EFFECT OF INORGANIC AND ORGANIC FERTILIZERS ON GROWTH, YIELD AND QUALITY OF SWEET PEPPER
(*Capsicum annuum* cv. 'Sungrow').

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This is to certify that the thesis entitled, "EFFECT OF INORGANIC AND ORGANIC FERTILIZERS ON GROWTH, YIELD AND QUALITY OF SWEET PEPPER (*Capsicum annuum* cv. 'Sungrow')" **submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of** *MASTER OF SCIENCE IN HORTICULTURE*, **embodies the result of a piece of bona fide research work carried out by** *MD. EKRAMUL HAQUE*, Registration No. 01521 **under my supervision and my guidance. No part of the thesis has been submitted for any other degree or diploma.**

I further certify that any help or source of information, received during the course of this investigation has been duly acknowledged.

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Dedicated to

My

Respectable

Parent & Teachers

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EFFECT OF INORGANIC AND ORGANIC FERTILIZERS ON GROWTH, YIELD AND QUALITY OF SWEET PEPPER (*Capsicum annuum* cv. 'Sungrow').

ABSTRACT

Two experiments were conducted at the Horticulture Farm and Laboratory of Sher-e-Bangla Agricultural University, Dhaka during the period from November 2005 to April 2006 to study the growth, yield, and quality (shelf life) of *Capsicum annuum* cv. 'Sungrow' as influenced by inorganic and organic fertilizers. The first experiment was laid out in randomized complete block design with three replications. The different sources of organic fertilizers used were; poultry manure T_1:30, T_2:40, T_3:50, T_4:60 t/ha; cowdung T_5:33, T_6:50, T_7:66, T_8:83 t/ha and inorganic fertilizer was urea: 340, TSP: 105, MP: 165 kg/ha. The second experiment was conducted with two temperature regimes for determining the shelf life of fruits each having two different conditions (with wrapping and without wrapping). The highest plant height (61.98 cm) was recorded from T_4 treatment and the 2nd highest (52.52 cm) from T_8 while the plant height (46.99 cm) was recorded from inorganic fertilizer treatment. At 90 days after transplanting, the highest stem diameter (1.61 cm) was recorded from T_4 and 1.56 cm was obtained from T_8 whereas 1.29 cm was recorded from inorganic fertilizer. The highest fruit yield (12.9 t/ha) and the second highest (12.00 t/ha) were recorded from T_2 and $T_{6,}$ treatments respectively. The maximum shelf life (35 days) was recorded from poultry manure compared to that of (27 days) from cowdung and inorganic fertilizer (25 days). Maximum shelf life (35 days) was recorded in refrigerated (8-10^{0}C) condition compared (15 days).to normal room temperature (26-30^{o}C). Shelf life of fruit wrapping with thin polythene paper was maximum (35 days) compared to that of non-wrapping (22 days) in refrigerated condition. In normal room temperature condition, shelf life was15 days with wrapping and 10 days without wrapping. Benefit Cost Ratio (BCR) of the treatments varied from 1.69 to 4.34. The highest BCR (4.34) was calculated in T_2 treatment. In connection with growth, yield, shelf life and BCR; T_2 treatment showed better performance than the other treatments.

ABBREVIATIONS AND ACRONYMS

ABBREVIATIONS	*ACRONYMS*
Benefit Cost Ratio	BCR
Bangladesh Bureau of Statistics	BBS
Cowdung	CD
Days After Transplanting	DAT
Duncan's Multiple Range Test	DMRT
Farm Yard Manure	FYM
Least Significant Difference	LSD
Number	No.
Muriate of potash	MP
Poultry Manure	PM
Randomized Complete Block Design	RCBD
Tones Per Hectare	t /ha
Tipple Superphosphate	TSP
Continued	Cont'd

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Chapter 1
Introduction

INTRODUCTION

Sweet pepper or bell pepper (*Capsicum annuum* cv. 'Sungrow') belongs to the family Solanaceae, may be eaten as cooked or raw as well as in salad. Sweet peppers are chosen because of their high nutritive value and are rich source of vitamin C, bioflavonoid and ß-carotene. Peppers are rich in capsaicin that may help works against inflammation, they have powerful antioxidant properties. Sweet peppers are used either green or red, come in a variety of different colors-range from green to yellow, red, orange, purple, and black. Red bell peppers are fully ripened with a milder, sweeter flavor. Other peppers include the red, heart-shaped; the pale green, slender and curved bull's horn which range in color from yellow to red and the sweet banana pepper which is yellow and banana shaped (Teshm Tadesse Michael. *et. al.*1999).

Sweet pepper is considered a minor vegetable crop in Bangladesh and its production statistics is not available (Hasanuzzaman, 1999). Small scale cultivation is found in peri-urban areas primarily for the supply to some city markets in Bangladesh (Saha and Hossain, 2001). Economically it is the second most important vegetables crop in Bulgaria (Panajotov, 1998) and is thought to be the original home of pepper. It is now widely cultivated in America, Europe and some countries of the Asia-Pacific. It has great demand in Japan, Thailand, Philippines, Taiwan, Egypt and other countries even in Bangladesh.

Fertilizer is one of the major factors of crop production. Among the factors, nitrogen is very much essential for good plant establishment and expected growth (Uddin and Khalequzzaman, 2003). Use of inorganic and organic fertilizers has assumed a great significance in recent years in vegetables production, for two reasons. Firstly, the need for continued increase production and per hectare yield of vegetables requires the increase amount of nutrients. Secondly, the results of a large number of experiments on inorganic and organic fertilizers conducted in several countries reveal that inorganic fertilizer alone can not sustain the productivity of soils under highly intensive cropping systems (Singh and Yadav, 1992).

On the other hand, cowdung is more available than poultry manure in our country and poultry manure is cheap compared to inorganic fertilizer. The effect of organic fertilizers particularly poultry manure and cowdung is important and uncontroversial factor for maximizing the yield of a crop. However, a compromise with the effect of poultry manure and cowdung is necessary to make the cultural practice easier and economic. Optimum dose of poultry manure and cowdung can be maintained by adopting proper use of those manures. That's why the concept of organic farming and its practice is increasing day by day throughout the world. Optimum dose of fertilizers (organic and inorganic) increase the pepper growth, development, maximize the yield and prolong the shelf life of sweet pepper. Above all, slow-release fertilizers hold great promise for the production of solanaceous vegetables such as egg plant and tomato (Gezerel and Donmez, 1988). They found that slow-release fertilizers produced 92 t/ha of tomato, compared to only 42 t/ha when ordinary commercial fertilizers were used. Many researchers of different countries of the world have been attempting for commercial cultivation of sweet pepper under various cultural aspects.

Sweet pepper as a new and promising crop in Bangladesh, production technology like, the use of poultry manure and cowdung are not yet standardized to compare the inorganic fertilizer. Considering the above facts, the present study was undertaken to investigate 'the effects of inorganic and organic fertilizers on growth, yield and quality of sweet pepper.

The present study was undertaken with the following objectives:

- To study the effect of poultry manure, cowdung and inorganic fertilizer on growth and yield of sweet pepper.
- To find out the optimum dose of fertilizer for successful growth and yield of sweet pepper.
- To find out the effect of poultry manure, cowdung and inorganic fertilizer on the quality (shelf life) of sweet pepper.
- To find out the cost effectiveness of different fertilizers for the production of sweet pepper.

Chapter 2

Review of literature

REVIEW OF LITERATURE

Sweet pepper is an important vegetable in many parts of the world. It is sensitive to various environmental factors viz. temperature, humidity, light intensity and moisture for proper growth and yield. Many researches have been conducted on various cultural aspects of sweet pepper in different countries. Literature regarding the studies on effect of poultry manure and cowdung on growth and yield of sweet pepper are scanty in Bangladesh. Sweet pepper, eggplant and tomato belonging to the same family have more or less same growth habit and nutrient requirements. Because of the limitation of published report on sweet pepper, relevant literature on tomato and eggplant is presented in this chapter along with sweet pepper. The available literatures related to the present study are reviewed here.

Review on plant growth and yield components

Bottini (1967) reported that in soils containing abundant organic matter, application of P and K at100 and 250 kg/ha was found optimum for sweet pepper production.

Matev (1966) in an experiment with sweet pepper variety Sirija 600 concluded that earlier top dressing was beneficial for higher yield.

Petkov (1972) showed that application of 40 tons FYM and two–third of P and K (in trials of 120 kg N, 240 kg P and 180 kg K/ha.) and top dressing with the rest NPK increased yield of sweet pepper by 43% compared to control.

Ozaki and Hortenstine (1963) reported that application of phosphorus increased early and total yields of sweet peppers and both band placement and side dressing were found equally effective.

The nutrient removal of capsicum cultivar 'Yolo Wonder' showed that for production of 419 q/ha, the N, P, K, Ca and Mg uptake were 132.9, 43.9, 147.8, 124.6 and 19.9 kg/ha, respectively which indicated high nutrient uptake by the plants (Graifenberg *et al,* 1983).

Thomas and Eilman (1964) observed that N was translocated from leaf to fruit tissue. Under conditions of N stress, the P content in leaf increased significantly as the fruit matured. The low fruit weight of bell pepper under different moisture regimes was observed by Hegde (1988) at Bangalore in India. During off season in Cuba when the average temperature was 28^0 C, some sweet pepper genotypes produced fruits in the field where individual fruit weight ranges from 14.61 to 30.06 g (Depestre and Gomez, 1995).

Dahma (1997) showed that per 10 tons fresh poultry manure has 96-230 kg N, 24-120 kg P, 38-116 kg K and 12-22 kg Mg.

Rahman, Matiur *et al* (2001) in a thesis paper, effects of spacing on growth and yield of capsicum (*Capsicum annuum* var.*grassum* L) recommended that considering the yield of fruit per hectare, cost of production and the benefit cost ratio, the spacing combination of 45x35 cm be the best for sweet pepper production under Mymensing condition.

In south India, during summer season the average fruit weight varied from 27.9 g to 50.9 g (Anand and Deshpande, 1986). Sadykov *et al* (1981) in an experiment opined that more frequent irrigation decreased the yield. Gill *et al* (1974b) reported that number of days required for flowering of sweet pepper was found to increase with high dose of nitrogen application.

Spaldom *et al (1996)* opined that higher rate of potassium increased the uptake of phosphorus. Uptake of 'K' increased the yield of red pepper. Low light intensity enhances pepper flower abortion and thus reduces fruit yields while fertilization was sensitive to high temperature (El-Ahmadi and stevens, 1979; Kuo *et. al* 1986 and Mutters and Hall, 1992).

Baker *et al* (1999) suggested cultural practices for field cultivation of sweet peppers They put the opinion that sweet peppers grow best between 21 and 24°C. When temperature fall below 18°C or exceed 27°C for extended periods, growth and yield are usually decreased. Sweet peppers can tolerate day time temperatures over 30°C, as long as high temperatures are within 21-24°C. Sweet peppers are photoperiod and humidity sensitive (day length and relative humidity do not affect flowering or fruit set). They grow best in loam or silty-loam soil with good water holding capacity. Soil pH should be between 5.5 and 6.8. Sweet peppers are fairly shallow-rooted crop and have low tolerance to drought or flooding.

Aliyu and Olarewaju (1964) obtained fruit length and diameter ranged from 4 to 9 cm and 2 to 4.5 cm respectively for "Cherry Red" and "Santafe Grande".

Joshi *et al* (1987) stated that *Capsicum* is the most important summer crop of temperate regions as it requires temperature ranging 25 +(5-7°C) for its different phases of development and are also grown in tropical and sub-tropical areas during winter months.

Rylski and Spigerman (1982) suggested that the highest fruit set was obtained at the lowest night temperature, the highest night temperature caused considerable blossom drop. Hasanuzzaman (1999) reported that sweet pepper is considered a minor vegetable crop in Bangladesh and its production statistics is not available. Application of 150 kg N/ha in equal splits, at planting, 30 days and 60 days after planting gave continuously higher yield of sweet pepper cv.'California Wonder' under Hessarghata (Bangalore) condition (Srinivas and Prabhokar, 1982).

Magnesium sufficient soil produced significantly larger plants than magnesium deficient soil or magnesium treated deficient soil (Dempsey and Boswell, 1979).

Spraying with EDTA, chelates of Cu, Zn, Mn and Fe five times at 15 day interval increased the yield of sweet pepper cv. Vinedale. The color of the fruits was found to improve by spraying with B, Cu, and Zn or Cu and Zn (Navrot and Levin, (1976).

Seeds when treated with zinc chloride or zinc sulphate (25,50,75 and 100 mg/L) for 20-24 hours before sowing and sprayed with similar solvent at two-leaf stage, the treated plants showed 1.3 times more leaves and were taller than control plants (Sestunov and Zolotukhin, 1973).

Among the different micronutrients, Cu and B had a beneficial effect on capsaicin content (Nowak, 1980).

Gezerel and Donmez (1988) showed that slow-release fertilizers hold great promise for the production of solanaceous vegetables such as eggplant and tomato. They compared slow-release fertilizer (Plantacote) and conventional fertilizers of N,P,K,Mg. @ 100, 80, 90, 30 kg/ha They also found that slow-release fertilizers produced 92 t/ha of tomato, compared to only 42 t/ha when ordinary commercial fertilizers were used.

Nitrogen enhanced the growth and development, which ultimately increased the yield. While conducting an experiment in a solar greenhouse with the aid of a computer, Xin *et al* (1997) established the relationship between N, P, K and effects on the yield and quality of tomato. Nitrogen had the largest effect on the yield and quality, while the interaction between N and K was the most significant.

Islam *et al*. (1997) studied yield contributing characters of tomato due to the effect of planting patterns and different nitrogen levels. They reported that nitrogen at the rate of 250 kg/ ha gave the highest number of flower and fruit per plant. Such influence of nitrogen has also been reported by Midan *et al* (1985). The length and diameter of individual fruit were increased with increasing nitrogen levels.

Csizinszky (1996) conducted a field experiment with tomato cultivars 'Equinox' and 'Sun bean' received foliar application of bio-stimulant, Key plex-350 and Tri-Ag, at two N plus K rates, 195 kg N+324 kg K/ha or times of this rate. The higher N+K rate resulted in an increased yield of medium sized fruits.

In an experiment, supplied 2, 4, 8, 16 or 32 m.e N/liter and 2, 4, 8, or 16 m.e K/liter to tomato plant at the third true leaf stage and observed that the plant height increased with increasing nutrient concentrations, except at the highest concentrations where it was not significant. Top : root ratio increased with increasing nitrogen concentration and flowering response was the best at 8 m.e N /liter by Chung *et al.* (1992).

Nasreen and Islam (1990) also investigated the fertilizer effect on tomato yield and found that the yield response was linear with the levels of nitrogen and nitrogen application had certain optimum range beyond which the yield of tomato would not increase.

Kaniszewski and Rumpel (1987) studied the effects of nitrogen fertilization at rates from 37.5 to 300 kg N/ha and irrigation was studied under field conditions on a tomato variety. They reported that nitrogen fertilization up to the rate of 225 kg N/ha resulted in a significant increase of total and marketable yield with both irrigation whereas the yield increased up to the rate of 150 kg N/ha without irrigation

Patil and Bojoppa (1984) conducted an experiment to study the effect of cultivars and graded levels of nitrogen and phosphorus on certain quality attributes of tomato. The experiment consisted of the cultivars 'Pusa ruby' 'Sioux and Sweet 72'. The plant received nitrogen at 70,110 and 150 kg/ha and phosphorus at 44 or 61.6 kg/ha with basal dressing of potassium at 49.8 kg/ha and FYM at 25 ton/ha. The highest fruit content of total sugar and next highest dry matter content were in 'sweet 72' while juice percentage was highest in 'Pusa ruby.' Raising nitrogen rates increased fruit total sugars and juice percentage but decreased the dry matter content. Phosphorus had no appreciable effect as any of the indices studies.

Belichki (1993) reported that nitrogen was the most important nutrient for tomato. Flower and fruit number per plant were increased by nitrogen up to 240 kg/ha and fruit size was maximum at 6. 20 cm.

Kaniszewski and Rumpel (1983) worked on multiple harvested transplanted tomatos and found that early yield decreased with the increase of nitrogen fertilization.

Doss *et al* (1981) conducted an experiment to determine the effect of nitrogen rates on the growth and yield of tomato, and found that there was no consistent effect from nitrogen rate on marketable yield of tomato fruits. Average yields from the lower nitrogen rate were greater than the higher nitrogen rate in the two driest years and were similar or higher from the higher nitrogen rate in year of more average rainfall.

Hassan (1978) reported that with the increased nitrogen levels the fruit yield increased.

Fisher (1969) observed that heavy dressings of nitrogen reduced the number of truss, the flowers per plant and the number of fruit set.

Joshi and Singh (1975) opined that a good crop of capsicum may yield 10-12 tones of quality fruits/ha if proper care is taken during its growth.

Nicklow and Downess (1971) reported that nitrogen results in a significant reduction of fruit size; but in most cases, fruit size was decreased as plant population was increased.

Green sweet peppers ready for harvest are relatively firm and crisp (Shoemaker and Teskey, 1955).

Fallik *et. al* (1995) stated that eggplant harvested at earlier stage were more susceptible to chilling injury during storage at 6 or 8° C (87-90 % RH) than fruits harvested later.

Review on shelf life of sweet pepper fruit.

Sweet pepper can be kept in good condition for at least 40 days at 0°C and at relative humidity of 95-98 percent. Shrinkage of fruits stored under those conditions was only 4 percent in 40 days (Platenius *et. al*,1934).

De Vos (1966) stated that temperature requirement of fruit for slow ripening depends upon the stage of maturity. For prolonged storage, green fruit at 15° C, Orange green fruit at 10° C and red fruit at 8° C was kept. He also stated that at 20° C the fruit quality was deteriorated and under very low temperature condition. Chilling injury was caused and such situation arose below 10° C.

Chapter 3

Materials and methods

MATERIALS AND METHODS

The present research works were carried out during the period from November 2005 to April 2006. This chapter deals with the location, materials and methods that were used in conducting the experiments.

Location of the experimental site

The research works were conducted at Horticultural Farm and Laboratory of Sher-e-Bangla Agricultural University (SAU), Dhaka-1207.

Climate of the experimental site

The area is characterized by hot and humid climate. The average rainfall of the locality during experimental period was very little; the minimum and maximum temperature was 19.19°C and 28.81°C respectively as the average of 24°C. Average relative humidity was 68%. During the period from December to January, the humidity was low; temperature was mild with plenty of sunshine. The atmospheric temperature increased from February as the season proceeded towards. The experimental area was under the sub-tropical monsoon climatic zone, which is characterized by little amount of rainfall, low humidity, low temperature and short day during Rabi season (15^{th} October to 15^{th} March). At that time, the details of the meteorological data in respect of temperature, rainfall, relative humidity during the period of experiment were collected from meteorological department, Agargaon, Dhaka are in appendix I

Characteristics of soil

Selected plot was medium high land located near the SAU pond. The soil of the experimental plot was sandy loam in texture belonging to the Modhupur soil tract. The inorganic properties of the soil were analyzed at the Soil Resources Development Institute (SRDI), Krishi Khamar Sharak, Farmgate , Dhaka1215. The pH of the soil was 5.8, amount of organic carbon, total nitrogen were very low. Details of the soil characteristics have been presented in Appendix II.

Planting materials used

Thirty five days old seedlings of sweet pepper were used in the experiment and collected from horticultural centre, Asad gate, Dhaka.

Method used for the experiment

The experiment was laid out in randomized complete block design.

Experimental procedure:

Design and layout of the experiment

There were 9 treatments with three replications. Total numbers of unit plots were 27, each plot measuring 2 meter in length and 1.5 meter in wide and plant spacing was 50 cm x 40 cm. The distance maintained between plots was 0.5 m while between blocks was 0.75 m.

Treatments

The experiment consisted of four different doses of poultry manure, four different doses of cowdung and one inorganic fertilizer. They are mentioned below:

Table 1. Different doses of organic and inorganic fertilizers used in the experiment

Manures	Different treatments	Doses (kg/ plot)	Doses (t/ha)
Poultry manure	T_1	9	30
	T_2	12	40
	T_3	15	50
	T_4	18	60
Cowdung	T_5	10	33
	T_6	15	50
	T_7	20	66
	T_8	25	83
Inorganic fertilizer	T_9, Urea	102 g	340 kg/ha
	TSP	31.5 g	105 kg/ha
	MP	49.5 g	165 kg/ha

One week before transplanting of seedling, the entire amount of well decomposed poultry manure, cow dung, TSP, MP and half of the urea were applied as basal dose and well mixed with the soil (Table 1).

R1	R2	R3
T_3	T_1	T_4
T_2	T_4	T_1
T_7	T_3	T_9
T_5	T_6	T_2
T_9	T_2	T_5
T_4	T_5	T_3
T_8	T_7	T_6
T_6	T_9	T_8
T_1	T_8	T_7

Figure 1. Layout of the experiment

Application of inorganic and organic fertilizers

Standardization of organic fertilizers (manures) for sweet pepper production has still not been done under Bangladesh condition so far as it was reviewed. However, recommended doses of inorganic fertilizer and based on the inorganic fertilizer different doses of poultry manure and cowdung were used in the experiment. Details of the doses of inorganic and organic fertilizers are given in Table 1.

Preparation of the experimental field

The selected field for growing sweet pepper was first opened at 5th November, 2005 with a power tiller and was exposed to the sun for a week. The plot was partitioned into the unit plots according to the experimental design. Irrigation and drainage channels were prepared around the plots. Each unit plot was prepared keeping 6 cm height from the drains.

Land preparation

The land was ploughed and cross ploughed three times with power tiller, laddering to break the clods and to level the soil followed each ploughing. During land preparation weeds and other stubbles of the previous crop were collected and removed from the land. These operations were done to bring the land under a good tilth condition.

Manuring

The inorganic and organic fertilizers under different treatments (Table-1) were applied in the experimental plot (except 1/2 of the urea) during final land preparation. The remaining urea was applied as top dressing.

Transplanting of seedlings

Healthy and uniform sized seedlings were transplanted in the experimental field on 4th December, 2005. Transplanting was carried out during the late afternoon providing one seedling in each hole. The seedlings were watered late hours in the evening. Seedlings were also planted around the experimental area to check the border effect.

Harvesting

Harvesting of fruits was started at 70 DAT and continued up to 100 DAT with an interval of 3 days. Harvesting was done usually by hand picking.

Data collection

In order to study the effect of treatments, data in respect of the following parameters were recorded from the sample plants during the course of experiment. Out of 15 plants, 8 plants were selected randomly from each unit plot for data collection.

Plant height

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

Number of leaves per plant

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

Diameter of stem

Diameter of stem in cm was recorded with a slide calipers at 30, 60, 90 and 120 (at final harvest) DAT.

Number of branch per plant

Primary and secondary branches of plants were recorded at final harvest (at 120 DAT). Main shoots were considered as primary branches and lateral shoots were considered as secondary branches.

Fruit length (mm)

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

Fruit diameter (mm)

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

Weight of individual fruit (g)

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

Weight of fruit per plant (g)

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

Analysis of data

The data in respect of yield and yield contributing characters were statistically analyzed to find out the statistical significance for the experimental results. The means for all the treatments were calculated and analyses of variance for all the characters were performed by F test.

Fruit Quality (Shelf life)

The shelf life of sweet pepper experiment was conducted with two temperature regimes each having two different conditions (with wrapping and without wrapping). Shelf life of fruits under each treatment was recorded during the period of study. It was recorded from the date of harvest to the edible quality.

Benefit Cost Ratio (BCR) Analysis

Economic analysis was done with a view to compare the benefit cost ratio among the different treatments. For this purpose, the cost of inputs, land preparation, planting material, fertilizer, irrigation, crop protection, harvesting, lease of land and manpower required etc per hectare was considered. A presumptive price (60 Tk/kg) of sweet pepper was considered for estimating the return ratio per hectare.

Chapter 4
Results and Discussion

RESULTS AND DISCUSSION

This chapter comprises the presentation and discussion of the results obtained from the present investigation. The results have been presented in the table 1 to 9 and figure 1 to 3. The results have been presented, discussed and possible interpretations wherever necessary have been given under the following headings.

Plant height

Plant height at different days after transplanting (DAT) and different doses of manures showed significant variation (Appendix No. III).The highest (61.98 cm) plant height was recorded from poultry manure compared to cowdung (52.52 cm) and inorganic fertilizer (46.99 cm).

In case of poultry manure, the highest (61.98 cm) plant height was recorded from T_4 which was followed by T_3 (58.23), T_2 (54.3) and T_1 (52.36).

In case of cowdung, the highest (52.52 cm) plant was recorded from T_8 which was followed by T_7 (50.89), T_6 (48.76) and T_5 (46.41).

At 30 DAT, plant height ranged from 20.49 to 24.26 cm. The maximum plant height (24.26 cm) was found from the inorganic treatment and the minimum was observed from T_2 (20.43 cm).

At 60 DAT, plant height varied from 33.08 cm to 40.4 cm, the maximum 40.4 cm recoded from T_8 and the minimum 33.08 cm plant height were recorded from treatment T_1.

At 90 DAT, plant height varied from 44.75 cm to 55.65 cm. The highest (55.65 cm) plant height was recorded from T_4 and the lowest (44.75) cm plant height was found from inorganic fertilizer.

At 120 DAT, plant height ranged from 46.41 cm to 61.98 cm. The highest (61.98 cm) plant height was recorded from T_4 and the lowest (46.41cm) was observed from T_5 and in inorganic fertilizer treatment was 46.99 cm.

In case of poultry manure; at 30 and 60 DAT, the plant height from inorganic treatment was found higher than poultry manure. But at 90 and 120 DAT, the plant height of T_4 was higher than inorganic treatment

In case of cowdung; only at 30 DAT, the plant height of inorganic treatment was the highest but later time T_8 was highest. This increase was possibly due to readily available nitrogen from inorganic fertilizer than other manures. Nitrogen from slow release poultry manure might have encouraged more vegetative growth and development of the plant at later stage of growth.

Salam (2001) showed that nitrogen enhances the protein synthesis, which allows plant to grow faster, rate of metabolism, cell division, cell elongation and thereby stimulated apical growth.

Melton and Default (1991) found that plant height increased as the level of nitrogen was increased (Table. 1).

Table 2. Effect of inorganic and organic fertilizers on plant height of sweet pepper.

Treatments	30 DAT	60 DAT	90 DAT	120 DAT
T_1	20.49	33.08	48.49	52.36
T_2	20.43	33.16	49.32	54.3
T_3	21.49	33.81	52.68	58.23
T_4	21.71	35.42	55.65	61.98
T_5	21.66	34.8	45.03	46.41
T_6	22.01	36.42	46.97	48.76
T_7	22.36	39.45	49.14	50.89
T_8	23.5	40.4	51.64	52.52
T_9	24.26	38.53	44.75	46.99
LSD (0.05)	1.87	5.92	5.31	6.54

Poultry Manure: T_1= 30 (t/ha), T_2= 40 (t/ha), T_3= 50 (t/ha), T_4= 60 (t/ha).

Cowdung: T_5 = 33 (t/ha), T_6 = 50 (t/ha), T_7 = 66 (t/ha), T_8 = 83 (t/ha).

DAT= Days after Transplanting.

Number of leaves per plant

The number of leaves per plant at different stages of growth showed significant variation (Appendix-IV) among the different doses of manures and fertilizer. The highest (174.3) number of leaves per plant was recorded from poultry manure compared to cowdung (170.31) and inorganic fertilizer (146.7).

In case of poultry manure the highest (174.3) number of leaves per plant was recorded from T_4 which was followed by T_3 (168.4), T_2 (157.14) and T_1 (155.95).

In case of cowdung the highest (170.91) number of leaves per plant was recorded from T_8 which was followed by T_7 (166.39), T_6 (161.66) and T_5(160.5). At 30 DAT, number of leaves per plant varied from 22.66 to 26.05 The highest (26.05) number of leaves per plant at 30 DAT was found from inorganic treatment and the lowest (22.66) was in T_5.

At 60 DAT, it ranged from 93.43 to 115.23. The highest number 115.23 was recorded from T_4 and the lowest (93.18) number was observed in T_5. At 90 DAT, the maximum number (151.33) of leaves was recorded from treatment of T_4 and the lowest 126.66 was found from inorganic fertilizer treatment. At 120 DAT, the maximum (174.3) number of leaves per plant was observed in T_4 treatment and the minimum number (146.7) leaves per plant was recorded in inorganic fertilizer treatment.

It has been observed that more than 30%, 60% and 84% of total leaves per plant were found at 30 DAT, 60 DAT and 90 DAT respectively. Different manures had appreciable effect on the number of leaves per plant. The T_4 produced the highest number (174.3) of leaves and those from inorganic treatment produced the lowest number (146.7) of leaves. The result clearly showed that the number of leaves per plant was gradually increased with increasing doses of different of manures indirectly different levels of nitrogen. Sharma and Mann (1971) also reported that increasing level of nitrogen application increased the number of leaves per branch (Table 3).

Table 3. Effect of inorganic and organic fertilizers on number of leaves per plant of sweet pepper.

Treatments	30 DAT	60 DAT	90 DAT	120 DAT
T_1	23.5	109.33	142.38	155.95
T_2	24.37	111.5	144.66	157.14
T_3	25	114.16	148.88	168.4
T_4	25.72	115.23	151.33	174.33
T_5	22.66	93.43	137.66	160.5
T_6	25.22	100.79	139.33	161.66
T_7	25.76	102.5	143	166.39
T_8	25.95	105	146	170.31
T_9	26.05	79.51	126.66	146.7
LSD (0.05)	1.85	16.94	25.15	18.25

Poultry Manure: T_1= 30 (t/ha), T_2= 40 (t/ha), T_3= 50 (t/ha), T_4= 60 (t/ha).

Cowdung: T_5 = 33 (t/ha), T6 = 50 (t/ha), T_7 = 66 (t/ha), T_8 = 83 (t/ha).

DAT= Days after Transplanting.

Diameter of stem

Stem diameter of plants have been found significant due to different doses of inorganic and organic fertilizers. The highest (1.61 cm) of stem diameter was recorded from poultry manure compared to cowdung (1.56 cm) and inorganic fertilizer (1.29 cm).

In case of poultry manure the highest (1.61 cm) was recorded from T_4 which was followed by T_3 (1.52 cm), T_2 (1.43 cm) and T_1 (13.2 cm).

In case of cowdung the highest (1.56 cm) stem diameter was recorded from T_8 which was followed by T_7 (1.53 cm), T_6 (1.4 cm) and T_5 (1.33 cm).

The diameter of stem gradually increased up to 90 DAT. In case of poultry manure, at 90 DAT, it varied from 1.29 to 1.61 cm. It was found to provide the maximum stem diameter (1.61 cm) in T_4 and the lowest (1.29 cm) was in inorganic fertilizer treatment respectively.

Incase of cowdung, stem diameter varied from 1.29 to 1.56 cm. At 90 DAT, it was found to provide maximum stem diameter (1.56 cm) in T_8 and that of lowest (1.29 cm) in inorganic treatment.

But at 120 DAT, both the cases (of poultry manure and cowdung) the scenario was different. At this period, stem diameter ranged from 1.27 cm to 1.45 cm which was lower than that of at 90 DAT.

In case of poultry manure, the maximum diameter (1.45 cm) was recorded in T_4 and the lowest (1.28 cm) was recorded in T_1 treatment.

In case of cowdung, the maximum (1.44 cm) stem diameter was recorded in T_8 and minimum1.28 cm was in T_5 (Table 4).

Thomas and Heilman (1964) observed that N was translocated from leaf to fruit tissue. Under conditions of N stress, the P content in leaf increased significantly as the fruit mature

Table 4. Effect of inorganic and organic fertilizers on stem diameter (cm) of sweet pepper.

Treatments	30 DAT	60 DAT	90 DAT	120 DAT
T_1	0.56	1.02	1.32	1.28
T_2	0.56	1.22	1.43	1.38
T_3	0.61	1.24	1.52	1.4
T_4	0.71	1.28	1.61	1.45
T_5	0.67	1.2	1.33	1.28
T_6	0.72	1.23	1.4	1.36
T_7	0.68	1.32	1.53	1.43
T_8	0.6	1.35	1.56	1.44
T_9	0.59	1.05	1.29	1.27
LSD (0.05)	0.09	0.18	0.18	0.18

Poultry Manure: T_1= 30 (t/ha), T_2= 40 (t/ha), T_3= 50 (t/ha), T_4= 60 (t/ha).

Cowdung: T_5 = 33 (t/ha), T6 = 50 (t/ha), T_7 = 66 (t/ha), T_8 = 83 (t/ha).

DAT= Days after Transplanting.

Branches per plant

Number of primary branches per plant.

Number of primary branches per plant was not statistically significant by different manures and fertilizer. The highest (2.83) number of primary branches recorded from poultry manure compared to cowdung (2.69) and inorganic fertilizer was 2.53.

The highest (2.83) number was found from T_4 which was followed by T_3 (2.75), T_2 (2.75), T_7 (2.69) etc. The mean number of primary branches of the poultry manure was 2.73 and that of cowdung was 2.6 (Table 5).

Number of secondary branches per plant.

No significant variation was observed in the number of secondary branches per plant in the case of poultry manure. The highest (10.9) number of secondary branches were recorded from cowdung compared to poultry manure (10.8) and inorganic fertilizer was 7.65.

The highest (10.9) number was recorded from T_5 which was followed by T_4, T_3, T_2 (10.8), T_8 (10.74), T_1 (10.1), T_7 (10.1) and T_6 (8.8). The mean of poultry manure was 10.6 and cowdung was 10.2. In case of inorganic fertilizer, it was 7.65 (Table 5).

Table 5. Effect of inorganic and organic fertilizers on primary and secondary branches of sweet pepper.

Branching	Poultry mannure					Cowdung					Inorganic fertilizer
	T_1	T_2	T_3	T_4	Mean	T_5	T_6	T_7	T_8	Mean	
Primary	2.35	2.75	2.75	2.83	2.73	2.53	2.65	2.69	2.52	2.60	2.53
Secondary	10.1	10.8	10.8	10.86	10.6	10.9	8.8	10.15	10.74	10.2	7.65
LSD value (0.05)	NS (Applicable both primary and secondary branching)					NS for primary branching, 2.14 for secondary branching only.					

Poultry Manure: T_1= 30 (t/ha), T_2= 40 (t/ha), T_3= 50 (t/ha), T_4= 60 (t/ha).

Cowdung: T_5 = 33 (t/ha), T_6 = 50 (t/ha), T_7 = 66 (t/ha), T_8 = 83 (t/ha).

Number of fruits per plant

A significant variation was found in number of fruits per plant due to different doses of poultry manure and cowdung. The highest (12.93) number of fruit was recorded from poultry manure compared to cowdung (9.6) and inorganic fertilizer was (5.6).

The highest (12.93) number of fruits per plant was recorded from T_2 which was followed by T_1 (10.03), T_3 (9.93), T_6 (9.6), T_7 (8.2), T_5 (8), T_4 (7.8) and T_8 (6.6).

In Case of marketable fruits per plant, the highest (3.84) number was recorded from cowdung compared to poultry manure (3.81) and the inorganic fertilizer was (3.03).

It has been observed that fruit per plant decreased gradually with the increasing rate of manure. The increasing doses of poultry manure decreased the number of fruits per plant (Table 6). With the increasing doses of cowdung, fruit per plant decreased gradually.

Bottini (1967) reported that in soils containing abundant organic matter, application of P and K at100 and 250 kg/ha was found optimum for sweet pepper production. Rylski and Spigerman (1982) got the result that at higher night temperature of 24^0 C and lower night temperature of 18^0C, the number of fruits produced per plant were 6.6 and 12.6 respectively.

Table 6. Effect of inorganic and organic fertilizers on number of fruits per plant (N= 15 plants / plot).

Treatments	Total number of fruit per plant	Number of Marketable fruit per plant
T_1	10.03	3.37
T_2	12.93	3.81
T_3	9.93	3.08
T_4	7.80	2.63
T_5	8.00	2.99
T_6	9.60	3.84
T_7	8.20	3.30
T_8	6.6	2.66
T_9	*5.6*	3.03

Poultry Manure: T_1= 30 (t/ha), T_2= 40 (t/ha), T_3= 50 (t/ha), T_4= 60 (t/ha).
Cowdung: T5 = 33 (t/ha), T_6 = 50 (t/ha), T_7 = 66 (t/ha), T_8 = 83 (t/ha).

Fruit length (mm)

A significant variation in the length of fruit was observed both due to poultry manure and cowdung. The maximum fruit length (69.2 mm) was recorded from poultry manure compared to cowdung (66 mm) and inorganic fertilizer was 52.4 mm. The maximum fruit length (69.2 mm) was found from T_2 which was followed by T_6 (66.7 mm), T_1 (66 mm), T_5 (65 mm), T_3 (64.3 mm), T_4 (62.9 mm), T_7 (61.5 mm) and T_9 (52.2 mm)

This result showed that the fruit length, after a certain dose, gradually decreased with the increasing doses of manures (Table 7).

Fruit diameter (mm)

The variation in diameter of fruit among the different doses of manure was found to be statistically significant. The maximum (66.3 mm) diameter of fruit was recorded from poultry manure compared to cowdung (65.3 mm) and inorganic fertilizer was 50.7 mm.

The maximum (66.3 mm) fruit diameter was recorded from T_2 which was followed by T_1 (65.3 mm), T_5 (63.9 mm), T_7 (62.9 mm), T_8 (62.7 mm) T_3 (61 mm), T_6 (59.4 mm) and T_4 (58.5 mm. Austin and Dulton (1970) observed that fertilizer application had no effect on fruit size of tomato. On the other hand, Nassar (1986) reported the breadth of individual fruit was increased with the increasing nitrogen levels (Table 7).

Individual fruit weight (g)

Sweet pepper grown under different doses of poultry manure and cowdung varied significantly. The highest fruit weight (67.58 g) was recorded from poultry manure compared to cowdung (66.91 g) and the inorganic fertilizer was 53.5 g. The highest fruit weight (67.58 g) was recorded from T_2 which was followed by T_1 (66.95 g), T_5 (66.91 g), T_3 (65.27 g), T_6 (62.46 g), T_4 (62.09 g), T_7 (58.66 g) and T_9 (53.5 g).

Table 7 showed that treatment with lower doses of manure produced fruits those are low in weight. Medium doses treatments produced fruit those are higher in weight and more number of fruits compared to low and high doses. Higher doses of manure gradually decreased the fruit weight.

Doss *et al.* (1981) reported that average yield from the lower nitrogen rate were greater than the higher nitrogen rate. Fisher (1969) observed that heavy dressings of nitrogen reduced the number of truss, the flowers per plant and the number of fruit set.

Table 7. Effect of inorganic and organic fertilizers on fruit length, fruit diameter and individual fruit weight of sweet pepper.

Treatments	Fruit length (mm)	Fruit diameter (mm)	Individual fruit weight (g)
T_1	66	65.3	66.95
T_2	69.2	66.3	67.58
T_3	64.3	61	65.27
T_4	62.9	58.5	62.09
T_5	65	63.9	66.91
T_6	66.7	59.4	62.46
T_7	61.5	62.9	58.66
T_8	55.2	62.7	54.66
T_9	52.4	50.7	53.5
LSD (0.05)	8.65	8.65	8.65

Poultry Manure: T_1= 30 (t/ha), T_2= 40 (t/ha), T_3= 50 (t/ha), T_4= 60 (t/ha).
Cowdung: T_5 = 33 (t/ha), T6 = 50 (t/ha), T_7 = 66 (t/ha), T_8 = 83 (t/ha).

Yield per plant (g)

Yield per plant (of marketable fruits) varied significantly by the effect of poultry manure and cowdung The highest (258.15 g) yield was obtained from poultry manure compared to cowdung (240 g) and inorganic fertilizer (166.13 g). The highest yield per plant (258.15 g) was found from T_2 which was followed by T_6 (240 g), T_1 (225.77 g), T_3 (201.53), T_5 (200.47 g) etc (Figure 2).

Fruit yield (t/ha)

Analysis of variance showed that the different doses of treatments had significant influence on yield (Appendix No. VII).The highest (12.9 t/ha) marketable fruit yield was obtained from poultry manure compared to cowdung (12 t/ha) and inorganic fertilizer was 8.3 t/ha. The highest (12.9 t/ha) yield was recorded from T_2 which was followed by T_6 (12. t/ha), T_1 (11.28 t/ha), T_3 (10.07 t/ha), T_5 (10.02 t/ha), T_7 (9.68), T_9 (8.3 t/ha), T_4 (8.17) and T_8 (7.12 t/ha) (Figure 3).

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The result showed that higher doses of manure decreased the fruit yield gradually. From the figure 3, it has been noted that yield of fruit was lower at later time. On the other hand, heavy doses of manure keeps the plants always at vegetative growth condition i.e. higher amount of nitrogen absorption transform the plant from reproductive phase to vegetative phase. Ultimately, yield may become low.

Doss *et al* (1981) reported that average yields from the lower nitrogen rate were greater than the higher nitrogen rate in the two driest years and were similar or higher from the higher nitrogen rate in year of more average rainfall.

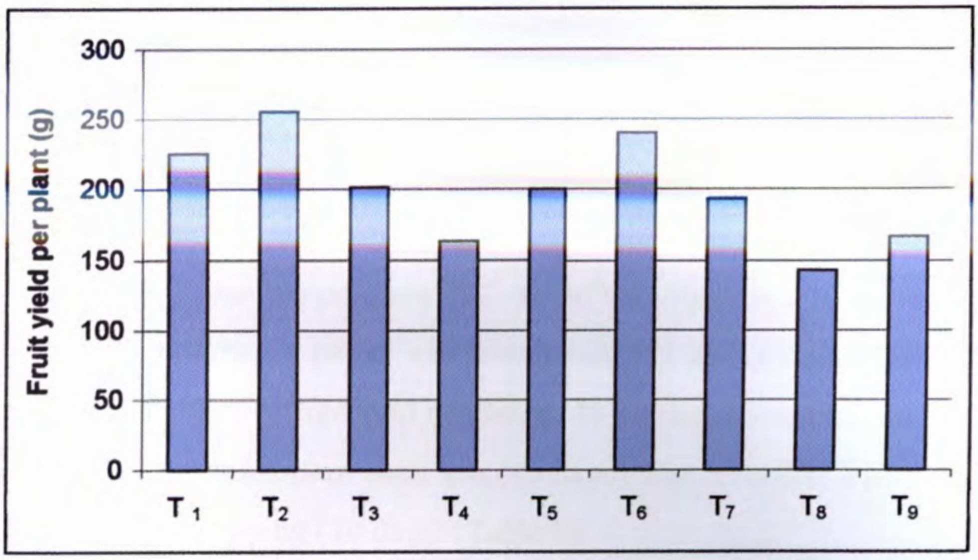

Figure 2. Effect of inorganic and organic fertilizers on fruit yield per plant (g)

Poultry Manure: T_1= 30 (t/ha), T_2= 40 (t/ha), T_3= 50 (t/ha), T_4= 60 (t/ha).

Cowdung: T_5 = 33 (t/ha), T6 = 50 (t/ha), T_7 = 66 (t/ha), T_8 = 83 (t/ha).

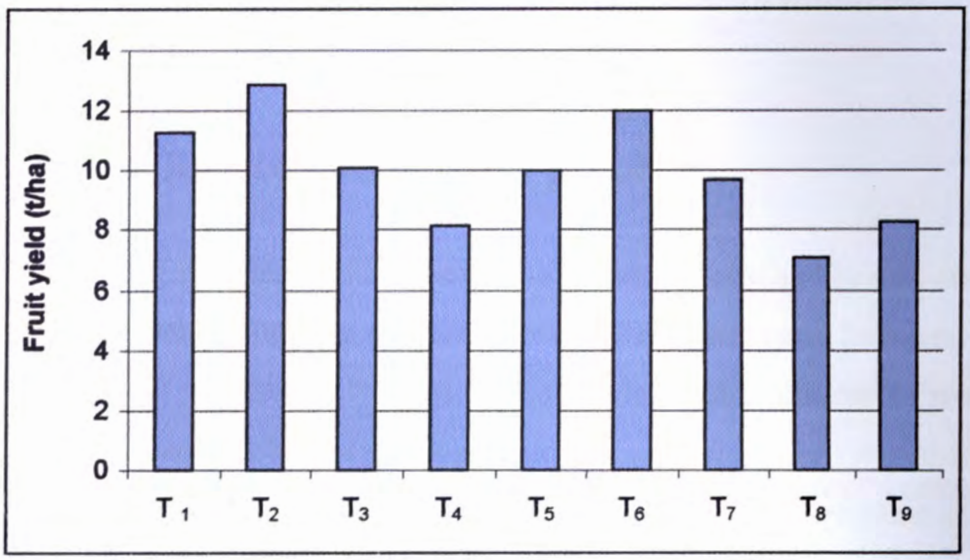

Figure 3. Effect of inorganic and organic fertilizers on fruit yield (t/ha)

Poultry Manure: T_1= 30 (t/ha), T_2= 40 (t/ha), T_3= 50 (t/ha), T_4= 60 (t/ha).

Cowdung: T_5 = 33 (t/ha), T6 = 50 (t/ha), T_7 = 66 (t/ha), T_8 = 83 (t/ha).

Shelf life of sweet pepper

Maximum shelf life (35 days) was recorded from poultry manure treatment compared to cowdung (27 days) and inorganic fertilizer was (25 days). Shelf life was maximum (35 days) in refrigerated (8-10°C) condition compared (15 days) to normal room temperature (26° to 30°C). Shelf life of sweet pepper wrapping with polythene paper was maximum (35 days) compared to non-wrapping (22 days) in refrigerated condition. In normal room temperature (26° to 30°C) condition, maximum shelf life (15 days) was recorded with wrapping compared to non-wrapping (10 days) (Table 8).

BCR of treatments was good in T_2

It has been found that shelf life of sweet pepper produced by 40 t/ha of poultry manure was the highest both in refrigerated and non-refrigerated conditions. Platenius *et al* (1934) showed that sweet pepper can be kept in good condition for at least 40 days at 0°C and at relative humidity of 95-98 percent. Shrinkage of fruits stored under those conditions was only 4 percent in 40 days.

De Vos (1966) stated that for prolonged storage, green fruit at 15° C, orange green fruit at 10° C and red fruit at 8° C was kept.

Benefit Cost Ratio (BCR) of sweet pepper

Benefit cost ratio was done with a view to compare the cost and benefit among the different doses of poultry manure, cowdung and inorganic fertilizer. For this purpose, cost per hectare was calculated against each treatment. Minimum whole sale price (60 Tk/kg) of sweet pepper was considered for estimating the return. It was observed that there was a variation in the cost of production due to different treatments (Table-9).The va riation was noticed due to different doses of manures and fertilizers. The ratio of BCR varied from 1.69 to 4.34. The highest BCR (4.34) was calculated from T_2 which was followed by T_1 (4.01), T_6 (3.54), T_3 (3.38), T_5 (3.37), T_9 (3.11), T_4 (3.04), T_7 (2.55) and T_8 (1.69). The highest BCR might be due to the economic use of poultry manure.

Table 8. Effect of inorganic and organic fertilizer on shelf life (days) of sweet pepper.

Treatment	Shelf life (days) of sweet pepper			
	Normal (ambient) room temperature (26-30^{o}C) condition		Refrigerated condition (8-10^{o}C)	
	Ro	Rw	Ro	Rw
T_1	10	15	20	32
T_2	9	15	22	35
T_3	8	13	18	30
T_4	7	12	16	28
T_5	9	13	17	26
T_6	8	11	18	27
T_7	7	11	16	24
T_8	6	10	15	22
T_9	7	9	19	25

Ro= without wrapping, Rw= with wrapping

Poultry Manure: T_1= 30 (t/ha), T_2= 40 (t/ha), T_3= 50 (t/ha), T_4= 60 (t/ha).

Cowdung: T_5 = 33 (t/ha), T6 = 50 (t/ha), T_7 = 66 (t/ha), T_8 = 83 (t/ha).

Table 9. Effect of inorganic and organic fertilizers on Benefit Cost Ratio (BCR) of sweet pepper.

	Cost			Return			BCR
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Treatments	Applied Poultry manure (t/ha)	Treatment PM cost @ 1000 Tk. and CD cost @ Tk. 1500 per ton	Total cost (tk/ha)=cost in Appendix VIII (128,262 Tk)+ Cost of column 3.	Yield (t/ha)	Price per ton (Tk)	Return/ha (in'000'Tk.)	
T_1	30	30,000	1,58,262	11.28	60,000	676	4.01
T_2	40	40,000	1,68,262	12.90		774	4.34
T_3	50	50,000	1,78,262	10.07		604	3.38
T_4	60	60,000	1,88,262	8.17		490	3.04
T_5	33	49,500	1,77,762	10.00		600	3.37
T_6	50	75,000	2,03,262	12.00		720	3.54
T_7	66	99,000	2,27,262	9.68		580	2.55
T_8	83	1,24,500	2,52,262	7.12		427	1.69
T_9	Urea=340 kg TSP=10 5kg MP=165 kg	Urea @ 7 Tk/kg, TSP @ 18 Tk/kg and MP @ 15Tk/kg.	1,28,262+5,044= 1,33,306	8.31		4,15	3.11

Chapter 5

Summary and conclusion

SUMMARY

Two experiments were conducted at Horticultural Farm and Laboratory of Sher-e-Bangla Agricultural University, Dhaka during the period from November 2005 to April 2006. The objectives of the research works were to study the growth, yield and quality of *Capsicum annuum cv.*'Sungrow' as influenced by four doses of poultry manure, four doses of crowding and inorganic fertilizer. Experiments were conducted and were laid out in RCBD. The field experiment had 9 treatments each having three replications and the size of unit plot was 2m x1.5m. Fifteen plants were accommodated in each plot with the spacing of 50 cm x 40 cm. Thirty five days old seedlings were planted in the field on 4th December, 2005. From each plot, 8 plants were randomly selected for collection of data on growth, yield and yield contributing characters.

Laboratory experiment was conducted for recording shelf life of fruit with normal (ambient) room temperature (26°C-30°C) and refrigerated temperature (8°C-10°C) condition. Each condition was with wrapping and without wrapping. Thus, there were all together 36 laboratory treatment combinations. Observations were made on shelf life. Data were collected at 3 days interval.

The highest plant height (61.98 cm) was found from poultry manure treatment compared to cowdung (52.52 cm) and inorganic fertilizer (46.99 cm). The highest plant height (61.98 cm) was recorded from T_4 compared to T_8 (52.52 cm). The maximum (174.33) number of leaves per plant was found from poultry manure treatment compared to cowdung (170.31) and inorganic fertilizer (146.7). The maximum (174.33) number of leaves per plant was found from T_4 compared to T_8 (170.31).

At 90 DAT, the maximum (1.61 cm) diameter of stem was found from poultry manure treatment compared to cowdung (1.56 cm) and inorganic fertilizer was (1.29 cm). Maximum (1.61 cm) stem diameter was recorded from T_4 compared to T_8 (1.56 cm). The highest (12.93) number of fruit per plant was recorded from poultry manure treatment compared to cowdung (9.6) and T_9 was 5.6. The maximum (12.93) number of fruit per plant was found from T_2 and the lowest from T_9 (5.6). The maximum (69.2 mm) fruit length was found from poultry manure compared to cowdung (66 mm) and T_9 was 52.4 mm. The maximum (69.2 mm) fruit length was recorded from T_2 and minimum from T_9 (52.4 mm). The maximum (66.3 mm) fruit diameter was recorded from poultry manure compared to cowdung (63.9 mm) and T_9 from 50.7 mm. Maximum fruit diameter (66.3 mm) was found from T_2 compared to T_5 (63.9 mm).

The maximum (67.58 g) individual fruit weight was recorded from poultry manure compared to cowdung (66.91 g) and T_9 was 53.5 g. The maximum (67.58 g) weight of fruit was found from T_2 and minimum from T_9 (53.5 g). The highest (12.9 t/ha) yield was found from poultry manure treatment compared to cowdung (12 t/ha). Maximum (12.9 t/ha) was harvested from T_2 compared to T_6 (12 t/ha) and minimum was in T_8.(7.12 t/ha) The maximum shelf life (35 days) was recorded from poultry manure (T_2) treatment compared to (T_6) cowdung treatment (27 days) and T_9 was 25 days. Shelf life was maximum (35 days) in refrigerated (8-10^{0}C) condition compared to normal room temperature (26-30^0) condition (15 days). Shelf life wrapping with polythene paper was maximum (35 days) compared to non-wrapping (22 days) in refrigerated condition. In normal room temperature condition, shelf life was15 days with wrapping and 10 days without wrapping.

Benefit Cost Ratio (BCR) varied from 1.69 to 4.34. The highest BCR (4.34) was calculated from T_2 treatment.

Conclusion:

- Considering growth parameter, 40 t/ha poultry and 50 t/ha cowdung showed better performance.
- The highest (12.93) number of fruit per plant was in 40 t//ha poultry manure but marketable fruit per plant was the highest (3.84) in 50 t/ha cowdung.
- Individual fruit weight was the highest (67.58 g) in 40 t/ha poultry manure and the second highest (66.91 g) was in 33 t/ha cowdung.
- Fruit yield was the highest (12.91 t/ha) in 40 t/ha poultry manure and the second highest (12 t/ha) was in 50 t/ha cowdung.
- Shelf life of fruit was the highest (35 days) with the fruit produced from 40 t/ha followed by 30 t/ha poultry manure.
- The highest (4.34) BCR was calculated in 40 t/ha poultry manure.

Recommendation

For the successful production of sweet pepper considering growth, yield, quality and cost effectiveness 40 t/ha poultry manure might be used.

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APPENDICES

Appendix No. I. Monthly record of air temperature, rainfall, and relative humidity of the experimental site during the period from October, 2005 to April, 2006.

Year	Month	Air temperature (°c)			Relative humidity (%)	Rainfall (mm)
		Maximum	Minimm	Mean		
2005	October	30.97	23.31	27.14	75.25	208
	November	29.45	18.63	24.04	69.52	00
	December	26.85	16.23	21.54	70.61	00
2006	January	24.52	13.86	19.19	68.46	04
	February	28.88	17.98	23.43	61.04	03
	March	31.25	21.55	26.4	64.65	3.5
	April	33.74	23.87	28.81	69.41	18.5

Source: Bangladesh Meteorological Department (climate division) Agargoan, Dhaka.

Appendix No. II. Chemical analysis of soil of the experimental area (SAU Horticultural farm).

Sample No.	Previous Crop	Soil PH	Organic Matter	Total nitrogen	Potassium	Phosphorus	Sulphur	Boron	Zinc
			%		meq/100 g soil	Microgram/gm soil			
1	Indian spinach	5.8 (slightly acidic	1.10 (low)	0.055 (very low)	0.17 (low)	65.3 (very high)	28.68 (optimum)	0.67 (high)	3.24(very high)
2	Fallow	5.6 (slightly acidic)	1.93 (medium)	0.097 (low)	0.15 (low)	83.5 (very high)	20.85 (medium)	0.85 (very high)	4.91 (very high)

Source: SRDI, Dhaka Memo No. Kaga branch /30(2) /03/557, dated: 31/10/2005.

Appendix No. III. Mean square values of variance analysis of plant height of sweet pepper as influenced by different organic and inorganic fertilizers at different Days After Transplanting (DAT).

Sources of variation	Degrees of freedom	Plant height at different days after transplanting.			
		30 DAT	60 DAT	90 DAT	120 DAT
Replication	2	6.789	5.658	45.476	70.37
Treatment	8	4.615 * *	24.362 NS	38.524 * *	76.048 **
Error	16	1.066	11.722	9.421	14.12

* = 5% level of significant

**=1% level of significant

NS=Non significant.

Appendix No. IV. Mean square values of analysis of variance of No. of leaves per plant of sweet pepper as influenced by different inorganic and organic fertilizers at different days after transplanting.

Sources of variation	Degree of freedom	*Mean square values of No. of leaves at days after transplanting.*			
		30 DAT	60 DAT	90 DAT	120 DAT
Replication	2	7.148	184.379	1111.111	711.111
Treatments	8	3.955 NS	304.309 * *	0.1188 NS	398.125 * *
Error	16	1.14	95.79	211.1	111.1

* = 5% level of significant
**=1% level of significant
NS=Non significant.

Appendix No. V. Mean square values of analysis of variance of stem diameter (cm) at different days after transplanting.

Sources of variation	Degrees of freedom	Mean square values of stem diameter at differentdays after transplanting.			
		30 DAT	60 DAT	90 DAT	120 DAT
Replication	2	0.010	0.068	0.071	0.071
Treatment	8	0.014 **	0.037 *	0.041 *	0.026 NS
Error	16	0.003	0.011	0.011	0.011

* = 5% level of significant
**=1% level of significant
NS=Non significant.

Appendix No. VI. Mean square values of analysis of variance of the data on fruit length and diameter as influenced by different organic and inorganic fertilizers.

Sources of variation	Degrees of freedom	Fruit length(mm)	Fruit diameter (mm)
Replication	2	100.000	100.000
Treatment	8	110.678 **	66.026 *
Error	16	25	25

Appendix No. VII. Mean square values of analysis of variance of the data on number of fruit per plot and fruit yield per ha.

Source of variation	Degree of freedom	*Mean square values*	
		Number of fruit per plot	*Fruit yield (t/ha)*
Replication	2	177.689	7.123
Treatment	8	557.623 ***	19.630 ***
Error	16	27.789	1.111

* = 5% level of significant
**=1% level of significant
NS=Non significant.

Appendix No.VIII. Cost of sweet pepper production.

Item	Rate (Tk.)	Cost (Tk.)
1.Cost of labour		
i) Land preparation (without ploughing) 30 man days	100	3,000
ii) Seedling planting (500 seedling planted/labour) 100	100	10,000
iii) Intercultural operation 100 labour	. 100	10,000
iv) Harvesting and processing 60 labour	100	6,000
2. Input cost		
i) Power tiller 3 times	2250	6,750
ii) Seedling cost (including transport) per 100 seedling	60	30,000
iii) Gypsum fertilizer cost 60 kg	4	240
iv) $ZnSO_4$ 11 kg	60	660
v) Boron 4 kg	100	400
vi) Insecticide cost		1,000
3. Irrigation cost		8,000
5. Depreciation cost of agricultural equipments/implements		5,000
6. Cost for leasing of 1 ha land for 6 months		30,000
7. Miscellaneous cost (5% of the total from 1 to 6)		5,552
8. Interest on capital (10% for 6 month)		11, 660
		Total cost= 1,28,262

9. Cost of organic and inorganic fertilizers variable (shown in table 9).