INTEGRATED NUTRIENT MANAGEMENT PRACTICES ON THE GROWTH AND YIELD OF SWEET PEPPER

(*Capsicum annuu*m cv.Lin**)**

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BY

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Approved by:

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CERTIFICATE

This is to certify that the thesis entitled, ***"INTEGRATED NUTRIENT MANAGEMENT PRACTICES ON THE GROWTH AND YIELD OF SWEET PEPPER)"*** *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* ***SOIL SCIENCE,*** *embodies the result of a piece of bona fide research work carried out by* ***SHAMIMA AKTER BALY****, Registration No.* ***11-04564*** *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 of during the course of this investigation has duly been acknowledged.

Dated:

Place: Dhaka, Bangladesh

(Prof. Dr. Alok Kumar Paul)

Superviso

DEDICATED TO

MY BELOVED PARENTS

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ABSTRACT

The experiment was conducted at the research farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh during November 2016 to March 2017 to examine integrated nutrient management practices on the growth and yield of sweet pepper. The experimental treatments included T_0 = No chemical fertilizer, T_1 = 120 kg N/ha from urea + PKS, T_2 = 100 kg N /ha from urea + 20kg N from cow dung + PKS, T_3 = 80kg N /ha from urea + 40kg N from cow dung + PKS, T_4 = 60kg N /ha from urea + 60kg N from cow dung + PKS, T_5 = 40kg N /ha from urea + 80kg N from cow dung + PKS, T_6 = 20kg N /ha from urea + 100kg N from cow dung + PKS, T_7 = all organic(120 kg N from cow dung). The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. The effects of nutrient management practices were evident recorded significantly influenced on all parameter. The tallest plant was produced in the T_2 treatment. The maximum number of branch per plant, length of fruit, individual fruit weight were also produced from the T_2 treatment. Fruit yield was varied significantly due to the levels of different nitrogen with cow dung. The maximum fruit yield (20.00 t/ha) was produced in the T_2 treatment. BARI Mistimorich 1 variety of sweet pepper coupled with 100 kg N /ha from urea + 20kg N from cow dung and recommended PKS was found to be a promising practice for good yield. This result might be due to integrated nutrient management practices of fertilizers.

CONTENTS

CONTENTS (Contd.)

LIST OF TABLES

LIST OF FIGURE

LIST OF APPENDICES

LIST OF ABBREVIATION AND ACRONYMS

AEZ	=	Agro-Ecological Zone
BARI	=	Bangladesh Agricultural Research Institute
BBS	=	Bangladesh Bureau of Statistics
FAO	=	Food and Agricultural Organization
N	=	Nitrogen
et al.	=	And others
TSP	=	Triple Super Phosphate
MOP	=	Muriate of Potash
RCBD	=	Randomized Complete Block Design
DAT	=	Days after Transplanting
ha^{-1}	=	Per hectare
g	=	gram (s)
kg	=	Kilogram
SAU	=	Sher-e-Bangla Agricultural University
SRDI	=	Soil Resources and Development Institute
wt	=	Weight
LSD	=	Least Significant Difference
^{0}C	=	Degree Celsius
NS	=	Not significant
Max	=	Maximum
Min	=	Minimum
%	=	Percent
NPK	=	Nitrogen, Phosphorus and Potassium
CV%	=	Percentage of Coefficient of Variance

CHAPTER I

INTRODUCTION

Sweet pepper or bell pepper (*Capsicum annuu*m cv. Lin) 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 6-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, 1998).

Pepper is considered an excellent source of bioactive nutrients. Main antioxidant compounds found in sweet pepper is ascorbic acid (vitamin C), carotenoids and phenolic compounds (Marin *et al.*, 2004). The levels of vitamin C, carotenoids and phenolic compounds in vegetables varied based on several factors, including cultivar, agricultural management practices, Physiological maturity and storage duration (Lee and Kader, 2000).

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 sweet pepper. It is now widely cultivated in America, Europe and some countries of the Asia-Pacific. It has great demand in Japan, Thailand, Philippines, Taiwan, Egypt and other countries even in Bangladesh.

Intensive synthetic fertilizer usage in agriculture caused so many health problems and environmental pollution. To reduce and eliminate the adverse effects of synthetic fertilizers and pesticides on human health and environment, new agricultural practices were developed in the organic agriculture, ecological agriculture or sustainable agriculture (Aksoy, 2001; Chowdhury, 2004; Malgorzata and Georgios, 2008).

Organic farming products are becoming very necessary in today's world to manage ecosystem health and to impart related human health benefits, world over there is growing demand for organic products. The organic areas in the whole world reached to 37.5 million hectares (FiBL and IFOAM, 2014).

The application of organic resources is essential for the balance of soil fertility status and crop productivity in agricultural systems. Imbalance use of chemical fertilizer in vegetable and other crop production is a common practice in Bangladesh. In Bangladesh, most of the cultivated soils have less than 1.5% organic matter (Islam, 2006) while a good agricultural soil should contain at least 2% organic matter. In continuous cropping area, organic matter supply to the crop field through different manuring practices is made only to a minimum extent. Under these imbalanced conditions various beneficial soil microorganisms are being adversely affected.

The organic fertilizers provide the nutritional requirements of plants. Additionally, they increase the microbial activity in soil, anion and cation exchange capacity, organic matter and carbon-content of soil. Organic fertilizers produce the yield and quality of agricultural crops in ways similar to inorganic fertilizers (Heeb *et al*. 2006; Liu *et al*. 2007; Tonfack *et al*. 2009).

Organic agriculture is one of the broad spectrum of production methods that are supportive of the environment. The demand for organic food is steadily increasing both in developed and developing countries with an annual growth rate of 20-25 per cent (Ramesh *et al.,* 2005). Organic cultivation which is responsible for material circulation in agricultural ecosystem and enhanced crop production with a minimal environmental load in keeping ecological balance contains the holistic approach for production and management system for enhancing health of agricultural ecosystem. Organic systems avoid the use of synthetic fertilizers, pesticides and growth regulators. Instead they rely on crop residues, animal manures, legumes, green manures, off – farm wastes, mechanical cultivation and biological pest control to maintain soil health, supply of plant nutrients and minimize insects, weeds and other inputs. Organic culture helps in improvement of crop quality and reduces environment pollution. It brightens the prospects of export of organic food items. Now there are signs of change across the agriculture landscape of the country towards organic farming.

Sustainability in crop yield and soil health could be achieved by the application of mineral fertilizers along with organic manures. Benefits of organic manures like cow dung, farm yard manure, green manures, poultry manure and vermi compost are well known but the availability is reducing day by day. These organic manures are not only good sources of nutrients but also improve the physical structure of the soil. Apart from containing NPK these also contain small amounts of trace elements especially boron, copper, iron, sulphur, zinc and with fair quantity of growth promoting substances. Integrated nutrient management involving both the organic and inorganic source is essential to realize higher yield potential. The information on the effect of integrated nutrient management on sweet pepper production and its seed quality is meager and scanty.

Sweet pepper as a new and promising crop in Bangladesh, production technology like, the use of cow dung are not yet standardized to compare the inorganic fertilizer. Considering the above facts, the present study was undertaken to investigate the Organic cultivation of sweet pepper using cow dung. The present study was undertaken with the following objectives:

i. To management on the growth and yield of sweet pepper. observe the effect of integrated nutrient

ii. To select the suitable ratio of inorganic and organic source of fertilizers.

CHAPTER II

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 researchers have been conducted on various cultural aspects of sweet pepper in different countries. Literature regarding the studies on organic cultivation of sweet pepper using cowdung is 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.

Islam et al (2017) conducted a field experiment on sweet pepper for yield and quality of fruits using different types of organic and inorganic fertilizers at the farm of Patuakhali Science and Technology University. Inorganic and organic fertilizers treatments were tested on California variety of sweet pepper. The fertilization treatments were T_1, (Urea +TSP+ MOP): (260 + 120 + 124) kg/ha; T_2, Cowdung: 9 t/ha; T_3, Poultry manure: 7 t/ha; T_4, (Urea + cowdung): (195kg +2.5 t/ha); T_5,(Urea + poultry manure): (180 kg + 2t/ha); T_6, (Urea + cowdung): (130kg + 4.5 t/ha); T_7 , (Urea + poultry manure): (140kg +3 t/ha);T8, Control: no manure and fertilizer. Obtained results showed that urea with cowdung (130kg + 4 t/ha)/; (T_6) , increased sweet pepper production. Combined application of urea with cowdung showed significant increase in leaves number per plant (174), leaf area (48.6 cm^2), root/canopy (15.2%), Plant fresh weight (378.5g), No. of fruits/plant (16.6), fruit length (9.9cm), fruit diameter (5.8cm), Average green fruit weight (142.1g), Average dry fruit weight (84.6g), yield/replicate (38.5Kg), no. of branching (10.6). Urea with cowdung influenced the total yield per replicate and extended the period of pepper fruit production compared to other treatments.

Alhrout (2017) was conducted a greenhouse experiment at Albalqa applied university research station in Jordan using randomized complete block design (RCBD) replicated four times. Three treatments were used using Randomized Complete Block Design (RCBD) with four replications: control (without fertilizer), chicken manure at the rate of 15 t/ha, and NPK (15:15:30) with trace elements at 100 Kg/ha. We evaluated plant height (cm), leaves number per plant, number of days to 50% flowering, fruit number per plant, fruit length, yield of fruit per plant (kg), and yield of fruit per hectare (t/ha). Treatments showed significant differences between. The NPK treatment gave the highest plant height (cm), leaves number per plant, fruits number per plant, yield of fruits per plant (kg), and yield of fruits per hectare (t/ha).

Alam *et al* (2016) an experiment was carried out at the on station research field of Agricultural Research Station, On-farm Research Division, Rangpur during 2014-15 and 2015-16 to investigate the effect of integrated nutrient management on the yield and quality of sweet pepper. There were six treatments: T1 = 100% RD ($N_{115}P_{70}K_{125}S_{20}Zn_2$ kg /ha), T2 = 75% RD + 5 t/ha CD, T3 = 75% RD + 5 t/h

CD Slurry, T4 = 75% RD + 3 t/h PM, T5 = 75% RD + 3 t/h PM Slurry, T6 = Native fertility. The tested variety was BARI Misti Morich-1. The experiment was laid out in randomize complete block design with 3 replications. Results revealed that the T5 (75% RD+ 3 tha-1 PM Slurry) produced the highest fruit yield (25.29 & 23.55 t/ha) and the lowest yield (16.34 & 17.10 t/h) was in control treatment (native fertility). An inclusion of 3 t PM Slurry/ ha with 75% RD can reduce 25% of chemical fertilizer. Integrated use of PM Slurry at the rate of 3 t/h with 75% RD was found as the best combinations in respect of sweet pepper yield and probable of enriching the soil organic matter.

Aguoru et al. (2015) carried out to compare the efficacy of cowdung and NPK fertilizer on the growth of cowpea (Vignaunguiculata), soya bean (Glycine max), tomato (Lycopersicon esculentum) and pepper (Capsicum frutescens). The treatments examined were 150g of cowdung, 130g of cowdung and 25g of NPK. For all experimental plants, cowpea under150 g cowdung treatments responded best, followed by 130g of cowdung. Soybean performance was enhanced by 150g and 130g cowdung while its least weight was recorded under NPK treatment. Tomato to which NPK soil was applied recorded the highest plant weight with the least value recorded under130g and 150g cowdung soil treatment. Performance of pepper was significantly low for all treatments. Therefore, cowdung has proven effective on the growth of cowpea, soybean, tomato and pepper. The implications of the findings in this work to agricultural enhancement in Nigeria and generally are discussed.

Shahein et al (2015) was conducted a plastic house experiment during the two successive seasons of 2013/2014 and 2014/2015, at organic farm in El-Aiat district, Giza Governorate, Egypt. This study aims to evaluate the organic production of two hybrids of sweet (bell) pepper using different sources of organic fertilizers under plastic house conditions. Five sources of organic fertilizers (quail, turkey chicken, rabbit manures and compost) as recommended dose of nitrogen for sweet pepper were investigated on vegetative growth, nutritional content, yield component and fruit quality of two hybrids of sweet pepper (Bunjii red fruit and Shunghi yellow fruit). Obtained results showed that using compost produced the highest values of plant height, N% of bell pepper plants, as well as the maximum early, total yield and fruit length. Applying compost and chicken manure produced the highest values of fruit weight, total soluble sold and vitamin C content of pepper fruits. Compost, chicken and turkey manure treatments gave the maximum number of leaves per plant and chlorophyll reading of pepper leaves, percent of P and K in plants, fruit diameter and number of fruits / plant. There were no significant differences among all organic fertilizer treatments in firmness of pepper fruits. Generally, Bunjii hybrid was superior in the most of tested parameters compared to Shunghi hybrid of pepper.

Kaeha *el at* , (2007) conducted a field experiment in Anand, Gujarat, India, during the kharii-rahi seasons of 2002-03 and 2003-04 to study the effects of levels of spacing (60 x *60 and 90 x 60* cm), castor *(Ricinus emnunis).* cake (0 and 1 t/ha) and N (100. 150, 200 and 250 kg / ha) on the green fruit yield of green chilli (C. *annun)* on a loamy sand soil. Transplanting chilli at the narrow spacing of 60 x 60 cm significantly decreased the number of secondary branches, green fruits per plant, plant height and green fruit yield compared to the wider spacing of 90 x 60 cm. Application of N at 150 kg / ha signiflcantly increased the growth, yield, and yield components compared to the control; on the other hand, it was at par with the 200 and 250 kg / ha treatments. Transplanting chilli at 60 x 60 cm spacing, applying castor cake at 1.0 t/ha including 150 kg N t / ha (C. *annun)*

Increased the green fruit yield. Hari el al. (2006) recommended the effects of nitrogen rate (50. 75 and 100%). In combination with neern cake (1 and 2 t / ha), poultry manure (5 and 10 t/ ha) and sheep manure (6 and 12 t / ha) on the yield and nutrient uptake of paprika (C. wlnwn) were determined in a field experiment conducted in Andhra Pradesh, India during the kharif season of 1998-2000. Application neem cake at 2 t/h in combination with 75% recommended nitrogen rate resulted in the highest dry pod yield (4.078 g), dry plant weight (141.67 g), N uptake (168.43 kg / ha) and K uptake (177.80 kg / ha. Whereas application of poultry manure at 10 t ha4 in combination with 75% recommended nitrogen fertilizer resulted in the highest P uptake (42.17 kg / ha) of the plant.

Ghoname *et al.* (2005) studied on the effects of differentN fertilizer sources, i.e. organic (chicken manure at 4 and 8 cm3). mineral (100-75-50 kg NPK / ha) and biofertilizer (rhizobacteria as commercial product called Microbin at 2 kg/greenhouse) on the growth and productivity of sweet pepper (C annum) grown on a sandy soil in a greenhouse. Application of organic fertilizer combined with bio fertilizer and mineral N resulted in vigorous plants growth, expressed as plant length, number of leaves and stems as well as shoots dry weight. In addition, it recorded the best values for total acidity, vitamin C content, total soluble solids percentage, dry matter and N, P, K, Fe, Mn, Zn, Cu, Ni and P contents of fruits.

Zhu et al (2005) was conducted a randomized-block greenhouse plot experiment on N utilization efficiency and N losses in intensive hot pepper (Capsicwn frutescens L..) production systems typical of commercial practice in Shouguang, snorthcast China. Cr01) yield and N utilization, soil mineral N dynamics and potential nitrate leaching losses were studied in control plots receiving no N fertilizer or organic manure and in experimental plots receiving 0,600, 1200 or 1800 kg urea-N / ha plus a basal dressing of 15 t / ha air dried poultry manure supplying 178 kg N / ha . Ammonia volatilization from the soil surface was monitored. A microplot was established in each of the plots receiving 1200 kg urea-N ha' (the local average commercial fertilizer N application rate). The urea applied to the microplot was labelled with 10 atom % I SN tracer and residual soil I 5N and 15N in harvested plant parts were determined. Previous intensive cropping led to a very high residual soil mineral N content (1117 kg N / ha) before the experiment began and control plots gave a satisfactory mean fruit yield of 5.7 t DM/ ha with no significant yield response to applied fertilizer and poultry manure. Only 10% of applied fertilizer N was recovered in the aboveground parts of the crop and about 52% was lost from the soil plant system. Substantial nitrate leaching losses occurred using the two highest fertilizer N application rates but there was little NFL volatilization from the soil surface.

Hasanuzzaman (1999) reported that sweet pepper is considered as minor vegetables in Bangladesh and its production statistics is not available. Application of 150 kg S/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 Prohhokar. 1982).

Kacha *et al* (2007) conducted a field experiment in Anand, Gujarat, India, during the kharii-rahi seasons of 2002-03 and 2003-04 to study the effects of levels of spacing (60 x *60 and 90 x 60* cm), castor *(Ricinus emnunis).* cake (0 and I t / ha) and N (100. 150, 200 and 250 kg / ha) on the green fruit yield of green chilli on a loamy sand soil. Transplanting chilli at the narrow spacing of 60 x 60 cm significantly decreased the number of secondary branches, green fruits per plant, plant height and green fruit yield compared to the wider spacing of 90 x 60 cm. Application of N at 150 kg / ha significantly increased the growth, yield, and yield components compared to the control; on the other hand, it was at par with the 200 and 250 kg ha treatments. Transplanting chilli at 60 x 60 cm spacing, applying castor cake at 1.0 t ha' including 150 kg N / ha increased the green fruit yield.

Aminifard *et al* (2012) carried out to evaluate response of paprika pepper (*Capsicum annum* L.) to nitrogen (N) fertilizer under field conditions. Nitrogen was supplied in four levels (0, 50, 100 and 150 kg / ha). Plant height, leaf chlorophyll content, fruit weight, yield, seed number, 1000 seed weight and vitamin C were assessed at immature and mature stages. The results showed that plant height, lateral stem length and leaf chlorophyll content were influenced by N fertilizer. Data indicated that fertilization with 50 g N / ha resulted to the best yield and quality components at ripening stage. Although, there was no significant difference in vitamin C content among treated plants with different nitrogen levels at mature stage, but significant differences were shown between treated plants and control. Thus, these results showed that fertilization with 50 kg N / ha had strong impact on vegetative and reproductive growth of paprika pepper under field conditions.

Ghonzeim *et al*, (2005) conducted on sweet pepper plants (cv. California Wonder) during the successive summer seasons of 2000 and 2001, in the Agricultural Experimental station, Alexandria University, at Abies. The objective of these experiments was to determine the effects of nitrogen rates (60, 90 and 120 kg / fed) and their application systems (three, four, five and six split applications), on vegetative growth, fruit yield and quality of sweet pepper. The obtained results indicated that increasing N applied rate was accompanied with significant increases in plant height, number of leaves, leaf area and dry mass plant -1m. Moreover, higher yield potential (yield / plant, number of fruits plant-1and average fruit weight-1) and better fruit quality (fruit dry matter, total soluble solids, ascorbic acid and k content) seemed to be associated with the application of 90 kg N / fed. Increasing number of split N applications up to six split doses, significantly, increased vegetative growth characters; plant height, number of leaves, leaf area and dry mass / plant. Leaf's N content, total fruit yield plant-1, number of fruits plant-1 and average fruit weight and some fruit quality characteristics were positively and significantly responded to the frequent N applications up to 5 or 6 doses. However, early yield was significantly decreased. Leaf's mineral contents (P and K) were not significantly affected. The interaction between N rates and their application systems reflected significant differences for most of the studied characters, and revealed that the rate of 90 Kg N / fed when applied at six split doses; at transplanting, 4, 6, 8, 10, and 12 weeks after transplanting, appeared to be the most efficient combination treatment, which favored the production of high yield with acceptable fruit quality.

CHAPTER III

MATERIALS AND METHODS

The experiment was conducted at the research farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka during November 2016 to March 2017 to integrated nutrient management practices on the growth and yield of sweet pepper.

3.1 Location of the experimental site

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

3.2 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 (15th October to 15th 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.

3.3 Characteristics of soil

Selected plot was medium high land located near the SAU administrative building . The soil of the experimental plot was silty clay loam in texture belonging to the Modhupur soil tract. Details of the soil characteristics have been presented in table 1and table 2.

Table 1.Morphological characteristics of experimental field

Mrphologica1 features	Characteristics
Location	Sher-e- Bangla Agricultural University Farm, Dhaka
AEZ No. and name	AEZ-28, Madhupur Tract
General soil type	Deep Red Brown Terrace Soil
Soil series	Tejgaon
Topography	Fairly leveled
Depth of Inundation	Above flood level
Land Type	High Land
Drainage condition	Well drained

Table2. Physical and chemical properties of the experimental soil

Soil properties	Value
A. Physical properties	
Particle size analysis	
% Sand	31.50
% Silt	39.34
% Clay	29.16
Soil texture	Silty clay loam
B. Chemical properties	
1.Soil pH	5.8
2.Organic carbon (%)	0.78
3.Organic matter (%)	1.34
4.Total **N (%)**	0.08
5.Available P (ppm)	20.5
6.Exchangeable K (m.eq/100g soil)	0.16
7.Available S (ppm)	18.00

3.4 Seeds and variety

BARI Mistimorich 1, a high yielding variety of capsicum *(Capsicum* annumn Lin.) developed by the scientist of the BARI (Bangladesh). It is found in our country cultivated for both commercial and domestic consuming purposes. Shiny green bell shaped fruits converted into red after reaping , average fruit weight 70-75 g, number of fruit per plant 5-6 , fruits can be harvested in 100-105 days low disease and insect infestation .seed rate (g/ha), 220-240 days of flowering , 50-60. No risk if sown/planted at optimum time and/with proper management.

3.5 Collection of seedlings

Seedlings of 20-25 days old were collected from horticulture centre Asad Gate Dhaka . Variety was BARI Mistimorich 1.

3.6 Treatments under investigation

There was one factor in the experiment namely fertilizer levels as mentioned below:

Factor-A: Fertilizer -7

$\mathbf{T_0}$ = No chemical fertilizer

$\mathbf{T_1}$ **=** 120 kg N from urea + PKS

$\mathbf{T_2}$ **=** 100 kg N /ha from urea + 20kg N from cowdung + PKS

$\mathbf{T_3}$ **=** 80kg N /ha from urea + 40kg N from cowdung + PKS

T_4 = 60kg N /ha from urea + 60kg N from cowdung + PKS

T_5 = 40kg N /ha from urea+80kg N from cowdung + PKS

T_6 = 20kg N /ha from urea + 100kg N from cowdung + PKS

T_7 = all organic (120kgN from cowdung)

Here, P = 65 kg/ha, K = 100 kg /ha, S = 20 kg/ha

Recomended NPS was applied using Triple Super phosphate Murate of potash and Gypsum P@65kg/ha, K@100kg/ha, S@20kg/ha respectively.

- ❖ Cowdung was applied in experimental plot as per treatment and amount of cowdung was calculated considering the percentage of nitrogen present in cowdung was 1 percent.

3.7 Experimental design and layout

The experiment was laid out in a one factors Randomized Complete Block Design (RCBD) design having three replications. Each replication had 8 unit plots to which the treatment combinations were assigned randomly. The unit plot size was 7.7 m^2 (2.2 m ×3.5m). The blocks and unit plots were separated by 0.5 m and 0.50 m spacing respectively. The layout of the experiment is presented below.

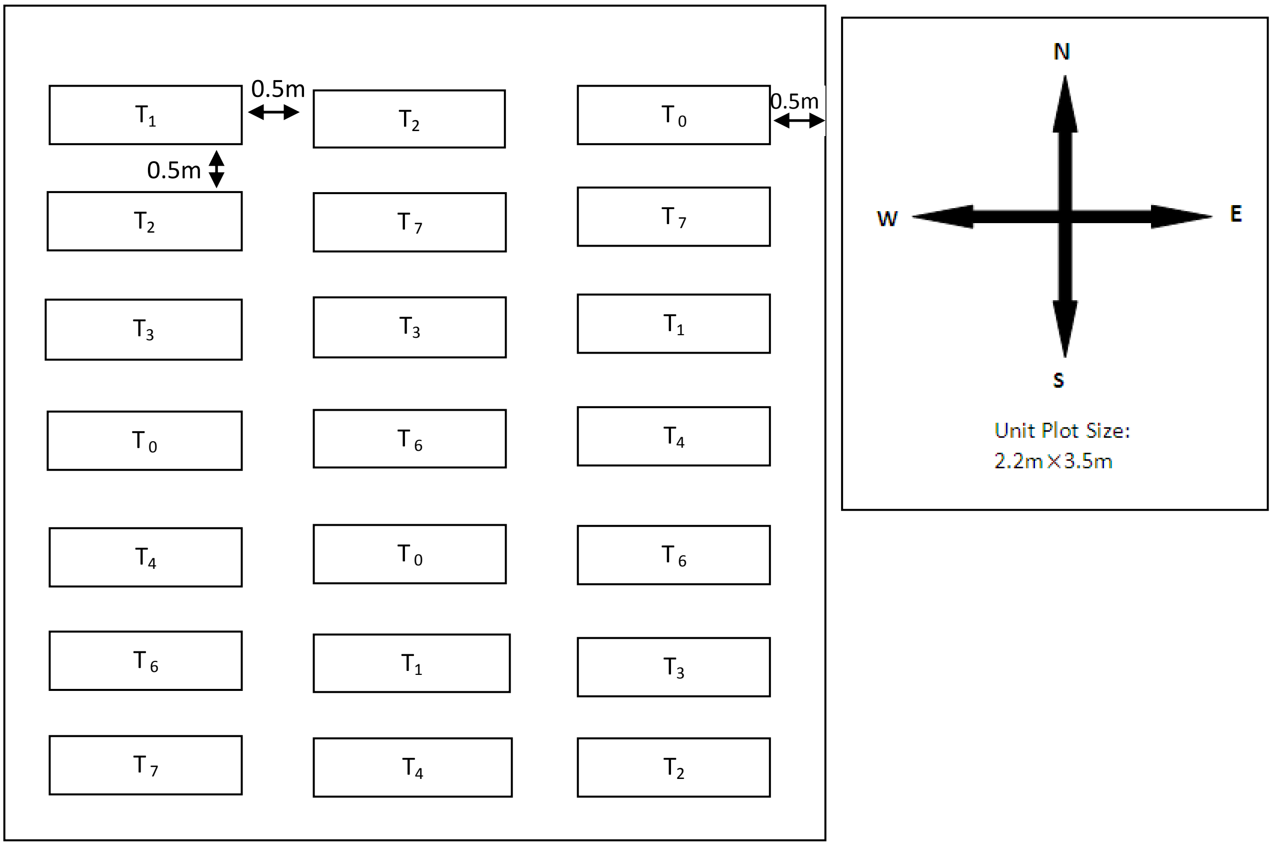

Fig.1. Layout of the Experimental Plot

3.8 Preparation of the experimental field

The selected field for growing sweet pepper was first opened at 4th November, 2016 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.

3.9 Application of manure and fertilizers

The P, K and S fertilizers were applied according to Fertilizer Recommendation Guide (BARC, 2012) through triple super phosphate (TSP), murate of potash (MoP) and Gypsum, respectively. One third (1/3) of whole amount of Urea and full amount of MoP, TSP and Gypsum were applied at the time of final land preparation for each treatment. The remaining Urea was top dressed in two equal installments- at 20 days after transplanting (DAT) and 50 DAT respectively. The organic fertilizers under different treatments were applied in the experimental plot during final land preparation.

3.10 Transplanting of seedlings

Healthy and uniform sized seedlings were transplanted in the experimental field on 4th December, 2016. Transplanting was carried out during the late afternoon providing one seedling in each hole and 15 plants each plot. The seedlings were watered late hours in the evening. Seedlings were also planted around the experimental area to check the border effect.

3.11 Gap filling and weeding

When the seedlings were established, the soil around the base of each seedling was pulverized. A few gaps filling were done by healthy plants from the border whenever it was required. Weeds of different types were controlled manually for the first time and removed from the field on 16 December 2016. Second and third weeding were done on 30 December 2016 and 21 January 2017, respectively.

3.12 Irrigation

Three irrigations were done. The first irrigation was given in the field on 18 December2016 at 20 days after transplanting (DAT) through irrigation channel. The second irrigation was given at the stage of maximum vegetative growth stage (35 DAT) on 2January 2017. The final irrigation was given at the stage of fruit formation (55 DAT) on21 January 2017.

3.13 Pest management

The crop was infested with cutworm, leaf hopper and others. The insects were controlled successfully by spraying Malathion 57 EC @ 2 mlL^{-1}water. The insecticide *was* sprayed fortnightly from a week after transplanting to a week before first harvesting. Mind 3-GNwas also applied during final land preparation as soil amendments. During foggy weather precautionary measures against disease infestation especially late blights of tomato was taken by spraying Dithane M-45 fortnightly @2 g $L^{-1}$of water.

3.14 Harvesting

Fruits were harvested at 8 days intervals during maturity to ripening stage. The maturity of the crop was determined on the basis of size of fruits. Harvesting was started from 8 March 2017 and completed by 31 March 2017.

3.15 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 final harvest.

Number of branch per plant

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

Fruit length (cm)

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

Fruit diameter (cm)

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

Number of fruits per plant

Number of pods per plant was counted from each selected plant sample and then averaged at harvest.

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.

Yield of fruits per plot (kg)

A per scale balance was used to take the weight of fruits per plot. It was measured by totaling the fruit yield of each unit plot separately during the period from fruit to final harvest and was recorded in kilogram (kg).

Yield of fruits per hectare (ton)

It was measured by the following formula

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

3.16 Post harvest soil sampling

After harvest of crop soil samples were collected from each plot at a depth of 0 to 15 cm. Soil sample of each plot were air-dried, crushed and passed through a two mm (10 meshes) sieve. The soil samples were kept in plastic container to determine the physical and chemical properties of soil.

3.17 Soil analysis

Soil samples were analyzed for both physical and chemical characteristics viz. organic matter, pH, total N and available P and exchangeable K contents. The soil samples were analyzed by the following standard methods as follows:

3.17.1 Organic matter

Organic carbon in soil sample was determined by wet oxidation method. The underlying principle was used to oxidize the organic matter with an excess of 1N $K_2Cr_20_7$ in presence of conc. H_2SO_4 and conc. H_3PO_4 and to titrate the excess $K_2Cr_20_7$ solution with 1N $FeSO_{4.}$ To obtain the content of organic matter was calculated by multiplying the percent organic carbon by 1.73 (Van Bemmelen factor) and the results were expressed in percentage (Page *et al.*, 1982).

3.17.2 Total nitrogen

Total N content of soil were determined followed by the Micro Kjeldahl method. One gram of oven dry ground soil sample was taken into micro kjeldahl flask to which 1.1 gm catalyst mixture (K_2SO_4: $CuSO_4$. $5H_2O$: Se in the ratio of 100: 10:

1), and 7 ml H_2SO_4 were added. The flasks were swirled and heated 160 ^{0}C and added 2 ml H_2O_2 and then heating at 360 ^{0}C was continued until the digest was clear and colorless. After cooling, the content was taken into 50 ml volumetric flask and the volume was made up to the mark with distilled water. A reagent blank was prepared in a similar manner. These digests were used for nitrogen determination (Page *et al*., 1982).

Then 20 ml digest solution was transferred into the distillation flask, Then 10 ml of H_3BO_3 indicator solution was taken into a 250 ml conical flask which is marked to indicate a volume of 50 ml and placed the flask under the condenser outlet of the distillation apparatus so that the delivery end dipped in the acid. Add sufficient amount of 10N-NaOH solutions in the container connecting with distillation apparatus. Water runs through the condenser of distillation apparatus was checked. Operating switch of the distillation apparatus collected the distillate. The conical flask was removed by washing the delivery outlet of the distillation apparatus with distilled water.

Finally the distillates were titrated with standard 0.01 N H_2SO_4 until the color changes from green to pink.

The amount of N was calculated using the following formula:

$$\% N = (T-B) \times N \times 0.014 \times 100 / S$$

Where,

T = Sample titration (ml) value of standard H_2SO_4

B = Blank titration (ml) value of standard H_2SO_4

N = Strength of H_2SO_4

S = Sample weight in gram

3.17.3 Available phosphorus

Available P was extracted from the soil with 0.5 M $NaHCO_3$ solutions, pH8.5 (Olsen *et al.*, 1954). Phosphorus in the extract was then determined by developing blue color with reduction of phosphomolybdate complex and the color intensity were measured colorimetrically at 660 nm wavelength and readings were calibrated the standard P curve (Page *et al*. 1982).

3.17.4 Available potassium

Exchangeable K was determined by 1N NH_4OAc (pH 7) extraction methods and by using flame photometer and calibrated with a standard curve (Page *et al*. 1982).

3.18 Data analysis technique

The collected data were compiled and analyzed statistically using the analysis of variance (ANOVA) technique with the help of a computer package program MSTAT-C and the mean differences were adjusted by Least Significance Difference (LSD) test (Gomez & Gomez, 1986).

CHAPTER IV

RESULTS AND DISCUSSION

The experiment was conducted to investigate the integrated nutrient management practices of sweet pepper cultivation using cowdund and urea. Data on different parameters were analyzed statistically. The result of the present study have been presented and discussed in this chapter under the following heading:

4.1. Plant height

The effects of integrated nutrient management practices on plant height at harvest were significant. The tallest plant (46.00 cm) was produced in T_2 (100 kg N /ha from urea + 20kg N/ha from cowdund + PKS). The lowest plant height (24.33 cm) was produced under control treatment. This increase was possibly due to readily available N from inorganic fertilizer than other manures. Nitrogen from urea and slow release cowdund might have encouraged more vegetative growth and development of the plant at later stage of growth. Salam (2001) showed that N 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 N was increased.

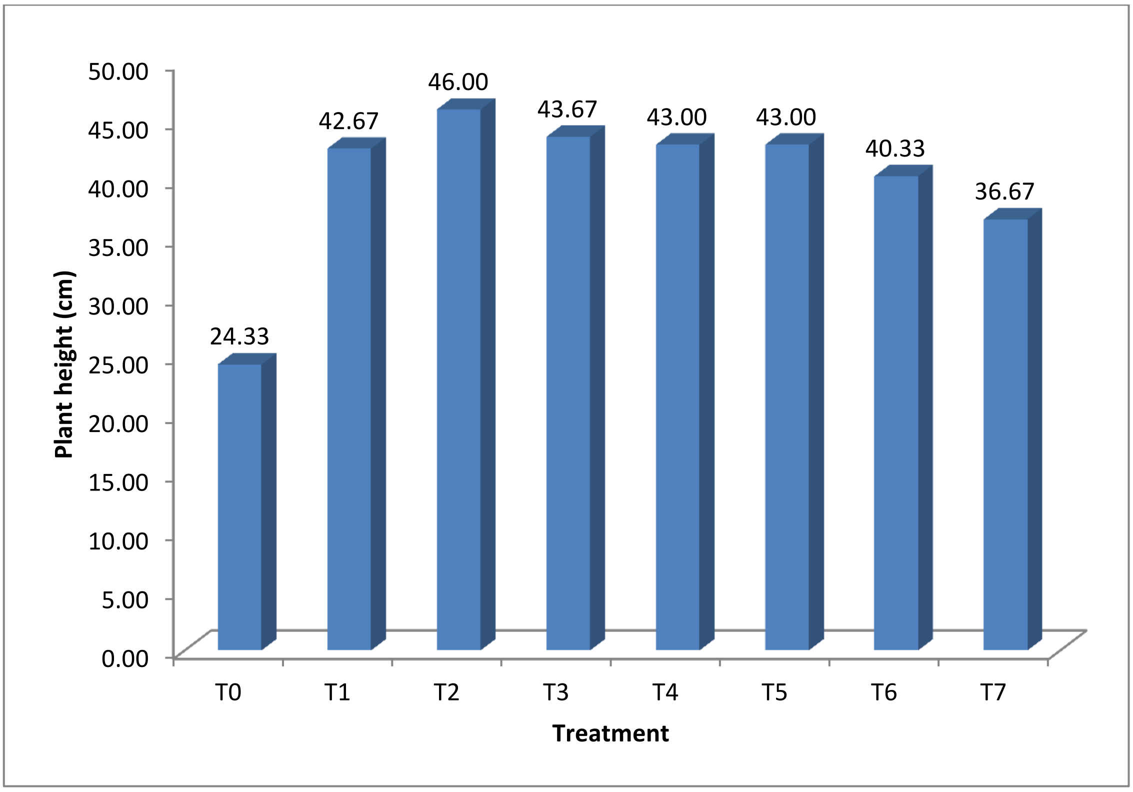

Fig.2. Effect of integrated use of urea and cowdund on plant height of sweet Pepper

$\mathbf{T_0}$ =No chemical fertilizer

$\mathbf{T_1}$ = 120 kg N from urea + PKS

$\mathbf{T_2}$ = 100 kg N /ha from urea+20kg N from cowdund + PKS

$\mathbf{T_3}$ = 80kg N /ha from urea+40kg N from cowdund + PKS

$\mathbf{T_4}$ = 60kg N /ha from urea+60kg N from cowdund + PKS

$\mathbf{T_5}$ = 40kg N /ha from urea+80kg N from cowdund + PKS

$\mathbf{T_6}$ = 20kg N /ha from urea+100kg N from cowdund + PKS

$\mathbf{T_7}$ = all organic (120kgN from cowdund)

4.2 Number of branch per plant

Number of branch per plant was statistically influenced by integrated nutrient management (Fig. 3). The maximum number of branch per plant (10.23) was produced from $T_{2,}$ which was statistically similar with T_1, T_3 and T_6. The minimum number of branch per plant (6.67) was produced form T_0 (control) treatment.

4.3 Fruit length

Fruit length was statistically influenced by levels of integrated nutrient management (Table 3). The highest fruit length (9.53cm) was found with T_2 treatment which was statistically similar with T_1 T_3 and T_7 treatments and the lowest fruit length (5.50 cm) was found in control treatment. Length of fruit increased gradually with the increase of nitrogen dose. For the reason of higher availability of nitrogen and their uptake by plant that sequentially increased the length of fruit.

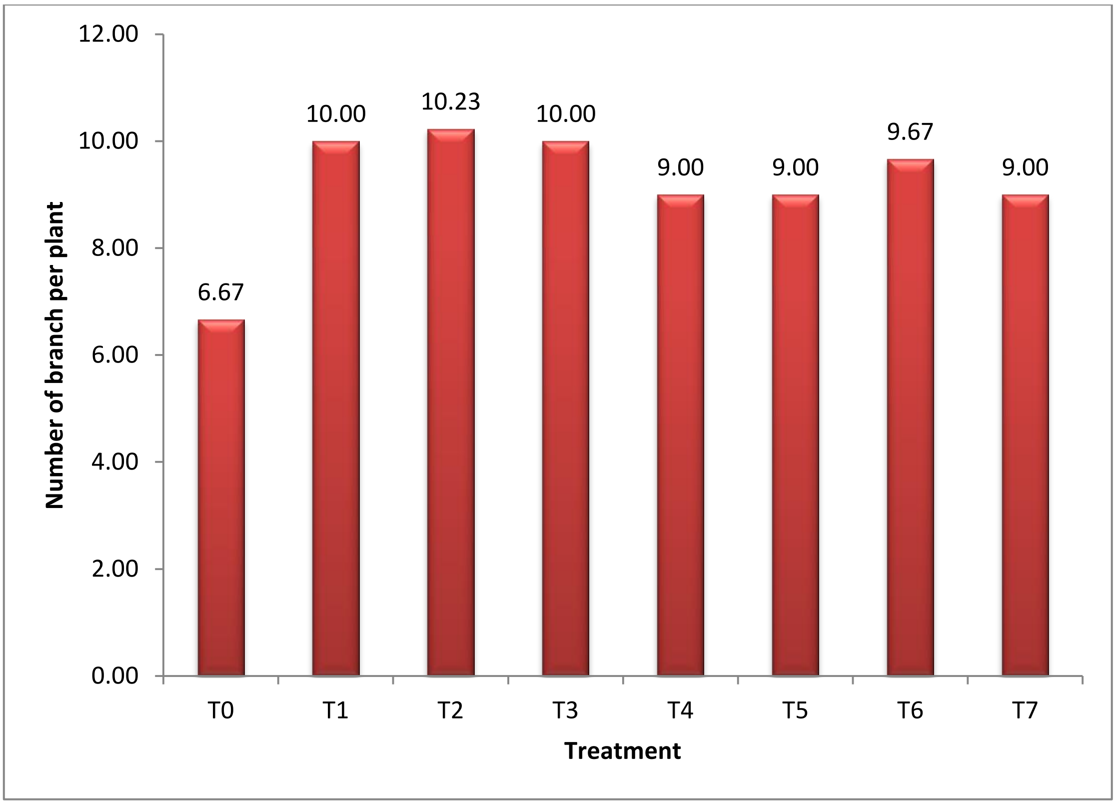

Fig.3. Effect of integrated use of urea and cowdund on number branch per plant of sweet pepper

T_0 = No chemical fertilizer

T_1 = 120 kg N from urea + PKS

T_2 = 100 kg N /ha from urea+20kg N from cowdund + PKS

T_3 = 80kg N /ha from urea+40kg N from cowdund + PKS

T_4 = 60kg N /ha from urea+60kg N from cowdund + PKS

T_5 = 40kg N /ha from urea+80kg N from cowdund + PKS

T_6 = 20kg N /ha from urea+100kg N from cowdund + PKS

T_7 = all organic (120kgN from cowdund)

Table3. Effect of integrated use of urea and cowdund on Length and diameter of fruit of sweet pepper

Treatment	Length of fruit (cm)	Diameter of fruit (cm)
T_0	5.50 d	5.00 d
T_1	8.83 ab	9.33 a
T_2	9.53 a	9.50 a
T_3	9.17 ab	7.50 c
T_4	8.03 c	8.63 b
T_5	7.97 c	7.67 c
T_6	8.50 bc	8.00 c
T_7	8.83 ab	9.13 ab
LSD $_{(0.05)}$	0.71	0.56
CV (%)	11.84	7.98

T_0=No chemical fertilizer

T_1= 120 kg N from urea + PKS

T_2= 100 kg N /ha from urea+20kg N from cowdund +PKS

T_3=80kg N /ha from urea+40kg N from cowdund +PKS

T_4=60kg N /ha from urea+60kg N from cowdund + PKS

T_5=40kg N /ha from urea+80kg N from cowdund +PKS

T_6=20kg N /ha from urea+100kg N from cowdund + PKS

T_7=all organic (120kgN from cowdund)

4.4 Diameter of fruit

Diameter of fruit was found to be statistically influenced by levels of integrated nutrient management practice (Table 3). The highest diameter of fruit (5.00 cm) was found from T_2 treatment, which was statistically similar with T_1 andT_7 treatments and the lowest diameter of fruit (5.00 cm), was found from control treatment. Mary *et al* (1990) found that the greatest fruit length and girth obtained from plants receiving the highest rates (N - 87.5 kg had and 1(20-52.5 kg had) and irrigated at 0.75 1W: CPE ratio.

4.5 Number of fruit per plant

From the table 4 it was observed that there was a statistical variation in number of fruit per plant due to integrated nutrient management. Results showed that highest number of fruit per plant was obtained (13.33) from T_2 treatment, which was very close with T_1 treatment. The lowest number of fruit per plant (5.33) was found from control treatment. Gradual adequate supply of N form cowdund contributed to fruit formation which probably increased number of fruit per plant with increasing urea level. Application of 100 kg N in combination with 25 kg P/ ha recorded the highest number of fruits plant1 (Pundit and Porwal *et al*, 1999). Nitrogen fertilization improved plant growth, but did not influence fruiting time. Moderate nitrogen applications (150 kg N ha^{-1}) gave best yields in most field trials (Vos *et al***,** 1997). This investigation was supported by Sharma *et at* (1996): Das *et at* (1992); Mishriky *et al* (1994); Ingle *et al* (1992); Shrivastava *et at* (1996). Nitrogen at 240 kg/ ha + P at 180 kg /ha produced the highest mean number of fruits per plant (7.51) (Srinivasan *et al.*, 1997). It has been observed that fruit per plant decreased gradually with the increasing rate of manure. Bottini (1967) reported that in soils containing abundant organic matter, application of P and K at 100 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° C and lower night temperature of 18°C, the number of fruits produced per plant were 6.6 and 12.6 respectively.

4.6 Individual fruit weight

Individual fruit weight was measured and found significant variation with the different level of integrated nutrient management (Table 4). The highest individual fruit weight (80.03 g) was found with T_2 treatment, which was statistically similar with T_1 treatment and at the same time the lowest individual fruit weight (38.60 g) was observed in control treatment. Average fruit weight per plant increased gradually with the increase of N dose. Table 4 shows that treatment with lower doses of manure produced fruits those are low in weight. Doss *et al.* (1981) reported that average yield from the lower N rate were greater than the higher N rate. Fisher (1969) observed that heavy dressings of N reduced the number of truss, the flowers per plant and the number of fruit set.

Table 4. Effect of integrated use of urea and cowdund on yield and yield contributing character of sweet pepper

Treatment	Number of fruit per plant	Individual fruit weight (g)	Yield per plant (kg)	Yield per plot (kg)	Yield (t/ha)
T_0	5.33 b	38.60 c	0.21 d	3.09 e	4.01 f
T_1	12.00 a	75.04 a	0.90 ab	13.51 b	17.54 b
T_2	13.33 a	80.03 a	1.07 a	16.00 a	20.78 a
T_3	11.67 ab	67.04 b	0.78 b	11.74 bc	15.24 c
T_4	10.33 ab	64.48 b	0.67 bc	9.99 c	12.98 d
T_5	10.00 ab	64.63 b	0.65 bc	9.69 c	12.59 d
T_6	8.33 ab	64.29 b	0.54 c	8.04 cd	10.44 e
T_7	8.00 ab	61.79 b	0.49 cd	7.41 d	9.63 ef
$LSD_{(0.05)}$	5.81	7.84	0.23	2.06	2.62
CV (%)	7.03	6.83	7.85	8.78	6.87

T_0 = No chemical fertilizer

T_1= 120 kg N from urea + PKS

T_2= 100 kg N /ha from urea+20kg N from cowdund + PKS

T_3= 80kg N /ha from urea+40kg N from cowdund + PKS

T_4= 60kg N /ha from urea+60kg N from cowdund + PKS

T_5= 40kg N /ha from urea+80kg N from cowdund + PKS

T_6= 20kg N /ha from urea+100kg N from cowdund + PKS

T_7= all organic (120kg N from cowdund)

4.7 Fruit yield (kg/plant)

Fruit yield was varied significantly due to the different levels of integrated nutrient management (Table 4). The maximum fruit yield (1.07 kg/plant) was produced from T_2 treatment. The minimum fruit yield (0.21 kg/plant) was produced from control treatment. Adequate amount of N application probably favoured to yield components i.e. fruit length, and number of fruit which ultimately gave higher fruit yield. This result was found by Hasanuzzaman (1999). With the increase of nitrogen fertilization the fruit yield increased up to a certain level (Hasan, 1978). The N and P treatment showed that 120 kg N + 60 kg P /ha gave significantly higher yield than the other combinations (Srivastava *et al.*, 2003).

4.8 Yield per plot (kg/plot)

Fruit yield per plot was varied significantly due to the levels of different integrated nutrient management (Table 4). The maximum fruit yield (16.00 kg/plot) was produced from T_2 treatment, which was statistically similar with T_1 and T_4 treatment. The minimum fruit yield (3.09 kg/plot) was produced from control treatment. Adequate amount of nitrogen application probably favoured to yield components i.e. fruit length, and number of fruit which ultimately gave higher fruit yield.

4.9 Yield (t/ha)

Fruit yield (t/ha) was varied significantly due to the different levels of integrated nutrient management (Table 4). The maximum fruit yield (20.78 t/ha) was produced from T_2 treatment. The minimum fruit yield (4.01 t/ha) was produced from control treatment. Adequate amount of nitrogen application probably favoured to yield components i.e. fruit length, and number of fruit which ultimately gave higher fruit yield. This result was found by Hasanuzzaman (1999). With the increase of nitrogen fertilization the fruit yield increased up to a certain level (Hasan, 1978). The N and P treatment showed that 120 kg N + 60 kg P/ ha gave significantly higher yield than the other combinations (Srivastava *et al.*, 2003).

4.10 Analysis of post-harvest soil

4.10.1. Organic matter in post-harvest soil

Organic matter in post-harvest soil showed statistically significant variation due to different treatments of urea with cowdung. The highest organic matter in post-harvest soil (1.851 %) was recorded from T_7, whereas the lowest organic matter (1.37%) was observed from T_0 (control) treatment (Table 5).

Table 5. Effect of integrated nutrient management on nutrient content in post-harvest soil

Treatment	Organic matter (%)		Total N (%)		Available P (ppm)		Exchangeable K (m.eq./ 100g of soil)	
T_0	1.370	g	0.07	c	8.97	c	0.121	d
T_1	1.420	f	0.07	c	11.08	bc	0.133	cd
T_2	1.600	c	0.08	bc	12.54	bc	0.150	ab
T_3	1.530	d	0.07	c	13.47	b	0.154	a
T_4	1.480	e	0.10	a	17.52	a	0.162	a
T_5	1.650	ab	0.08	bc	20.24	a	0.139	c
T_6	1.660	b	0.08	bc	17.34	a	0.140	bc
T_7	1.851	a	0.09	ab	20.13	a	0.153	a
$LSD_{(0.05)}$	0.123		0.02		3.62		0.016	
CV (%)	9.560		5.80		13.85		3.92	

T_0 = No chemical fertilizer

T_1 = 120 kg N from urea + PKS

T_2 = 100 kg N /ha from urea+20kg N from cowdund +PKS

T_3 = 80kg N /ha from urea+40kg N from cowdund +PKS

T_4 = 60kg N /ha from urea+60kg N from cowdund +PKS

T_5 = 40kg N /ha from urea+80kg N from cowdund +PKS

T_6 = 20kg N /ha from urea+100kg N from cowdund +PKS

T_7 = all organic (120kgN from cowdund)

4.10.2.Total Nitrogen content in post-harvest soil

There *was* significant difference among the different treatments of N with cowdund in respect of total N content in post-harvest soil (Table 5). The highest total N content in post-harvest soil was 0.103% from T_4 treatment. The lowest N content in post-harvest soil (0.071%) was found in control treatment. The result revealed that nitrogen content in post-harvest soil was increased with increasing rate of nitrogen and organic manure.

4.10.3. Available Phosphorus content in post-harvest soil

There was significant difference among the different treatments of integrated nutrient management on available P content in post-harvest soil (Table 5). Maximum available P content of 20.24ppm was found in T_5 treatment, which was statistically similar with $T_{4,}$ T_6 and T_7 and the minimum available P content in post-harvest soil (8.97ppm) was recorded in control treatment.

4.10.4. Potassium content in post-harvest soil

There was significant difference among the different treatments of N with cowdund in respect of exchangeable K content in post-harvest soil (Table 5). The highest exchangeable K content in post-harvest soil (0.162 m.eq /100gm 0f soil) was produced in T_4 (60 kg N /ha from urea+60kg N/ha from cowdund). The lowest K content in post-harvest soil (0.121 m.eq./100g soil) was produced under control treatment.

CHAPTER V

SUMMERY AND CONCLUSIONS

The experiment was conducted at the research farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka during November 2016 to March 2017 under integrated nutrient management practices on the growth and yield of sweet pepper. The experimental treatments included T_0=No chemical fertilizer, T_1 = 120 kg N from urea + PKS, T_2 = 100 kg N /ha from urea + 20kg N from cowdung + PKS, T_3=80kg N /ha from urea+40kg N from cowdung + PKS, T_4 = 60kg N/ha from urea+60kg N from cowdung + PKS, T_5 = 40kg N/ha from urea + 80 kg N from cowdung + PKS, T_6 = 20kg N/ha from urea+100kg N from cowdung + PKS, T_7 = all organic (120kg N from cowdung). The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications.

The effects of nutrient management practices were evident at harvest recorded significantly influenced on plant height. The tallest plant (46.00 cm) was produced in T_2 (100 kg N /ha from urea + 20 kg N from cowdung + PKS). Number of branch per plant was statistically influenced by the urea and cowdung. The maximum number of branch per plant (10.23) was recorded in the T_2 treatment. Fruit length was statistically influenced by the levels of urea with cowdung. The highest length of fruit (9.53cm) was produced from T_2 treatment. Diameter of fruit was found to be statistically influenced by the levels of urea with cowdung. The highest diameter of fruit (9.50cm) was found in T_2 treatment.

There was a statistical variation in number of fruit per plant due to urea with cowdung. Results showed that highest number of fruit per plant was obtained (13.33) from T_2 treatment. Individual fruit weight was measured and found significant differences due to the different levels of nitrogen with cowdung. The highest individual fruit weight (80.03 g) was found with T_2 treatment. Fruit yield was varied significantly due to the levels of different urea with cowdung. The maximum fruit yield (1.07 kg/plant) was produced from T_2 treatment. The minimum fruit yield (0.21 kg/plant) was produced from control treatment. Fruit yield per plot was varied significantly due to the levels of different integrated nutrient management. The maximum fruit yield (16.00 kg/plant) was produced from T_2 treatment, which was statistically similar with T_1 and T_4. The minimum fruit yield (3.09 kg/plot) was produced from control treatment. Fruit yield (t/ha) was varied significantly due to the levels of different integrated nutrient management. The maximum fruit yield (20.78 t/ha) was produced from T_2 treatment. The minimum fruit yield (4.01 t/ha) was produced from control treatment.

There was significant difference among the different treatments of N with cowdung in respect of N content in the post harvest soil. The highest N content in post harvest soil was 0.103% in the T_4 treatment. There were significant difference among the different treatments of N in respect of P content in post harvest soil. Maximum P content of 20.24% was found in T_5 treatment. There were significant difference among the different treatments of urea with cowdung in respect of K content in post harvest soil. The highest K content in post harvest soil (0.163) was produced in T_4 (100 kg N /ha from urea+20kg N from cowdung +PKS).

In conclusion it could be suggested that BARI Mistimorich 1 with 100 kg N /ha from urea and 20 kg N/ha from urea+20kg N from cowdung was found to be a promising practice for good yield. However, to reach a specific conclusion and recommendation, more research work on variety, level of different nutrient management should be done over different Agro-ecological zones.

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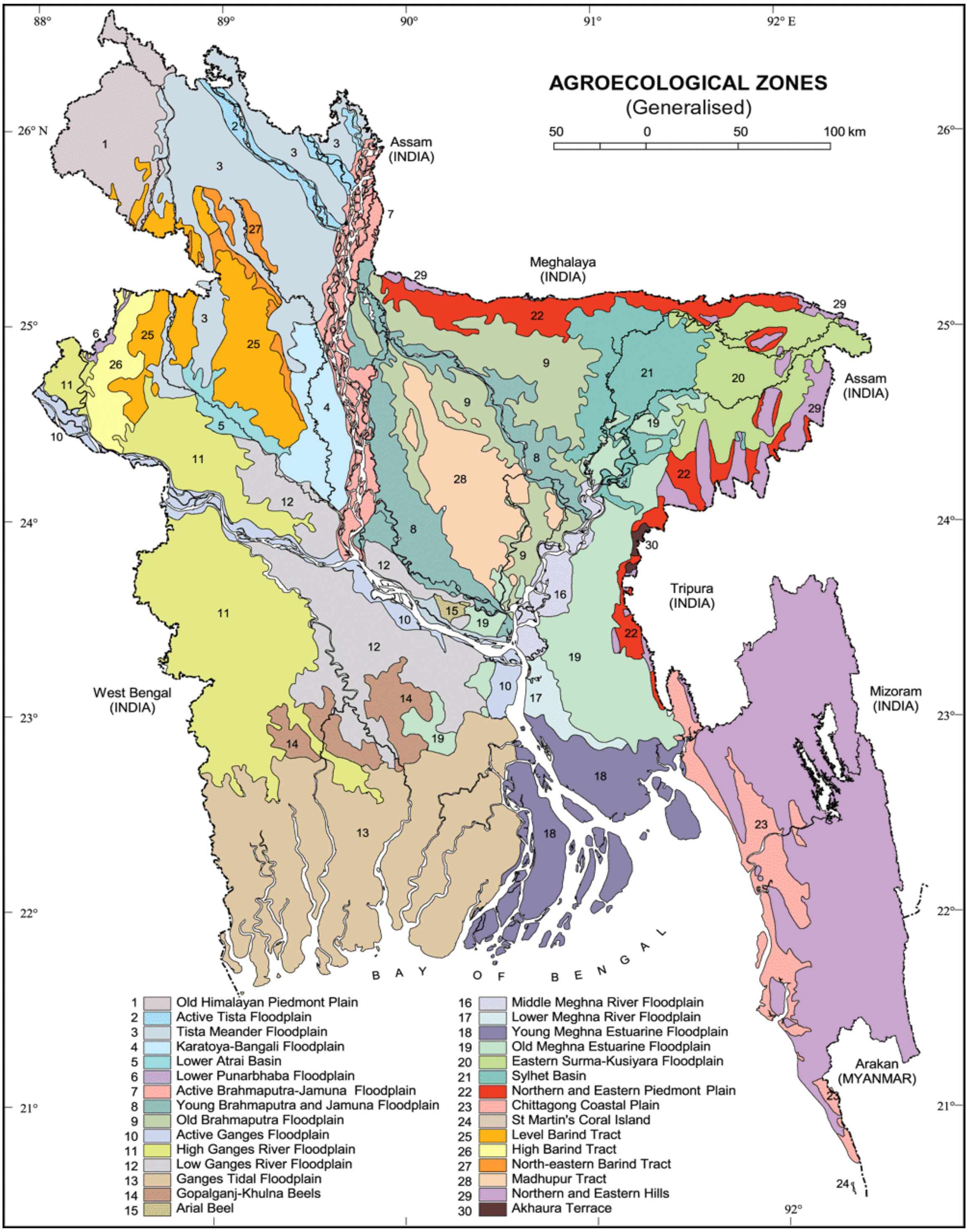
APPENDICES

Appendix I: Experimental location on the map of Agro-Ecological Zones of Bangladesh



Appendix II: Analysis of variance of the data on Plant height, Number of branch per plant, Length of fruit and Diameter of fruit of sweet pepper as influenced of nitrogen and cowdung

Source	Degrees of Freedom	Mean Square			
		Plant height (cm)	Number of branch per plant	Length of fruit (cm)	Diameter of fruit (cm)
Replication	2	18.667	140.29	0.292	1.868
Factor A	7	333.28*	141.95*	3.714*	4.673*
Error	14	0.01	43.196	1.054	0.965

*significant at 5% level of probability

Appendix III: Analysis of variance of the data on Number of fruit per plant, Individual fruit weight and yield of sweet pepper as influenced of nitrogen and cowdung

Source	**Degrees of Freedom**	**Mean Square**		
		Number of fruit per plant	**Individual fruit weight (g)**	**Yield per plant (kg)**
Replication	2	0.728	315.5	369.96
Factor A	7	6.429*	17.31*	499.06*
Error	14	1.104	21.024	120.02

*significant at 5% level of probability