EFFECT OF COWDUNG AND VERMICOMPOST ON GROWTH AND YIELD OF CHILLI

SHADIA AKTER SUMI

DEPARTMENT OF HORTICULTURE
SHER-E-BANGLA AGRICULTURAL UNIVERSITY
DHAKA-1207

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EFFECT OF COWDUNG AND VERMICOMPOST ON GROWTH AND YIELD OF CHILLI

BY

SHADIA AKTER SUMI

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Approved by:

…………………………………………………

…………………………………………

Prof. Dr. Md. Ismail Hossain	**Prof. Md. Ruhul Amin**
Department of Horticulture	Department of Horticulture
SAU, Dhaka	SAU, Dhaka
Supervisor	**Co-supervisor**

…………………………………………

Dr. Tahmina Mostarin
Chairman
Examination Committee
Department of Horticulture

DEPARTMENT OF HORTICULTURE

Sher-e-Bangla Agricultural University
Sher-e-Bangla Nagar, Dhaka-1207

CERTIFICATE

This is to certify that the thesis entitled, ***"Effect of cowdung and vermicompost on growth and yield of chilli"*** submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in the partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE (MS) IN HORTICULTURE,** embodies the result of a piece of *bona fide* research work carried out by ***Shadia Akter Sumi,*** Registration No. **14-06338** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that such help or source of information, as has been availed during the course of this investigation has been duly acknowledged and style of this thesis have been approved and recommended for submission.

Dated- December, 2015
Dhaka, Bangladesh

Prof. Dr. Md. Ismail Hossain
Department of Horticulture
Sher-e-Bangla Agricultural University
Dhaka, Bangladesh-1207
Supervisor

উবফরপধঃবফ ঃড়

গু Beloved Parents

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SAU, Dhaka. ***The Author***

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ABSTRACT

A study was conducted at the Horticulture Farm of Sher-e-Bangla Agricultural University, Dhaka to find out the effect of cowdung and vermicompost on growth and yield of chilli. The experiment consisted of two factors Factor A: Different levels of cowdung such as C_0: 0 t ha^{-1}, C_1: 10 t ha^{-1}, C_2: 15 t ha^{-1} and C_3: 20 t ha^{-1}; Factor B: Different levels of vermicompost such as V_0: 0 t ha^{-1}, V_1: 5 t ha^{-1} and V_2: 7 t ha^{-1}. The two factors experiment was laid out in Randomized Complete Block Design with three replications. In case of different levels of cowdung, the highest number of fruits per plant (58.62) and yield (9.26 t/ha) were found from C_2, while the lowest number of fruits per plant (45.29) and yield (6.06 t/ha) from C_0. For different levels of vermicompost, the highest number of fruits per plant (54.38) and yield (8.40 t/ha) were recorded from V_1, whereas the lowest number of fruits per plant (50.16), and yield (7.00 t/ha) from V_0. Due to interaction effect, the highest number of fruits per plant (61.07), and yield (10.08 t/ha) were recorded from C_2V_1, whereas the lowest number of fruits per plant (43.94) and yield (5.13 t/ha) from C_0V_0.From growth and yield point of view, it is apparent that the combination of15t/ha cowdung and 5t/ha vermicompost was suitable for chilli cultivation.

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ABBREVIATIONS AND ACRONYMS

@	:	***At the Rate of***
AEZ	:	Agro-ecological Zone
AVRDC	:	Asian Vegetables Research and Development Center
BARC	:	Bangladesh Agricultural Research Council
BARI	:	Bangladesh Agricultural Research Institute
BAU	:	Bangladesh Agricultural University
BBS	:	Bangladesh Bureau of Statistics
BCR	:	Benefit Cost Ration
DAS	:	Day After Sowing
et al.	:	et alii (and others)
FAO	:	Food and Agriculture Organization Of the United Nations
FW	:	Fresh weight
FYM	:	Farm Yard Manure
i.e.	:	That is
Kg	:	Kilogram
LSD	:	Least Significant Difference
NS	:	***Non-significant***
^{O}C	:	***Degree Celsius***
RCBD	:	***Randomized Complete Block Design***
Soc.	:	***Society***
t/ha	:	***Ton per hectare***

TSP	:	***Triple Super Phosphate***
UK	:	***United Kingdom***
UNDP	:	***United Nations Development Program***
Viz.	:	***Namely***

Chapter I

Introduction

CHAPTER I

INTRODUCTION

Chilli (*Capsicum sp.*) is an important spice in Bangladesh. It belongs to the family Solanaceae. Chilli is a native crop of central America and West Indies but spreaded quickly throughout the Tropical countries after the discovery of America and West Indies (Pruthi, 1993). Chilli is a favourite spice in Indian sub-continent. It is virtually a indispensible item in the kitchen for every day cooking. Chemical analysis of chilli have shown that red chilli fruit contains 15.9% protein, 31.6% carbohydrate, 50 mg/100g vitamin-C and small quantities of vitamin A, B and E.

It is an impotent cash crop in Bangladesh. It is also a cash crop of the country (Ahmed and Haque, 1980). It is cultivated on small family-owned farms where sale of its produce as a ready source of cash income throughout the year. A large number of cultivars or landraces are under cultivation in different parts of the country. At present, the total cultivated area under spices and condiments is 793 thousands acres (BBS, 2013). Depending on yield and consumers preference a number of chilli genotypes are being cultivated throughout the country. Winter chilli contributes about 90 % of its total production (Anonymous, 1987). The actual area under chilli cultivation in Bangladesh is not available due to its seasonal nature of cultivation. The total cultivated area covered by chilli is about 352 thousands acres (BBS, 2014) and total production of chilli is about 185 thousands M. Tons (BBS, 2014). In Bangladesh, the harvest price of chilli is about Tk. 56,100/M. Ton (BBS, 2015).

Conventional farm systems have been characterized by a high input of chemical fertilizer leading to qualitative deterioration of soil as well as agricultural yield. However, a growing awareness of the adverse impacts of inorganic fertilizers on crop production as well as increasing environmental and ecological concerns has stimulated greater interest in the utilization of organic amendments for crop production. Organic manures act not only as a source of nutrients and organic matter, but also increase microbial diversity and activity in soil, which influence soil structure and nutrients turnover, in addition to improvement in other physical, chemical and biological properties of the soil (Albiach *et al*., 2000). Thus organic amendments/manures are environmentally benign and help in maintaining soil fertility as well as agricultural productivity.

Cowdung is an important organic manure. It is also called the life of soil and plays an important role for sustainable soil fertility and crop productivity. It plays an important role physical, chemical and biological properties of the soils and ultimately enhance the crop productivity. The greatest benefit form cycling and recycling of organic matter in soils is the overall improvement in soil environment as well as supplying nutrients especially N, P, K and S.

Well rotten cowdung is also a good source of plant nutrient. It not only provide nutrient but also improve the soil physical and chemical properties like porosity water-holding capacity. It has been widely used for increasing crop production. Among various organic products, vermicompost has been recognized as potential soil amendment. Vermicompost is a product of non-thermophilic biodegradation of organic material by combined action of earthworms and associated microbes. It is a highly fertile, finely divided peat-like material with high porosity, aeration, water-holding capacity and low C:N ratios. So, vermicompost is very essential for the growth and yield of chilli.

If the light of the above perspective, the present experiment was conducted with chilli as the test crop having different combination of cowdung with vermicompost to find out the best combination of organic matter for chilli production. Considering the above fact the study was undertaken with the following objectives:

1. to find out the effect of cow dung on growth and yield of chilli;
2. to determine the effect of vermicompost on growth and yield of chilli and
3. to select the suitable combination of Cowdung and Vermicompost for higher yield of chilli.

Chapter II

Review of Literature

CHAPTER II

REVIEW OF LITERATURE

Chilli is the most important spice crop in the world as well as in Bangladesh. Many experiments were conducted in home and abroad on the nutritioanal requirement of chili. But information regarding the combined effects of cowdung and vermicompost in chilli is meagre. The research findings related to the present investigation so far in country and abroad have been reviewed are presented below.

Ishtiyaq *et al.* (2015) conducted to investigate the effect of different rates (2, 4 and 6 t/ha) of macrophyte-based vermicompost on germination, growth and yield of *Solanum melongena* under field conditions. The data revealed that different rates of vermicompost produced varied and significant effect (P\0.05) as compared to the control on germination, growth and yield parameters with maximum value recorded at 6 t/ha, followed by 4 t/ha and the least at 2 t/ha. The dose of 6 t/ha significantly (P\0.05) increased germination (22.56 ± 2.5 %), number of fruits per plant (3.55 ± 0.07) mean fruit weight (73± 5.0 g), yield per plant (1.48 ± 0.05 kg) and marketable fruits (28.66 ± 3.0 %) when compared with the control. This study suggests that macrophyte-based vermicompost as a potential source of plant nutrients for sustainable crop production.

Reshid *et al.* (2014) conducted that a plastic pot set-up with soil was used to determine the effects and efficiency level of vermicompost on the growth and yields of tomatoes (*Solanum lycopersicum* L.). The study was conducted through effect of increasing concentration of Vermicompost (control, 10%, 20%, 30% and 40%w/w) in target plant growth. The present study was carried out on the basis of Randomized Complete Block Design (RCBD) with 5 treatments and 3 replications. The obtained results from the present research indicated that applied vermicompost especially; at 20% level had significantly improving effects on better growth and development of vermicompost treated tomatoes as they had higher leaf area, leaf dry mass, fresh stem and dry weight, number of fruits and yields. Low doses of vermicompost (10%) and high doses (40%) produced lower yields of the tomato plants. Generally, the addition of vermicompost led to improve the yield of tomato cultivars as compared to control. Hence, it could be suggested that treated plants, with this vermicompost increased the growth, yield and the above chemical compositions and pH of the soil.

Kumar *et al.* (2013) conducted that Field efficacy of six botanicals in the management of major pests viz., spotted leaf beetle Epilachna vigintioctopunctata and shoot and fruit borer Leucinodes orbonalis of brinjal was evaluated in combination with vermicompost, farmyard manure and straight fertilizers as main treatments and six botanicals as sub treatments employing the split plot design. Organic manures proved to be superior when compared to the fertilizers as regards pest incidence. Vermicompost was significantly more effective as regards fruit borer infestation. NSKE 5% extract proved to be the most effective against fruit borer. Neemgold (Azadirachtin) 5 ml/l, Pongamia glabra 5% leaf extract and Annona squamosa 5% leaf extract also were effective in reducing the fruit borer incidence.

Murraya koenigi 5% extract and chilli-garlic 5% extract were less effective. Significantly highest marketable yield was obtained in Neemgold (Azadirachtin) 5 ml/l followed by NSKE 5%.

Mamta *et al.* (2012) conducted that the study was aimed at understanding the effect of vermicompost on the growth and productivity of brinjal plant. The vermicompost of cow dung, garden waste and kitchen waste in combination were used with brinjal plants under field conditions. The different treatments affected the seed germination of the test crop significantly. Plant height, number of leaves and fruit weight ware higher in the vermicompost treated field as compared to control and no disease incidence was observed in the fruits of vermicompost treated plot. The study revealed that vermicompost amendments affected brinjal crop differently and we recommend that while raising brinjal crop farmers should use vermicompost instead of synthetic fertilizers.

Lallawmsanga *et al.* (2012) conducted that the ameliorating effect of vermicompost and cowdung compost on growth and biochemical characteristics of *Solanum melongena* treated with paint industrial effluent was evaluated in this study. The color and odor of the effluent samples, physical and chemical parameters like pH, EC, TDS, TS, EC and heavy metals were analyzed. The effluent contained sulphates, chlorides, phosphates, dissolved solids and other pollutants in higher amounts. The effect of effluent with water, vermicompost and cow dung were studied on shoot length, root length, leaf area, fresh weight, dry weight and biochemical parameters like Chlorophyll a, Chlorophyll b, Total Chlorophyll and Carotenoids of S. melongena. It was noted that the length of the root and shoot, fresh and dry weight of the plant was considerably decreased with increase in concentration of the effluent. There was a gradual increase in all the parameters except the leaf area with increase in effluent concentration with vermicompost and cow dung. There was no change in the chlorophyll content on 80% effluent with vermicompost when compared to the control, whereas reduction in the carotenoids content was noted in 80% effluent with vermicompost.

Ali *et al.* (2011) conducted that the present research work was conducted in RBD. The experiment was designed with three treatments and three replications, with the view to studying the effect of Panchagavya and Sanjibani, liquid organic manure on the yield of green gram, Vigna radiata, chilli, Capsicum frutescens (Chili) and mustard, Brassica campestris. Their efficacy were compared by studying the yield contributing characters like plant height, primary branch, secondary branch/plant, number of seed/fruit, fruit length, weight of 100 seed, yield/plant, yield m^{-2} and experimental observation recorded that the Sanjibani and Panchagavya treated crops were higher than the control. A liquid manure specifically Sanjibani used in this study was pre-analysed to study the variation in microbial population between two Sanjibani sample prepared by using raw materials (Cow dung and Cow urine) obtained from two different source of cow breed (i.e., Native breed and Jersey breed) and the best source of breed was selected for the further research work. Meanwhile the effect of organic farming practice in soil-health was also studied by analysing the basic parameters of soil in the field were the research was conducted. The result shows increased microbial population, oxidisable organic carbon, nitrogen, phosphate, potash. The pH and E.C were found to be close to neutral.

Goutam *et al.* (2011) Field trials was conducted a field trials where using different fertilizers having equal concentration of nutrients to determine their impact on different growth parameters of tomato plants. Six types of experimental plots were prepared whereT_1 was kept as control and five others were treated by different category of fertilizers (T_2-Chemical fertilizers, T_3-Farm Yard Manure (FYM), T_4-Vermicompost, T_5 and T_6- FYM supplemented with chemical fertilizers and vermicompost supplemented with chemical fertilizer respectively).The treatment plots (T_6) showed 73% better yield of fruits than control, Besides, vermicompost supplemented with N.P.K treated plots (T_5) displayed better results with regard to fresh weight of leaves, dry weight of leaves, dry weight of fruits, number of branches and number of fruits per plant from other fertilizers treated plants.

Sathish *et al.* (2009) studies were carried out to evaluate biological activity of organic manures against tomato fruit borer, Helicoverpa armigera (Hub.) and safety of otanicals and biopesticides against egg parasitoid, richogramma chilonis Ishii and biochemical effects of Pseudomonas florescens on tomato under pot culture conditions. The feeding and infestation of the larvae of H. armigera were significantly low in farm yard manure (FYM) zospirillum+silicate solubilising bacteria (SSB)+Phosphobacteria+neem cake applied plants followed by FYM+Azospirillum+SSB+Phosphobacteria+mahua cake applied plants. Trichogramma parasitization on H. armigera eggs was adversely effected by neem oil 3% on treated plants followed by neem seed kernel extract (NSKE 5%)+spinosad 75 g a.i./ha. Under laboratory condition among the microbial pesticide tested Spinosad (75 g a.i./ha), HaNPV+Spinosad+Bt (1.5×1012 POBs/ha+75 g a.i./ha+15000 IU/mg (2 lit/ha)), Spinosad+Bt (75 g a.i./ha+15000 IU/mg-2 lit/ha) showed higher insecticidal toxicity (100 per cent mortality on 72 h) to all instars of H. armigera larvae. Biochemical parameters like phenol content, peroxidase and phenyl alanine ammonialyase (PAL) activity recorded higher levels in Pseudomonas florescens seed treatment @ 30 g/kg of seed and its foliar spray @ 1 g/litre in treated tomato plants.

Jagadeesha (2008) conducted a field experiment was conducted at the University of Agricultural Sciences, Dharwad during kharif season of 2007 to study the effect of organic manures and biofertilziers on plant growth, seed yield and quality parameters in tomato. Results of field experiment in kharif 2007 revealed that, application of RDF (60:50:30 kg NPK/ha) + biofertilzier (Azospirillum and P solubilizing bacteria 2.5 kg/ha each) records higher plant height (64.37, 109.50 and 162.33 cm), number of leaves (92.50, 153.33 and 146.50), leaf area (898.05, 4314.31 and 4310.94 cm^2) and leaf area index (898.05, 4314.31 and 4310.94 cm^2) at 30, 60 and 90 DAT respectively and records lesser days to 50 per cent flowering (38.00) followed by FYM (50%) + vermicompost (50%) + biofertilzier. The application of RDF + biofertilziers records higher seed yield (106.87 kg/ha) followed by FYM (50%) + vermicompost (50%) (101.94 kg/ha) over FYM alone. The seed yield was significantly higher with the application of RDF + biofertilziers was attributed to number of fruits per plant (45.22) number of seeds per fruit (109.45) fruit weight per plant (1280.98 g) and 1000 seed weight (2.84 g).

Ullah *et al.* (2008) conducted that a field experiment was conducted at the Horticultural Farm of Bangladesh Agricultural University (BAU), Mymensingh during the period from December 2004 to April 2005 to evaluate the effect of manures and fertilizers on the yield of brinjal. There were five treatments consisting of organic, inorganic and combined sources of nutrients, of which the combined treatment (60 % organic +40% inorganic) showed the best performances. The maximum branching (20.1) with the highest number fruits/plant (15.2), fruit length (14.1 cm) and fruit diameter (4.3 cm) were found combined application of manures and fertilizers. The highest yield (45.5 t ha^{-1}) was also obtained from the combined application of organic and inorganic sources of nutrients. Application of mustard oil cake or poultry manure alone gave better performance compared to only chemical fertilizers. The organic matter content and availability of N, P, K and S in soil were increased by organic matter application. On the other hand soil pH was increased with chemical application than organic.

Kattimani and Shashidhara (2006) conducted that a field experiment was conducted during kharif 2002, in Dharwad, Karnataka, India, to study the response of chilli genotypes to integrated nutrient management. The experiment was laid out in a split plot design with three genotypes in main plot and five fertilizer combinations in sub-plots. Among the genotypes, Vietnam-2 recorded significantly higher yield (932 kg/ha) compared with Byadagi dabbi and Byadagi kaddi. The values of growth and yield components were also significantly higher in Vietnam-2. Application of FYM at 10 t/ha along with 100% recommended dose of fertilizer (RDF) resulted in higher fruit yield (919 kg/ha) compared to RDF alone. Similarly, application of FYM at 10 t/ha with 100% RDF increased oleoresin content and yield by 17.5 and 16.0%, respectively, over 100% RDF alone. Application of FYM at 10 t/ha along with 100% RDF enhanced the uptake of nutrients like N, P, K, Ca, S and Fe by 14.1, 44.9, 37.4, 15.5, 20.3 and 26.7 per cent, respectively, over RDF alone in Vietnam-2. Similar trend was also found in other genotypes. The maximum net returns (Rs. 28 522/ha) was recorded with the application of FYM at 10 t/ha + 100% RDF followed by FYM at 5 t/ha + chilli stalk at 5 t/ha + 100% RDF + secondary and micronutrient +

biofertilizer (Rs. 25 638/ha) in Vietnam-2 compared to Byadagi kaddi and Byadagi dabbi.

Singh and Kushwah (2006) was conducted a field experiment at Central Potato Research Station, Gwalior, Madhya Pradesh, India, during the winter seasons (rabi) of 2001-02 and 2002-03 to study the effect of organic and inorganic sources of nutrients on potato production. The treatments included 25, 50, 75 and 100% doses of NPK with and without organic manures (farmyard manure (FYM) and Nadep compost at 30 t/ha). Application of 100% NPK+30 t FYM/ha resulted in significantly higher tuber yield of 456 q/ha compared with that of other treatments except 100% NPK+30 t Nadep/ha and 75% NPK+30 t FYM/ha. The effect of organic manures (FYM and Nadep compost) in combination with inorganic fertilizers was more pronounced compared with that of organic manures alone. However, FYM was more effective than Nadep compost in producing higher tuber yield. Maximum net return of Rs 63 627/ha was also obtained from 100% NPK+30 t FYM/ha. However, benefit:cost ratio was almost same under 75% NPK with 30 t/ha FYM or Nadep compost and 100% NPK with 30 t/ha FYM or Nadep compost.

Kushwah *et al.* (2005) was conducted an experiment during rabi 2004/05 on silty clay loam soil at Gwalior, Madhya Pradesh, India to study the effect of farmyard manure (FYM), Nadep compost, vermicompost and inorganic NPK fertilizers on yield and economics of potato. Application of FYM, Nadep compost and vermicompost alone or in combination did not influence tuber yield significantly. However, organic manures at 7.5 t/ha in combination with 50% recommended dose of NPK significantly increased tuber yield. The highest tuber yield (321 q/ha) was recorded with 100% recommended dose of NPK fertilizers. The highest incremental benefit cost ratio (7.5) was obtained with 50% recommended dose of NPK.

Ananthi *et al.* (2004) conducted that field experiments were carried out with chilli (*C. annuum*) cv. PKM 1 during the kharif and rabi seasons of 2001-02 in Coimbatore, Tamil Nadu, India. The treatments included 2 sources (muriate of potash (MOP) and sulfate of potash (SOP)) and 5 levels (0, 30, 45, 60 and 75 kg/ha) of K, with application of farmyard manure (FYM). Additional 2 treatments, i.e. 30

and 60 kg K< sub>2</ sub>O/ha as SOP, were tried without FYM. K at 60 kg SOP/ha increased the number of fruits per plant, fruit length and fruit weight during both seasons. This treatment also recorded the highest fruit set percentage, harvest index and dry fruit yield (5.77 and 5.09 t/ha during the kharif and rabi seasons, respectively). Economic analysis showed that application of K at 60 kg SOP/ha was significantly superior in increasing the net return and benefit cost ratio (5.80 and 5.11 during kharif and rabi, respectively).

Hangarge *et al.* (2004) conducted that a field experiment was conducted during the kharif and rabi seasons of 1996/97 to study the influence of vermicompost and other organics on the fertility and productivity of soil (Vertisol) under chilli-spinach cropping system in Parbhani, Maharashtra, India. The application of vermicompost at 5 t ha-1 + organic booster at 1 litre m-2, and soil conditioner (Tera care) at 2.5 t ha-1 + organic booster at 1 litre m-2 enhanced the availability of N, P, K and organic C content in soil. The recommended rates of NPK and organic sources each alone did not have any significant effect. The combined effect of organic + organic sources proved to be better than either organic alone or combination of organic + inorganic fertilizer.

Maheswari *et al.* (2004) conducted that the effects of foliar organic fertilizers (amino acid at 0.5 and 0.75%; humic acid at 0.1 and 0.2%; and vermiwash at 1:3 and 1:5 vermiwash : water ratios) on the quality and economics of chilli (*C. annuum*) were investigated on sandy loam soil in Tamil Nadu, India. The recommended fertilizer rate was applied as basal and top dressing (complete dose; N:P:K at 160:60:30 kg/ha), and as basal application alone (80:60:30 kg/ha). The highest ascorbic acid content (175.23 mg/100 g) was observed in the treatment combination of vermiwash at 1:5 and basal and top fertilizer dressing. Capsaicin content and seed number were highest (0.49%) with 0.75% amino acid + complete fertilizer dose. Amino acid at 0.75% + complete fertilizer dose produced the best returns.

Malawadi *et al.* (2004) conducted that in a field experiment conducted in Dharwad, Karnataka, India, chilli (*Capsicum annuum*), planted on 19 July 2001, was subjected to the following treatments: NPK alone; NPK+farmyard manure (FYM); NPK+Fe;

NPK+S; NPK+Ca; NPK+S+Fe; NPK+Ca+Fe; NPK+Ca+S; and NPK+Ca+S+Fe. N, P and K (100:50:50 kg/ha) were applied in the form of urea, diammonium phosphate and muriate of potash, respectively. Half of the recommended NPK was applied at transplanting, and the other half was applied after 6 weeks. FYM at 10 t/ha, Ca at 30 kg/ha (calcium carbonate) and S at 60 kg/ha (elemental sulfur) were applied 10 days before transplanting. Fe at 12 kg/ha (iron chloride) was applied at 6 weeks after transplanting. NPK+FYM recorded the highest fruit yield (844.39 kg/ha), followed by NPK+S+Fe, NPK+Ca+S and NPK+Ca+Fe (843.36, 841.20 and 840.42 kg/ha, respectively), compared with NPK alone (695 kg/ha). NPK+FYM also recorded the highest fruit weight per hill (86.60 g) and hundred fruit weight (200.50 g), while NPK alone recorded the highest value for weight of discoloured fruits (112.00 kg/ha). No significant differences in these parameters were observed among treatments. NPK+Ca+Fe recorded the highest oleoresin yield (109.41 kg/ha), followed by NPK+Ca+S+Fe and NPK+S+Fe (108.08 and 107.08 kg/ha, respectively). The highest ascorbic acid content was recorded for NPK+Ca+S+Fe (81.67 mg/100 g), followed by NPK+Ca+S and NPK+S (79.83 and 78.73 mg/100 g, respectively) compared with NPK alone (59.50 mg/100 g). Increased N, P, K, Ca, S and Fe uptake was obtained with the application of FYM or combinations of secondary and micronutrients along with NPK.

Subhasmita *et al.* (2004) conducted that the effects of vermicompost based on karanj, niger, mahua, Indian mustard, groundnut or neem oilseed cake, and NPK (120:80:60 kg/ha) as control, on leaf damage by L. trifolii and on the yield of chilli cv. Suryamukhi were studied in a pot experiment. Leaf damage varied from 20.0 to 53.3%, whereas fruit yield per plant ranged from 9.7 to 21.3%. The vermicompost based on mahua oilseed cake resulted in the lowest percentage of leaf damage (16.7%), whereas the vermicompost based on groundnut oilseed cake recorded the highest fruit yield (21.3 g per plant).

Yadav and Vijayakumari (2004) was conducted that a pot culture experiment was conducted at Avinashilingam University, Coimbatore, Tamil Nadu, India, to assess the effect of vermicomposted vegetable waste, alone and in combination with different organic manures and chemical fertilizer, on the biochemical characters of chilli (*Capsicum annuum*). The reducing sugar, free amino acid and phenol contents were higher in the vermicompost treatment on 30 (70.27, 7.98, 14.62 mg/g), 60 (95.51, 17.66, 22.32 mg/g) and 90 days after sowing (33.67, 3.17, 11.85 mg/g). The protein content was higher in vermicompost treatment on 60 and 90 days after sowing (113.37 and 79.69 mg/g, respectively), whereas it was higher in vermicompost+farmyard manure (FYM) treatment on 30 (35.73 mg/g) days after sowing. The carbohydrate content was higher in vermicompost+FYM treatment on 30 and 90 (4.67 and 6.46 mg/g, respectively) days after sowing, while on 60 days after sowing, it was higher in the vermicompost treatment (15.34 m/g). Chlorophyll a (0.23 mg/g), chlorophyll b (0.38 mg/g) and total chlorophyll (0.62 mg/g) were higher in vermicompost+neem cake treatment on 30 days after sowing. On 60 days after sowing, higher chlorophyll b (2.61 mg/g) and total chlorophyll (3.62 mg/g) contents were observed in the treatment containing vermicompost alone. On 90 days after sowing, chlorophyll a (1.01 mg/g) and total chlorophyll (1.92 mg/g) content was higher in vermicompost alone, and chlorophyll b (1.07 mg/g) in the vermicompost+FYM treatment.

Hiranmai and Vijayakumari (2003) conducted that a pot culture experiment was undertaken to evaluate the effect of vermicompost applied singly and in combination with different organic manures (farmyard manure (FYM), composted coir pith, composted press mud, composted sugarcane trash, biofertilizer, green manure, and neem cake) and inorganic fertilizers on the biometric and yield parameters of chilli (Capsicum annuum). The biometric parameters varied significantly among the treatments. Vermicompost alone and admixed with FYM, green manure, neem cake and NPK fertilizers were effective in improving various biometric parameters. Better yield parameters were observed in the vermicompost treatment.

Maheswari *et al.* (2003) conducted that an experiment was conducted in Annamalai, Tamil Nadu, India to study the nutrient uptake pattern in chilli through the foliar application of organic nutrients. Treatments comprised: amino acid at 0.50 and 0.75%; humic acid at 0.1 and 0.2%, vermiwash at 1:3 and 1:5 dilution and water spray as the control. The recommended dose of fertilizer (RDF) was given as: basal + top dressing (160:60:30 kg NPK/ha) and basal dose alone (80:60:30 kg NPK/ha). Six sprays of the foliar nutrients were given at 20-day intervals commencing from the 30th day after transplanting. Among the factorial combinations, application of 0.75% amino acid with complete (100%) dose of RDF resulted in the highest N and K uptake of 59.68 and 31.88 kg/ha, respectively. Application of vermiwash at 1:5 dilution with complete dose of RDF resulted in higher P uptake (7.74 kg/ha). The individual effect of amino acid improved the micronutrients, Fe, Zn, Mn and Cu (0.23, 0.04, 0.22 and 0.09 kg/ha). Fe and Zn (0.23 and 0.04 kg/ha) uptake was influenced by humic acid application.

Patil and Madalageri (2003) conducted that the field experiments were conducted during 1997 and 1998 at Kittur Rani Channamma College of Horticulture Farm, Arabhavi in Belgaum district of Karnataka, India, to study the effect of rock phosphate and P solubilizers on yield and quality of green chilli [Capsicum]. The results revealed that a recommended dose of P< sub>2</ sub>O< sub>5</ sub> (30 kg/ha) applied through rock phosphate along with Bacillus polymyxa [*Paenibacillus polymyxa*] and vermicompost recorded the highest mean fruit yield (74.2 q/ha), ascorbic acid, TSS and P uptake in green chillies over treatments comprising of rock phosphate with or without Bacillus polymyxa or vermicompost.

Hangarge *et al.* (2002a) conducted that the effects of single or combined applications of vermicompost (5 t/ha), coirpith compost (2.5 t/ha), organic booster (1 litre m^{-2}), cow dung urine slurry (1 litre m^{-2}) and NPK fertilizer (25, 50 and 100%) on the yield and nutrient uptake of chilli (*Capsicum annuum*) cv. Parbhani Tajes were determined in a field experiment conducted in Parbhani, Maharashtra, India, during 1996-97. Application of coirpith compost+organic booster resulted in the highest yield (105.67 q/ha), yield components and N (51.10 kg/ha), P (5.39 kg/ha) and K (49.34 kg/ha) uptake of chilli.

Hangarge *et al.* (2002b) conducted in order to evaluate effect of vermicompost and soil conditioner (Tera care) on physical properties of soil and yields of crops under chilli-spinach cropping system, field experiment was conducted during kharif and rabi season 1996-97 on Vertisol at Marathwada Agricultural University, Parbhani. There were eleven treatments replicated thrice in randomized block design. The results indicated that application of soil conditioner @ 2.5 t/ha in combination with organic booster @ 1 litre per m2 improved the physical condition of soil by reducing bulk density, increasing porosity, water holding capacity and infiltration rate. The yields of green chilli and spinach were significantly increased due to application of soil conditioner and vermicompost along with organic booster as compared to recommended dose of NPK.

Hangarge *et al.* (2001) conducted to a field experiment was conducted in Maharashtra, India, during the kharif season of 1996-97 to determine the response of chilli (*Capsicum annuum* cv. Parbhani Tejas) to integrated nutrient supply system. The treatments were control (recommended rate of NPK, T1), and vermicompost at 5 t/ha or soil conditioner (Tera care) at 2.5 t/ha combined with 25 and 50% NPK, organic booster at 1 litre/m^2 and cowdung urine slurry at 1 litre/m^2. Results revealed that soil conditioner+organic booster was the most effective in increasing the height, stem girth, number of branches, number of fruits and green chilli yield, followed by the treatment with vermicompost+organic booster. The application of vermicompost or soil conditioner in combination with chemical and organic fertilizers significantly increased growth and yield attributes of chilli compared to organic and chemical fertilizers alone.

Patil and Biradar (2001) conducted that a field experiment was conducted in Dharwad, Karnataka, India, during kharif 1997 on Vertisols to determine the nutrient uptake by chilli cv. Byadgi Kaddi as influenced by plant population and nutrient levels. The treatments consisted of 5 plant populations, i.e. 37 037, 55 555, 74 074, 111 111, and 148 148 plants/ha, and 4 nutrient levels, i.e. 100% recommended dose of fertilizer (RDF, 150:75:75 NPK kg/ha) + farmyard manure (FYM) at 10 tonnes/ha, 100% RDF + FYM + vermicompost (VC) at 2.5 tonnes/ha, 150% RDF + FYM + VC, 200% RDF + FYM + VC. The dry chilli yield and total uptake of nutrient by plant varied significantly with respect to plant population and nutrient levels. A wider spaced plant population of 55 555 plants/ha recorded significantly higher dry chilli yield (20.71 q/ha), followed by 37 037 plants/ha (18.68 q/ha) and further decreased with the increase in plant population. Similarly, higher total N uptake (129.6 kg/ha) was recorded at wider spacing of 37 037 plants/ha and decreased with the increasing plant population. The trend was similar with P and K uptake. The yield of chilli also increased significantly with the increase in nutrient supply. The highest fruit yield (19.12 q/ha) was recorded with the application of 200% RDF + FYM + VC. Similarly, N, P and K uptake increased with the increase in nutrient levels.

Sharu and Meerabai (2001) conducted that field experiment was conducted in Vellayani, Kerala, India, during 1999/2000 to study the effect of poultry manure, vermicompost, and neem cake, singly (100%) or in combination (25, 50, or 75%) with inorganic N (25, 50, or 75%), on chilli yield and quality. The highest fruit yield (9.66 t/ha) was obtained with 50% poultry manure+50% inorganic N. The best keeping quality and highest ascorbic acid content was recorded for 100% poultry manure, 50% inorganic N+50% poultry manure, 25% inorganic N+75% poultry manure, 25% inorganic N+75% vermicompost, 100% vermicompost, 25% inorganic N+75% neem cake, and 100% neem cake. Poultry manure was superior among the organic fertilizers, and a 1:1 ratio of inorganic to organic fertilizer was best for increasing chilli yield and quality.

Fugro (2000) conducted that the field experiments were conducted in the Konkan region of Maharashtra, India, to test the efficacy of several organic manures and organic pesticides, alone and in combination with inorganic fertilizers and chemical pesticides, for the control of leaf curl [pepper leaf curl virus] and die-back (caused by *Colletotrichum capsici*) diseases of chilli (*Capsicum annuum*). The organic manures tested included farmyard manure (FYM), organic manure, organic manure - cellrich, neem cake and vermicompost. The treatment comprising organic manure in combination with NPK superimposed with alternate sprays of organic and chemical pesticides produced the maximum yield of green chilli (166 q/ha). The lowest incidence of leaf curl (2.12%) and die-back (4.03%) was also observed in the same treatment. These results suggest that in lateritic soils like the Konkan region, it is not possible to maximise the crop yield merely with the use of organic manures and organic pesticides. However, the appropriate combination of both organic and inorganic fertilizers and pesticides is needed to maximise the crop yield and manage chilli diseases to a satisfactory level.

Rahman (2000) carried out a field experiment at the Bangladesh Agriculturl University, Mymensingh with three levels of fertilizers, viz. 206/141/159, 275/185/250 and 375/225/300 kg per hectare of urea, TSP and MP along with three doses of cowdung (25, 50 and 10 t/ha). He found that most of the growth parameters, yield components and seedling tuber yield were influenced significantly by NPK fertilizers cowdung. The yield was the highest at the highest dose of NPK fertilizer and cowdung manure.

Verma *et al.* (1997) conducted as experiment in calcareous soils of Forth Bihar with four levels of N: P_2O_5 : K_2O, namely zero level, 60 : 40 : 40, 120 : 80 : 80 and 180 : 120 : 120 kg/ha, and found that the chilli yield increased with increase in NPK fertilizer levels upto 120 : 80 : 80 kg/ha.

Elias *et al.* (1997) recommended a dose of 206 kg urea, 141 kg TSP, 159 kg MP and 15 t cowdung/ha was used by chilli cultivation. However, their recommendation appeared to be erratic when the dose per square meter of bed was considered. The dose recommended for a square meter of bed did not agree with the recommended dose per hectare. Perhaps the authors did not consider that the effective bed are in one hectare of land would be 6350 sq. m.

Sujatha and Krishnappa (1996) observed higher chilli yield at 120 : 100 : 120 kg NPK + 50 t FYM/Ha. In another experiment, Dixit (1997) noticed better vegetative growth and higher yield at 150 kg N + 20 t FYM along with 100 kg P_2O_5 + 50 K_2O/ha.

Durmitrescu (1965) from his experiment on “composts as organic manures of higher fertilizing value” reported that application of FYM at the rate of 5 t/ha gave higher total yield of tomato.

Prezotti *et al.* (1988) stated that application of poultry manure increaed tomato productivity by 48% and improved the proportion of large fruits in the total yield.

Babafoly (1989) reported that poultry manure and cowdung were separated to all other organic residues in terms of growth, vigor and yield of chilli.

Ahmen *et al.* (1993) reported that organic residues such as cowdung @ 20 t/ha in compaction with other fertilizer played an important role in respect of growth and fruit yield of chilli.

Shaheed (1997) conducted an experiment to investigate the effect of organic manures on yield and quality of rafted chilli. He reported that mustard oil cake (1500 g/plot) as an alternative of cowdung and poultry dropping played an important role in increasing the yield of grafted chilli.

Youssef *et al.* (2001) carried out an experiment to study the effect of different fertilizers, i.e. mineral (ammonium nitrate and potassium sulphate) and organic manure (cowdung) alone or in combination, on the quantity and quality of chilli under clear polythylene low tunnels. Treatment with 100% organic manure alone combination with ammonium nitrate resulted in taller plants than other treatments. However, fruit dimensions were the highest with organic manure alone.

Bhardwai *et al.* (2000) conducted a field experiment during 1995-1998 at jachh in India to find out the effect of organic sources of nutrients, i.e. Farmyard (*Azadirachta indica*) cake and rapeseed (Brussica campestries var toria) cake as partial or complex alternative to chemical fertilizer on yield of tomato, okra, cabbage and cauliflower, and its economic feasibility. Application of sole organic sources of nutrients recorded 11-17% lower yield in different vegetable crops.

Shashidhare *et al.* (1998) studied the effects of organic and inorganic fertilizers on growth and yield of chilli [*Capsicum* sp.] at the Chilli Research Centre at Karataka in India during Kharif for 2 years (1994-95). Treatment comprised organic sources like FYM (5 t/ha) in combination with 0, 50% or 100% of the recommended dose of fertilzers (RDF; N: P_2O_5 : K_2O at 150 : 75 : 75 kg/ha). Organic sources had no significant influence on fruit yield Application of 100% RDF together with organic fertilizer increased yield (mean 693 kg/ha) significantly over 50% and 0% RDF (558 and 506 kg/ha, respectively).

Hossain and Majid (1997) conducted field trials to study the effect of water hyacinth compost and cow manure as organic fertilizer on gourds, tomatoes and abubergines near Dhaka. The compost was applied alone or in a 2:1 mixture with cow manure to the gourds and in a 1:1 mixture with 180 kg manure to tomatoes and abuergines. Gourd yields were the highest with 180 kg wet compost added per planting hole. Tomato yields were higher with the mixture than with cow manure alone but ambergine yields were similar in the 2 treatments.

Anju *et al.* (2006) conducted a field experiment in Raichur, Karnataka. India during the rabi season of 1999-2000 on clay loam soils to study the influence of organic manures, biofertilizers and micronutrients of growth, yield and yield parameters of chilli. The results indicated that highest yield amont the organic manures was recorded by application poultry manure (1977 kg ha^{-1}) compare it the application of FYM (165 kg ha^{-1}) and no organic manure (1412 kg ha^{-1}) treatment. Seed treatment with biofertilizer Azaspirilhum was not significant. Among the micronutrients boron spray found significantly superior (1722 kg/ha) over the $MgSO_4$ spray (1641 kg ha^{-1}) and no micronutrient spray (1580 kg ha^{-1}) in terms of yield.

Shaktawat and Bansal (1999) carried out a field experiment during the winter season of 1993-94 at Udaipur, Rajasthan, India, chilli was given FYM at 5 t/ha, gobar gas slurry (biogas slurry) at 1.66 t/ha^{-1} or celrich (synthetic organic manure) at 2.5 t ha^{-1}, combined with 0, 40, 80 or 120 kg N ha^{-1}, of the organic manures, gober gas slurry gave significantly higher yield and values of yield components that other, while yields and yield component values increase with increasing N rate. There is no interaction between organic manures and N fertilizer.

Sharma *et al.* (1999) examined the role of organic manure on boron (B) availability, a green house experiment was conducted to study the effect of boron (0-5 mg B kg^{-1} soil) and FRM levels on growth, yields and boron accumulation of chilli. Application of boron or FYM individually increased the plant height, capitulum diameter, dry matter, yield of seeds and boron concentration and accumulation. The interaction of boron and FYM levels had a significant influence only on boron concentration of stalk and total boron accumulation of chilli. In the absence of boron application, use of highest level of FRM (910 g kg^{-1} soil) significantly increase boron concentration of FYM at lower rate was effective. The interaction of B and FYM levels had no significant effect on the content of hot water soluble soil B. Application of FYM increased apparent availability of native and fertilizer B from to chilli crops.

Awad and Griesh (1992) conducted a field experiment at Abo-Sweir, Ismailia in 1986-1987 chilli were grown 40, 80 and 120 kg N $feddan^{-1}$ or 20 litres organic manure + 80 kg N $feddan^{-1}$. The combination of cultivar and fertilizer showed that Maiak given 120 kg N $feddan^{-1}$ produced the greatest seed yield of 69.62 g $plant^{-1}$ (2 year average).

Nitta *et al.* (1989) conducted an experiment on the effect of application of crop residues and FYM on the root development, plant growth and yield of chilli and some soil properties for seven years. It was found that the yield increase with crop residues was smaller than that with FYM (cowdung). Application of both FYM and crop residues increased yields as much as FYM alone.

Gorlitz (1987) found that increasing soil organic matter content by the application of FYM (cowdung) in chilli improved plant growth in spring increased plant height and seed yield, weight of 1000 seeds in the absence of mineral fertilizer application.

Tilo and Sanvalentin (1984) found that 75% N + 25% N from cowdung produced more yield that the 100% N when 25% - 75% N from cowdung was used the yield decreased again.

In pot trials by Koul *et al.* (1990) Capsicum plants were supplied with mixed organic manure (containing microbial fertilizer, 10.75% N, 2.03% P_2O_5, 55.93% K_2O, 23.30% total CI and 39.17% organic manure cowdung on a dry weight basis), inorganic fertilizer or no fertilizer). In Capsicum plant height, leaf number/plant chlorophyll content and yield were 20.9 cm, 17.8 leave/plant, 43.4 mg/g and 273.6 g/pot, respectively in plants supplied with organic manure, compared with 19.3 cm, 14.2 leaves/plant, 43.4 ng/pot, respectively, in plnats supplied with in organic fertilizer, and 108.9 g/pot, respectively, in plnats with no fertilizers application.

Mamta *et al.* (2005) observed that the efficacy of several organic manures and organic pesticides alone and in combination with on organic fertilizers and chemical pesticides, for the control of leaf curl [Pepper leaf curl virus] and die-back (caused by *Collectrichum capsici*) diseases of chill (*Capsicum annuum*). The organic manures tested included farmyard manure (FYM), organic manure, organic manure – cellrich, neem cake and vermicompost.

Kulkarni *et al.* (2002) conducted experiment to determine the response of chilli (*Capsicum annuum* cv. Parbhani Tejas) to integrated nutrient supply system. The treatments were control (recommended rate of NPK T1), and vermicompost at 5 t/ha or soil conditioner (tera care) at 2.5 t/ha combined with 25 and 50% NPK organic booster at 1 liter/m^2 and cowdung urine slurry at 1 liter/m^2. Results revealed that soil conditioner organic booster was the most effective in increaing the height, stem girth, number of branches, number of fruits and greed chilli yield followed by the treatment with vermicompost + organic booster. The application of vermicompost chilli compared to organic and chemical fertilizer alone.

Singh *et al.* (1996) found that the integrated use of organic manures, chemical fertilizer and microbial inoculants as biofertilizers with microbial inoculants

(Azospirillum brasilense, Azotobacter chroooccum, and Bacillus polymxa [Paenicacillus poymyxa] and three sources of organic manure (cowdung slurry, poultry manure and need cake). Treatment with 50% N + 25% poultry manure + bilfertilizer resulted in the highest yield and benefit cost ratio (7.72).

Chapter III

Materials & Methods

CHAPTER III

MATERIALS AND METHODS

This chapter deals with the materials and methods that were used in the experiment. It includes short description of location of the experimental plot, characteristic of soil, climate, materials of the experiment, raising of seedlings, treatments, layout and design, land preparation, manuring and fertilizing, transplanting, intercultural operations, harvesting, collection of data and statistical analysis which are given below:

3.1 Location of the experimental field

The research work was conducted at the Horticulture Farm, Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, during the period from

October, 2014 to April, 2015. The location of the site was 23°71′ North Latitude and 90°33′ East Longitude with the elevation of 8.2 meter from the sea level (Anon, 1987) and presented in Appendex I.

3.2 Soil of the experimental field

The experimental plot belongs to the Modhupur Tract which was under the Agro Ecological Zone-28. The analytical data of the soil, collected from the experimental area were determined in SRDI, Soil Testing Laboratory, Khamarbari, Dhaka and presented in Appendix II.

3.3 Climate of the experimental area

The experimental site is situated in subtropical zone, the macro climate is characterized by heavy rainfall during the months from April to September (Kharif season) and scantly rainfall during the rest month of the year (Rabi season). Information regarding average monthly the maximum and minimum temperature, rainfall and relative humidity and sunshine hour as recorded by the weather yard, Bangladesh Meteorological Department (Climate Division), Agargaon, during the period of study has been presented in Appendix II.

3.4 Plant materials used

The variety of chilli used in the experiment was ‘BARI morich-1’. Seed was collected from Bangladesh Agricultural Research Institute (BARI).

3.5 Raising the Seedlings

Chilli seedlings were raised in the seedbed of 3 m × 1 m size. The soil was well prepared and converted into loose friable condition to obtain good tilth. All weeds, stubbles and dead root were removed. Twenty grams of seeds were sown in two seed bed. The seeds were sown in the seed bed on 15 October, 2014. Seeds were then covered with finished light soil and shading was provided by polyethylene bags to protect the young seedlings from scorching sunshine and rainfall. Light watering weeding and mulching were done as and when necessary to provide seedlings of a good condition for growth.

3.6 Treatments of the experiment

The experiment consisted of two factors as follows:-

Factor A: It included four different levels of cowdung which are mentioned below with alphabetic symbol.

C_0 : 0 t/ha (control)

C_1 : 10 t/ha (2.88 kg/plot)

C_2 : 15 t/ha (4.32 kg/plot)

C_3 : 20 t/ha (5.76 kg/plot)

Factor B: It consisted of three levels of vermicompost which are mentioned below with alphabetic symbol.

V_0 : 0 t/ha (control)

V_1 : 5 t/ha (1.44kg/plot)

V_2 : 7 t/ha (2.02kg/plot)

There were total 12 treatment combinations were such as: C_0V_0, C_0V_1, C_0V_2, C_1V_0, C_1V_1, C_1V_2, C_2V_0, C_2V_1, C_2V_2, C_3V_0, C_3V_1 and C_3V_2.

3.7 Layout and design of the experiment

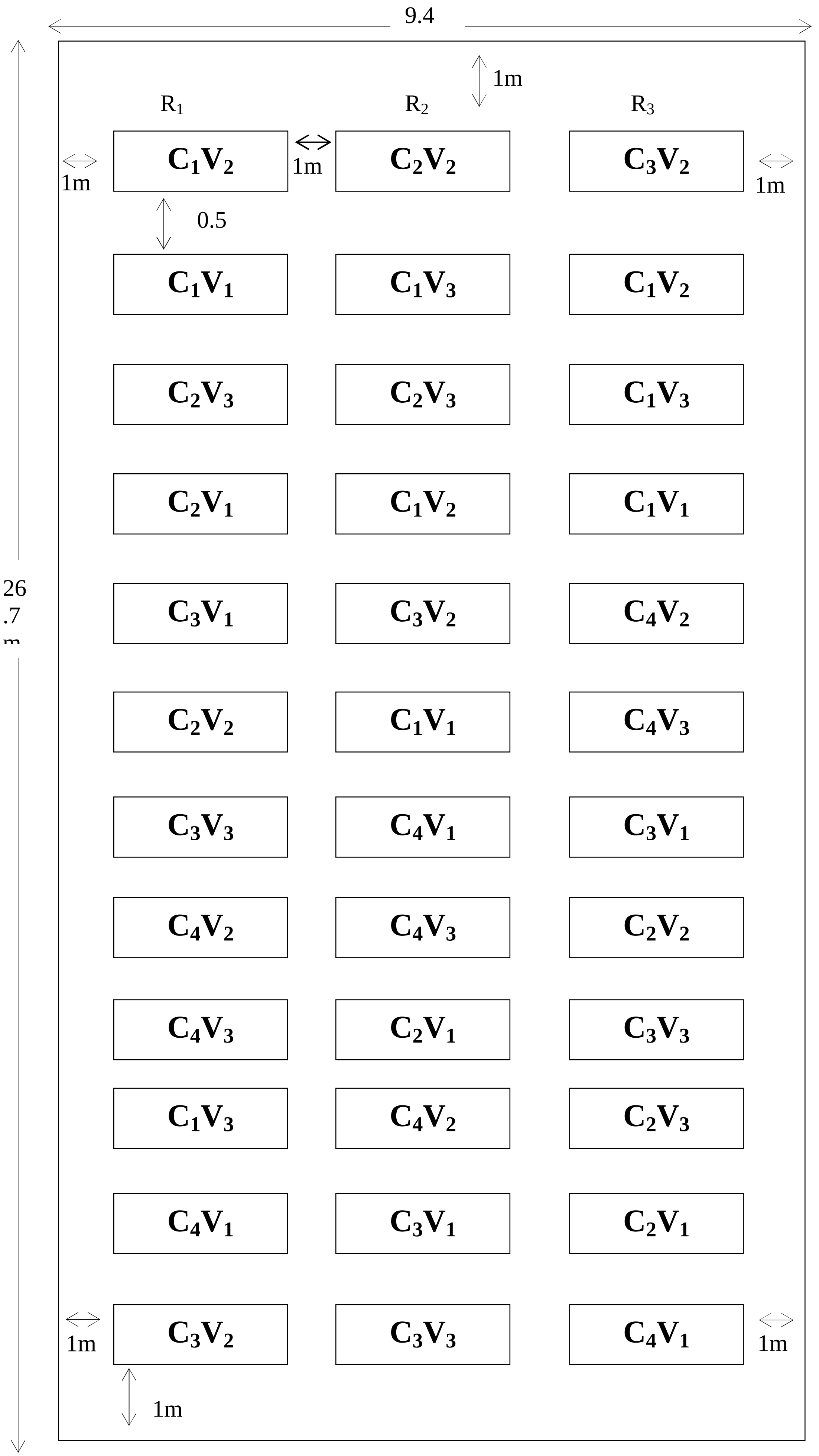
The two factor experiment was laid out in the Randomized Complete Block Design (RCBD) with three replications. Each block consisted of 12 plots where

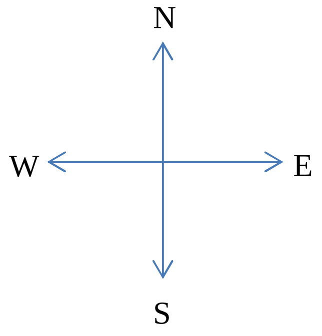
12 treatments combination of cowdung and vermicompost were assigned randomly as per design of the experiment. There were 36 unit plots altogether in the experiment. The size of the plot was 1.8 m × 1.6 m. Block to block distance was 1 m and plot to plot was 0.5 m. Seedlings were transplanted on the plots with 60 cm × 40 cm spacing.

3.8 Cultivation procedure

3.8.1 Land preparation

The selected plot was fallow at the time of period of land preparation. The land was opened on 02 November, 2014 with the help of the power tiller and then it was kept open to sun for seven days prior to further ploughing, cross ploughing followed by laddering. The weeds and stubbles were removed after each laddering. Simultaneously the clods were broken and the soil was made into good tilth for transplanting.





Total area field: 250.98M^2
Plot Size: 1.8m×1.6m
Plot Spacing: .5m
Between replication: 1M
Factor A. Cowdung.
C_1= 0 t/ha (control)
C_2= 10 t/ha (2.88 kg/plot)
C_3= 15 t/ha (4.32 kg/plot)
C_1= 20 t/ha (5.76 kg/plot)
Factor B.Vermicompost
V_0= 0 t/ha (control)
V_1= 5 t/ha (1.44 kg/plot)
V_2= 7 t/ha (2.02 kg/plot)

Figure 1. Layout of the experimental plot

3.8.2 Application of manures

Well decomposed cowdung and vermiconpost was applied to the plots as per treatment and incorporated to the soil during final land preparation.

3.8.3 Transplanting the seedlings

Thirty days old healthy and uniform sized seedlings were transplanted in the experimental plots on 25 November, 2014. The seedbed was watered one hour before uprooting the seedlings to minimize the damage to the roots of the seedlings. Transplanting was done in the afternoon. During transplanting of seedling, 60 cm × 40 cm spacing were followed. 12 plants were transplanted in each unit plot. The seedlings were watered immediately after transplanting. To protect from scorching sunshine and unexpected rain, banana leaf sheath pieces were used over the transplanted seedlings. Shading and watering were continued until the seedlings were well established and it required for 6 days. A number of treated seedlings were planted on the border of the experimental plots for gap filling.

3.8.4 Gap filling

Very few seedlings were damaged after transplanting and such seedling were replaced by new seedlings from the same stock planted earlier on the border of the experimental plots. The seedlings were transplanted with a mass of root attached with soil ball to avoid transplanting shock.

3.8.5 Intercultural operations

The plants were kept under careful observation. Light watering was done every morning and afternoon following transplanting and was continued for 6 days for early and well establishment of the seedlings. Weeding and other intercultural operations were done as and when required. Earthing up was done on both sides of rows after 60 days of transplanting, using the soil from the space between the rows.

3.8.6 Control of pest and disease

Insect attack was serious problem at the time of establishment of the seedling. Mole cricket, field cricket and cut warm attacked the young transplanted seedlings. Basudin was applied for controlling the soil born insects. Cut worms were controlled both mechanically and spraying by Dursban 20 EC @ 3%. Some of the plants were attacked by aphids and were controlled by spraying Diazinon 60 EC@560 ml/ha.

Few plants were infected by Alternaria leaf spot disease caused caused by *Alternaria brasicae.* To prevent the spread of disease Copper oxychloride (50%) was sprayed in the field at the rate of 1.35 kg per 450 liters of water.

3.8.7 Harvesting

The crop was harvested during the period from 20 March, 2015 to 20 April, 2015 when the chilli was completely mature. Harvesting was done plot wise after testing the maturity of the chilli by thumb.

3.9 Data collection

When the fruit were well mature, the fruits were harvested at random from each unit plot. Plants were randomly selected from each plot and data were recorded according to the characters were studied. However, for yield per plot, all plants of each unit plot were considered. Periodical data i.e. plant height and number of leaves per plant were taken 30, 45, 60 and 75 days after transplanting whereas the rest parameters were recorded at the time of harvest.

3.9.1 Plant height

Plant height was taken to the length between the base of the plant and the shoot tip. The plant height was recorded at 30, 45, 60 and 75 days after transplanting (DAT).

3.9.2 Number of leaves per plant

The number of leaves per plant was manually counted at 30, 45, 60 and 75 days after transplanting on tagged plants. The average of five plants were computed and expressed in average number of leaves per plant.

3.9.3 Number of branches per plant

The number of branch per plant was manually counted at 50 days after transplanting from tagged plants. The average of five plants were computed and expressed in average number of branch per plant.

3.9.4 Canopy of plant

The canopy of plant was manually measured at 50 days after transplanting from tagged plants. The canopy of plant was measured by using meter scale. The average of five plants were computed and expressed in average canopy of plant.

3.9.5 Stem diameter of plant

The stem diameter of plant was manually counted at 50 days after transplanting from tagged plants. The average of five plants were computed and expressed in average stem diameter of plant.

3.9.6 Days to flower initiation

The number of days from the date of transplanting to the date of first flower opening was recorded.

3.10.7 Number of flowers per plant

The number of flowers per plant was counted at 50 days after transplanting from the 5 sample plants. The final average value of number of flowers was calculated from 5 averages from five plants.

3.9.8 Number of fruits per plant

The total number of fruits produced in a plant was counted and recorded.

3.9.9 Length of fruit

The length of fruit was measured with a meter scale from the neck of the fruit to the bottom of 10 randomly selected marketable fruits from each plot and there average was taken and expressed in cm.

3.9.10 Diameter of fruit

Diameter of fruit was measured at the middle portion of 10 randomly selected marketable fruit from each plot with a digital calipers-515 (DC-515) and average was taken and expressed in cm.

3.9.11 Individual fruit weight

The weight of individual fruit was measured with a digital weighing machine from 10 randomly selected marketable fruits from each unit plots and there average was taken and expressed in gram.

3.9.12 Fruit weight per plant

Average fruit weight per plant was measured by using the following formula-

$$\text{Average fruit weight per plant} = \frac{Yield\ of\ fruit/plot}{Number\ of\ plant/plot}$$

3.9.13 Yield per plot

The yield per plot was measured by totalling the head yield of each unit plot separately during the period from first to final harvest and was recorded in gram (g).

3.9.14 Yield per hectare

The yield per hectare was calculated from per plot yield data and their average was taken. It was measured by the following formula,

$$\text{Yield per hectare (ton)} = \frac{\text{Yield per plot (kg)} \times 10000}{\text{Area of plot in square meter} \times 1000}$$

3.9.15 Weight of 1000 seeds

500 seeds were counted from the tagged plant of each of the plot and weight was taken with the help of electrical balance then the weight of 500seeds were multiplied by 2 to get 1000 seed weight.

3.10 Statistical analyses

The data obtained for different characters were statistically analyzed to find out the significance of the difference for cowdung and vermicompost on growth and yield contributing characters of chilli. The mean values of all the recorded characters were evaluated and analysis of variance was performed by the 'F' (variance ratio) test. The significance of the difference among the treatment combinations of means was estimated by Least Significant Different Test (LSD) at 5% level of probability (Gomez and Gomez, 1984).

Chapter IV

Results and Discussion

CHAPTER VI

RESULTS AND DISCUSSION

This chapter comprises of the presentation and discussion of the results obtained from the present study. The results have been presented, discussed and possible interpretations were given in under separate headings as follows:

4.1 Plant height

Plant height of chilli was significantly influenced by different levels of cowdung application at different days after transplanting (Figure 2 and Appendix III). The tallest plant at 30 DAT (7.53 cm), 45 DAT (18.68 cm), 60 DAT (31.30 cm) and 75 DAT (37.63 cm) was recorded from 15 t/ha cowdung application. On the other hand, the shortest plant at 30 DAT (5.23 cm), 45 DAT (10.81 cm), 60 DAT (20.45 cm) and 75 DAT (23.59 cm) was observed in control treatment of cowdung. Lallawmsanga*et* *al*. (2012), Jagadeesha (2008) and Hangarge*et al*. (2004) found that the plant height were higher in the cowdung treated field than the control.

Different levels of vermicompost application showed significant effect on plant height of chilli at different days after transplanting (Figure 3 and Appendix III). The tallest plant at 30 DAT (6.71 cm), 45 DAT (16.39 cm), 60 DAT (27.58 cm) and 75 DAT (32.22 cm) was recorded from 5 t/ha vermicompost application. In comparison, the shortest plant at 30 DAT (5.75 cm), 45 DAT (13.63 cm), 60 DAT (23.39 cm) and 75 DAT (28.23 cm) was observed in control treatment of vermicompost. Mamta*et al.* (2012) observed the similar result. They reported that plant height were higher in the vermicompost treated field as compared to control. Ali *et al.* (2011) observed that the plant height of chilli variety (Sanjibani) in the vermicompost used filed were higher than the control.

Interaction of cowdung and vermicompost had significant effect on plant height of chilli (Table 1 and Appendix III). At 30 DAT, 45 DAT, 60 DAT and 75 DAT, the tallest plant (8.20, 19.53, 32.90 and 38.70 cm, respectively) was recorded from the treatment combination of 15 t/ha cowdung and 5 t/ha of vermicompost (C_2V_1). On the other hand, the shortest plant at 30 DAT, 45 DAT, 60 DAT and 75 DAT (4.50, 8.50, 17.50 and 21.00 cm, respectively) was observed in control treatment combination (C_0V_0).

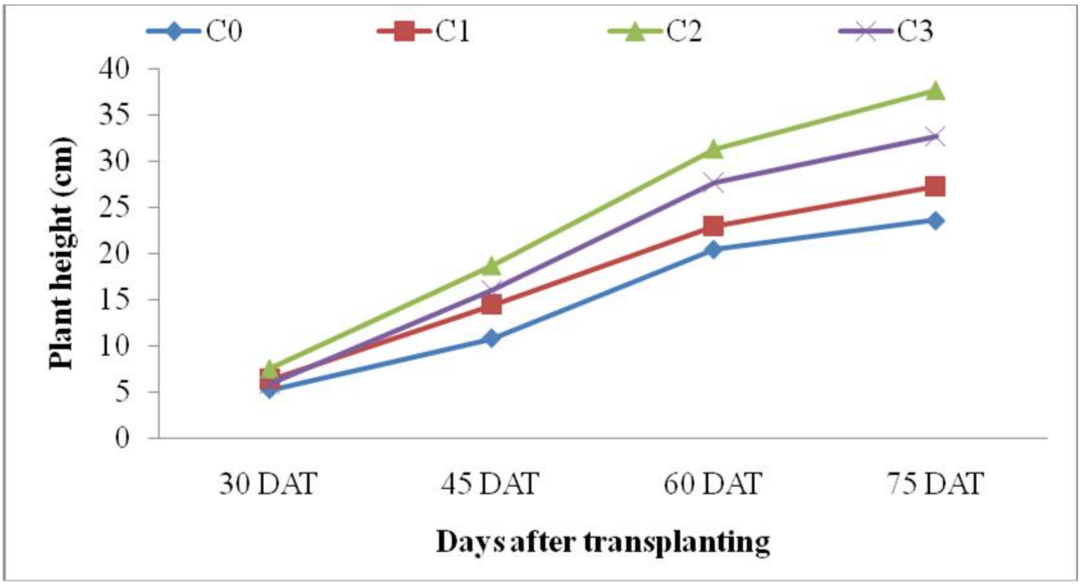


Figure 2. Effect of cowdung on plant height of chilli

C_0 – 0 t/ha, C_1 – 10 t/ha, C_2 – 15 t/ha, C_3 – 20 t/ha

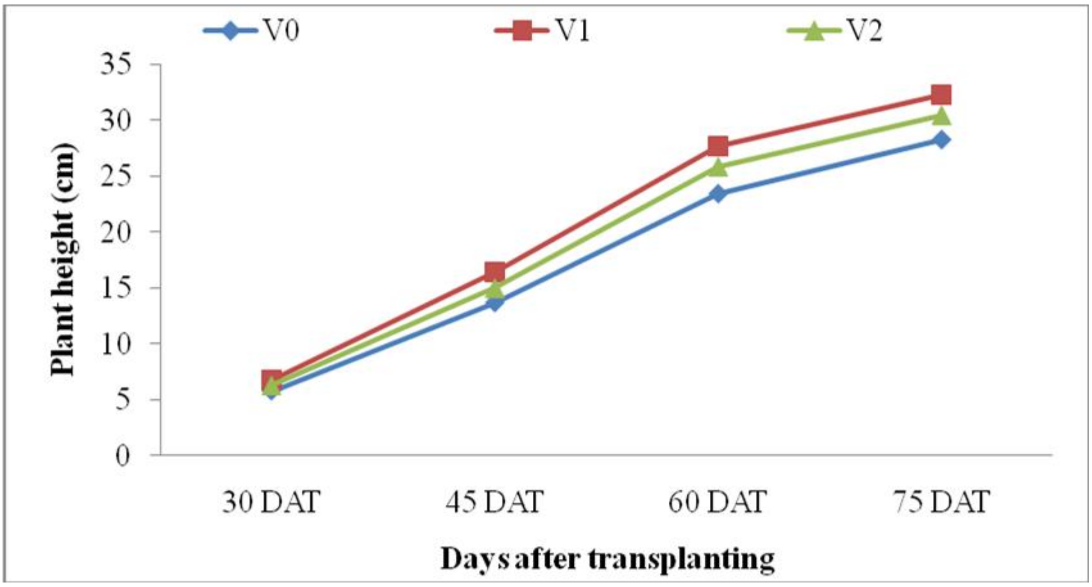


Figure 3. Effect of vermicompost on plant height of chilli
V_0 – 0 t/ha, V_1 –5 t/ha, V_2 – 7 t/ha

Table 1. Interaction effect of cowdung and vermicompost on plant height of chilli at different days after transplanting

Treatments	Plant height (cm)			
	30 DAT	45 DAT	60 DAT	75 DAT
C_0V_0	4.50 h	8.50 j	17.50 k	21.00 j
C_0V_1	5.67 ef	12.87 h	22.37 h	25.73 h
C_0V_2	5.53 fg	11.06 i	21.49 i	24.03 i
C_1V_0	6.00 d	13.00 h	20.00 j	24.50 i
C_1V_1	6.53 c	16.07 e	25.13 f	29.49 f
C_1V_2	6.50 c	14.20 g	23.73 g	27.80 g
C_2V_0	7.10 b	18.00 c	30.00 c	36.80 b
C_2V_1	8.20 a	19.53 a	32.90 a	38.70 a
C_2V_2	7.30 b	18.50 b	31.00 b	37.40 b
C_3V_0	5.40 g	15.00 f	26.07 e	30.60 e
C_3V_1	6.43 c	17.07 d	29.93 c	34.97 c
C_3V_2	5.80 de	16.07 e	27.00 d	32.35 d
$LSD_{(0.05)}$	0.25	0.37	0.36	0.61
CV (%)	2.38	3.47	5.83	5.19

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability
C_0 – 0 t/ha, C_1 – 10 t/ha, C_2 – 15 t/ha, C_3 – 20 t/ha and
V_0 – 0 t/ha, V_1 –5 t/ha, V_2 – 7 t/ha

4.2 Number of leaves per plant

Number of leaves per plant of chilli was significantly influenced by different levels of cowdung application at different days after transplanting (Figure 4 Appendix IV).

The highest number of leaves per plant at 30 DAT (9.21), 45 DAT (38.22), 60 DAT (47.79) and 75 DAT (55.65) was recorded from 15 t/ha cowdung application. On the other hand, the lowest number of leaves per plant at 30 DAT (6.37), 45 DAT (16.72), 60 DAT (31.07) and 75 DAT (36.56) was observed in control treatment of cowdung. Babafoly (1989) reported that cowdung were separated to all other organic residues in terms of number of leaves per plant of chilli. Ahmen*et al.* (1993) reported that organic residues such as cowdung @10 t/ha in compaction with other fertilizer played an important role in respect of growth parameter of chilli.

Different levels of vermicompost application showed significant effect on number of leaves per plant of chilli at different days after transplanting (Figure 5 Appendix IV). The maximum number of leaves per plant at 30 DAT (8.30), 45 DAT (29.32), 60 DAT (42.35) and 75 DAT (49.40) was recorded from 5 t/ha vermicompost application. In comparison, the minimum number of leaves per plant at 30 DAT (7.25), 45 DAT (25.47), 60 DAT (36.45) and 75 DAT (43.30) was observed in control treatment of vermicompost. Mamta*et al.* (2012) observed the similar result. They reported that number of leaves per plant were higher in the vermicompost treated field as compared to control.

Interaction of cowdung and vermicompost had significant effect on number of leaves per plant of chilli (Table 2 and Appendix IV). At 30 DAT, 45 DAT, 60 DAT and 75 DAT, the highest number of leaves per plant (9.70, 38.86, 49.77 and 58.47, respectively) was recorded from the treatment combination of 15 t/ha cowdung and 5 t/ha of vermicompost (C_2V_1). On the other hand, the lowest number of leaves per plant at 30 DAT, 45 DAT, 60 DAT and 75 DAT (5.30, 12.90, 26.80 and 32.80, respectively) was observed in control treatment combination (C_0V_0).

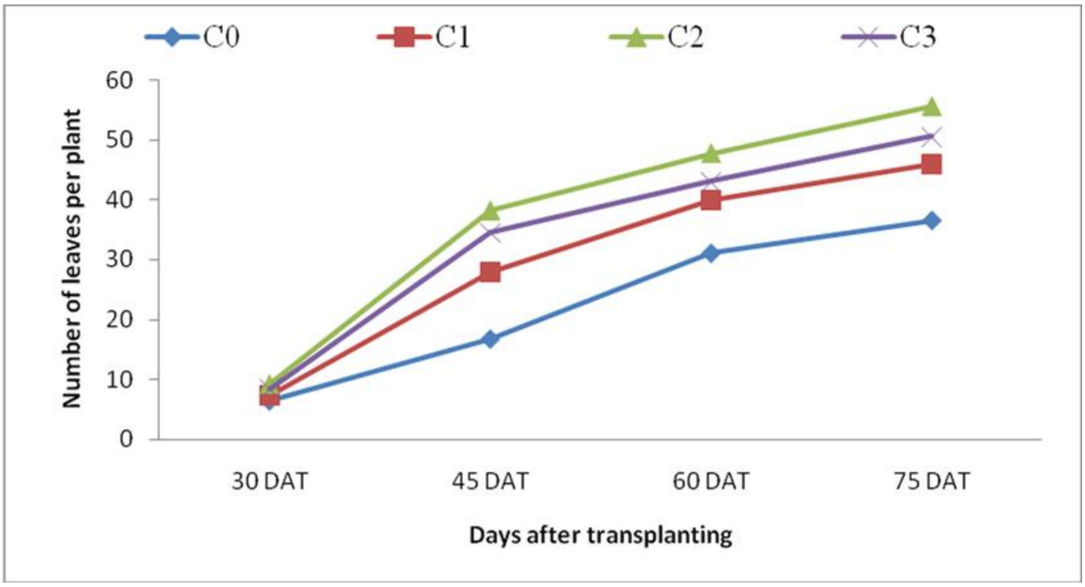


Figure 4. Effect of cowdung on number of leaves per plant of chilli
C_0 – 0 t/ha, C_1 – 10 t/ha, C_2 – 15 t/ha and C_3 – 20 t/ha

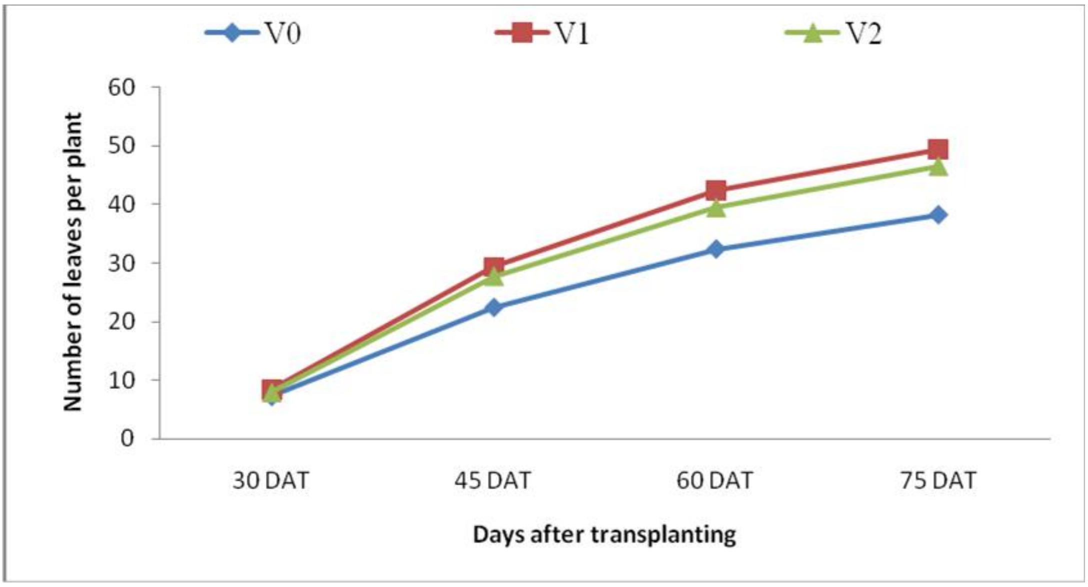


Figure 5. Effect of vermicompost on number of leaves per plant of chilli
V_0 – 0 t/ha, V_1 –5 t/ha and V_2 – 7 t/ha

Table 2. Interaction effect of cow dung and vermicompost on number of leaves per plant of chilli at different days after transplanting

Treatments	Number of leaves per plant

	30 DAT	45 DAT	60 DAT	75 DAT
C_0V_0	5.30 i	12.90 l	26.80 k	32.80 k
C_0V_1	7.00 g	20.10 i	34.90 h	40.27 h
C_0V_2	6.80 h	17.17 k	31.52 j	36.60 j
C_1V_0	6.90 gh	19.17 j	34.00 i	39.47 i
C_1V_1	7.80 e	21.70 g	37.90 g	46.00 f
C_1V_2	7.20 f	20.77 h	35.36 h	43.07 g
C_2V_0	8.87 c	37.50 c	45.90 d	53.00 c
C_2V_1	9.70 a	38.86 a	49.77 a	58.47 a
C_2V_2	9.07 b	38.30 b	47.70 b	55.49 b
C_3V_0	7.93 e	32.30 f	39.10 f	47.93 e
C_3V_1	8.70 c	36.63 d	46.83 c	52.87 c
C_3V_2	8.33 d	34.63 e	43.24 e	50.93 d
$LSD_{(0.05)}$	0.19	0.33	0.57	0.66
CV (%)	4.39	4.72	4.85	4.84

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability
C_0 – 0 t/ha, C_1 – 10 t/ha, C_2 – 15 t/ha, C_3 – 20 t/ha and
V_0 – 0 t/ha, V_1 –5 t/ha, V_2 – 7 t/ha

4.3 Number of branches per plant

Different levels of cowdung application showed significant effect on number of branches per plant of chilli (Table 3 and appendix V). The maximum number of branches per plant (8.85) was recorded from 15 t/ha cowdung application. In comparison, the minimum number of branches per plant (6.07) was observed in control treatment of cowdung. Ali *et al.* (2011) recorded that the primary branch and secondary branches per plant of chilli were higher in cowdung treated field then the control. Ahmen*et al.* (1993) reported that organic residues such as cowdung @15 t/ha in compaction with other fertilizer played an important role in respect of number of branches per plant of chilli.

Number of branches per plant of chilli was significantly influenced by different levels of vermicompost application (Table 4 and Appendix V). The maximum number of branches per plant (8.18) was recorded from 5 t/ha vermicompost application. In comparison, the minimum number of branches per plant (6.95) was observed in control treatment of vermicompost. Hiranmai and Vijayakumari (2003) reported that the branches per plant varied significant among the vermicompost treatment.

Cowdung and vermicompost showed significant interaction effect on number of branches per plant of chilli (Table 5 Appendix V). The highest number of branches per plant (9.75) was recorded from the combination of 15 t/ha cowdung and 5 t/ha of vermicompost (C_2V_1).In comparison, the lowest number of branches per plant (5.52) was observed in control treatment combination (C_0V_0).

4.4 Stem base diameter

Different levels of cowdung application showed significant effect on stem base diameter of chilli plant (Table 3 and Appendix V). The largest stem base diameter (1.38 cm) was recorded from 15 t/ha cowdung application. In comparison, the smallest stem base diameter (0.94 cm) was observed in control treatment of cowdung.

Stem base diameter of chilli plant was significantly influenced by different levels of vermicompost application (Table 4 and Appendix V). The largest stem base diameter (1.29 cm) was recorded from 5 t/ha vermicompost application. In comparison, the smallest stem base diameter (1.04 cm) was observed in control treatment of vermicompost.

Interaction of cowdung and vermicompost significantly affected the stem base diameter of chilli (Table 5 and Appendix V). The longest stem base diameter (1.60 cm) was recorded from the combination of 15 t/ha cowdung and 5 t/ha of vermicompost (C_2V_1). In comparison, the shortest stem base diameter (0.75 cm) was observed in control treatment combination (C_0V_0).

4.5 Canopy size

Different levels of cowdung application showed significant effect on canopy size of chilli plant (Table 3 and Appendix V). The largest canopy size (46.00 cm) was recorded from 15 t/ha cowdung application. In comparison, the smallest canopy size (37.27 cm) was observed in control treatment of cowdung. Lallawmsanga*et al.* (2012) found that the canopy size was increase when increase the organic manure levels.

Canopy size of chilli plant was significantly influenced by different levels of vermicompost application (Table 4and Appendix V). The largest canopy size (43.07 cm) was recorded from 5 t/ha vermicompost application. In comparison, the smallest canopy size (40.10 cm) was observed in control treatment of vermicompost. Kulkarni*et al.* (2002) suggested that the vermicompost @ 5 t/ha used the chilli cultivation field then all the growth parameter including canopy size was maximum.

Cowdung and vermicompost showed significant interaction effect on canopy size of chilli (Table 5and Appendix V). The maximum canopy size (49.00 cm) was recorded from the combination of 15 t/ha cowdung and 5 t/ha of vermicompost (C_2V_1). In comparison, the minimum canopy size (35.80 cm) was observed in control treatment combination (C_0V_0).

Table 3. Effect of cowdung on number of branches per plant, stem base diameter, canopy size, days to flower initiation, number of flowers per plant and number of fruit per plant of chilli

Treatments	Number of branches per plant	Stem base diameter (cm)	Canopy size (cm)	Days to flower initiation	Number of flowers per plant	Number of fruits per plant
C_0	6.07 d	0.94 c	37.	55.80	54.35	45.29

			27 d	a	d	d
C_1	6.81 c	1.14 b	39.93 c	53.32 b	60.55 c	50.46 c
C_2	8.85 a	1.38 a	46.00 a	48.63 d	70.35 a	58.62 a
C_3	8.54 b	1.19 b	42.76 b	52.51 c	65.48 b	54.56 b
$LSD_{(0.05)}$	0.29	0.05	0.50	0.59	0.49	0.41
CV (%)	2.24	2.82	3.72	4.66	3.46	4.46

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability

C_0 – 0 t/ha, C_1 – 10 t/ha, C_2 – 15 t/ha and C_3 – 20 t/ha

Table 4. Effect of vermicompost on number of branches per plant, stem base diameter, canopy size, days to flower initiation, number of flowers per plant and number of fruit per plant of chilli

Treatments	Number of branches	Stem base diameter	Canopy size (cm)	Days to flower initiation	Number of flowers	Number of fruits per plant

	per plant	(cm)			per plant	
V_0	6.95 c	1.04 c	40.10 c	54.22 a	60.20 c	50.16 c
V_1	8.18 a	1.29 a	43.07 a	50.83 c	65.25 a	54.38 a
V_2	7.57 b	1.16 b	41.30 b	52.65 b	62.60 b	52.17 b
$LSD_{(0.05)}$	0.25	0.05	0.44	0.51	0.42	0.35
CV (%)	2.24	2.82	3.72	4.66	3.46	4.46

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability

V_0 – 0 t/ha, V_1 –5 t/ha and V_2 – 7 t/ha

4.6 Days to flower initiation

Different levels of cowdung application showed significant effect on days to flower initiation of chilli (Table 3 and Appendix V). The maximum days to flower initiation (55.80) was recorded from control treatment of cowdung. In comparison, the minimum days to flower initiation (48.63) was observed in 15 t/ha cowdung application. Babafoly (1989) reported that cowdung were separated to all other organic residues in terms of flower initiation day of chilli. Ahmen*et al.* (1993) reported that organic residues such as cowdung @15 t/ha in compaction with other fertilizer played an important role in respect of flower initiation day of chilli.

Different levels of vermicompost application showed significant effect on days to flower initiation of chilli (Table 4 and Appendix V). The maximum days required to flower initiation (54.22) was recorded from control treatment of vermicompost. In comparison, the minimum days to flower initiation (50.83) was observed in 5 t/ha vermicompost application. Kulkarni*et al.* (2002)revealed that soil conditioner organic booster was the most effective in decreaing the days to flower initiation followed by the treatment with vermicompost + organic booster.

Cowdung and vermicompost showed significant interaction effect on days to flower initiation of chilli (Table 5 and Appendix V). The maximum days to flower initiation (58.33) was recorded from control treatment combination (C_0V_0). In comparison, the minimum days to flower initiation (46.30) was observed in the combination of 15 t/ha cowdung and 5 t/ha of vermicompost (C_2V_1).

4.7 Number of flowers per plant

Different levels of cowdung application showed significant effect on number of flowers per plant of chilli (Table 3 and Appendix V). The highest number of flowers per plant (70.35) was recorded from 15 t/ha cowdung application. In comparison, the lowest number of flowers per plant (54.35) was observed in control treatment of cowdung.

Number of flowers per plant of chilli was significantly influenced by different levels of vermicompost application (Table 4 and Appendix V). The highest number of flowers per plant (65.25) was recorded from 5 t/ha vermicompost application. In comparison, the lowest number of flowers per plant (60.20) was observed in control treatment of vermicompost.

Cowdung and vermicompost showed significant interaction effect on number of flowers per plant of chilli (Table 5 and Appendix V). The maximum number of flowers per plant (73.28) was recorded from the combination of 15 t/ha cowdung and 5 t/ha of vermicompost (C_2V_1). In comparison, the minimum number of flowers per plant (52.73) was observed in control treatment combination (C_0V_0).

4.8 Number of fruits per plant

Different levels of cowdung application showed significant effect on number of fruits per plant of chilli (Table 3 and Appendix V). The highest number of fruits per plant (58.62) was recorded from 15 t/ha cowdung application. In comparison, the lowest number of fruits per plant (45.29) was observed in control treatment of cowdung. Ahmen*et al.* (1993) reported that organic residues such as cowdung @15 t/ha in compaction with other fertilizer played an important role in respect of number of fruits per plant of chilli.

Number of fruits per plant of chilli was significantly influenced by different levels of vermicompost application (Table 4 and Appendix V). The maximum number of fruits per plant (54.38) was recorded from 5 t/ha vermicompost application. In comparison, the minimum number of fruits per plant (50.16) was observed in control treatment of vermicompost. Ishtiyaq*et al.* (2015) suggested that the vermicompost dose of 6 t/ha significantly increased number of fruits per plant when compared with the control. This study suggests that macrophyte-based vermicompost as a potential source of plant nutrients for sustainable crop production. Reshid*et al.* (2014) reported that the vermicompost treated filed as they had higher number of fuitrs per plant.

Cowdung and vermicompost showed significant interaction effect on number of fruits per plant of chilli (Table 5 and Appendix V). The maximum number of fruits per plant (61.07) was recorded from the combination of 15 t/ha cowdung and 5 t/ha of vermicompost (C_2V_1). In comparison, the minimum number of fruits per plant (43.94) was observed in control treatment combination (C_0V_0).

Table 5. Interaction effect of cowdung and vermicompost on number of branches per plant, stem base diameter, canopy size, days to flower initiation, number of flowers per plant and number of fruit per plant of chilli

Treatments	Number of branches per plant	Stem base diameter (cm)	Canopy size (cm)	Days to flower initiation
C_0V_0	5.52 h	0.75 g	35.80 j	58.33 a
C_0V_1	6.58 f	1.09 e	38.60 h	53.73 d
C_0V_2	6.10 g	0.98 f	37.40 i	55.33 b
C_1V_0	6.23 g	1.10 e	38.60 h	54.50 c
C_1V_1	7.20 e	1.21 cd	41.00 f	52.00 f
C_1V_2	7.00 e	1.12 e	40.20 g	53.47 de
C_2V_0	8.10 d	1.20 d	44.00 c	50.80 g
C_2V_1	9.75 a	1.60 a	49.00 a	46.30 i
C_2V_2	8.69 c	1.35 b	45.00 b	48.80 h
C_3V_0	7.95 d	1.12 e	42.00 e	53.27 de
C_3V_1	9.20 b	1.26 c	43.67 c	51.27 g
C_3V_2	8.47 c	1.20 d	42.60 d	52.98 e
LSD $_{(0.05)}$	0.29	0.05	0.50	0.59
CV (%)	2.24	2.82	3.72	4.66

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability

C_0 – 0 t/ha, C_1 – 10 t/ha, C_2 – 15 t/ha, C_3 – 20 t/ha and

V_0 – 0 t/ha, V_1 –5 t/ha, V_2 – 7 t/ha

4.9 Fruit length

Different levels of cowdung application showed significant effect on fruit length of chilli (Table 6 and Appendix VI). The tallest fruit (7.23 cm) was recorded from 15 t/ha cowdung application. In comparison, the shortest fruit (6.10 cm) was observed in control treatment of cowdung. Ali *et al.* (2011) reported that fruit length and fuir diameter of the chilli variety viz., Sanjibani and Panchagavyawere higher than the control.

Vermicompost application at different rate significantly influenced the fruit length of chilli (Table 7 and Appendix VI). 5 t/ha of vermicompost application produced the tallest fruit in chilli (6.91 cm) while control treatment returned the shortest size of fruit in chilli (6.32 cm). Kulkarni*et al.* (2002) revealed that increasing the fruit length and fruit diameter of chilli when vermicompost dose of 5 t/ha.

Interaction of cowdung and vermicompost significantly influenced the fruit length of chilli (Table 8 and Appendix VI). The tallestfruit (7.60 cm) was reported from the combination of 15 t/ha cowdung and 5 t/ha of vermicompost (C_2V_1). In comparison, the shortestfruit (5.80 cm) was recorded from control treatment combination (C_0V_0).

4.10 Fruit diameter

Cowdung application at different rate significantly influenced the fruit diameter of chilli (Table 6 and Appendix VI). The largest fruit diameter (0.99 cm) was recorded from 15 t/ha cowdung application. On the other hand, the smallest fruit diameter (0.85 cm) was observed in control treatment of cowdung. plant height, primary branch, secondary branch/plant, number of seed/fruit, fruit length, weight of 100 seed, yield/plant, yield m^{-2} and experimental observation recorded that the Sanjibani and Panchagavya treated crops were higher than the control.

Different levels of vermicompost application showed significant effect on fruit diameter of chilli (Table 7 and Appendix VI). 5 t/ha of vermicompost application produced the largest fruit diameter in chilli (0.96 cm) while control treatment returned the smallest fruit diameter in chilli (0.87 cm).plant height, primary branch, secondary branch/plant, number of seed/fruit, fruit length, weight of 100 seed, yield/plant, yield m^{-2} and experimental observation recorded that the Sanjibani and Panchagavya treated crops were higher than the control.

Interaction of cowdung and vermicompost significantly influenced the fruit diameter of chilli (Table 8 and Appendix VI). The largest fruit diameter (1.10 cm) was reported from the combination of 15 t/ha cowdung and 5 t/ha of vermicompost (C_2V_1). In comparison, the smallest fruit diameter (0.80 cm) was recorded from control treatment combination (C_0V_0).

4.11 Number of seeds per fruit

Different levels of cowdung application showed significant effect on number of seeds per fruit of chilli (Table 6 and Appendix VI). The highest number of seeds per fruit (83.17) was recorded from 15 t/ha cowdung application. In comparison, the lowest number of seeds per fruit (40.67) was observed in control treatment of cowdung. Ali *et al.* (2011) reported that number of seed/fruit of the chilli variety viz., Sanjibani and Panchagavya were higher than the control.

Number of seeds per fruit of chilli was significantly influenced by different levels of vermicompost application (Table 7 and Appendix VI). The maximum number of seeds per fruit (64.25) was recorded from 5 t/ha vermicompost application. On the other hand, the minimum number of seeds per fruit (51.75) was observed in control treatment of vermicompost. Goutam*et al.* (2011) suggested that chemical fertilizer with vermicompost showed the better seeds/fruit then the control.

Cowdung and vermicompost combined effect was significantly influenced the number of seeds per fruit of chilli (Table 8 and Appendix VI). The highest number of seeds per fruit (90.00) was reported from the combination of 15 t/ha cowdung and 5 t/ha of vermicompost (C_2V_1). In comparison, the lowest numbeof seeds per fruit (22.00) was recorded from control treatment combination (C_0V_0).

Table 6. Effect of cowdung on fruit length, fruit diameter, number of seeds per fruit, average fruit weight and 1000 seed weight of chilli

Treatments	Fruit length (cm)	Fruit diameter (cm)	Number of seeds per fruit	Average fruit weight (g)	1000 seed weight (g)
C_0	6.10 d	0.85 c	40.67 d	1.07 d	4.43 d
C_1	6.43 c	0.91 b	52.17 c	2.35 b	4.62 c
C_2	7.23 a	0.99 a	83.17 a	2.86 a	6.50 a

C_3	6.71 b	0.91 b	59.33 b	1.91 c	4.77 b
$LSD_{(0.05)}$	0.11	0.05	0.51	0.28	0.08
CV (%)	4.99	3.16	4.15	5.40	5.82

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability
C_0 – 0 t/ha, C_1 – 10 t/ha, C_2 – 15 t/ha and C_3 – 20 t/ha

Table 7. Effect of vermicompost on fruit length, fruit diameter, number of seeds per fruit, average fruit weight and 1000 seed weight of chilli

Treatments	Fruit length (cm)	Fruit diameter (cm)	Number of seeds per fruit	Average fruit weight (g)	1000 seed weight (g)
V_0	6.32 c	0.87 b	51.75 c	1.71 c	4.45 c
V_1	6.91 a	0.96 a	64.25 a	2.39 a	5.83 a
V_2	6.63 b	0.91 b	60.50 b	2.05 b	4.96 b
$LSD_{(0.05)}$	0.09	0.05	0.44	0.24	0.07
CV (%)	4.99	3.16	4.15	5.40	5.82

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability
V_0 – 0 t/ha, V_1 –5 t/ha and V_2 – 7 t/ha

4.12 Average fruit weight

Different levels of cowdung application showed significant effect on average fruit weight of chilli (Table 6 and Appendix VI). The highest average fruit weight (2.86 g) was recorded from 15 t/ha cowdung application. In comparison, the lowest average fruit weight (1.07 g) was observed in control treatment of cowdung.

Average fruit weight of chilli was significantly influenced by different levels of vermicompost application (Table 7 and Appendix VI). The maximum average fruit weight (2.39 g) was recorded from 5 t/ha vermicompost application. On the other hand, the minimum average fruit weight (1.71 g) was observed in control treatment of vermicompost. Ishtiyaq*et al.* (2015) suggested that the vermicompost dose of 6 t/ha significantly increased average fruit weight when compared with the control. This study suggests that macrophyte-based vermicompost as a potential source of plant nutrients for sustainable crop production.

Interaction of cowdung and vermicompost significantly influenced the average fruit weight of chilli (Table 8 and Appendix VI). The maximum average fruit weight (3.34 g) was reported from the combination of 15 t/ha cowdung and 5 t/ha of vermicompost (C_2V_1). In comparison, the minimum average fruit weight (1.20 g) was recorded from control treatment combination (C_0V_0).

4.13 1000 seed weight

1000 seed weight of chilli was significantly influenced by different levels of cowdung application (Table 6 and Appendix VI). The highest weight of 1000 seed (6.50 g) was recorded from 15 t/ha cowdung application. On the other hand, the lowest weight of 1000 seed (4.43 g) was observed in control treatment of cowdung. Ali *et al.* (2011) reported that weight of 100 seed of chilli were higher than the control.

Different levels of vermicompost application showed significant effect on 1000 seed weight of chilli (Table 7 and Appendix VI). The highest weight of 1000 seed (5.83 g) was recorded from 5 t/ha vermicompost application. In comparison, the lowest weight of 1000 seed (4.45 g) was observed in control treatment of vermicompost. Goutam*et al.* (2011) suggested that chemical fertilizer with vermicompost showed the better 1000 seed weight then the control.

Interaction of cowdung and vermicompost significantly influenced the weight of 1000 seed of chilli (Table 8 and Appendix VI). The maximum weight of 1000 seed (8.70 g) was reported from the combination of 15 t/ha cowdung and 5 t/ha of vermicompost (C_2V_1). In comparison, the minimum weight of 1000 seed (4.00 g) was recorded from control treatment combination (C_0V_0).

Table 8. Interaction effect of cowdung and vermicompost on fruit length, fruit diameter, number of seeds per fruit, average fruit weight and 1000 seed weight of chilli

Treatments	Fruit length (cm)	Fruit diameter (cm)	Number of seeds per fruit	Average fruit weight (g)	1000 seed weight (g)

C_0V_0	5.80 i	0.80 f	22.00 i	1.20 h	4.00 g
C_0V_1	6.31 f	0.89 de	52.50 g	2.00 f	4.80 d
C_0V_2	6.20 g	0.85 ef	47.50 h	1.50 g	4.50 f
C_1V_0	6.00 h	0.88 de	52.00 g	2.20 d	4.50 f
C_1V_1	6.80 d	0.95 bc	52.50 g	2.50 c	4.70 e
C_1V_2	6.50 e	0.90 c-e	52.00 g	2.35 cd	4.65 e
C_2V_0	6.98 c	0.90 c-d	76.00 c	2.45 cd	4.80 d
C_2V_1	7.60 a	1.10 a	90.00 a	3.34 a	8.70 a
C_2V_2	7.10 b	0.96 b	83.50 b	2.80 b	6.00 b
C_3V_0	6.50 e	0.90 c-e	57.00 f	1.67 ef	4.50 f
C_3V_1	6.94 c	0.91 b-d	62.00 d	2.20 d	5.10 c
C_3V_2	6.70 d	0.91 b-d	59.00 e	1.85 e	4.70 e
$LSD_{(0.05)}$	0.11	0.05	0.51	0.28	0.08
CV (%)	4.99	3.16	4.15	5.40	5.82

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability

C_0 – 0 t/ha, C_1 – 10 t/ha, C_2 – 15 t/haC_3 – 20 t/ha and

V_0 – 0 t/ha, V_1 –5 t/ha, V_2 – 7 t/ha

4.14 Fruit yield per plant

Different treatment levels of cowdung showed significant effect on fruit weight per plant of chilli (Table 9 and Appendix VII). The maximum fruit weight per plant (227.20 g) was recorded from 15 t/ha of cowdung application. On the other hand, the minimum fruit weight per plant (94.08 g) was observed in control treatment of cowdung. Ali *et al.* (2011) reported that yield/plant of chilli were higher than the control.

Fruit weight per plant was significantly influenced by different treatment levels of vermicompost (Table 9 and Appendix VII) The highest fruit weight per plant of chilli (187.10 g) was recorded from 5 t/ha of vermicompost application. On the other hand, the lowest fruit weight per plant (138.40 g) was observed in control treatment of vermicompost. Ishtiyaq*et al.* (2015) suggested that the vermicompost dose of 6 t/ha significantly increased mean fruit weight per plant when compared with the control. This study suggests that macrophyte-based vermicompost as a potential source of plant nutrients for sustainable crop production.

Interaction of cowdung and vermicompost significantly influenced the fruit weight per plant of chilli (Table 10 and Appendix VI). The maximum fruit weight per plant (265.00 g) was reported from the combination of 15 t/ha of cowdung and 5 t/ha of vermicompost (C_2V_1). In comparison, the minimum fruit weightper plant (65.91 g) was recorded from control treatment combination (C_0V_0).

Table 9. Effect of cowdung and vermicompost on fruit yield per plant and per plot of chilli

Treatments	Effect of cowdung		Treatments	Effect of vermicompost	
	Fruit yield per plant (g)	**Fruit yield per plot (kg)**		**Fruit yield per plant (g)**	**Fruit yield per plot (kg)**
C_0	94.08 c	1.09 d	V_0	138.40 c	1.20 c
C_1	169.20 b	1.30 c	V_1	187.10 a	1.50 a
C_2	227.20 a	1.70 a	V_2	161.60 b	1.38 b
C_3	159.00 b	1.50 b	LSD $_{(0.05)}$	11.17	0.19
LSD $_{(0.05)}$	12.89	0.22	CV%	4.96	4.96
CV%	4.69	4.96			

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability
C_0 – 0 t/ha, C_1 – 10 t/ha, C_2 – 15 t/ha, C_3 – 20 t/ha and
V_0 – 0 t/ha, V_1 –5 t/ha, V_2 – 7 t/ha

4.15 Yield per plot

Different treatment levels of cowdung showed significant effect on yield per plot of chilli (Table 9 and Appendix VII). The highest yield per plot (1.70kg) was recorded from 15 t/ha cowdung application. In comparison, the lowest yield per plot (1.09 kg) was observed in control treatment of cowdung.

Yield per plot was significantly influenced by different treatment levels of vermicompost (Table 9 and Appendix VII). The maximum yield per plot of chilli (1.50 kg) was recorded from 5 t/ha of vermicompost application. On the other hand, the minimum yield per plot (1.23kg) was observed in control treatment of vermicompost.

Interaction of cowdung and vermicompost significantly influenced the yield per plot of chilli (Table 10 and Appendix VII). The highest yield per plot (1.81 kg) was reported from the combination of 15 t/ha of cowdung and 5 t/ha of vermicompost (C_2V_1). In comparison, the lowest yield per plot (0.92 kg) was recorded from control treatment combination (C_0V_0).

4.16 Yield

Different treatment levels of cowdung showed significant effect on yield (t/ha) of chilli (Figure 6 and Appendix VII). The highest yield (9.26 t/ha) of chilli was recorded from 15 t/ha cowdung application. In comparison, the lowest yield (6.06 t/ha) chilli was observed in control treatment of cowdung. Kattimani and Shashidhara (2006) suggested that application of FYM at 10 t/ha along with 100% recommended dose of fertilizer (RDF) resulted in higher fruit yield (919 kg/ha) compared to RDF alone. Rahman (2000) suggested that the yield was highest at the dose of PNK fertilizer @ 375-225-300 kg/ha and cowdung manure @ 15 t/ha.

Yield (t/ha) was significantly influenced by different treatment levels of vermicompost (Figure 7 and Appendix VII). The maximum yield (8.40 t/ha) was recorded from 5 t/ha of vermicompost application. On the other hand, the minimum yield (7.00 t/ha) was observed in control treatment of vermicompost. Goutam*et al.* (2011) suggested that chemical fertilizer with vermicompost show 73% the better yield then the control. Hiranmai and Vijayakumari (2003) found that the better yield parameters were observed in the vermicompost treatment.

Interaction of cowdung and vermicompost significantly influenced the yield (t/ha) of chilli (Table 10 and Appendix VII). The highest yield (10.08 t/ha) was reported from the combination of 15 t/ha of cowdung and 5 t/ha of vermicompost (C_2V_1). In comparison, the lowest yield (5.13 t/ha) was recorded from control treatment combination (C_0V_0). Hangarge *et al.* (2002a) suggested that the application of vemcompost+organic booster resulted in the highest yield (105.67 q/ha). Patil and Biradar (2001) suggested that the yield of chilli also increased significantly with the increase in nutrient supply. Fugro (2002) reported that the treatment comprising organic manure in combination with NPK superimposed with alternate sprays of organic and chemical pesticides produced the maximum yield of green chilli (166 q/ha).

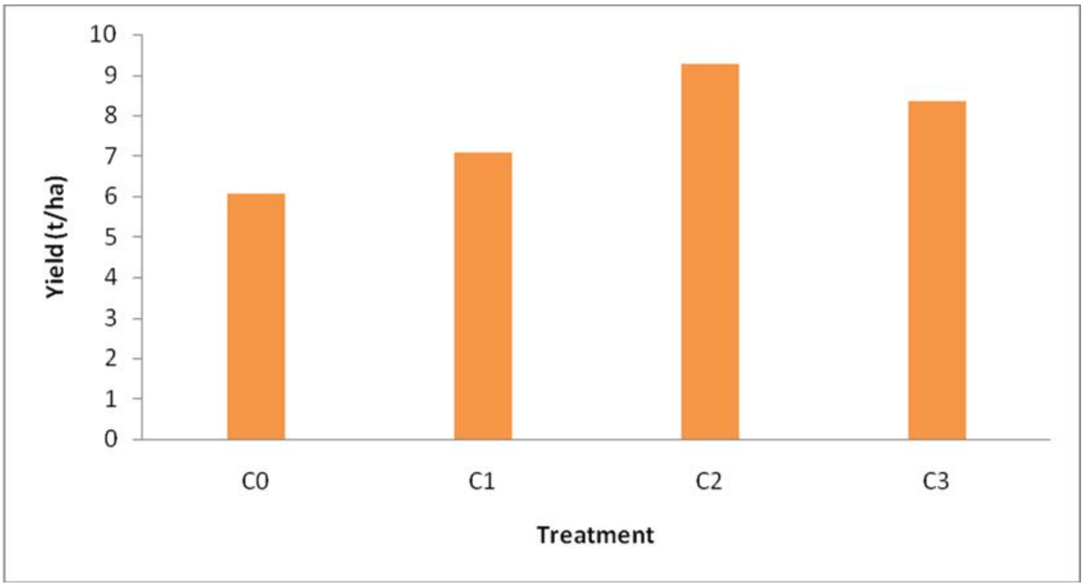


Figure 6. Effect of cowdung on yield of chilli
C_0 – 0 t/ha, C_1 – 10 t/ha, C_2 – 15 t/ha and C_3 – 20 t/ha

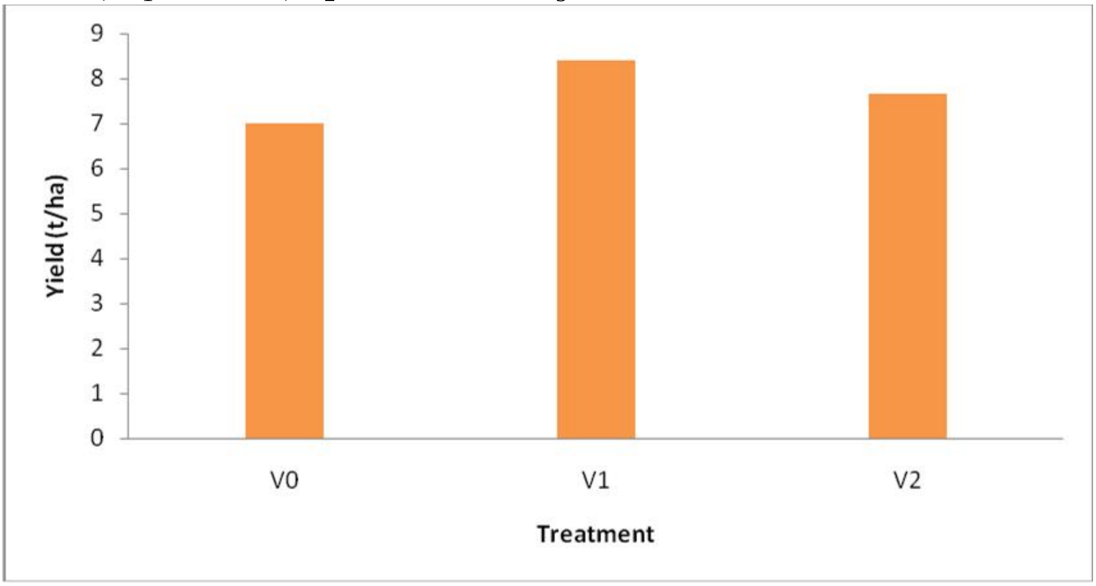


Figure 7. Effect of vermicompost on yield of chilli
V_0 – 0 t/ha, V_1 –5 t/ha andV_2 – 7 t/ha

Table 10. Interaction effect of cowdung and vermicompost on fruit yield per plant, yield per plot and Yield of chilli

Treatments	Fruit yield per plant (g)	Yield per plot (kg)	Yield (t/ha)
C_0V_0	65.91 i	0.92 k	5.13 k

C_0V_1	117.20 g	1.27 h	7.03 h
C_0V_2	99.15 h	1.08 j	6.01 j
C_1V_0	155.20 e	1.19 i	6.63 i
C_1V_1	184.00 c	1.34 g	7.45 g
C_1V_2	168.50 d	1.28 h	7.13 h
C_2V_0	193.20 c	1.51 d	8.40 d
C_2V_1	265.00 a	1.81 a	10.08 a
C_2V_2	223.40 b	1.68 b	9.31 b
C_3V_0	139.40 f	1.41 f	7.83 f
C_3V_1	182.40 c	1.63 c	9.03 c
C_3V_2	155.30 e	1.47 e	8.17 e
$LSD_{(0.05)}$	12.89	0.22	0.11
CV (%)	4.69	4.96	4.96

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly by LSD at 0.05 levels of probability

C_0 – 0 t/ha, C_1 – 10 t/ha, C_2 – 15 t/ha, C_3 – 20 t/ha and

V_0 – 0 t/ha, V_1 –5 t/ha, V_2 – 7 t/ha

Chapter V

Summary and

CHAPTER V

SUMMARY AND CONCLUSION

The field experiment was conducted in the Horticultural farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka-1207 during the period from October, 2014 to April, 2015 to find out the effect of cowdung and vermicompost on growth and yield of chilli. The experiment consisted of two factors Factor A: Different levels of cowdung such as C_0: 0 t ha^{-1}, C_1: 10 t ha^{-1},C_2: 15t $ha^{-1}$and C_3: 20 t ha^{-1}; Factor B: Different levels of vermicompost such as V_0: 0 t ha^{-1}, V_1: 5 t ha^{-1} and V_2: 7 t ha^{-1}. Data on different growth and yield contributing characters were recorded.

Plant height and number of leaves per plant of chilli was significantly influenced by different levels of cowdung application at different days after transplanting. At 75 DAT, the maximum plant height (37.63 cm) and number of leaves per plant (55.65) was recorded from 15 t/ha cowdung application whereas, the minimum plant height (23.59 cm) and number of leaves per plant (36.56) was observed in control treatment of cowdung.

Different levels of cowdung application showed significant effect on number of branches per plant, stem base diameter, canopy size, days to flower initiation, number of flowers, number of fruits per plant, fruit length, fruit diameter, fruit weight, 1000 seeds weight, yield per plot and yieldof chili.The maximum number of branches per plant (8.85), the largest stem base diameter (1.38 cm), the highest canopy size (46.00 cm), number of flowers per plant (70.35), number of fruits per plant (58.62), fruit length (7.23 cm), fruit diameter (0.99 cm), number of seeds per fruit (83.17), average fruit weight (2.86 g), weight of 1000 seed (6.50 g), fruit weight per plant (227.20 g), yield per plot (1667.00 g) and yield (9.26 t/ha) and minimumdays to flower initiation (48.63) were recorded from 15 t/ha cowdung application.

On the other hand, the minimum number of branches per plant (6.07), stem base diameter (0.94 cm), canopy size (37.27 cm), number of flowers per plant (54.35), number of fruits per plant (45.29), fruit length (6.10 cm), fruit diameter (0.85 cm),number of seeds per fruit (40.67), average fruit weight (1.07 g), weight of 1000 seed (4.43 g), fruit weight per plant (94.08 g), yield per plot (1090.00 g) and yield (6.06 t/ha) and maximumdays to flower initiation (55.80) were observed in control treatment of cowdung.

Different levels of vermicompost application showed significant effect on plant height and number of leaves per plant of chilli at different days after transplanting. At 75 DAT, the highest plant height (32.22 cm) and number of leaves per plant (49.04) was recorded from 5 t/ha vermicompost application whereas, the lowest plant height (28.23 cm) and number of leaves per plant (43.30) was observed in control treatment of vermicompost.

Different levels of vermicompost application showed significant effect on number of branches per plant, stem base diameter, canopy size, days to flower initiation, number of flowers, number of fruits per plant, fruit length, fruit diameter, fruit weight, 1000 seeds weight, yield per plot and yieldof chilli. The maximum number of branches per plant (8.18), stem base diameter (1.29 cm), canopy size (43.07 cm), number of flowers per plant (65.25), number of fruits per plant (54.38), fruit length (6.91 cm), fruit diameter (0.96 cm), number of seeds per fruit (64.25), average fruit weight (2.39 g), weight of 1000 seed (5.83 g), fruit weight per plant (187.10 g), yield per plot (1511.00 g) and yield (8.40 t/ha) and minimum days to flower initiation (50.83),) were recorded from 5 t/ha vermicompost application.

On the other hand, the minimum number of branches per plant (6.95), stem base diameter (1.04 cm), canopy size (40.10 cm), number of flowers per plant (60.20), number of fruits per plant (50.16), fruit length (6.32 cm), fruit diameter (0.87 cm), number of seeds per fruit (51.75), average fruit weight (1.71 g), weight of 1000 seed (4.45 g), fruit weight per plant (138.40 g),yield per plot (1259.00 g)and yield (7.00 t/ha)and maximumdays to flower initiation (54.22), were observed in control treatment of vermicompost.

Interaction of cowdung and vermicompost had significant effect on plant height and number of leaves per plant of chilli. At 75 DAT, the highest plant height (38.70 cm) and number of leaves per plant (58.47) was recorded from the treatment combination of 15 t/ha cowdung and 5 t/ha of vermicompost (C_2V_1) whereas, the lowest plant height (21.00 cm) and number of leaves per plant (32.08) was observed in control treatment combination (C_0V_0).Cowdung and vermicompost showed significant interaction effect on number of branches per plant, stem base diameter, canopy size, days to flower initiation, number of flowers, number of fruits per plant, fruit length, fruit diameter, fruit weight, 1000 seeds weight, yield per plot and yield of chilli.

Themaximum number of branches per plant (9.75),stem base diameter (1.60 cm), canopy size (49.00 cm)number of flowers per plant (73.28), number of fruits per plant (61.07), fruit length (7.60 cm), fruit diameter (1.10 cm), number of seeds per fruit (90.00), average fruit weight (3.34 g), weight of 1000 seed (8.70 g), fruit weight per plant (265.00 g), yield per plot (1814.00 g) and yield (10.08 t/ha) and minimumdays to flower initiation (46.30) and was recorded from the combination of 15 t/ha cowdung and 5 t/ha of vermicompost (C_2V_1).

On the other head, the minimum number of branches per plant (5.52), stem base diameter (0.75 cm), canopy size (35.80 cm),number of flowers per plant (52.73),number of fruit per plant(43.94)fruit length (5.80 cm), fruit diameter (0.80 cm),number of seeds per fruit (22.00), average fruit weight (1.20 g),weight of 1000 seed (4.00 g),fruit weight per plant (65.91 g), yield per plot (922.70 g) and yield (5.13 t/ha) and maximum days to flower initiation (58.33) were recorded from control treatment combination (C_0V_0).

Conclusion

This study revealed that cowdung and vermicomposthave positive effect on the growth and yield of chilli, and the combination of 10 t/ha cowdung and 5 t/ha vermicompost were given the better performance of all of the growth and yield parameters of chilli cultivation.

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Appendices

APPENDICES

lix I. Monthly average record of air temperature, rainfall, relative humidity and Sunshine of the experimental site during the period from October 2014 to April 2015.

Month	Air temperature (°c)		Relative humidity (%)	Total rainfall (mm)	Sunshine (hr)
	Maximum	Minimum			
October, 2014	31.6	23.8	78	172.3	5.2
November, 2014	29.6	19.2	77	34.4	5.7
December, 2014	26.4	14.1	69	12.8	5.5
January, 2015	25.4	12.7	68	7.7	5.6
February, 2015	28.1	15.5	68	28.9	5.5
March, 2015	32.5	20.4	64	65.8	5.2
April, 2015	33.7	23.6	69	165.3	4.9

Source: Bangladesh Meteorological Department (Climate & Weather Division) Agargoan, Dhaka - 1212

Appendix II. Physical characteristics and chemical composition of soil of the experimental plot

Soil characteristics	Analytical results
Agrological Zone	Madhupur Tract
pH	6.00 – 6.63
Organic matter	0.84
Total N (%)	0.46
Available phosphorous	21 ppm
Exchangeable K	0.41 meq / 100 g soil

Source: Soil Resource and Development Institute (SRDI), Dhaka

Appendix III. Error mean square values for plant height of chilli at different days after transplanting

Source of variation	Degrees of freedom	Plant height			
		30 DAT	45 DAT	60 DAT	75 DAT
Replication	2	0.512	6.929	6.929	70.355
Cowdung (A)	3	61.214*	258.021*	258.021*	262.010*
Vermicompost (B)	2	5.027*	121.587*	55.037**	79.470*
A × B	6	0.716**	6.669**	6.669*	3.795*
Error	22	1.949	15.077	15.077	36.725

*Significant at 5% level of probability ** Significant at 1% level of probability

Appendix IV. Error mean square values for number of leaves plant^{-1} of chilli at different days after transplanting

Source of variation	Degrees of freedom	Number of leaves plant^{-1}			
		30 DAT	45 DAT	60 DAT	75 DAT
Replication	2	0.008	0.612	0.401	0.737
Cowdung (A)	3	3.909**	8.810*	12.801*	6.418**
Vermicompost (B)	2	0.268*	13.934**	9.808*	7.435*
A × B	6	0.087*	0.679*	0.368**	0.081*
Error	22	0.185	0.350	0.481	0.522

*Significant at 5% level of probability ** Significant at 1% level of probability

Appendix V. Error mean square values for number of branches per plant, stem base diameter, canopy size, days to flower initiation, number of flowers per plant and number of fruit per plant of chilli

Source of variation	Degrees of freedom	Number of branches per plant	Stem base diameter (cm)	Canopy size (cm)	Days to flower initiation	Number of flowers per plant
Replication	2	0.054	0.054	2.406	0.944	70.355
Cowdung (A)	3	0.700*	2.633*	68.689*	1340.745*	262.010*
Vermicompost (B)	2	4.104*	5.378*	4.726*	1623.569*	79.470*
A × B	6	0.049*	0.106*	0.063*	35.573*	3.795*
Error	22	0.017	0.017	0.513	1.447	36.725

*Significant at 5% level of probability ** Significant at 1% level of probability

Appendix VI. Error mean square values for fruit length, fruit diameter, number of seeds per fruit, average fruit weight and 1000 seed weight of chilli

Source of variation	Degrees of freedom	Fruit length	Fruit diameter	Number of seeds per fruit	Average fruit weight	1000 seed weight
Replication	2	0.003	0.016	0.054	0.200	0.083
Cowdung (A)	3	0.694*	19.888*	3.298*	2.300*	46.829*
Vermicompost (B)	2	6.185*	18.347**	11.310*	1.867**	41.675**
A × B	6	1.130**	3.123*	1.238*	1.033*	9.744**
Error	22	0.083	0.078	0.123	0.057	0.046

*Significant at 5% level of probability   ** Significant at 1% level of probability

Appendix VII. Error mean square values for fruit weight per plant, yield per plot and Yield of chilli

Source of variation	Degrees of freedom	Fruit weight per plant (g)	Yield per plot (g)	Yield (t/ha)
Replication	2	0.003	0.046	0.054
Cowdung (A)	3	0.464*	23.845*	2.633*
Vermicompost (B)	2	4.895*	168.336*	5.378*
A × B	6	1.30**	5.123*	0.106*
Error	22	0.083	0.2678	0.017

*Significant at 5% level of probability   ** Significant at 1% level of probability