EFFECT OF ORGANIC MANURES AND NITROGEN ON THE GROWTH AND YIELD OF BRINJAL (*Solanum melongena* L.)

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CERTIFICATE

This is to certify that the thesis entitled, *"EFFECT OF ORGANIC MANURES AND NITROGEN ON THE GROWTH AND YIELD OF BRINJAL (Solanum melongena L.)"* 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. MIJANUR RAHMAN,* Registration No. *26202/00494* 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 been duly acknowledged by him.

Dated:

Place: Dhaka, Bangladesh

Md. Hasanuzzaman Akand
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Dedicated to my
beloved parents

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The author dedicated this manuscript to his beloved parents.

The author

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LIST OF ABBREVIATIONS

FULL NAME	ABBREVIATION
Agro-ecological zone	AEZ
And others (at elli)	*et al.*
Bangladesh Bureau of Statistics	BBS
Centimeter	cm
Degree Celsius	^{0}C
Duncan's Multiple Range Test	DMRT
Dounum	Da
Date After Transplanting	DAT
Etcetera	etc
Food and Agricultural Organization	FAO
Gram	g
Hectare	ha
Hour	hr
Kilogram	kg
Meter	m
Millimeter	mm
Month	mo
Muriate of Potash	MP
Number	no
Percent	%
Randomized Complete Block Design	RCBC
Sher-e-Bangla Agricultural University	SAU
Square meter	m^2
Triple Super Phosphate	TSP
United Nations Development Program	UNDP

EFFECT OF ORGANIC MANURES AND NITROGEN ON THE GROWTH AND YIELD OF BRINJAL (*Solanum melongena* L.)

ABSTRACT

Brinjal (*Solanum melongena* L.) is one of the most important vegetable crops in terms of both acreage and production in Bangladesh and widely cultivated throughout the country. The experiment was carried out during the period from March to October 2006 at Sher-e-Bangla Agricultural University, Dhaka to find out the effect of organic manures and different levels of nitrogen on the growth and yield of brinjal. There were three nitrogen levels, N_0 (control): No nitrogen, N_1: 100 kg nitrogen/ha and N_2: 150 kg nitrogen/ha and three different treatments of manures; M_0 (Control): No manure, M_1: 10 ton cowdung /ha and M_2: 3 ton poultry litter/ha. The experiment was laid out in a randomized complete block design (RCBD) with three replications. Increasing the dose of nitrogen increased the plant height, number of leaves, days to first flowering, number of flower, number of fruit, length and diameter of fruit, weight of individual fruit, total yield of fruit per plant and number of fruit per plant. Plant height (45.18 cm), number of leaves (93.0), length (13.70) and diameter of fruit (4.0), number of fruit per plant (17.8), weight of individual fruit (88.92 g) and total weight of fruit per plant (1602.1 g) was the highest in M_1. M_1 gave the highest yield than M_2 and M_0 (control). The combined effect of M_1 and N_2 produced the highest yield (30.20 ton/ha) of brinjal. Maximizing the yield of brinjal besides organic manures inorganic fertilizer (nitrogen) needed to be used.

CHAPTER I

Introduction

INTRODUCTION

Brinjal or Eggplant (*Solanum melongena* L.) is one of the most common popular vegetable grown in Bangladesh and other parts of the world. It belongs to the family Solanaceae. It is grown extensively in India, China, Pakistan and the Philippines. It is also a popular vegetable crop in France, Italy, USA, Mediterranean and Balkan areas (Bose and Som, 1986).

Brinjal is locally known as "Begoon" and its early name is Aubergine or eggplant. It is thought to be originated in Indian sub-continent because of maximum genetic diversity and closely related species of *Solanum* are grown in this region (Zeven and Zhukovesky, 1975).

There are several varieties of brinjal grown in our country, such as Kazla, Zhumka, Nayantara, Islampuri, Uttara, Khotkhotia, Singnath, Luffa (BAU), Luffa (elongated), Luffa (Black), Luffa (white), Bholanath, Dohajari, ISD-006, China EG-190, Dhundul etc. All the varieties are not high yielding, some high yielding varieties in our country are BARI Begun-2 (Tarapuri), BARI Begun-4 (Kazla), BARI Begun-5 (Nayantara).

Brinjal is the second most important vegetable crop next to potato in Bangladesh in respect of acreage and production (BBS, 2005). The total area of brinjal cultivation is 60100 hectare where 22500 ha is grown in Kharif season (summer) and 37500 ha in Rabi season (winter) with a total annual production of 358400 mt (BBS, 2005). It is grown round the year both as Rabi and Kharif crops (Rashid, 1993).

Brinjal has been a staple vegetable in our diet since ancient times. It is quite high in nutritive value. Brinjal contains 92.7% moisture, 1.4 g protein, 0.3 fat, 0.3 g minerals, 4 g carbohydrates, 18 mg calcium, 16 mg magnesium, 18 mg oxalic acid, 47 mg phosphorus, 124 I.U. vitamin A, 0.04 mg Thiamine, 0.11

mg Riboflavin, 0.09 mg Nicotinic acid, 12.0 mg Vitamin C etc. (www.agridept.gov.lk)

It is largely cultivated in almost all districts of Bangladesh. About eight million farm facilities are involved in eggplant cultivation (Islam, 2005). This gives small, marginal and landless farmers a continuous source of income and provides employment facilities for the rural people.

Crop growing with organic manures is now a popular practice in agriculture. People has realized the benefits of organic manures for crops production and more specifically for the vegetables. Very few publication is available focusing the organic manures practices. Now-a-days modern cultivation practices includes organic manure for crops production including different fruits and vegetables. Vegetables that are produced by organic manures possess a better quality than that of produced by inorganic fertilizer. In Bangladesh condition population is increasing day by day. On the other hand, area under crops production is decreasing day by day, because of the limitation of land. By the proper management of fertilizer specially organic and inorganic fertilizer management, it will be easy to grow vegetable to meet up the requirement of food of the nation. Hence, the study has been undertaken to find out the effect of organic manures and different levels of nitrogen on the growth and yield of brinjal.

Objectives of the study are-

1. To study the effect of organic manures on the growth and yield of brinjal.
2. To find out the effect of nitrogen on the growth and yield of brinjal.
3. To study the combined effect of organic manures and nitrogen on the growth and yield of brinjal.

CHAPTER II

Review of Literature

REVIEW OF LITERATURE

The benefits of using organic manures in crop production had long been known. Now-a-days, many experimental evidences are available regarding the usefulness of using organic matter in the soil. The information on the effect of organic manures on the growth and yield of brinjal seems to be inadequate. There is a relationship between nitrogen application and organic manures. However, some of the available literature related to the present experiment have been reviewed in this chapter.

2.1 Effect of different levels of nitrogen on the growth and yield of brinjal.

Among the factors that affect crop production, fertilizer is one of the most crucial factors, which ultimately increase the total yield of any crop. Now a days, fertilizer holds the key to the success of the crop production system of Bangladesh. Nitrogenous fertilizer is one of the most used fertilizer, which has an important physiological activity on plant body. Formation of chlorophyllous tissue is one of the most important functions of nitrogen, which help in photosynthesis of plant. Thus application of more nitrogenous fertilizer caused more vegetative growth and development of plant.

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 *et al.* (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 fertilization up to the rate of 225 kg N/ha resulted in a significant increase of total and marketable yield with irrigation

whereas the yield increase was found up to the rate of 150 kg N/ha without irrigation.

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. 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.

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

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

Razia and Islam (1981) conducted a similar field experiment at Bangladesh Agricultural Research Institute (BARI), Joydebpur and found that different nitrogen levels had significant increasing yield on brinjal cv. Singnath. The highest nitrogen level of 150 kg/ha produced the highest yield of 11973 kg/ha. Nitrogen was applied at the rate of 0, 30, 60, 90, 120 and 150 kg N/ha from urea.

Subramanian *et al.* (1993) stated that plant height and quality were increased with increasing rate of N application. They obtained the highest yield with 150 kg N/ha. The levels used were 0, 5, 100 and 150 kg/ha.

Singh and Maurya (1992) reported that same trend of increasing rate of N application on brinjal plant. They obtained the best yield from 120 kg N/ha. The levels of nitrogen were 0, 60, and 120 kg N/ha.

Rastogi *et al.* (1979) studied on the effect of different levels of nitrogen and spacing and they found that 45 kg N/ha at a spacing of 45 x 30 cm or 60 x 30 cm gave the highest fruit yield. They also found that high dose of nitrogen increased the number of fruits per plant and the length of the fruit but the diameter of the fruit was decreased.

In another experiment, determining the effect of NPK fertilizer in conjunction with "Spartin" on the growth and yield of brinjal, Chandrasekhram and George (1973) found that the highest level of nitrogen (125 kg N/ha) gave the highest number of flowers and yield than the two lower levels 75 and 100 kg N/ha).

Higher nitrogen level also increased the fruits per plant and size of fruit. Umrani and Khot (1972) also found such increasing effect of nitrogen level on "Manjarigota" brinjal. They obtained the best result at 112 kg N/ha.

In another experiment Gnanakumari and Satyanarayana (1970) reported that application of 280 kg N/ha gave the highest number and maximum weight of brinjal and consequently the highest yield of 59.9 tones per hectare.

Mertia and Chauhan (1970) studied the effect of different levels of nitrogen, phosphorus and potassium on vegetative growth and yield of brinjal. Nitrogen was applied at 22, 45, 67 and 89 kg per hectare and they found that plant height, number of leaves per plant, number of flowers per plant, number of fruits per plant, fruit length, fruit diameter and individual fruit weight were increased with the increased nitrogen level.

Banerjee *et al.* (1997) worked on the effect of N fertilization (0, 75, 100 or 125 Kg N/ha) and planting pattern on fruit yield of tomato. Total fruit yield /plant and total yield (t/ha) were significantly influenced by both N and planting

pattern treatments. The highest total fruit yield/plant was recorded from the treatment of 125 kg/ha.

Sharma (1995) reported that in tomato (cv. Pusa Ruby) the plant height, fruit number, seed yield/plant and seed yield/ha were increased with increasing rates of N. The highest yield of seeds was observed due to 120 kg N/ha.

Seth and Choudhury (1970) also observed that higher nitrogen level increased the fruit and seed yield.

Saimbhi *et al.* (1969) reported that a combination of 112 Kg N and 56 kg P_2O_5 resulted in marked increase in yield and it was found to be the most economic dose of nutrients for the production of late cauliflower cultivar Snowball in Punjab, India.

Deshi *et al.* (1964) found that application of 224 kg N/ha increased the yield of cauliflower significantly. The response to P (50 kg/ha) and K (112 kg/ha) was, however, not significant.

Lawande *et al.* (1987) in their experiment with cauliflower noted maximum effect by adding 240 kg N and 80 kg P_2O_5 / ha but the response to added K_2O at 0-80 kg/ha was not significant.

Khurana *et al.* (1987) reported that N application at the rate of 60 kg/ha gave the highest yield and was the most economic treatment. The average curd weight was also highest in this treatment.

Farroque and Mondal (1987) observed that increased level of nitrogen application resulted in a significant increase in cabbage yield. The highest yield (48.6 t/ha) was obtained with the application of 336 kg N/ha.

Naidu *et al.* (1997) mentioned that the effects NPK fertilizers in combination with organic manures (farmyard manure, poultry manure and vermicompost) and biofertilizers (phosphate solubilizing bacteria and Azospirillum) on the growth and yield of aubergine cv. JB-64 were investigated during the rabi seasons of 1996/97, 1997/98 and 1998/99 in Jabalpur, Madhya Pradesh, India. Data were recorded for plant height, number of leaves per plant, number of branches per plant, fruit length, fruit girth, number of fruits per plant and fruit yield. NPK at 100:60:50 kg/ha + farmyard manure at 25 t/ha recorded the highest values for most parameters studied. NPK at 75:35:0 kg/ha + farmyard manure at 25 t/ha recorded the highest fruit girth and earliest 50% flowering. The highest mean fruit yield (161.62 q/ha) and net return (Rs. 24 140.50) were obtained with the former, while the highest benefit: cost ratio (2.212) was obtained with the latter treatment. The differences in yield and profitability between these treatments were not significant.

Khattak *et al.* (2001) studied the effect of different levels of nitrogen on the growth and yield of different cultivars of eggplant under the agro-climatic conditions of Peshawar. Effect of different nitrogen levels (0, 50, 75, 100, 125, 150 kg/ha) on aubergines (*Solanum melongena*) cultivars Black Bahar, Long Purple, Neelam Long and Special Black were studied at Agriculture Research Institute Tarnab, Peshawar, Pakistan, in 2000. Different levels of nitrogen significantly increased number of branches, leaves and fruits/plant, stem thickness, plant height and yield at 125 kg nitrogen/ha, while minimum values for these parameters were observed in different treatments. Maximum number of branches (7.84), leaves (285.380) and fruits/plant (13.67), stem thickness (1.19 cm) and yield (17674.91 kg/ha) were noted for the plants receiving 125 kg nitrogen/ha, while minimum number of branches (6.37), leaves (280.77) and fruits/plant (11.08) were obtained in control treatment and minimum stem thickness (1.01 cm) and yield (14062.41 kg/ha) were found when 50 kg nitrogen/ha was applied.

2.2 Effect of organic manures on the growth and yield of brinjal

Rahman *et al.* (1998) observed increase vegetative growth and yield of berry of brinjal was by using animal blood meal, mustard oil cake, epil-epil leaves or the combination of these three in the soil as organic manures. The vegetative growth was highest with blood meal and lowest with epil-epil leaves. The dates of flowering and maturity were earlier both with blood meal and the combined application of the 3 manures than the untreated control. The yield of berry was highest with the combined application of the manures. Of the 3 manures, yield was lowest with epil-epil leaves.

Ismail *et al.* (1997) conducted an experiment to determine the influence of some organic manure as soil amendments on development and reproduction of *Rotylenchulus reniformis* infecting eggplant and *Hirschmanniella oryzae* infecting rice. The effect and use of soil amended with rabbit, camel, poultry, quail, pigeon, horse, buffalo and duck manures to *manage H. oryzae* on Giza 171 rice plants, and the effects of the first 5 manures in the management of *R. reniformis* on Balady eggplants [aubergines] were studied under greenhouse conditions. All treatments significantly reduced final populations, rate of build-up and reproduction of both nematodes compared to the unamended soil. Generally, pigeon manure was highly effective against *R. reniformis* on eggplant followed by quail, poultry and rabbit manures, while camel treatment was the least potent manure. Buffalo dung was a very potent inhibitor of *H. oryzae* build-up followed by camel, horse, poultry, duck, quail, rabbit and pigeon manures. Horse dung improved, to some extent, the growth of rice but none of the other organic manures succeeded in doing the same.

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.

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

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

Asiegbu *et al.* (1984) carried out an experiment in Nigeria on onion with farmyard manure and reported that bulb diameter and the percentage of grade I bulbs were increased with increasing FYM application. They also found that onion yields were maximum with 20 t FYM/ha.

Bevacqua *et al.* (1994) observed that onion seedlings transplanted to compost treated plots established more vigorously than those in the control plots. They also found that compost treatments increased yields (FW) of onions compared to controls.

Castro *et al.* (2005) evaluated no tillage systems in aubergine (*Solanum melongena*)-based organic cropping systems in Seropedica, Rio de Janeiro State, Brazil. Crotalaria juncea and Pennisetum glaucum cv. BRS 1501 were used as pre-plant crops or there was a fallow period, and these were compared to the conventional system of ploughing. Three cropping managements were evaluated: aubergine sole cropping, intercropping with C. juncea, and intercropping with cowpea (*Vigna unguiculata cv. Maua*). No differences were observed among the cropping systems with regard to aubergine yield. *C. juncea* was more effective than *P. glaucum* and fallow for soil mulching. Intercropping with leguminous species did not reduce aubergine yield. In a succeeding experiment, no-tillage (with C. juncea and spontaneous weed mulches) and conventional ploughing were compared. These treatments were combined with increasing levels of poultry manure (0, 100, 200 and 400 kg N

ha-1). In terms of biomass input, C. juncea was superior to spontaneous weeds. The highest yield of aubergine (50.6 t ha-1) was obtained with the highest rate of manure (36.9 t ha-1 for the control plots).

Almeida *et al.* (2004) conducted an experiment from March to December 2001, in Rio de Janeiro, Brazil, to evaluate biological nitrogen fixation (BNF) for green manures pre-cropped and intercropped with aubergine in an organic cropping system, the use of N derived from BNF by the aubergine crop, and the impact of green manuring on aubergine yield and soil N balance. Plots with sunn hemp, millet and spontaneous weeds were established before aubergine planting. After 60 days, 53% of sunn hemp N came from BNF. Green manuring during pre-cropping was cut in aubergine plantings under no-till system, except for half of the plot where spontaneous weeds were incorporated into the soil. Aubergine was either intercropped with sunn hemp and cowpea or cropped alone. At 52 days, the legumes were cut and left close to the aubergine crop. The BNF contribution depended on the pre-cropped species and varied between 20 and 90%. Using the 15N technique, it was verified that aubergine plants benefited from the green manure N under both pre-cropping and intercropping. BNF did not affect aubergine yield, but the BNF in legumes was enough to compensate for the exported N in the harvest fruits.

Godase and Patel (2001) studied the influence of organic manures and fertilizer doses on the intensity of sucking pests: (*Amrasca biguttula biguttula* Ishida) and Aphid (Aphid gossypii Glover) infesting brinjal. The nine treatments of organic manures and fertilizers, namely 100:37.5:37:5 kg NPK, 50 t FYM, 10 t FYM+50:18.75:18.75 kg NPK, 4 t vermicompost, 1.7 t neem cake, 200:37.5:37.5 kg NPK, 50:37.5:75 kg NPK, 0.85 t neem cake+50:18.75:18.75 kg NPK and zero fertilizer application were evaluated against jassid (Amrasca biguttula biguttula) and aphid (Aphis gossypii) infesting aubergine at N.M.

College of Agriculture, Navsari (Gujarat, India) during 1993/94-1994/95. Significantly highest jassid population (24.71/9 leaves) was recorded in treatment of double dose of N (T6), whereas, significantly less jassid population (9.14/9 leaves) was noticed in treatment of double K (T7). The jassid nymphs developed faster (9.86 days) with growth index 7.61 on treatment T6, whereas it took longest period of 11.41 days with growth index 5.26 on treatment T7. The jassids preferred the plants which received higher level of nitrogen (T6). Significantly lowest aphid population (11.29/9 leaves) was observed in treatment of neem cake (T5), whereas the maximum aphids (40.29/9 leaves) were recorded on treatment of higher level of nitrogen (T6).

Prasanna, Rajan (2001) showed that brinjal [aubergine] cv. Surya plants were supplied with farmyard manure (FYM, at 20 and 38 t/ha); poultry manure (at 6.67 and 12.92 t/ha); FYM at 20 t/ha and NPK at 75 : 40 : 25 kg/ha; and fertilizers equivalent to the NPK content in 20 and 38.5 t/ha FYM, and 6.67 and 12.92 t/ha poultry manure, in an experiment conducted during 1993-97. Fruits from the different treatments were harvested and stored in paper plates under open conditions. After 5 and 7 days of storage, the highest number of unmarketable fruits were from plants treated with inorganic fertilizers, while the lowest were from plants treated with organic fertilizers.

Yadav *et al.* (2002) stated that a field experiment was conducted on sandy loam Typic Ustocrept soil, in Hisar, Haryana, India, during 1996-97 and 1998-99 to study the effect of high RSC water along with gypsum and farmyard manure (FYM) on the soil, growth and yield of brinjal [aubergine] cv. Hisar Pragati. The initial soil pH, ECE, ESP, CEC and organic carbon was 7.2, 1.5 dS/m, 6.7, 9.3 cmol/kg soil and 0.30%, respectively. It was observed that the pH and the ESP of the soil decreased significantly both with the addition of FYM and gypsum. There was a significant increase in growth and yield of brinjal with

the addition of gypsum in both the years. The yield and growth parameters also increased up to addition of 10 t FYM/ha.

Hedge (1988) studied the effect of different regimes of irrigation & nitrogen on bell pepper at Bangalore in India and found low fruit weight under the irrigation regimes.

CHAPTER III

Materials and Methods

MATERIALS AND METHODS

This chapter deals with materials and methods that were used in conducting the experiment. It includes a short description of experimental site and duration of the experiment, characteristics of soil, climate, materials used for the experiment, raising of seedlings, layout and design, land preparation, manuring and fertilization, transplantation of seedlings, intercultural operation, harvesting, collection of data analysis and statistical analysis.

3.1 Experimental site:

The experiment was conducted in the field of SAU (Sher-e-Bangla Agricultural University) farm, Dhaka allotted for the Department of Horticulture and Post Harvest Technology.

3.2 Experimental Period:

The experiment was carried out during the period from March to September.

3.3 Characteristics of Soil:

The soil of the experimental plot was medium high land belonging to the Modhupur Tract and AEZ 28 (UNDP and FAO, 1988). The land had adequate irrigation facilities. The soil is sandy loam with a P^H value 5.5. Some of the basic soil properties are presented below:

The description of the Agro Ecological Zone (UNDP and FAO, 1988) of the experimental site is mentioned below:

- Agro Ecological Region : Madhupur Tract (AEZ-28).
- Land Type : Medium High Land
- General Soil Type : Non Calcareous Dark Gray flood plain soil

- Soil Series : Tejgaon
- Topography : Upland
- Elevation : 8.45
- Location : SAU Farm, Dhaka
- Field Level : Above Flood Level
- Drainage : Fairly good
- Firmness (consistency) : Compact to friable when dry

The physical and chemical characteristics of the soil collected from Soil Resource Development Institute (SRDI), Farmgate, Dhaka are presented (For 0-14 cm depth).

3.4 Analytical methods used for soil analysis:

Determination		**Method**
Soil Texture	:	Hydrometer method (Bouyoucos, 1927)
Soil P^H	:	1:2.5 soil and water ratio using glass electrode method (Black et al, 1965)
Organic carbon	:	Walkley and Black method (Black et al, 1965)
Total nitrogen	:	Microkjeldahl method (Yoshida et al, 1972)
Available P	:	Bray and Kurtz method (Bray and Kurtz, 1945).

3.5 Climate

The climate of the experimental area was of sub tropical in nature characterized by high temperature associated with little rainfall during Kharif season (April to September).

3.6 Weather

The monthly mean of daily maximum, minimum and average temperature, relative humidity, monthly total rainfall and sunshine hours received at the experimental site during the period of the study have been collected from Bangladesh Meteorological Department, Sher-e-Bangla Nagar, Dhaka and Shown in Appendix—III.

3.7 Materials used for the experiment

The variety of brinjal used in this experiment was "Khotkhotia". The seeds of the variety were produced by Bangladesh Agricultural Development Corporation (BADC) and were collected from BADC Sales Centre, Narsingdi. Khotkhotia is a local variety of Rangpur District. It is cultivated in summer because at that time hybrid variety does not give good yield. But the local recognized variety such as Khotkhotia, Singnath etc. can be cultivated well. For this reason, Khotkhotia was selected for this experiment.

3.8 Raising of Seedling:

For raising of seedlings, the soil was well ploughed and converted into loose friable and dried masses to obtain good tilth. All weeds, stubbles and dead roots were removed. Well rotten cowdung manure was applied to the seedbed at the rate of 5 kg/ seed bed.

Brinjal seedlings were raised in seedbeds situated on a relatively high land in the Horticulture Farm.

The seeds were sown in the seed bed of 3 m x 1 m size on 20 March, 2006. After sowing, the seeds were covered with a thin layer of soil or light soil. Complete germination took place within 10 days after sowing seeds in the beds. When the seeds were germinated, shade by bamboo mat (Chatai) was provided to protect the young seedlings from scorching sun shine and rain. No chemical fertilizers were applied for raising the seedlings. Seedlings were not attacked by any kind of insect or diseases.

The healthy 30 days old seedlings were transplanted in the experimental field on 20 April, 2006.

3.9 Land Preparation:

The experimental plot was opened first on 11 March, 2006 by a power tiller for growing the desired crop. It was then thoroughly prepared by ploughing and cross ploughing several times with a power tiller fallowed by laddering to bring about a good tilth suitable for establishing the seedlings and left exposed to sunlight for 7 days. Then the land was leveled and the corners of the experimental plot were shaped and the clods were broken into pieces. The land was cleaned of weeds and stables and was finally leveled. The soil was treated with insecticides when the plot was finally ploughed. Insecticide (Miral) @ 4 kg/ha was used to protect the young plants from the attack of soil insects. The pits were made 5 days before planting.

3.10 Treatments of the Investigation:

The experiment was undertaken to study the effects of different levels of nitrogen and organic manures on the growth and yield of brinjal. Thus the experiment included two factors as follows:

3.10.1. Factor A: Levels of nitrogen

N_0 = Without nitrogen (control)

N_1 = 100 kg N/ha

N_2 = 150 kg N/ha

3.10.2 Factor B: Levels of manure:

M_0 = No manure (control)

M_1 = 10 ton cowdung /ha

M_2= 3 ton poultry litter/ha.

There were altogether 9 (nine) treatments -

N_0M_0	N_0M_1	N_0M_2
N_1M_0	N_1M_1	N_1M_2
N_2M_0	N_2M_1	N_2M_2

3.11 Layout and Design of the experiment

After the land was finally prepared, the two factor experiment was laid out in the randomized complete block design with three replications on 3 May, 2006. The experimental field was first divided into three blocks. Each block consisted of 9 plots. Thus the total number of plot was 27. Three different levels of nitrogen and three levels of manures were assigned to each block as per design of the experiment. The size of unit plot was 3 m x 1 m. A distance of 0.5 m between the plots and 0.75 m between the block were kept. 1 meter border was maintained from each side of experimental plot. Thus the total area of the experimental field was 187.5 square metre.

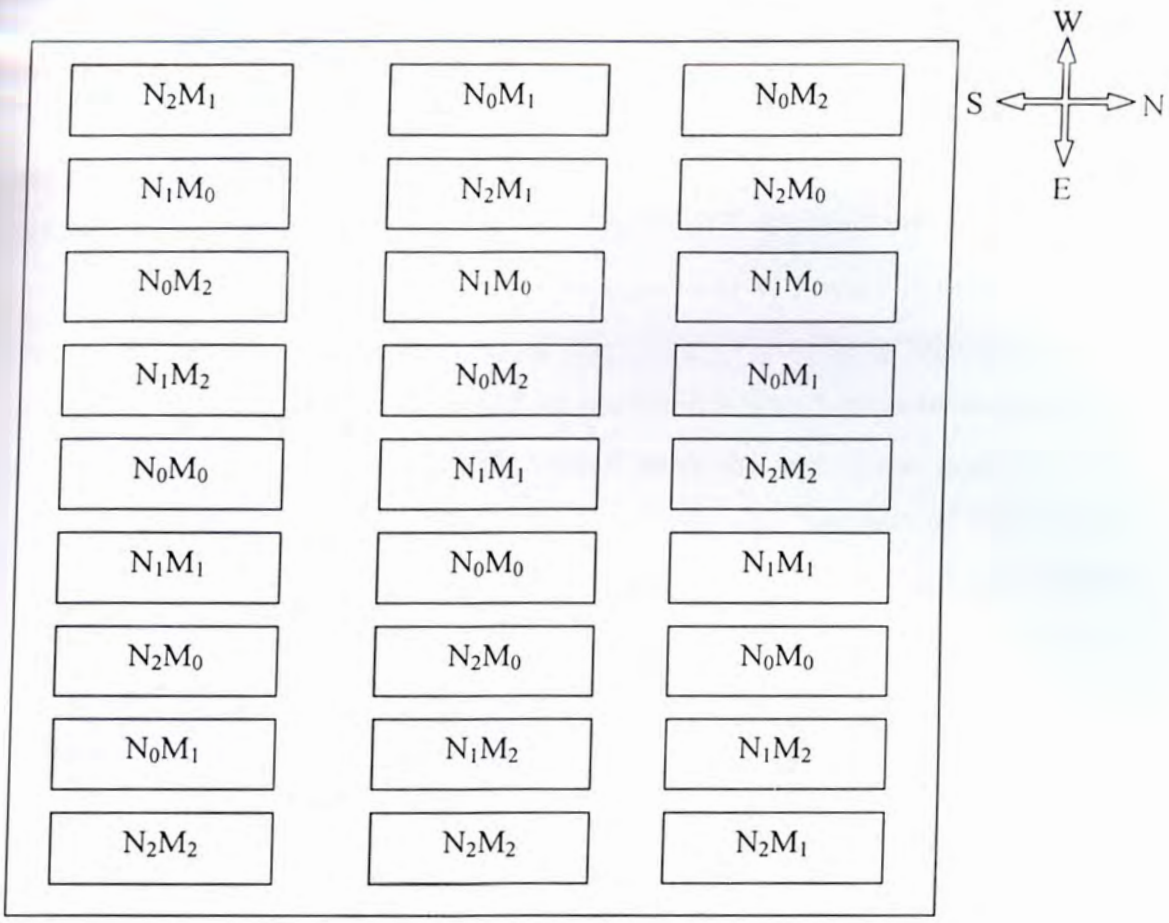

Figure 1: Field layout of the two factorial experiment in Randomized Complete Block Design (RCBD)

Nitrogen:

N_0= No nitrogen (Control)

N_1= 100 kg nitrogen/ha

N_2= 150 kg nitrogen/ha

Organic manures:

M_0= No manure (Control)

M_1= 10 ton cowdung/ha

M_2= 3 ton poultry litter/ha.

Block to block distance = 0.75 m

Border = 1 meter

Size of the plot = 3 m x 1 m

Total plot = 27

Treatment = 27

Replication = 3

Plot to plot distance = 0.5 meter

3.12 Application of manures and fertilizers

Urea, Triple Super Phosphate (TSP) and Muriate of Potash (MP) were applied as the sources of nitrogen, phosphorus and potash respectively. Well-decomposed cowdung @ 10 ton/ha, MP @ 250 kg/ha. Urea @ 325 kg/ha and TSP @ 200 kg/ha were applied in this experiment (Rashid, 1993). Two thirds of each amount of well-decomposed cowdung and TSP were applied just after opening the land and the remaining one third of cowdung and triple super phosphate were applied in the small pit prepared before 5 days of transplanting of seedlings, and were thoroughly mixed with the soil. Urea and MP were applied in two installments. One third of urea and muriate of potash was applied in ring methods after 21 days of transplanting. One third was applied after 42 days and the rest of urea and MP were applied after 60 days of transplanting. Irrigation was done just after fertilizer application.

3.13 Transplanting and aftercare

The seedbeds were watered before uprooting the seedlings. At the time of uprooting care was taken so that root damage was minimum and some soil remained with the roots. Healthy and uniform sized seedlings of 30 days were taken separately from the seedbed and were transplanted in the experimental field on 22 April, 2006. The seedlings were transplanted maintaining 60 cm x 60 cm spacing.

Planting was done in the evening. Light irrigation was given immediately after transplanting around each seedling and continued for several days for their better establishment. Seedlings were also transplanted around the border of the experimental plots for gap filling.

3.14 Intercultural operations

After transplanting the seedlings, different intercultural operations were accomplished for better growth and development of the plants.

3.14.1 Gap filling

When the seedlings were established, the soil around the base of each seedling was pulverized. Very few seedlings were damaged after transplanting and the damaged seedlings were replaced by new healthy seedlings from the same stock. Those seedlings were transplanted with a high mass of soil with roots to minimize transplanting shock.

3.14.2 Weeding

The plants were kept under careful observation. Weeding was done as and when necessary to keep the plots clean. Weeding was done at every 15 days interval from planting peak flowering stage. As the land was covered by plant canopy by that time weeding was discontinued. Spading was done from time to time specially to break the soil crusts and keep the land weed free after each irrigation.

3.14.3 Irrigation

Irrigations were given as and when necessary by observing the soil moisture condition. Irrigation was given throughout the growing period. The first irrigation was given 40 days after planting followed by another irrigation 20 days after the first irrigation. Each fertilizing was followed by irrigation.

3.14.4 Earthing up

Earthing up was done as and when required by taking the soil from the space between the rows.

3.15 Plant Protection

3.15.1 Insect Pest

As preventive measure against the insect pest like cutworms, shoot and fruit borer, leafhopper etc. Malathion 60 EC @ 2 ml/litre was applied to reduce the

attack in the field. Many cleaning practices were also done to reduce the insect attack. Ripcord was also given to control the insect pest.

3.15.2 Diseases

Precautionary measures against various diseases of brinjal were taken. Neem powder mixed with water and ash spraying were done to control the diseases of brinjal. In case of fungal infection, Bavistin was applied.

3.16 Harvesting

Harvesting was started on the 28 June, 2006 and was continued till 22 September, 2006. At each harvest, the weight of the fruits, number of fruits and individual weight of fruit was taken plot wise which was graduated in gram and kilogram.

3.17 Methods of Data Collection

The data pertaining to following characters were recorded from selected uniform sized plant. The spacing was 60 cm x 60 cm. Data on plant height was collected during heaviest flowering time.

Data were collected on the following parameters

i) Plant height in centimeter
ii) Number of leaves per plant
iii) Number of branches per plant
iv) Average length of branch (cm)
v) Days to first flowering
vi) Number of flowers per plant
vii) Length of fruit (cm)
viii) Diameter of fruit (cm)
ix) Average number of fruit per plant
x) Weight of individual fruit (g)
xi) Weight of fruit per plant (g)

3.18 Collection of Data

3.18.1 Plant height (cm)

The height of the sample plants was measured in centimeter from the ground level to the tip of the longest stem. Five plants were randomly selected to record the data.

3.18.2 Average number of leaves/ plant

The number of leaves of sample plant was counted at the time of harvesting and the average number of leaves produced per plant was recorded.

3.18.3 Average number of branches per plant

The number of branches of sample plant was counted at the time of harvesting and the average number of leaves produced per plant was recorded.

3.18.4 Average length of branch (cm)

Samples of branch from selected plants were taken from each plot and branch length was recorded in centimeter and means was calculated.

3.18.5 Days to first flowering

The number of flowering days were counted from the time of transplanting.

3.18.6 Number of flowers per plant

At peak flowering time this was counted from sample plants and then the average number of flowers produced per plant was recorded.

3.18.7 Length of fruit (cm)

Fruit lengths were measured and average of fruit length was recorded. Five plants were selected for this parameter.

3.18.8 Diameter of fruit (cm)

Diameter of randomly selected fruit were measured and then the average was determined.

3.18.9 Number of fruits per plant

All the fruits of five selected plants were counted and average was calculated.

3.18.10 Weight of individual fruit (g) :

Individual fruit of each plant was weighed first, the total weight was counted and then the average of each fruit was calculated.

3.18.11 Weight of fruit per plant (g)

Fruit weights of selected plants were taken and the average weight of fruits per plant was recorded.

❒ Statistical Analysis

The data on various parameters under study were statistically analyzed using MSTAT package program. The mean for all the treatments was calculated and analyses of variances for all the characters were performed by F-variance test. The significance of differences between pairs of treatment means was evaluated by the least significant difference (LSD) test at 5% and 1% level of probability.

CHAPTER IV

Results and Discussion

RESULTS AND DISCUSSION

The experiment was conducted to investigate the performance of different manures and organic fertilizer on the growth and yield of brinjal. The data have been presented in Table 1 to 5 and Figures 1 to 10 and a summary of the analysis of variance in respect of all the parameters have been shown in Appendix IV to VII. The results of each parameter have been presented and discussed under the following headings.

4.1 Plant height (cm)

Different doses of nitrogen showed highly significant effect (Appendix IV) on plant height. The maximum plant height (52.00 cm) was measured from N_2. The minimum plant height (35.41 cm) was measured in the control. Plant height showed a general trend of gradual increase with the increasing levels of nitrogen (Figure 2). Higher plant height with increasing nitrogen possibly may increase nutrients to encourage more vegetative growth. Nitrogen is an element, which is very much important for many physiological processes in plants. It helps in producing chlorophyll, nucleotide, phosphotide, alkaloids, enzyme, nucleoprotein and many other necessary substances which have a function in cell organells and create balance and more cell division resulted with more vegetative growth (Edmond, *et al.* 1979).

Highly significant variation (Appendix IV) was found in respect of plant height due to the application of different doses of organic manures. The maximum height (49.06 cm) was measured from M_1 treatment followed by M_2 (45.18 cm) and the minimum (38.84 cm) was with the control (Table 1).

The plant height of brinjal was significantly influenced (Appendix IV) by the interaction effect of nitrogen and organic manures. The highest plant height (58.60 cm) was recorded in the N_2M_1 treatment due to the fact that inorganic fertilizer (urea) released nutrients quickly and supplied adequate plant nutrients and improvement of soil physical properties by organic matter which might have encouraged more vegetative growth and development. The lowest plant height (32.33 cm) was recorded in N_0M_0 (control) treatment (Table 1)

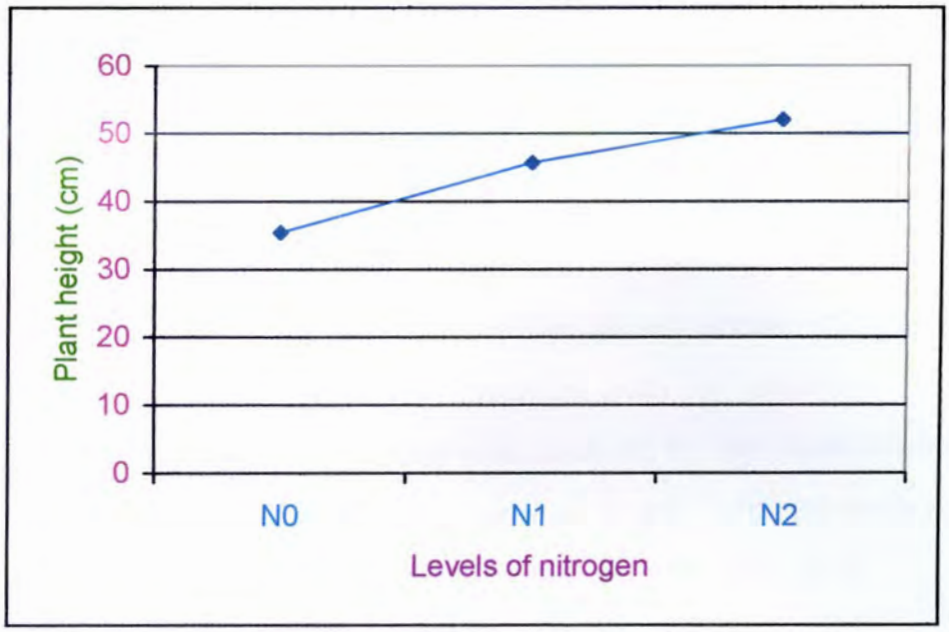

Figure 2. Effect of nitrogen on the plant height of brinjal.

N_0 = No nitrogen

N_1 = 100 kg nitrogen/ha

N_2= 150 kg nitrogen/ ha.

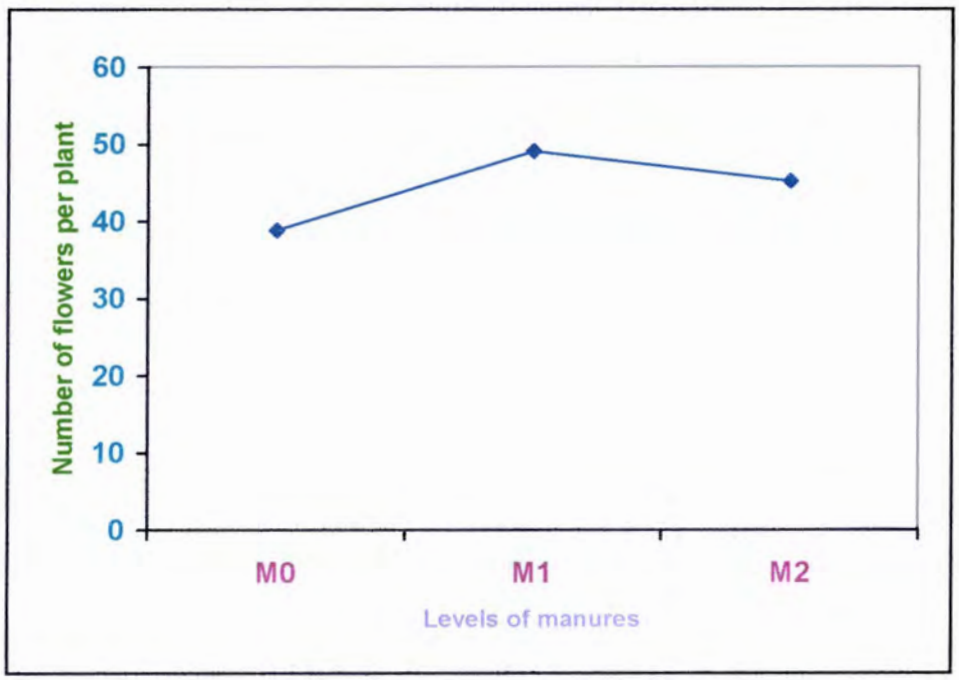

Figure 3. Effect of manures on the plant height of brinjal.

M_0= No manures

M_1= 10 ton cowdung/ha

M_2 = 3 ton poultry litter/ha

4.2 Number of leaves per plant

Different doses of nitrogen showed highly significant variations (Appendix IV) in the total number of leaves per plant. The number of leaves per plant showed a gradual increase with the increasing rates of nitrogen (Figure 3). The highest dose of nitrogen N_3 treatment produced the highest number of leaves (102.00) per plant, which was statistically identical with N_1 treatment. The lowest number of leaves (80.78) per plant was produced by the plants raised without fertilizer. Comparatively higher number of leaves with increasing rates of nitrogen may be attributed to vigorous vegetative growth of plant.

Number of leaves per plant was also highly influenced (Appendix IV) by different doses of organic manures. The maximum number of leaves (97.11) per plant was recorded from M_1 treatment followed by M_2 (93.00) and the minimum (84.67) was with the control (Table 1).

The interaction effect of nitrogen and organic manures were significant (Appendix IV). The combined effect of N_2 and M_1 produced the maximum (110.0) number of leaves whereas the control treatment produced only 75.0 leaves (Table 1)

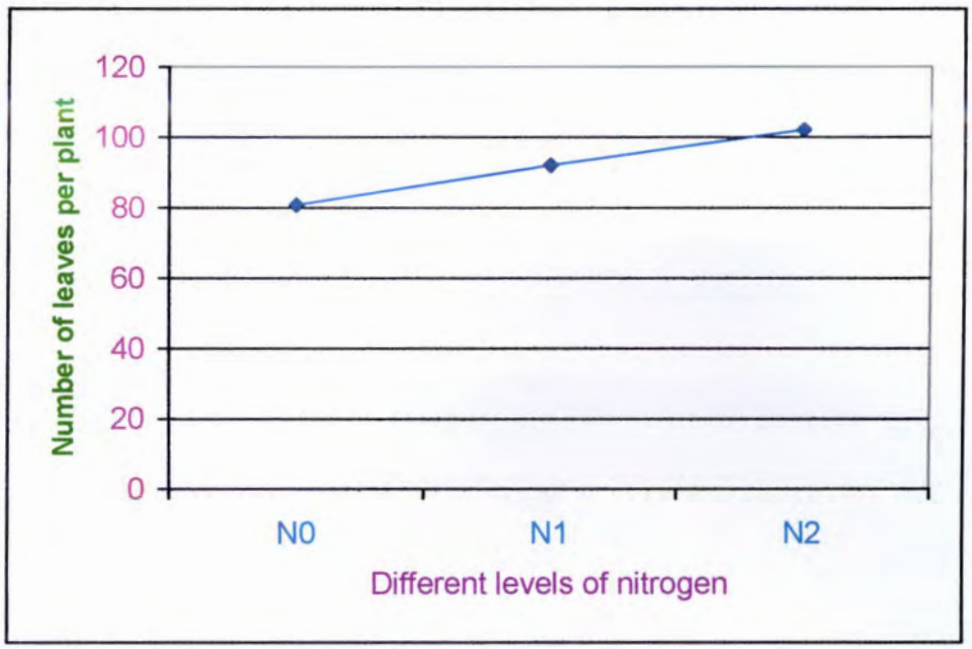

Figure 4. Effect of nitrogen on the number of leaves per plant.

N_0 = No nitrogen

N_1 = 100 kg nitrogen/ha

N_2= 150 kg nitrogen/ ha.

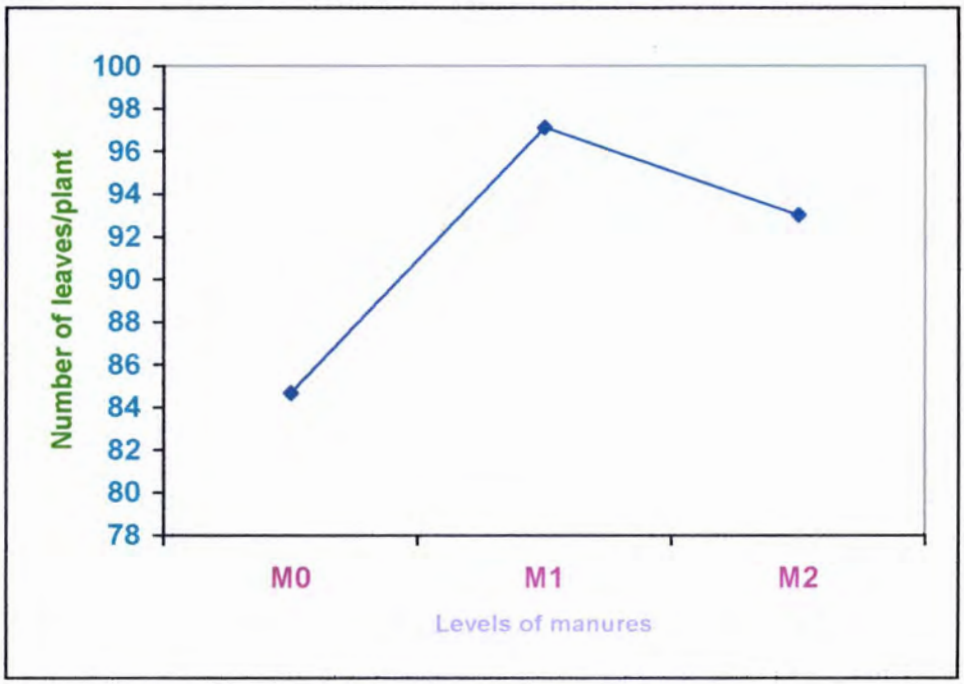

Figure 5. Effect of manures on the number of leaves per plant.

M_0= No manures
M_1= 10 ton cowdung/ha
M_2 = 3 ton poultry litter/ha

Table 1. Interaction effect of nitrogen and organic manures on the plant height (cm) and number of leaves per plant.

Treatments	Plant height (cm)	Number of leaves/plant
N_0M_0	32.33	75.00
N_0M_1	38.37	85.33
N_0M_2	35.53	82.00
N_1M_0	40.50	88.00
N_1M_1	50.20	96.00
N_1M_2	46.30	92.00
N_2M_0	43.70	91.00
N_2M_1	58.60	110.00
N_2M_2	53.70	105.00
LSD (0.05)	2.921	3.023
CV (%)	3.80	1.91

N_0= No nitrogen (control)

N_1= 100 kg nitrogen/ha

N_2= 150 kg nitrogen/ha

M_0= No manure (control)

M_1= 10 ton cowdung/ha

M_2= 3 ton poultry litter/ha

4.3 Number of branch per plant

Different doses of nitrogen showed significant variation (Appendix IV) in the number of branch per plant. Maximum number of branch per plant (17.11) which was produced by N_2 treatment which was also statistically significant. The minimum number of branch per plant (10.00) was produced by the control treatment (Table 2).

Highly significant variation (Appendix IV) was found in respect of number of branches per plant. The plant fertilized with M_1 produced maximum (15.33) number of branches per plant and the minimum number (11.67) of branches per plant was produced by the control (Table 2). There were no statistically significant difference between M_1 and M_2 treatment.

The interaction effect between nitrogen and manures was non-significant (Appendix IV). The maximum (19.00) number of branch per plant was found in N_2M_1 and the minimum (9.00) number of branches per plant was produced by the control. The average number of branches/plant in case of interaction effect between nitrogen and organic manures was 13.85.

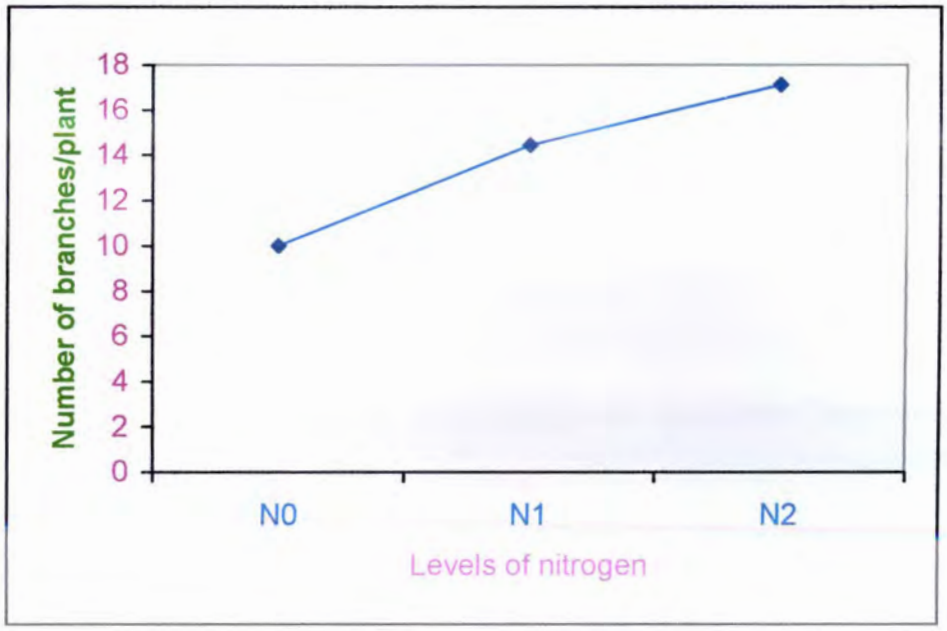

Figure 6. Effect of nitrogen on the number of branches/ plant.

N_0 = No nitrogen

N_1 = 100 kg nitrogen/ha

N_2= 150 kg nitrogen/ ha.

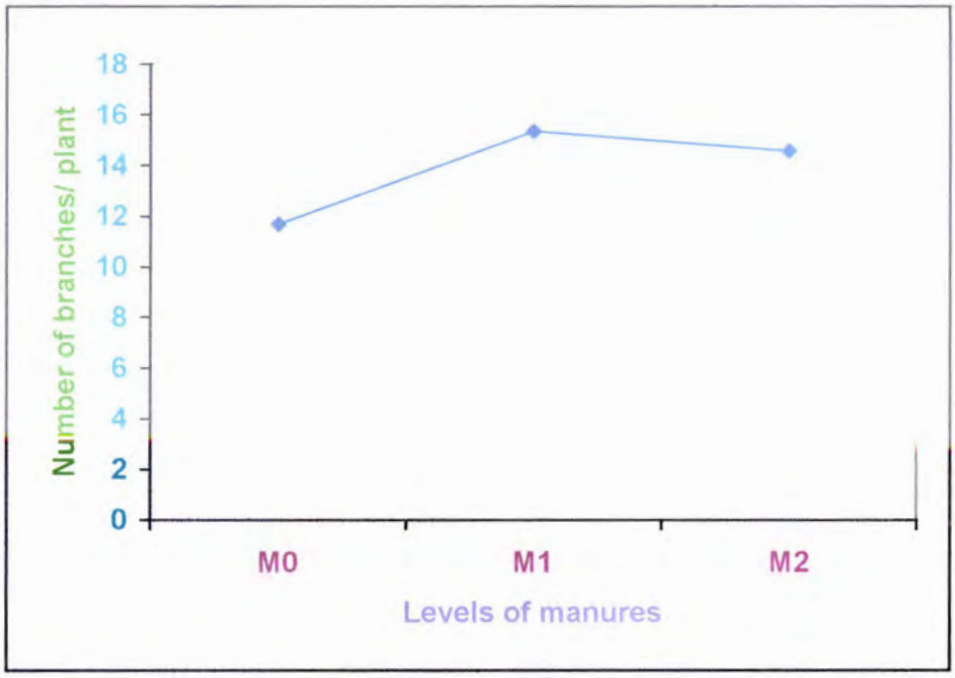

Figure 7. Effect of manures on the number of branches/plant.

M_0= No manures
M_1= 10 ton cowdung/ha
M_2 = 3 ton poultry litter/ha

4.4 Length of branch (cm)

Highly significant variation (Appendix IV) was observed in respect of average length of branches due to the application of different doses of nitrogen. The maximum (53.78 cm) length of branch was produced by N_2 and the minimum (40.97cm) number by the control (N_0) (Table 2).

Different doses of manures showed significant variations (Appendix IV) in respect of average number of branch length. The maximum branch length was found in M_1 treatment (51.79 cm) followed by M_2 (48.53 cm) (Table 2). The minimum (43.87 cm) branch length was recorded in the control.

The interaction effect between nitrogen and manures was significant (Appendix IV). The highest branch length (58.93 cm) was measured from the combination of N_2 and M_1 treatment. The lowest (37.80 cm) in this regard was measured from the control (N_0M_0) treatment (Figure 4).

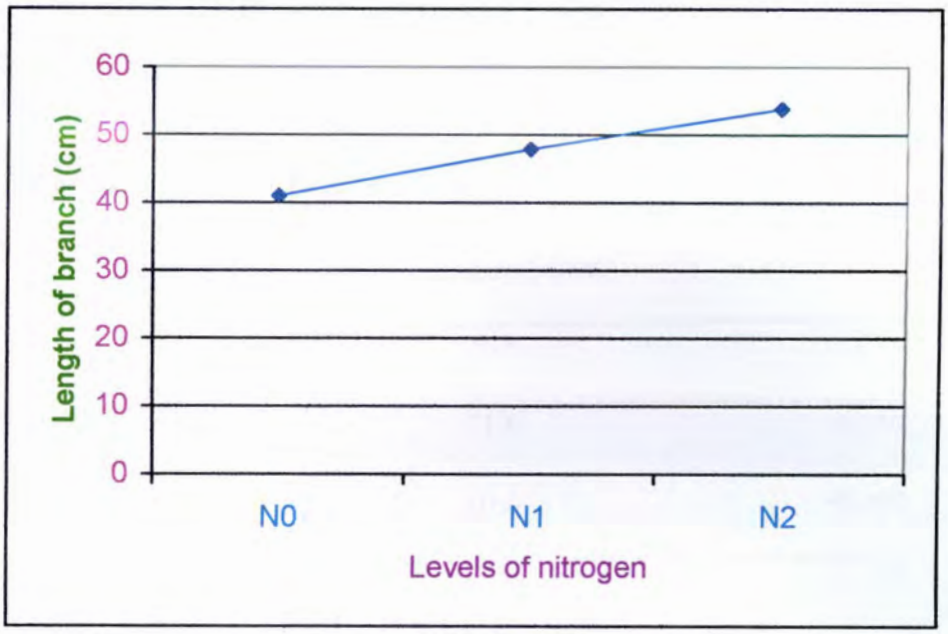

Figure 8. Effect of nitrogen on the length of branches/plant.

N_0 = No nitrogen

N_1 = 100 kg nitrogen/ha

N_2= 150 kg nitrogen/ ha.

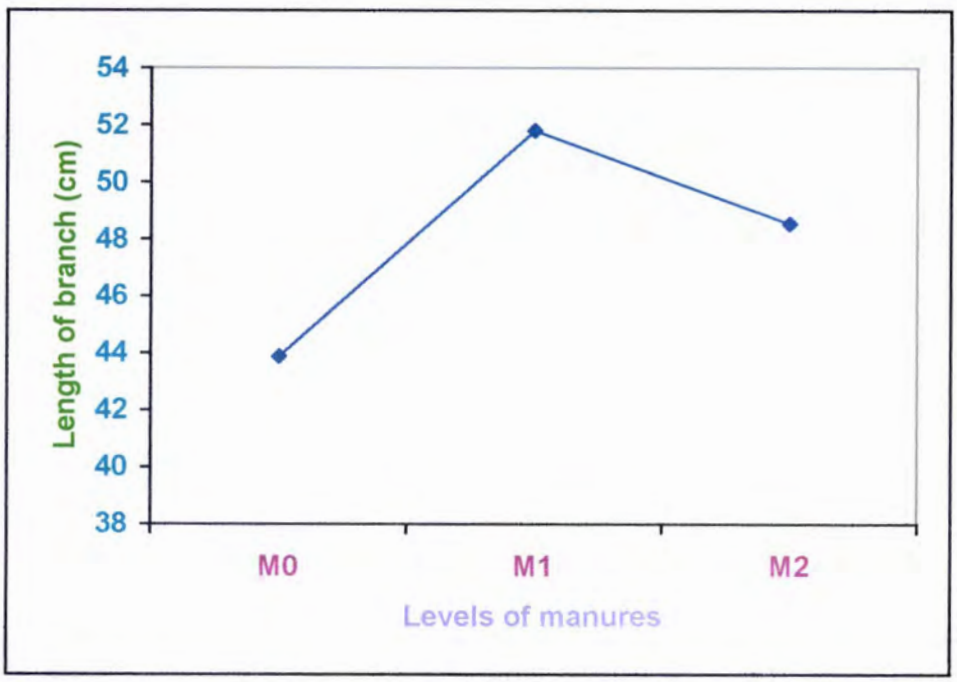

Figure 9. Effect of manures on the length of branch (cm).

M_0= No manures
M_1= 10 ton cowdung /ha
M_2 = 3 ton poultry litter/ha

Table 2. Interaction effect of nitrogen and organic manures on the number of branches per plant and length of branch (cm).

Treatments	Number of branches/plant	Length of branch (cm)
N_0M_0	9.0	37.80
N_0M_1	11.0	43.80
N_0M_2	10.0	41.40
N_1M_0	12.0	45.50
N_1M_1	16.0	52.73
N_1M_2	15.33	50.10
N_2M_0	14.0	48.30
N_2M_1	19.0	58.93
N_2M_2	18.33	54.10
LSD (0.05)	2.277	1.641
CV (%)	9.50	1.97

N_0= No nitrogen (control)
N_1= 100 kg nitrogen/ha
N_2= 150 kg nitrogen/ha

M_0= No manure (control)
M_1= 10 ton cowdung/ha
M_2= 3 ton poultry litter/ha

4.5 Days to first flowering

Different nitrogen levels showed highly significant variation (Appendix V) in the requirement of days to first flowering. The plant fertilized with N_2 treatment produced early flowering (56 days) and delayed flowering (64.67 days) occurred in the control treatment (Table 3). The result showed that high nitrogen doses caused early flowering. Varis and George (1985) also found that high nitrogen level caused early flowering in case of tomato.

Different levels of organic manures had insignificant effect (Appendix V) in the requirement of days to first flowering. M_0 showed 59.33 days, M_1 61.33 days and M_2 61.00 days.

Interaction effect of nitrogen and manures had significant variation (Appendix V) on days to first flowering. The control treatment (N_0M_0) caused delayed flowering (65.00 days) which was statistically similar to the treatment combination of N_0M_2. The earlier flowering (53.00 days) was found in the treatment combination of N_2M_0. So there were significant differences between the control treatment (N_0M_1) and N_2M_0 (Table 3).

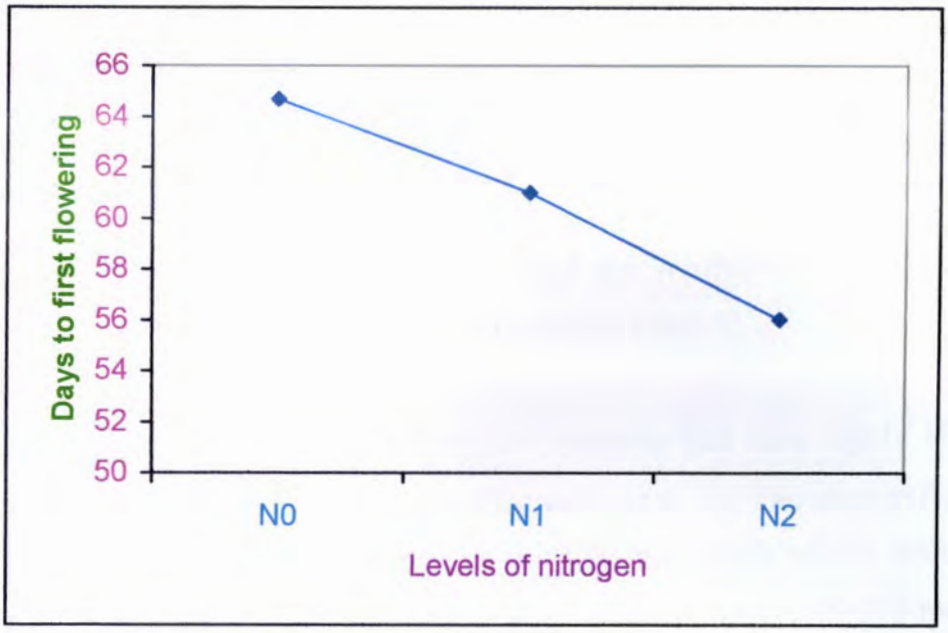

Figure 10. Effect of nitrogen on the days to first flowering.

N_0 = No nitrogen

N_1 = 100 kg nitrogen/ha

N_2= 150 kg nitrogen/ ha.

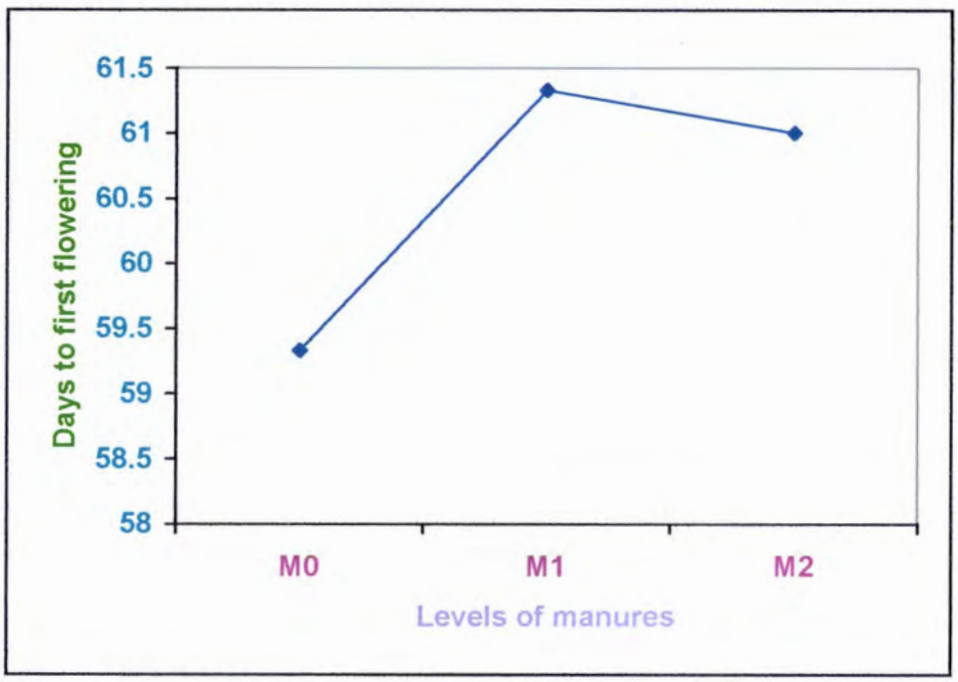

Figure 11. Effect of manures on the days to first flowering.

M_0= No manures
M_1= 10 ton cowdung/ha
M_2 = 3 ton poultry litter/ha

4.6 Number of flowers per plant

The effect of different doses of nitrogen in respect of flowers per plant was highly significant (Appendix V). The maximum number of flowers per plant (57.56) was found from N_2 treatment and the minimum number of flower (34.88) was found from the N_0 (control) plants (Table 3).

Application of various levels of organic manures had also highly significant effect (Appendix V) on the number of flowers per plant. The maximum number of flowers (53.22) per plant was produced by the plants which were treated with M_1 treatment and the control produced the minimum (39.33) number of flowers per plant (Figure 5).

There was significant effect (Appendix V) of interaction between nitrogen and manures in case of number of flowers per plant. The most effective treatment combination in this regard was N_2 and M_1 treatment. This treatment combination gave the maximum (66.33) flowers whereas that the control treatment (N_0M_0) produced the minimum (31.67) flowers (Table 3).

The above results clearly indicated that number of flowers was increased with the increasing rate of nitrogen and manures. These results were in conformity with the findings of Rastogi *et al.* (1979). They found an increasing number of flower production by the application of higher levels of nitrogen and manures.

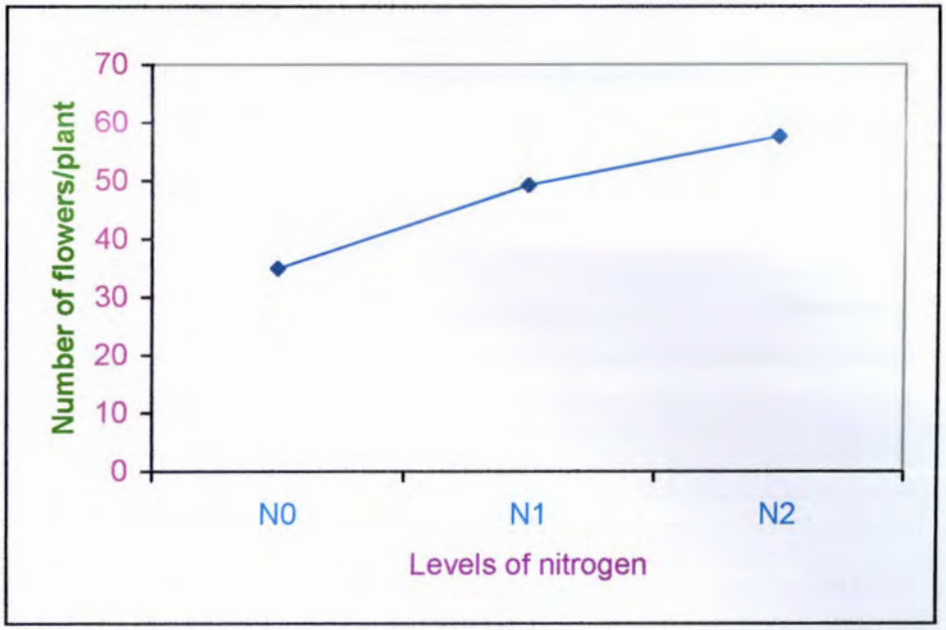

Figure 12. Effect of nitrogen on the number of flowers per plant.

N_0 = No nitrogen

N_1 = 100 kg nitrogen/ha

N_2= 150 kg nitrogen/ ha.

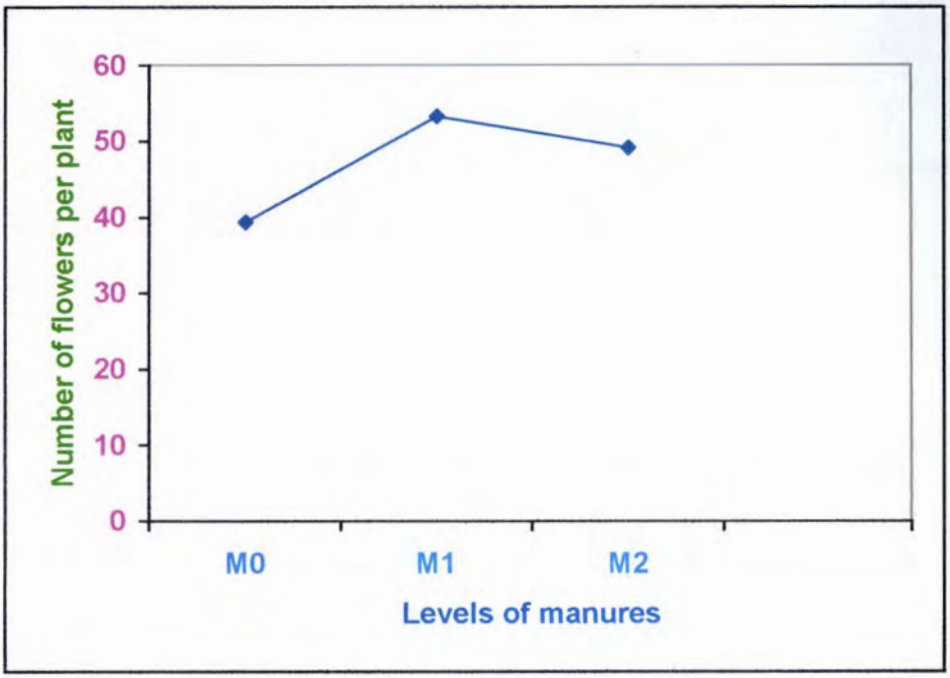

Figure 13. Effect of manures on the number of flowers per plant.

M_0= No manures
M_1= 10 ton cowdung/ha
M_2 = 3 ton poultry litter/ha

Table 3. Interacton effect of nitrogen and organic manures on the days to first flowering and number of flowers per plant.

Treatments	Days to first flowering	Number of flowers/plant
N_0M_0	65.0	31.67
N_0M_1	65.0	38.00
N_0M_2	4.0	35.00
N_1M_0	62.0	41.33
N_1M_1	61.0	55.33
N_1M_2	60.50	51.00
N_2M_0	58.0	45.00
N_2M_1	57.0	66.33
N_2M_2	53.0	61.33
LSD (0.05)	3.060	3.638
CV (%)	2.46	4.45

N_0= No nitrogen (control)

N_1= 100 kg nitrogen/ha

N_2= 150 kg nitrogen/ha

M_0= No manure (control)

M_1= 10 ton cowdung/ha

M_2= 3 ton poultry litter/ha

4.7 Length of fruit (cm)

It is evident from data presented in Table 4 that the length of fruit was increased with the increasing levels of nitrogen. So different doses of nitrogen showed a highly significant (Appendix VI) variation in respect of length of fruit. The maximum length (14.07 cm) was measured from the N_2 treatment and the minimum (11.93 cm) from control (N_0). The above results in respect of fruit length were in conformity with the result of Mertia and Chauhan (1970). They stated that higher levels of nitrogen increased the length of brinjal fruit.

A highly significant variation (Appendix VI) was recorded in respect of length of fruit due to the application of different doses of organic manures. Maximum fruit length (13.70 cm) was recorded in M_1 followed by M_2 (13.23) The minimum (12.33 cm) length was found in the control treatment (Table 4).

Combined interaction effect of nitrogen and organic manures was not significant (Appendix VI) in respect of fruit length of brinjal. The maximum fruit length (14.90 cm) was recorded from N_2M_1 treatment. The minimum fruit length (11.50 cm) was measured in the control treatment (N_0M_0). The average length of fruit in case of combined effect of nitrogen and manures was 13.08 cm .

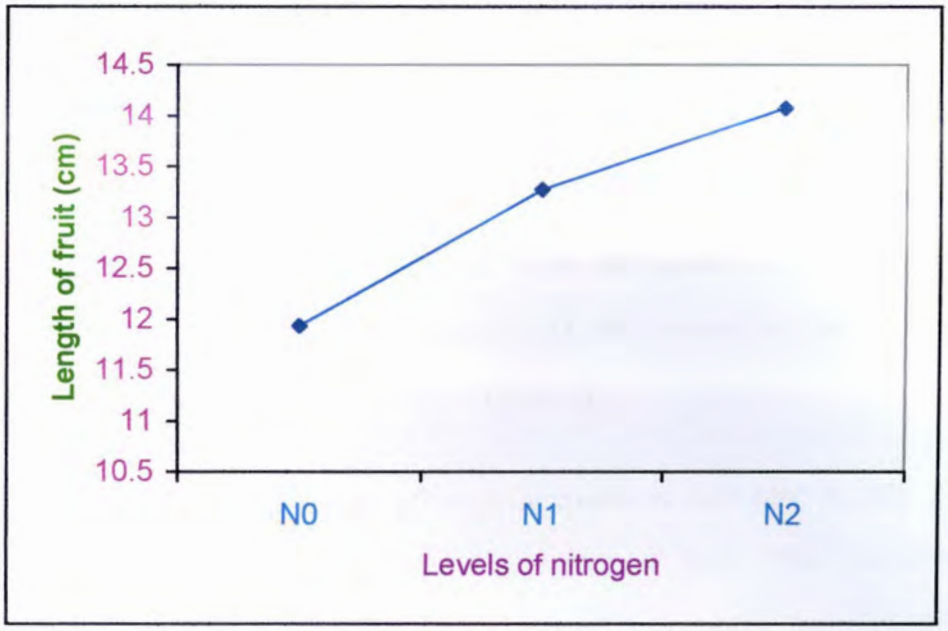

Figure 14. Effect of nitrogen on the length of fruit (cm).

N_0 = No nitrogen

N_1 = 100 kg nitrogen/ha

N_2= 150 kg nitrogen/ ha.

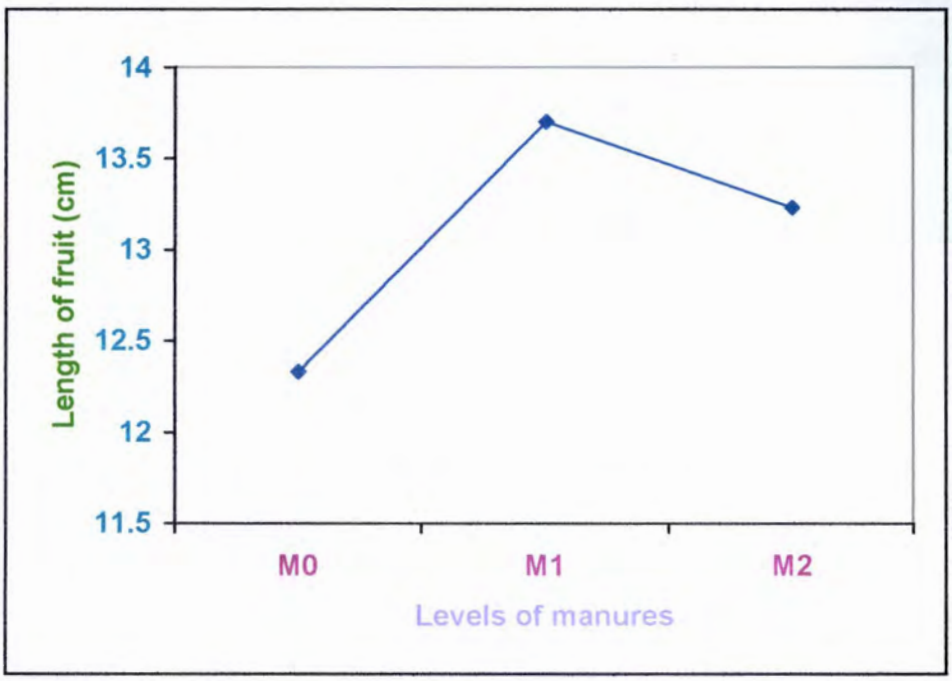

Figure 15. Effect of manures on the length of fruit (cm).

M_0= No manures
M_1= 10 ton cowdung/ha
M_2 = 3 ton poultry litter/ha

4.8 Diameter of fruit (cm)

Different doses of nitrogen showed highly significant (Appendix VI) variations in the diameter of fruits. The data presented in the table no. 2 revealed that the diameter of fruit tended to increase with increased level of nitrogen. The maximum (4.17 cm) and minimum (3.23 cm) diameter were found in the treatment of N_2 and N_0 respectively (Table 4).

Application of various levels of organic manures had also highly significant effect (Appendix VI) in respect of diameter of fruit. The treatment of M_1 showed the maximum (4.00 cm) diameter of fruit while the minimum (3.367 cm) was recorded in N_0 treatment for fruit diameter. (Table 4).

Interaction effect of nitrogen and organic manures was found to be non significant (Appendix VI) in respect of diameter of fruit. The maximum diameter of fruit (4.60 cm) was measured from N_2M_1. The minimum (3.00 cm) diameter of fruit was found in the control treatment (N_0M_0) (Figure 6).

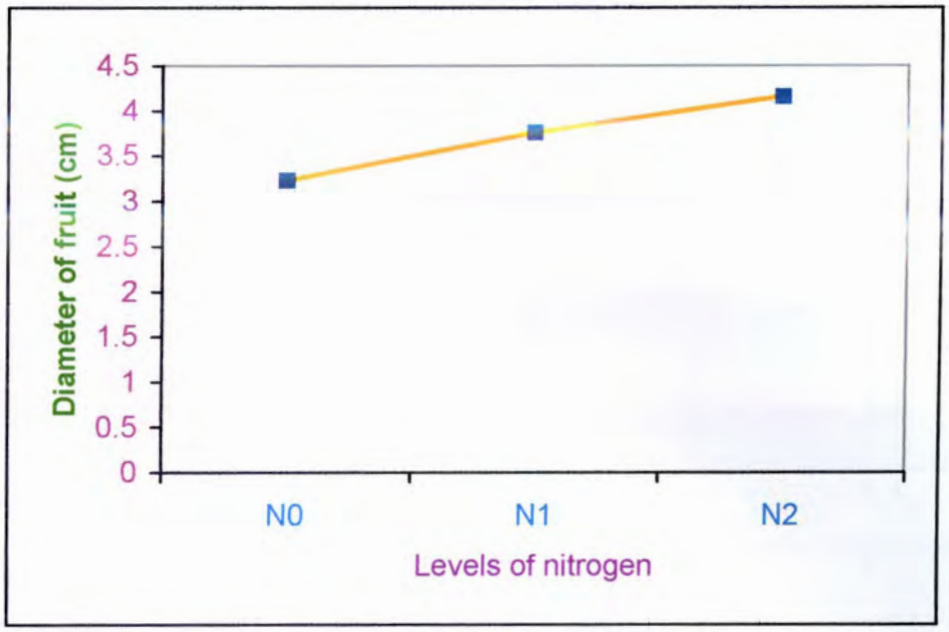

Figure 16. Effect of nitrogen on the diameter of fruit (cm).

N_0 = No nitrogen

N_1 = 100 kg nitrogen/ha

N_2= 150 kg nitrogen/ ha.

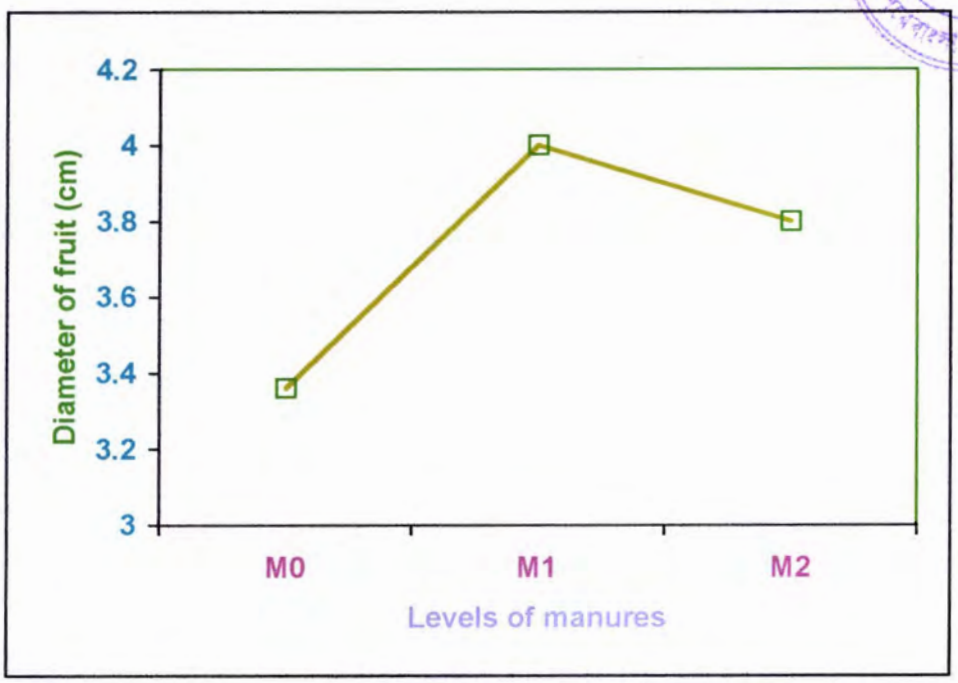

Figure 17. Effect of manures on the diameter of fruit (cm).

M_0= No manures

M_1= 10 ton cowdung/ha

M_2 = 3 ton poultry litter/ha

Table 4. Interaction effect of different levels of nitrogen and organic manures on the length of fruit (cm) and diameter of fruit (cm).

Treatments	Length of fruit (cm)	Diameter of fruit (cm)
N_0M_0	11.50	3.0
N_0M_1	12.3	3.4
N_0M_2	12.0	3.3
N_1M_0	12.5	3.5
N_1M_1	13.9	4.0
N_1M_2	13.4	3.8
N_2M_0	13.0	3.6
N_2M_1	14.9	4.6
N_2M_2	14.3	4.3
LSD (0.05)	1.245	0.3631
CV (%)	5.49	5.64

N_0= No nitrogen (control)
N_1= 100 kg nitrogen/ha
N_2= 150 kg nitrogen/ha

M_0= No manure (control)
M_1= 10 ton cowdung/ha
M_2= 3 ton poultry litter/ha

4.9 Number of fruit per plant

It is evident from data presented in table 5 that the average number of fruit per plant was increased with the increasing levels of nitrogen. So highly significant variation (Appendix VII) was recorded in respect of number of fruit per plant of brinjal. The maximum (18.4) number of fruit/ plant was measured from N_2 and the minimum (13.7) from the control (N_0). Satyanarayana (1970) also reported that the highest level of nitrogen gave the highest number of fruits per plant. He measured the highest number of fruits per plant by the application of 280 kg N/ha.

The data presented in the table no. 5, was found to be highly significant (Appendix VII) in respect of average number of fruit per plant. The maximum (17.8) number of fruit was measured from the treatment M_2 and the minimum (14.4) number of fruits was measured from the control.

The interaction effect between nitrogen and manures were non significant (Appendix VII). The highest (20.50) number of fruits per plant was measured from N_2M_1 and the lowest (12.00) number of fruits per plant was measured from the control (N_0M_0) treatment. The average number of fruit incase of interaction was 16.28.

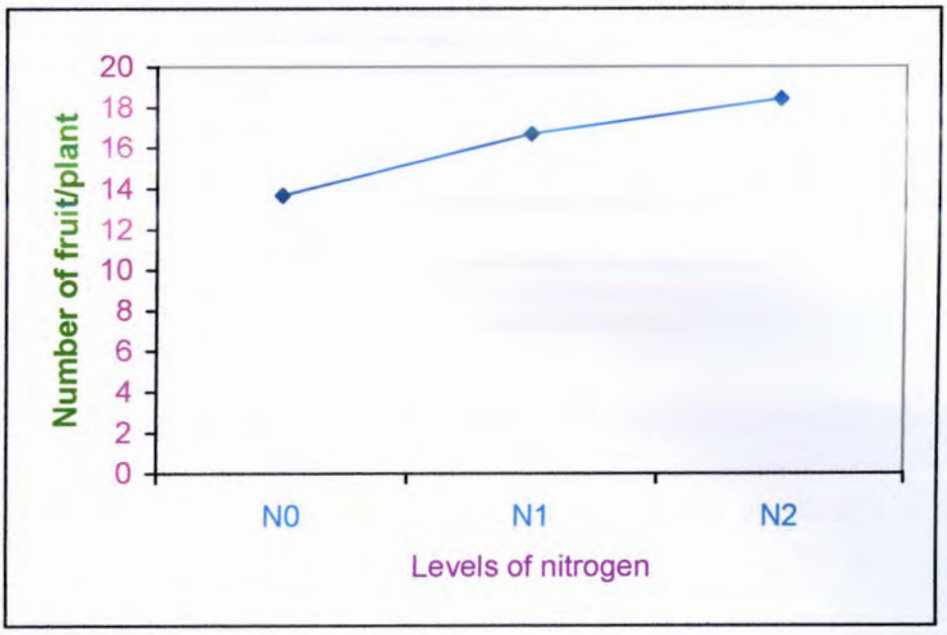

Figure 18. Effect of nitrogen on the number of fruit/plant.

N_0 = No nitrogen

N_1 = 100 kg nitrogen/ha

N_2= 150 kg nitrogen/ ha.

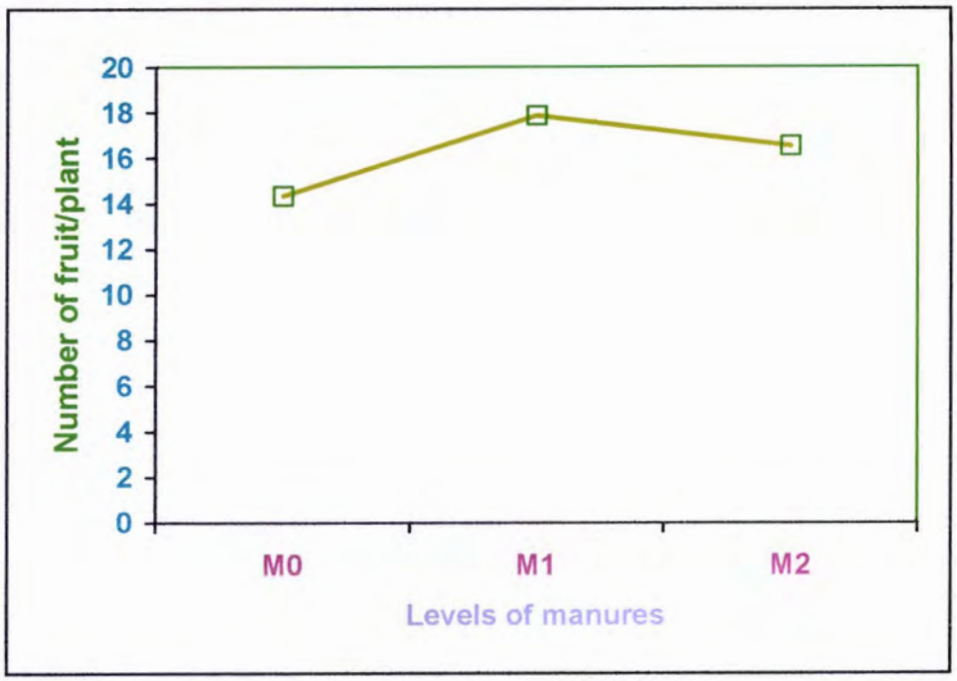

Figure 19. Effect of manures on the number of fruit/plant.

M_0= No manures
M_1= 10 ton cowdung/ha
M_2 = 3 ton poultry litter/ha

4.10 Weight of individual fruit (g)

Highly significant variation was recorded (Appendix VII) in respect of weight of individual fruit (g) due to the application of different doses of nitrogen. The highest (90.32 g) weight of individual fruit was measured from N_2 followed by N_1 (84.50 g). The lowest (77.57 g) was measured form the control treatment (Table 5).

A significant variation (Appendix VII) was measured in respect of weight of individual fruit (g) due to the application of different doses of manures. The highest (88.92 g) weight of individual fruit was measured from the treatment M_1 followed by M_2 (84.90 g). The lowest (78.57 g) weight of individual fruit was found from the control (Table 5).

The interaction effect between nitrogen and organic manures were highly significant (Appendix VII). The highest (96.27 g) weight of fruit was found in N_2M_1 and lowest (72.70 g) from the control (N_0M_0) (Figure 7).

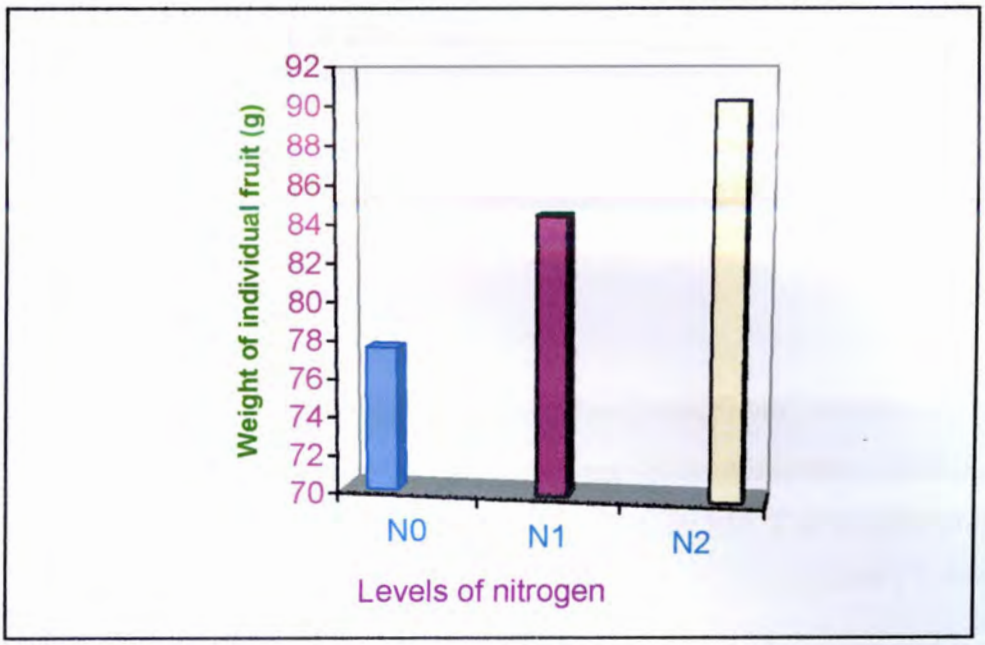

Figure 20. Effect of nitrogen on the weight of individual fruit (g).

N_0 = No nitrogen

N_1 = 100 kg nitrogen/ha

N_2= 150 kg nitrogen/ ha.

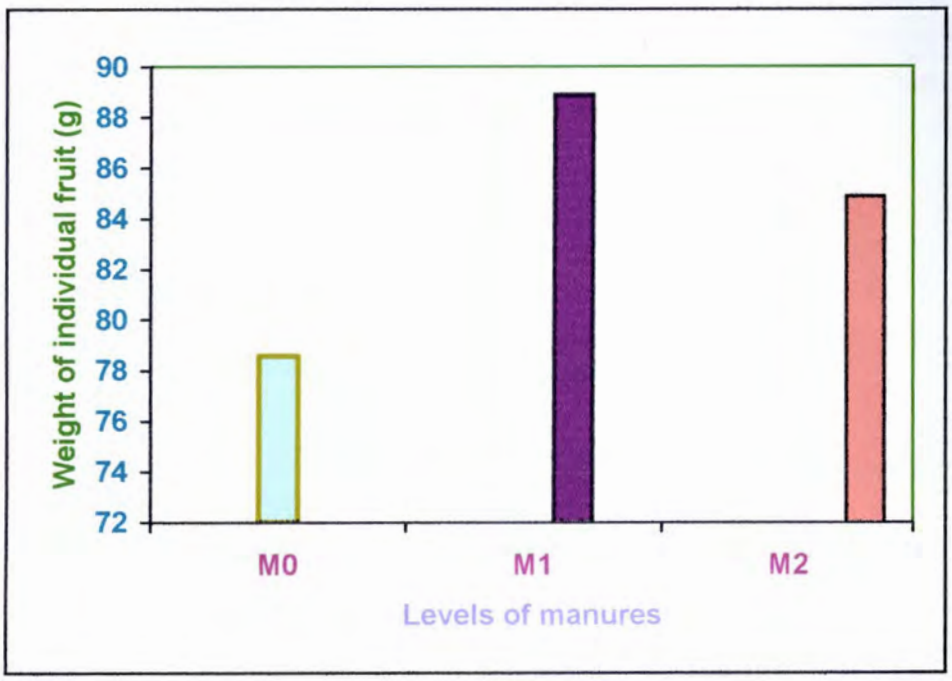

Figure 21. Effect of manures on the weight of individual fruit (g).

M_0= No manures
M_1= 10 ton cowdung/ha
M_2 = 3 ton poultry litter/ha

4.11 Weight of fruit per plant (g)

There was highly significant variation (Appendix VII) in the total weight of fruit per plant. The highest (1673.1 g) weight of fruit per plant was measured from N_2 and the lowest (1065.1 g) was measured from the control (N_0) (Table 5).

From the data presented in the table 5, showed significant variation (Appendix VII) in respect of total fruit weight per plant. The maximum (1602.1 g) fruit weight per plant was measured from the treatment M_1. The minimum (1135.2 g) fruit weight per plant was measured from the control treatment (Table 5).

The interaction effect between nitrogen and manures was highly significant (Appendix VII) in respect of total fruit weight per plant. The maximum (1974.1 g) weight of fruit per plant was measured form the treatment combination of N_2 and M_1. The minimum (872.8 g) was measured from the control treatment (Figure 8).

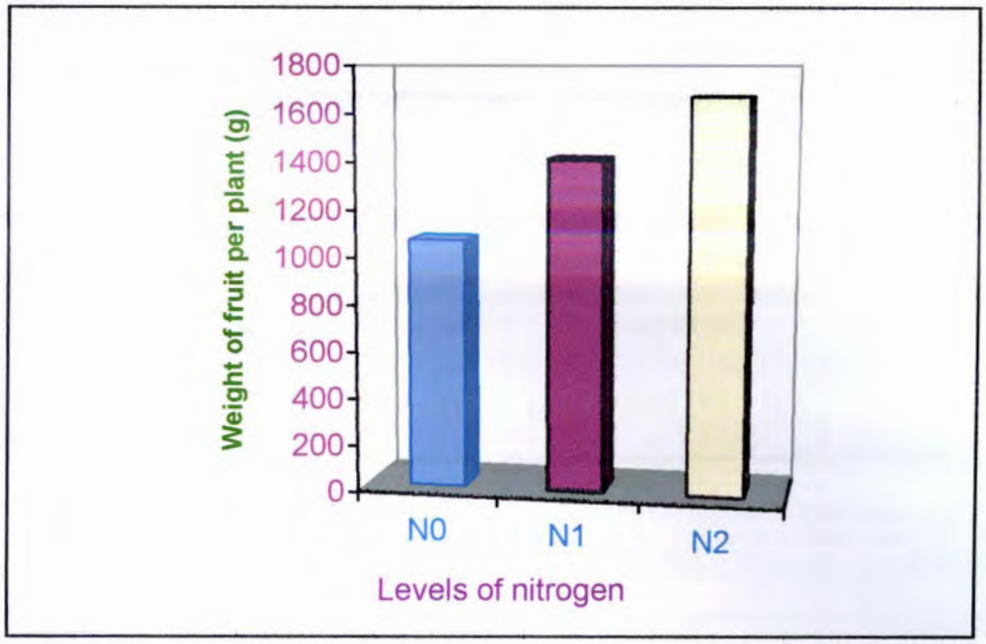

Figure 22. Effect of nitrogen on the weight of fruit/plant (g).

N_0 = No nitrogen

N_1 = 100 kg nitrogen/ha

N_2= 150 kg nitrogen/ ha.

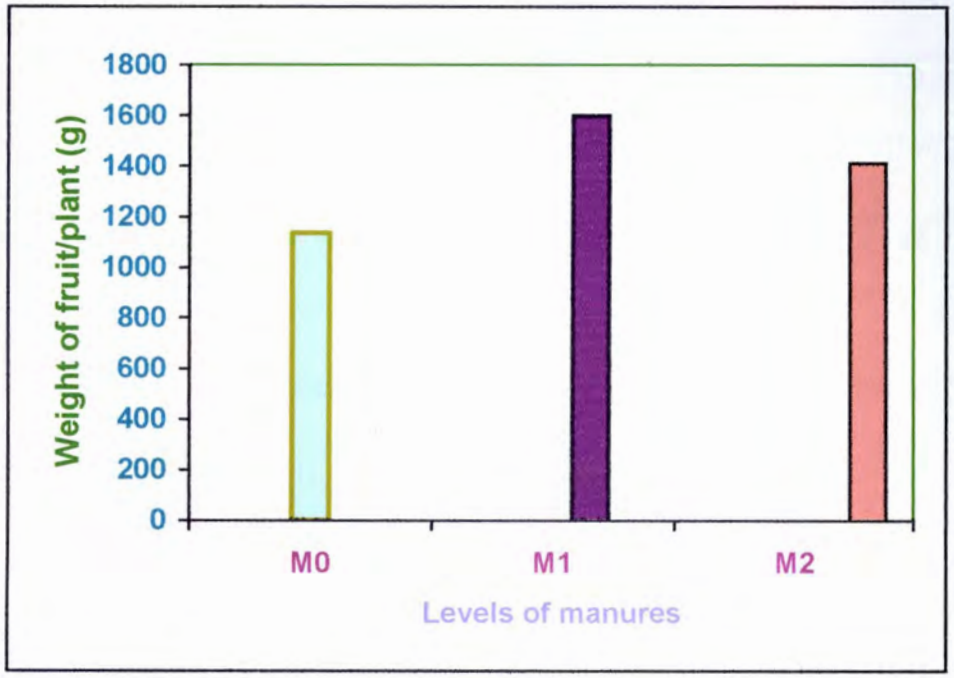

Figure 23. Effect of manures on the weight of fruit/plant (g).

M_0= No manures
M_1= 10 ton cowdung/ha
M_2 = 3 ton poultry litter/ha

Table 5. Interaction effect of nitrogen and organic manures on the number of fruit/plant, weight of individual fruit (g) and weight of fruit per plant (g).

Treatments	Number of fruit/plant	Weight of individual fruit (g)	Weight of fruit per plant (g)
N_0M_0	12.0	72.70	872.8
N_0M_1	15.10	81.90	1237.1
N_0M_2	13.90	78.10	1086.2
N_1M_0	15.36	79.50	1222.0
N_1M_1	18.0	88.60	1595.1
N_1M_2	16.70	85.40	1423.3
N_2M_0	15.70	83.50	1311.2
N_2M_1	20.50	96.27	1974.1
N_2M_2	19.00	91.20	1734.4
LSD (0.05)	0.9337	1.521	88.12
CV (%)	3.32	1.04	3.68

N_0= No nitrogen (control)
N_1= 100 kg nitrogen/ha
N_2= 150 kg nitrogen/ha

M_0= No manure (control)
M_1= 10 ton cowdung/ha
M_2= 3 ton poultry litter/ha

CHAPTER V

Summary and Conclusion

SUMMARY AND CONCLUSION

The experiment was conducted at the Horticultural Farm, SAU, Dhaka during the period from March to October, 2006 to investigate the effects of different levels of nitrogen and organic manures on the growth and yield of brinjal.

The treatment consisted of three levels of nitrogen- N_0 (Control): No nitrogen, N_1: 100 kg nitrogen/ha, N_2: 150 kg nitrogen/ha and four levels of organic manures- M_0 (control): no manures, M_1: 10 ton cowdung/ha and M_2: 3 ton poultry litter/ha.

The experiment was laid out in the randomized complete block design (RCBD) with three replications. Brinjal seeds of 'Khotkhotia' variety were collected from the Seed Sales center of BADC, Narsingdi. The collected seeds were sown in 4 beds of 3 m x 1 m size on 20 March, 2006. Healthy and uniform sized seedlings of 30 days were transplanted in the experimental plots on 20 April, 2006 maintaining a spacing of 60 cm x 60 cm. Five plants were randomly selected from each plot to record growth, fruit yield components. The collected data were statistically analyzed for evaluation of the treatment effect.

Plant height was highly significantly influenced by different levels of nitrogen and manures. Maximum plant height (52.00 cm) was measured at N_2 and the minimum (35.41 cm) was measured from the control (N_0) treatment. The tallest plant (49.06 cm) was recorded from M_1 and the shortest one (38.84 cm) from the M_0 (control treatment). The combined effect of M_1 with N_2 showed the highest (58.60 cm) height of plant.

Number of leaves per plant was also highly significantly influenced by different levels of nitrogen and highest results were given by the highest level of nitrogen (N_2). The maximum (97.11) leaves per plant was recorded from M_1.

Incase of combined effect, M_1 with N_2 produced a maximum (110.00) number of leaves per plant.

Number of flowers per plant was highly significantly influenced by different levels of nitrogen and manures. The maximum (57.56) number of flowers per plant was obtained from the treatment of N_2. On the other hand, the highest number (53.22) of flowers per plant was recorded from M_1. M_1 with the combination of N_2 produced maximum number (66.33) of flowers/plant.

Highly significant variation was observed in respect of days to first flowering due to the different levels of nitrogen and manures. Delayed flowering (64.67 days) occurred in the control treatment (0 kg N/ha) and early flowering (56.00 days) observed in N_2. On the other hand, M_1 showed delayed flowering (61.33 days) than the control treatment (59.33 days). M_1 with N_2 caused delayed flowering (65.00 days).

Length of fruit varied significantly with different levels of nitrogen and manures. Different nitrogen levels showed remarkable effect and values of these parameters gradually increased up to N_2. Different organic manure levels had also significant effect on length of fruit. Maximum length (13.70 cm) was measured from the treatment M_1 and the minimum (12.33 cm) was recorded from the control (0 kg manures/ha). The interaction effect of nitrogen and organic manures also gave a significant result (14.90 cm).

Highly significant variation on the diameter of fruit was observed by different levels of nitrogen and manures. The highest (4.167 cm) diameter of fruit was observed from N_2. The highest (4.00 cm) diameter of fruit was recorded from M_1. The highest (4.60 cm) diameter of fruit was found from the combined treatment of M_1 and N_2.

Number of branch per plant was also significantly influenced by different doses of nitrogen and manures. The maximum (17.11 cm) branch length was recorded from N_2 and M_1 showed the maximum (15.33 cm) length of branch. The combination of M_1 and N_2 gave the highest number (19.00) number of branch/plant.

Highly significant variations on the length of branch was observed by different levels of nitrogen and manures. The highest (53.78 cm) branch length was measured from N_2. M_1 showed the maximum (51.79 cm) length of branch than the control treatments (43.87 cm). Incase of combined effect, M_1 with N_2 gave the maximum (58.93 cm) length of branch.

The average number of fruit per plant was found to be highly significant due to the application of various levels of nitrogen and organic manures. The maximum (18.40) number of fruit was found with the treatment N_2 and the highest (51.79) number of fruit was measured from M_1. The combined effect of N_2 with M_1 produced highest (20.50) number of fruit per plant.

Weight of individual fruit was also significantly influenced by different levels of nitrogen and organic manures. The combined effect of M_1 with N_2 produced highest (96.27 cm) weight of individual fruit. N_2 produced 90.32 gm weight of fruit. On the other hand, M_1 alone produced highest (88.92 gm) weight of single fruit.

A highly significant variation was found in respect of total weight of fruit per plant due to the application of different doses nitrogen and manures. N_2 gave the highest (1673.11 gm) weight of fruit/plant and M_1 also gave maximum (1602.1 gm) weight of fruit per plant than the control treatment. The combined effect of N_2 with M_1 gave the highest (1974.1 gm) weight of fruit per plant.

Conclusion :

The result of the present experiment revealed that different levels of nitrogen and organic manures play an important role on the growth and yield of brinjal. In respect of yield and yield contributing characters nitrogen exerted marked effect over the control. On the other hand, organic manures, such as cowdung and poultry litters help to increase the yield of brinjal. From this experiment, it was found that different levels of nitrogen showed a gradual increase of growth and yield of brinjal. On the other hand, cowdung application was more effective than the poultry litter but both of them were more effective than the control. The combined effect of cowdung and nitrogen was more effective than any other single or combined treatment. Combined effect of poultry litter with nitrogen was also beneficial but less effective than cowdung and nitrogen combination. Therefore, it could be suggested that M_1 with N_2 were the optimum doses for the growth and yield of brinjal.

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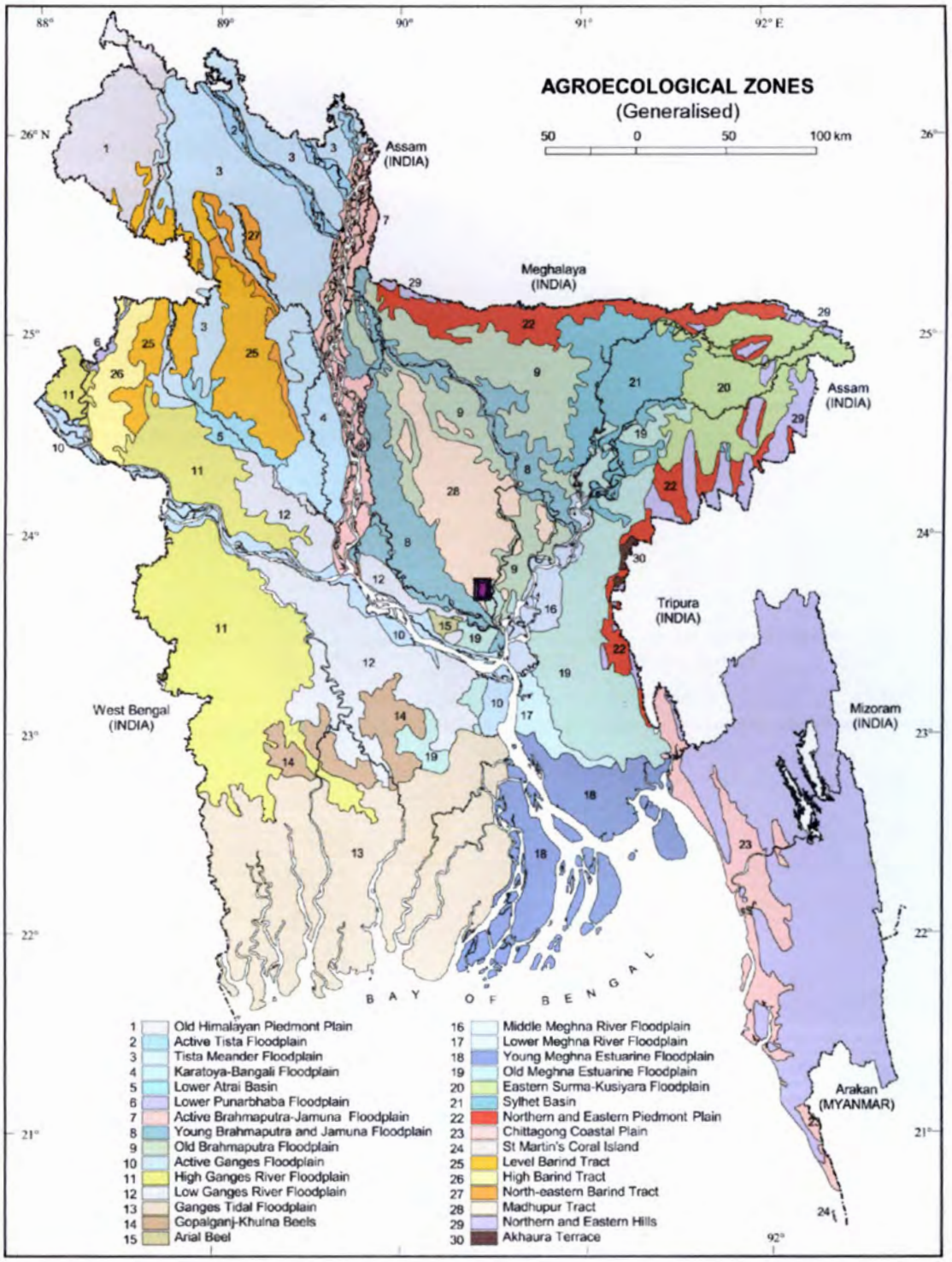
Appendices

APPENDICES

Appendix I. Map showing the experimental sites under study



The experimental site under study

Appendix II. Physiochemical properties of the initial soil

Characteristics	*Value*
Partical size analysis.	
% Sand	46
% Silt	29
% Clay	26
Textural class	sandy loam
pH	5.6
Organic carbon (%)	0.70
Organic matter (%)	0.78
Total N (%)	0.03
Available P (ppm)	20.00
Exchangeable K (me/100 g soil)	0.10
Available S (ppm)	45

Source: SRDI, Farmgate, Dhaka.

Appendix III. Weather data, 2006, Dhaka

Month	*RH (%)*	*Max. Temp. (c°)*	*Min. Temp. (c°)*	*Rain fall (mm)*
April	66.5	34.4	24.1	91
May	74.60	33.2	24.2	298
June	78.60	33.4	26.8	260
July	80.78	31.1	26.1	542
August	83.22	32.0	26.7	361
September	81.71	31.7	26.0	514
October	88.42	30.6	23.3	413
November	73.90	29.0	19.8	03
December	62.79	27.0	15.7	00

Source: Bangladesh Meteorological Department (Climate division), Agargaon, Dhaka-1212.

Appendix IV. Mean squares for plant height, number of leaves per plant, number of branches per plant and length of branch (cm).

Source of Variation	*Degree of Freedom*	*Mean Squares*			
		Plant height (cm)	*Number of leaves/plant*	*Number of branches/plant*	*Length of branch(cm)*
Replication	2	6.707	25.92	3.815	1.231
Nitrogen (N)	2	630.718**	1014.48	116.148**	382.092**
Manures (M)	2	239.12**	361.81	33.593**	142.633**
Interaction (NxM)	4	16.34**	30.31	2.648 ^{NS}	4.528**
Error	16	2.84	3.05	1.731	0.899
CV (%)		3.8	1.91	9.5	1.97

** = Significant at 1% level

* = Significant at 5% level

NS= Non Significant

Appendix V. Mean squares for days to first flowering and number of flowers per plant.

Source of Variation	*Degree of Freedom*	*Mean Squares*	
		Days to first flowering	*Number of flowers per plant*
Replication	2	28.0	8.33
Nitrogen (N)	2	169.0**	1183.0 **
Manures (M)	2	1.00 ^{NS}	458.11**
Interaction (NxM)	4	8.00 *	49.77**
Error	16	2.25	4.417
CV(%)		2.64	4.45

** = Significant at 1% level

* = Significant at 5% level

NS = Non Significant

Appendix VI. Mean squares for length of fruit (cm) and diameter of fruits (cm).

Source of Variation	*Degree of Freedom*	*Mean Squares*	
		Length of fruit (cm)	*Diameter of fruits (cm)*
Replication	2	0.568	0.068
Nitrogen (N)	2	10.45**	1.973**
Manures (M)	2	4.34**	0.943**
Interaction (NxM)	4	0.24 ^{NS}	0.083 ^{NS}
Error	16	0.52	0.044
CV(%)		5.49	5.64

** = Significant at 1% level

* = Significant at 5% level

NS = Non Significant

Appendix VII. Mean squares for average number of fruit/plant, total weight of fruit (g) and weight of individual fruit (g).

Source of Variation	*Degree of Freedom*	*Mean Squares*		
		Average number of fruit/plant	*Total weight of fruit (g)*	*Weight of individual fruit (g)*
Replication	2	4.013**	41266.495**	4.107**
Nitrogen (N)	2	51.695**	837262.174**	367.010**
Manures (M)	2	28.292**	496061.866**	245.290**
Interaction (NxM)	4	1.171 ^{NS}	23220.872**	3.367**
Error	16	0.291	2591.642	0.772
CV(%)		3.32	3.68	1.04

** = Significant at 1% level

* = Significant at 5% level

NS = Non Significant