29	
T ₄	Before planting	1.59	1.90	39	7.40	32	
	After harvesting	1.52	2.00	34	7.30	31	
T ₅	Before planting	1.50	1.90	39	7.90	36	
	After harvesting	1.52	2.00	33	7.75	34	
T ₆	Before planting	1.55	1.98	29	6.98	28	
	After harvesting	1.59	2.12	33	6.54	29	
T ₇	Before planting	1.40	2.20	32	7.45	35	
	After harvesting	1.55	2.18	35	7.00	28	
T ₈	Before planting	1.18	2.40	40	8.30	36	
	After harvesting	1.50	2.35	38	8.28	34	
T ₉	Before planting	1.20	2.65	46	8.90	38	
	After harvesting	1.00	2.75	48	9.00	40	

b) Soil chemical properties

Treatments	Parameters	Soil pH	OM (%)	EC (µs/m)	Available N (%)	Ca	Mg	K	P	S	B	Fe	Zn
						meq/100 ml			µg/g				
T ₁	Before planting	6.50	0.30	126	0.08	2.2	1.00	0.04	04	10	0.02	90	0.60
	After harvesting	6.40	0.20	116	0.05	1.0	0.80	0.03	02	08	0.01	82	0.50
T ₂	Before planting	6.50	0.80	135	0.30	4.5	4.00	0.16	10	25	0.10	108	1.80
	After harvesting	6.20	0.65	129	0.12	4.0	2.00	0.10	09	25	0.10	102	1.65
T ₃	Before planting	6.50	0.80	134	0.25	4.6	3.80	0.12	11	21	0.11	105	1.50
	After harvesting	6.70	1.00	127	0.20	4.5	2.00	0.12	08	20	0.10	102	1.37
T ₄	Before planting	6.50	1.20	133	0.21	4.3	3.00	0.13	15	19	0.11	110	1.90
	After harvesting	6.60	1.20	127	0.10	4.0	2.80	0.12	12	14	0.10	103	1.70
T ₅	Before planting	6.50	1.10	134	0.32	4.4	4.00	0.15	13	25	0.10	112	2.00
	After harvesting	6.50	1.20	138	0.22	4.2	2.70	0.11	11	25	0.10	110	1.90
T ₆	Before planting	6.50	1.50	135	0.33	3.8	4.0	0.14	12	23	0.09	99	2.20
	After harvesting	6.60	1.60	135	0.17	3.0	2.50	0.13	10	19	0.07	102	2.00
T ₇	Before planting	6.50	1.50	154	0.28	3.7	3.00	0.10	13	20	0.08	106	2.10
	After harvesting	6.70	1.60	145	0.23	2.4	2.00	0.10	12	15	0.08	104	1.90
T ₈	Before planting	6.50	1.45	139	0.20	4.5	4.50	0.12	13	24	0.10	112	2.25
	After harvesting	6.40	1.50	132	0.12	4.1	3.00	0.12	11	22	0.10	110	2.20
T ₉	Before planting	6.72	2.20	164	0.41	5.6	5.00	0.18	18	28	0.30	118	2.65
	After harvesting	6.98	2.50	165	0.48	5.5	4.98	0.20	19	30	0.29	118	2.63
Critical level					0.12	2.0	0.80	0.20	14	14	0.20	10	2.0

Table 2 Vegetative parameters of capsicum

Treatments	Plant height (cm)				Number of leaves per plant				No. of branches/plant
	30 DAT	60 DAT	90 DAT	120 DAT	30 DAT	60 DAT	90 DAT	120 DAT	
T ₁	18.49	32.00	48.49	52.36	22.50	93.34	139.33	157.95	6.67
T ₂	20.49	33.28	52.68	58.23	24.37	111.50	143.56	166.39	9.23
T ₃	19.43	33.16	49.32	57.30	24.37	107.33	137.66	159.14	8.22
T ₄	20.20	33.08	50.50	57.77	24.32	112.12	142.38	160.50	8.00
T ₅	19.49	32.33	48.66	58.09	25.00	114.16	148.88	168.41	7.88
T ₆	20.41	33.08	51.23	57.02	25.72	105.05	151.38	160.66	8.76
T ₇	20.22	33.45	53.44	59.11	22.66	101.54	144.17	161.66	8.88
T ₈	19.92	31.42	51.01	56.09	25.22	100.79	140.08	158.66	7.98
T ₉	21.71	35.08	55.65	61.98	25.76	115.23	144.66	169.33	10.85
LSD at 0.05	1.87	5.92	5.31	6.94	0.85	5.76	2.90	1.77	5.68
CV	0.95	8.05	7.67	8.83	2.85	6.87	5.94	15.15	6.25

DAS, Days After Transplanting; LSD, Least Significant Difference; CV, Coefficient of Variation.

Table 3 Reproductive parameters of capsicum

Treatments	Number of fruit/plant	Fruit length (cm)	Diameter of fruit (cm)	Individual fruit weight (gm)	Yield per plant (gm)	Yield (t/ha)
T ₁	5.33	5.50	5.00	48.60	310	4.01
T ₂	12.00	9.53	8.63	75.04	900	15.24
T ₃	8.33	6.36	5.50	61.79	490	6.78
T ₄	10.33	6.90	7.40	64.48	670	8.93
T ₅	7.00	7.29	6.50	62.63	540	7.90
T ₆	10.00	9.53	7.50	67.29	760	9.59
T ₇	11.67	8.50	7.80	67.04	835	12.44
T ₈	8.00	6.20	7.00	66.32	830	10.08
T ₉	13.33	9.53	9.33	80.03	1007	16.54
LSD at 0.05	5.81	3.65	0.56	7.84	0.23	2.62
CV	7.03	4.05	4.91	19.83	7.85	6.87

DAS, Days After Transplanting; LSD, Least Significant Difference; CV, Coefficient of Variation.

3.2.5. Fruit Length (cm)

Fruit length was statistically influenced by levels of integrated nutrient management (Table 3). The highest fruit length (9.53 cm) was found with T₉ treatment which was statistically similar with T₂ and T₆ treatments and the lowest fruit length (5.50 cm) was found in control treatment.

3.2.6. Diameter of Fruit (cm)

Diameter of fruit was found to be statistically influenced by levels of integrated nutrient management practice (Table 3). The highest diameter of fruit (9.33 cm) was found from T₉ treatment and the lowest diameter of fruit (5.00 cm), was found from control treatment.

3.2.7. Individual Fruit Weight (gm)

Individual fruit weight was measured and found significant variation with the different level of integrated nutrient management (Table 3). The highest individual fruit weight (80.03 g) was found with T₉ treatment and at the same time the lowest individual fruit weight (48.60 g) was observed in control treatment.

3.2.8. Fruit Yield (g/plant)

Fruit yield was varied significantly due to the different levels of treatments (Table 3). The maximum fruit yield (1007 g/plant) was produced from T₉ treatment. The minimum fruit yield (310 g/plant) was produced from control treatment.

3.2.9. Yield (t/ha)

Fruit yield (t/ha) was varied significantly due to the different levels of integrated nutrient management (Table 3). The maximum fruit yield (16.54 t/ha) was produced from T₉ treatment. The minimum fruit yield (4.01 t/ha) was produced from control treatment T₁.

4. CONCLUSION

This study illustrates that combinations of mixed fertilizers or an integrated plant nutrient system (IPNS) produced the best results on plant growth, fruit measurements and yield. Combined applications of organic and inorganic sources of nutrients are more productive and sustain soil fertility. To

maintain sustainability in quality production through the proper use of organic and inorganic fertilizers from different sources will help to maintain soil fertility as well as soil productivity.

REFERENCES

- Aguoru, C. U., Hassan, A. & Olasan, J. O. (2015). Comparative study on the efficacy of cowdung and N.P.K fertilizer on the growth of cowpea (*Vigna unguiculata*), soyabean (*Glycine max*), tomato (*Lycopersicon esculentum*) and pepper (*Capsicum frutescens*) in North Central Nigeria. *Int. J. Pure Appl. Sci. Technol.*, 28(1), 24-33.
- Alam, M. A. U., Hossain, M. A., Khatun, M. U. S., Islam, M. K., Anwar, M. M. & Haque, M. E. (2016). Effect of integrated nutrient management on yield and quality of sweet pepper. *J. Bioscience and Agric.*, 10(2), 892-898.
- BARC, (2012). *Fertilizer recommendation guide*. Bangladesh Agriculture Research Council, Dhaka.
- Chandini, C. H., Kumar, R., Kumar, R. & Prokash, O. M. (2019). The Impact of chemical fertilizers on our environment and ecosystem. In: Research Trends in Environmental Sciences, Chandini CH & Kumar R. (Eds.), Springer Link, pp. 69-86.
- Chowdhury, R. (2004). Effects of chemical fertilizers on the surrounding environment and the alternative to the chemical fertilizers. *Ies-Envis Newsletter*, 7(3), 4-5.
- Heeb, A., Lundegardh, B., Savage, G. P. & Ericsson, T. (2006). Impact of organic and inorganic fertilizers on yield, taste, and nutritional quality of tomatoes. *J. Plant Nut. Soil Sci.*, 169(4), 535-541.
- Islam, M. M., Islam, M. K., Proshad, R., Islam, M. S., Islam, M. S., Kormoker, T. & Masum, B. K. M. M. (2017). Effect of inorganic and organic fertilizers on soil properties with vegetative growth and yield quality of sweet pepper (*Capsicum annuum* L.) in Bangladesh. *Int. J. Agron. Agri.*, 11(5), 37-46.
- Islam, M. S. (2006). Use of bioslurry as organic fertilizer in Bangladesh agriculture. *International Workshop on the Use of Bioslurry Domestic Biogas Programme*. (27-28 September, Bangkok, Thailand). pp. 1-18.
- Lee, S. K. & Kader, A. A. (2000). Pre-harvest and post-harvest factors influencing vitamin C content of horticultural crops. *Postharvest Biology and Technology*, 20, 207-220.
- Malgorzata, B. & Georgios, K. (2008). Physiological response and yield of pepper plants to organic fertilization. *J. Central European Agriculture*, 9(4), 715-722.
- Marin, A., Ferreres, F., Tomas-Barberan, F. A. & Gil, M. I. (2004). Characterization and quantitation of antioxidant constituents of sweet pepper (*Capsicum annuum* L.). *Journal of Agriculture and Food Chemistry*, 52(12), 3861-3869.
- Marimuthu, S., Surendran, U. & Subbian, P. (2014). Productivity, nutrient uptake and postharvest soil fertility as influenced by cotton-based cropping system with integrated nutrient management practices in semi-arid tropics. *Arch. Agron. Soil Sci.*, 60(1), 87-101.
- Michael, T. T. (1999). Nutrient conductivity effects on sweet pepper plants grown using a nutrient film technique. *New Zealand Journal of Crop and Horticultural Science*, 27(3), 229-237.
- Olsen, S. R., Cole, C. V., Cole, F. S., Watandbe, L. A. & Dean, L. A. (1954). *Estimation of available phosphorus in soil by extraction with sodium bicarbonate*. Circular Road 939, United States Department of Agriculture, Washington DC.
- Page, A. L., Miller, R. H. & Keeney, D. R. (1982). *Methods of soil analysis*, Part-2. Ameri. Soc. Agron. Madison, WI, USA.
- Ramesh, P., Mohan, S. & Subba R. A. (2005). Organic farming; its relevance to the Indian context. *Current Science*, 88(4), 561-567.
- Sinha, R. H. (2009). Earthworms vermicompost: a powerful crop nutrient over the conventional compost and protective soil conditioner against the destructive chemical fertilizers for food safety and security. *American-Eurasian Journal of Agricultural and Environmental Sciences*, 5, 1-55.
- Shahein, M. M., El-Sayed, S. F., Hassan, H. A. & Abou-El-Hassan, S. (2015). Producing sweet pepper organically using different sources of organic fertilizers under plastic house conditions. *International Conference on Advances in Agricultural, Biological & Environmental Sciences* (22-23 July, London, UK). pp. 72-78.
- Tonfack, L. B., Bernadac, A., Youmbi, E., Mbouapouognigni, V. P., Nguenguim, M. & Akoa, A. (2009). Impact of organic and inorganic fertilizers on tomato vigor, yield and fruit composition under tropical andosol soil conditions. *Fruits*, 64(3), 167-177.
- Wu, W. & Ma, B. (2015). Integrated nutrient management (INM) for sustaining crop productivity and reducing environmental impact: A review. *Science of The Total Environ.*, 512, 415-427.