EFFECT OF SPACING AND BUD PRUNING ON THE GROWTH AND YIELD OF BRINJAL (*Solanum melongena* L.)

KAZI RUKSHANA SULTANA

DEPARTMENT OF HORTICULTURE AND POSTHARVEST TECHNOLOGY

SHER-E-BANGLA AGRICULTURAL UNIVERSITY
DHAKA-1207

DECEMBER 2006

EFFECT OF SPACING AND BUD PRUNING ON THE GROWTH AND YIELD OF BRINJAL (*Solanum melongena* L.)

By

KAZI RUKSHANA SULTANA

REGISTRATION NO. 26215/00506

A Thesis

Submitted to the Department of Horticulture and Postharvest Technology
Sher-e-Bangla Agricultural University, Dhaka,
in partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

IN

HORTICULTURE

SEMESTER: JULY-DECEMBER 2006

Approved by:

(Dr. Md. Nazrul Islam)	**(Md. Hasanuzzaman Akand)**
Supervisor	**Co-supervisor**

(Professor Md. Ruhul Amin)
Chairman
Examination Committee

CERTIFICATE

This is to certify that the thesis entitled, "*EFFECT OF SPACING AND BUD PRUNING 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 *KAZI RUKSHANA SULTANA*, Registration No. *26215/00506* 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 her.

Dated:

Place: Dhaka, Bangladesh

Dr. Md. Nazrul Islam
Supervisor

Dedicated to my beloved parents

ACKNOWLEDGEMENT

All praises are due to the almighty Allah Rabbul Al-Amin who has guided the author with blessing to complete the thesis leading to M.S. degree.

The author would like to express her heartfelt gratitude and most sincere appreciations to her Supervisor Dr. Md. Nazrul Islam, Associate professor, Department of Horticulture and Postharvest Technology, Sher-e-Bangla Agricultural University, Dhaka for her valuable guidance, advice, immense help, encouragement and support throughout the study. Likewise grateful appreciation is conveyed to Co-supervisor Md. Hasanuzzaman Akand, Assistant Professor, Department of Horticulture and Postharvest Technology, Sher-e-Bangla Agricultural University, Dhaka for constant encouragement, cordial suggestions, constructive criticisms and valuable advice to complete the thesis.

The author would like to express her deepest respect and boundless gratitude to all the respected teachers of the Department of Horticulture and Postharvest Technology, Sher-e-Bangla Agricultural University, Dhaka for their valuable teaching, sympathetic co-operation, and inspirations throughout the course of the study and research work.

The author wishes to extend her special thanks to her friends Mizan, Shuvo, Pavel, Nasim, Parul, Movy, Lima and cousin Mukta and Choto Apa for their inspiration and help during the study period.

The author is deeply indebted to her father and grateful to her reverent mother, brothers, sisters and other relative's for their moral support, encouragement and love with cordial understanding.

Finally the author appreciate the assistance rendered by the staffs of the Department of Horticulture and Postharvest Technology, Sher-e-Bangla Agricultural University, Dhaka, who have helped her during the period of study.

The author dedicated the manuscript to her beloved parents.

The author

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS AND ACRONYMS

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 SPACING AND BUD PRUNING ON THE GROWTH AND YIELD OF BRINJAL (*Solanum melongena* L.)

ABSTRACT

A study was undertaken to find out the effect of spacing and bud pruning on the growth and yield of brinjal (cv. 'Khotkhotia'). The experiment was conducted at Sher-e-Bangla Agricultural University, during March to September 2006. Three different spacing S_1 (60 cm x 60 cm), S_2 (80 cm x 80 cm) and S_3 (100 cm x 100 cm) and three types of bud pruning; P_0 (without pruning), P_1 (pinching off of the lateral bud), P_2 (Pinching off of the terminal bud) were tested. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. Increasing the spacing increased the number of branches per plant, number of leaves per plant, number of flowers per plant, average number of fruits per plant and individual weight of fruit. Number of branches (14.11), number of leaves (100.2) and length of lamina (19.2 cm) was the highest in S_3. Number of flowers (12), number of fruit (18.47) and individual weight of fruit (90.24 g) was the highest in S_3. The closest spacing S_1 gave the highest number of fruits per plot (68.50) but the total yield of fruit per plot was the highest in S_3 (1677 g). Neither spacing nor bud pruning had any significant influence on the plant height of brinjal. P_2 produced the highest number (17.7) of branches and leaves (101.78). P_1 gave the largest size (88.84 g) of fruits compared to P_2 (84.47 g). The result of the present study showed that the widest spacing (S_3) and lateral bud pruning (P_1) gave the highest yield per plant. Further study could be undertaken with spacing higher than S_3 (100 cm x 100 cm) and pinching off of the lateral bud.

CHAPTER I

Introduction

INTRODUCTION

Brinjal or Aubergine (*Solanum melongena* L.) belongs to the family Solanaceae. It is also known as Aubergine or brinjal or Guinea squash or garden egg. Brinjal is the second most important vegetable crop next to potato in Bangladesh in respect of acreage and production (BBS, 2005). Brinjal is one of the most common, popular and principle vegetable crops grown in Bangladesh and others parts of the world. It is cultivated as a populous and commercial vegetable throughout the tropical and sub tropical regions of the world.

In tropical climate, brinjal can be grown as perennial crop and in sub tropical, it is grown as summer annual. It was probably a native wild plant of India. The domesticated types of brinjal spreaded eastward from India into China by fifth Century B.C. So, the center of origin is the Indian Sub-continent with a secondary center of origin in China and South-East Asia. It is also grown in Bangladesh, India, Pakistan, Nepal, China, Japan, Philippines, France, Italy, USA, the Mediterranean and Balkan area (Bose and Som, 1986). Various form, colors and shapes of brinjal are found throughout South East Asia.

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. Some high yielding varieties in our country are BARI Begun-2 (Tarapuri), BARI Begun-4 (Kazla), BARI Begun-5 (Nayantara).

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 is selected for this experiment.

Brinjal is nutritious vegetable and has got multifarious use as a dish item (Bose and Som, 1986 and Rashid, 1993). It is largely cultivated in almost all districts of Bangladesh. It can be grown at homestead area and kitchen garden because of its popularity especially for urban people. About 8 million farm families are involved in brinjal cultivation (Islam, 2005). This gives small, marginal and landless farmers a continuous source of income provides employment facilities for the rural people. For most of the time, except peak production period, market price of brinjal compared to other vegetables remains high which is in favour of the farmer's solvency.

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, 0.9 mg iron, 44 mg Sulphur, 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.ik)

The unripe fruit is primarily used as a cooked vegetable for the preparation of various dishes in different regions of the world. It has potentially as raw material in pickle making (Singh et al, 1963). It is supposed to contain certain medicinal properties and white brinjal is said to be good for diabetic patients (Chowdhury, 1976). Fried brinjal in till oil has some medicinal value to cure liver problem (Chaudhan, 1981)

Brinjal is equally preferred by both rich and poor people. The vegetable production in summer is scanty and brinjal plays an important role to meet up the shortage of vegetable in this lean period. The total area of brinjal cultivation is 60100 hectare where 22500 ha in Kharif season (March to September) and 37500 ha in Rabi season (October to February) with total annual production of 35840 ton and the average yield is 6.0t/ha in 2003-2004 year (BBS, 2004).

Yield expression of a genotype is mainly governed by environment and other management factors. Yield differences may also be occurred due to variation in cultural practices. Plant density and pruning are two important cultural practices which may be the limiting factors of yield. Pruning operation which can be done successfully, with negligible cost, has been found to increase the yield on tomato (*Lycopersicum esculentum*) a member of the same family as the brinjal belongs to.

By the proper management of cultural practices such as pruning and optimum spacing, influence the yield and yield contributing characters of brinjal. By applying proper spacing and pruning, plant growth continues perfectly and ultimate yield become higher than that of done in normal cultural practices.

Considering the above facts, the present study was undertaken to find out the optimum plant population, suitable pruning practice for higher yield, better quality of brinjal and to reduce the production cost.

Objectives of the present study were-

1. To find out the optimum spacing for growth and yield of brinjal.
2. To find out the effect of pruning operation on the growth and yield of brinjal.
3. To find out the interaction effect of spacing and pruning on the growth and yield of brinjal.

CHAPTER II

Review of Literature

REVIEW OF LITERATURE

The growth and yield of brinjal are influenced by different spacing and types of pruning. The review of literature includes reports as studied by several investigator who found pertient in understanding the problems which may help in the explanation and interpretation of results of the present investigation. In this chapter, an attempt has been made to review the available information in home and abroad on the effect of spacing and bud pruning on the growth and yield of brinjal.

2.1 Effect of spacing on the growth and yield of brinjal.

Harminder *et al.* (1997) conducted a field experiment in Punjab, India to determine the effect of various plant spacings on plant growth and yield of 2 aubergine hybrids (BH-1 and BH-2). The treatments were: 5 plant spacings (45 x 45, 60 x 45, 75 x 45, 90 x 45 and 105 x 45 cm) with corresponding plant densities (4.9, 3.7, 2.9, 2.4 and 2.1 plants/m^2) arranged in all possible combinations. Plant spacings at 105 x 45 cm had maximum plant height (80.66 cm), number of branches/plant (7.88), plant spread (69.50 cm), days to first fruit picking (60.50), average fruit weight (129.3 g) and average number of fruits/plant (18.50). Plant spacings at 45 x 45 had maximum dry matter accumulation (66.58 q/ha), early yield/ha (167.0 q/ha), marketable yield/ha (663.0 q/ha) and total yield/ha (716.8 q/ha) while plant spacing at 75 x 45 had maximum days to 50% flowering.

Chadha *et al.* (1997) conducted an experiment in rabi [winter] 1993-94 on a sandy loam soil at Jabalpur, India, to determine the effect of levels of N,P,K and plant spacings on yield and economics of brinjal (*Solanum melongena* L.). Brinjal [aubergine] cv. JB 64-1-2 were planted at 75 X 50, 75 X 70 or 75 X 90 cm and supplied with N at 0, 75 or 150 kg/ha, P_2O_5 at 0, 30 or 60 kg/ha and K_2O at 0, 30 or 60 kg/ha. One-third of the N and the full dose of P and K were applied basally, and the remainder of the N was applied in 2 equal splits at 30

and 50 days after transplanting. Crop yield was the highest (237.88 q/ha) at the closest plant spacing (75 X 50 cm). This yield was reduced by 38.06 and 77.59% at 75 X 70 and 75 X 90 cm, respectively.

Vijayakumar *et al.* (1995) conducted an experiment to find out the influence of mother crop nutrition and spacing on seed yield and quality in brinjal. Seeds under the experimental treatments exhibited the highest percentage germination. Of the 3 spacing tested that of 75 x 60 cm produced the highest seed yield.

Singh and Syamal (1995) conducted and experiment to find out the effect of nitrogen and spacing on and quality attributes of brinjal. Transplanting at the widest spacing (60 cm X 90 cm) resulted in the highest number of fruits, fruit weight as well as ascorbic acid content. However, the yield was the highest at the closest spacing (60 cm X 60 cm).

Hassan (1993) conducted an experiment at El-Minia University, Egypt to find out the effect of plant density and additional dose of nitrogen after the first harvest on eggplant cv. "Black Beauty". Increasing plant density significantly reduced early fruit weight/plant (2nd season only), total number and weight of fruit/plant and increased the average fruit weight. Spacing 80 cm apart without additional N fertilizer is recommended.

Reddy and Abbashussen (1988) reported that Pusa Kranti was planted at 4 spacings: 75 X 60 cm (S_1), 60 X 60 cm (S_2), 60 X 45 cm (S_3) and 60 X 30 cm (S_4), with 3 rates of NPK fertilizer application: 62:50:25 (F_1), 125:100:50 (F_2) and 187:150:75 (F_3) in kg/ha. The highest mean fruit yield (17.57 t/ha) was obtained with a 60 X 30 cm spacing and 187:150:75 kg NPK/ha (S_4F_3). This was on a par with the results of the S_2F_3 treatment and it is suggested that due to the ease of cultivation at the 60 X 60 cm spacing, the latter treatment combination should be used for cultivation of Pusa Kranti.

Vadivel and Balasubra (1988) reported that plants of the aubergine cultivars Annamalai and Pattabiram, spaced at 90X60 or 90X90 cm received N at 0, 100, 200, 300 or 400 kg/ha. In both cultivars the highest yields (28.5-29.6 t/ha) were obtained with 300 kg N/ha applied to plants spaced at 90X60 cm.

Abutiate (1988) reported that the two closer spacing of 90 X 60 and 75 X 60 cm significantly out yielded all other treatments in terms of number and weight of marketable fruits. The yield of unmarketable fruits increased sharply with the closest spacing. The widest spacing (100 X 90 cm) gave the lowest yields of both marketable and unmarketable fruits. Total yields increased from the first to the fourth harvest and declined thereafter.

Shukla and Prabhakr (1987) studied the effect of plant spacing on yield and attack by insect pests, such as the pyralid *Leucinodes orbonalis*, and fungi with brinjal [aubergine] in the field in Karnataka, India. The lowest yield (67 q/ha) was recorded with a row spacing of 100 cm compared with a yield of 132 q/ha with a row spacing of 50 cm. The highest yield (154 q/ha) was recorded with a density of 50 000 plants/ha (50 cm X 40 cm).

Paturde *et al.* (2002) conducted an experiment for the performance of Arka Mahima (Tetraploid) against Arka Sanjeevini (Diploid) varieties of wild brinjal under different plant spacing 60 x 30 or 30 x 30 cm^2 and two fertility levels (60:40:40 and 90:60:60 kg N, P_2O_5 and K_2O per hectare). Arka Sanjeevini recorded significantly more dry berry yield than Arka Mahima. However, solasodine content (%) and solasodine yield were significantly higher in Arka Mahima than in Arka Sanjeevini. Plant spacings had no significant effect on dry berry yield and solasodine yield. The solasodine content was significantly higher upon treatment with the 30 x 30 cm^2 than the 60 x 30 cm^2 spacing

Tai Chen Yang *et al.* (2001) found that total yield increased as plant density increased. The highest yield was obtained from plant density at 1.11 plant/m2 while the ratio of grade A fruit number to total fruit number decreased from

64.5% to 61.1% as plant density increased from 0.56 to 1.11 plant/m2. There is no significant effect on fruit length and diameter among different density treatments. However, based on the consideration of both total yields and fruit quality, the plant density at 0.67-0.84 plant/m2 is recommended for aubergines with V-type training.

Barbieri and Deveronico (1989) mentioned that plant densities of 1.6, 3.1, 4.6, 6.2, 7.8 or 9.4 plants/m^2 was irrigated at rates of 50, 100 or 150% of estimated evapotranspiration (ETe, Class A pan). There were significant interactions between plant density and irrigation regime. The best results (a marketable yield of 65 t/ha) were obtained with a plant density of 4.6.

Campbell and Hodnett (1961) conducted an experiment on the egg-plant and observed that among the square spacings ranging from 18" to 36" closer spacings resulted in increased yields.

Richharia and Roy (1944) in a spacing trial on brinjal found that, if distance varied from 2 to 3ft. between both plant to plant and line to line, depending upon the soil, manure & variety.

Hawthorn and pollard (1953) suggested that the spacing of egg-plant should be 3 to 4 ft. between rows and 2 to 2.5 ft. between plants depending on the variety as well as on the preference of the grower. They also indicated that, when closer planting is possible the yield of fruit is likely to be some what higher.

Thompson and Kelly (1957) suggested that egg-plant should be spaced 3 to 4 ft. between rows while 2 to 3 ft. between plants and for small growing varieties row to row distance should be 2.5 to 3 ft. and 1.5 to 2ft. between plants.

Roy *et al.* (1954) in an experiment with Marglobe Sabour variety of tomato observed that the highest yield was obtained from the spacing of 4'x2' while

yield per plant was the highest at 4'x4' and the lowest at 4'x2'. Increased spacing resulted in a slight increase of weight per fruit and number of fruits per plant.

Butter (1961) in a tomato spacing trial observed that the yields of tomatoes increased as the spacing in the rows decreased from 15 to 19 inches. He also found that the size of the fruit was reduced by closer spacing.

Verma & Bhatnagar (1962) in a spacing experiment on *Zea mays* found that 2'x1' spacing was most profitable. The increase in yield in this treatment appears to be due to the greater number of plants in comparison to other wider spacings such as 2'x2', 3'x1' and 3'x2' . As 2'x1' spacing has given the highest yield, it is very likely that a further increase in yield may be obtained by still closer spacing.

Brayan *et al.* (1946) found that 21"x21" spacing for corn had a significant advantage over 42"x42" spacing. In an experiment at cowthron Institute it was found that the early removed of the laterals from the lower part of the stem reduced the yields but improved the quality of the glass-house tomatoes.

An experiment was conducted at BARI regional station Khagachari during October to March with cabbage to determine the effect of plant spacing and starter solution on the growth and yield of cabbage. The treatments of the experiment were three plant spacing viz. 60 cm x 60 cm, 65 cm x 45 cm and 60x30 cm and three concentrations of Urea solution as starter solution viz 1.0%, 2.0% with control (0%). Almost all the parameters under study were significantly influenced by the spacing except survival (%) seedlings and number of outer leaves. The wider spacing (60cmx60cm) produced larger sized head in respect of diameter and thickness/plant than the closer spacing. A similar trend was also found in the case of head weight. Both gross and marketable heads/plant had the highest weight from the widest spacing of

60cmx 60cm. This was followed by the spacing 60cmx45cm and 60cm x 30cm. The head weight/plant decreased gradually as the spacing was narrowed and statistically the lowest yield/plant was recorded from 60cmx30cm.

Shahnaz conducted an experiment in the field of Institute of Post Graduate Studies in Agriculture (IPSA), Salna, Gazipur from October 1990 to April 1991 to determine the effects of spacing and support on the growth and yield of Lablab Bean. *Lablab purpurea* cv L. (sweet). The three spacing treatments were 150x150cm, 150 x 100cm, 150 x 150cm and three types of support were horizontal match, Vertical matcha and single stick support. Each treatment was replicated three times in a Randomized Complete Block Design. Maximum weight of pods per plant (1.7 kg) and number of pods per plant (327.1) were obtained from the widest spacing of 150 x 150 c. The yield of pod increased significantly with a decrease in plant spacing. The highest yield (12.3t/ha) was obtained at spacing of 150 x 150 cm . Maximum yield (13.7t/ha) was obtained form close spacing (150x50cm) in combination with vertical matcha which was closely followed (12.4t/ha) by the horizontal matcha in the same spacing.

Md. Akhteruz conducted an experiment in the field of citrus and vegetable Seed Research centre, BARI, Joydebpur during the year 1990-1991 to find out the effect of planting time and spacing on the seed yield of cabbage variety "Probhati". Six time of plantings e.g. 1 October, 16 October, 1 November 16 November, 1 December and 16 December and six spacing e.g. 60x60cm, 60x45 cm, 60x30cm, 45x45cm, 45x45cm and 30x30cm were the experimental treatments. Both time of planting and spacing significantly influenced most of the characters pertaining to seed yield per plant and per hectare. The highest seed yield per plant and per hectare was obtained from the plants of 16 November planting. Seed yield per plant was found higher with plants of wider spacing while seed yield/ha was higher with closer spacing. Interaction effect shows that the highest seed yield (574.0 kg/ha) was obtained from the plants of 16 November planting with 30x30cm spacing.

An experiment was conducted at BARI regional station Khagrachari from 28 April to 10 August with BARI Dharash-1 to determine the effect of plant spacing and harvesting internal on the growth and yield of Okra CV. BARI Dharash-I. The experiment was laid out in randomized complete block design (factorial) with three replication. There were 9 treatment combinations with 3 plant spacing, mainly 50cmx20cm, 50cm x 30cm, 50cmx40cm and 3 levels of picking interval 2, 3, days. Spacing significantly influenced the number and the weight of fruit per plant and yield per ha. The highest number of fruits per plant was observed 1n 50 cm x 40 cm followed by 50 cm x 30 cm (15.3) and the lowest was in 50cm x 20cm (11.7). The weight of fruits per also increased with the increase of plant spacing. Plants at wider spacing produced more yield/plant. The closest spacing 50cmx20cm gave significantly the maximum yield (13.9t/ha) which was statistically different from other plant densities. The lowest yield was obtained from 50cmx40cm (7.55t/ha). The maximum yield was obtained from the closest spacing because of the increased number of plants per unit area. Only number of fruits per plant showed significant interaction. The most satisfactory yield (16-9t) was observed in the closest spacing of 50cm with 3 days of picking interval which was statistically different from all other treatments and the lowest yield (6.0t/ha) was found in 50cmx20cm with 3 days pickling internal. The yield of Okra increased with the decrease in spacing and the highest yield was found from the closest spacing of 50 cm x 20 cm.

2.2 Effect of bud pruning on the growth and yield of brinjal

Singh *et al.* (1999) conducted an experiment to examine the effect of leaf pruning on growth and yield of brinjal in a cv. Pusa purple Long. Pruning of older leaves was very light (2-3), light (4-5), medium (6-7), heavy (8-9) and very heavy (10-11 leaves) with the control having no leaf pruning. Very heavy pruning advanced flowering and fruiting by 10 days but total yield was reduced. Light and medium leaf pruning generally induced flowering 6-7 days earlier and produced the highest yield (5.5 kg/plant). Generally, very light leaf pruning was not effective in influencing flowering and fruiting.

Poksoy *et al.* (1993) conducted an experiment to examine the effects of different pruning on the yield and quality of eggplant cultivars grown in green house conditions. Plants of the F_1 aubergine cultivars Dusky, Vittoria, Valentina, Indra, Sicilia, Palmira and Imperial were pruned to leave either 2 or 3 main shoots above 30-35 cm height, with lateral shoots pruned to leave a fruit and 3 leaves or left not pruned. Both pruning methods (i.e. to 2 or 3 shoots) significantly increased main-shoot length and 1st class fruit yield. Total yield was not affected by pruning method. The highest total and 1st class fruit yields were obtained with the cultivars Sicilia and Imperial.

Campbell (1961) in a series of experiment of tomatoes observed that the pruning had no favorable effect upon the yield.

Bail and Corbett (1892) in New York found that the yield of tomato per plant was decreased in the pruned plants than the unpruned ones.

Lioyds and Brooks (1910) obtained large yields per plant from unpruned tomato plants than those pruned.

Watts (1931) found that the yield of tomatoes per plant was larger in the case of unpruned plants than that of pruned ones.

Chipman (1961) in an experiment with tomatoes observed that the topping at the early stage gave maximum early yields.

M. R. Uddin *et al.* (1996) Conducted an experiment in the field of kasetsart University, Kamaphaeng Saen campus, Thailand from October 1995 to February 1996 to determine the effect of stem pruning (one stem), Two stem, three stem and no pruning) and plant spacing (40 & 50cm) on the yield was evaluated on indeterminate type F1 hybrid tomato variety FMTT22. Two stem pruning yielded the highest (56.20t/ha) closer spacing (40cm) gave higher yield (55.34t/ha). Two stem pruning along with 40cm plant spacing showed superior interaction.

Mr. Pandit *et al.* (1997) found in a trial at Mehovpur, West Bengla that root cutting of pointed gourd cv. Damodar were planted in the first week of November. Each year 30, 45, 60, 0.75 or 0.90m apart in rows 0.30m apart. Total number of fruits per plant and fruit length increased as plant spacing increased. Total and early fruit yields where the highest (101.71 & 169.82 q/ha) respectively, when plants were spaced 0.60 m apart in rows.

Bose and Som (1986) also suggested that for quality seed production of carrot, after selection of true to type roots, their tops and tips are to be cut and replanted in well prepared soil.

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 and statistical analysis.

3.1 Experimental site:

The experiment was conducted in the field of SAU (Sher-e-Bangla Agricultural University) farm allotted for the Department of Horticulture and Postharvest Technology, Sher-e-Bangla Agricultural University, Dhaka-1207.

3.2 Experimental Period:

The experiment was carried out during the period from March to September, 2006.

3.3 Characteristics of Soil:

The land was medium high with adequate irrigation facilities. The soil is sandy loam with a P^H value 5.6. Some of the basic properties are presented below:

The description of the Agro Ecological Zone 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 is presented below (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 is sub tropical in nature characterized by high temperature associated with medium rainfall during Kharif season (April

to September) and scanty rainfall with moderately low temperature during Rabi season (October to March).

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.

3.8 Raising of Seedlings:

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

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

The seeds were sown in the seed beds 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 of the seed 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 of 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 the 12 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) was @ 4 kg/ha used to protect the young plants from the attack of soil inhibiting insects. The planting pits were made 5 days before planting.

3.10 Treatments of the Investigation:

The experiment was undertaken to study the effects of three types of pruning and three different spacing on the growth and yield of brinjal. Thus the experiment included two factors as follows:

3.10.1 Factor A: Different Spacing (S)

S_1 = 60 cm x 60 cm

S_2 = 80 cm x 80 cm

S_3 = 100 cm x 100 cm

3.10.2 Factor B: Types of pruning (P)

P_0 = Without pruning

P_1 = Pinching off of the lateral buds

P_2 = Pinching off of the terminal bud

There were altogether 9 (nine) treatment combination-

S_1P_0	S_1P_1	S_1P_2
S_2P_0	S_2P_1	S_2P_2
S_3P_0	S_3P_1	S_2P_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 1 May, 2006. The experimental plot was first divided into three blocks. Each block consisted of 9 plots. Thus the total number of plot was 27. Three types of pruning and three different spacings were assigned to each block as per design of the experiment. The size of a unit plot was 3 m x 1.8 m. A distance of 0.5 m between the plots and 0.75 m between the block were kept. Half a meter border was maintained from each side of experimental plot. Thus the total area of the experiment was 243.8 square metre.

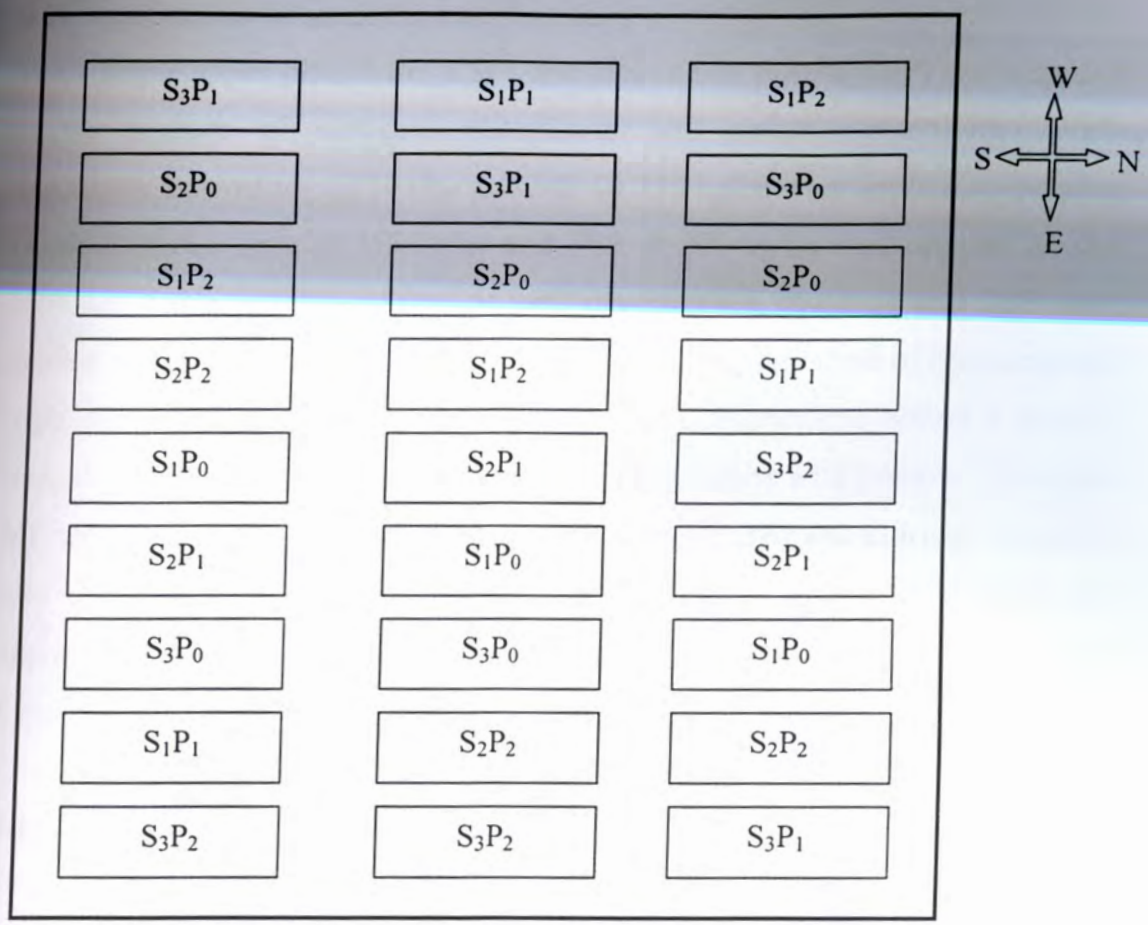


Figure 1. Field layout of the two factorial experiment in Randomized Complete Block Design (RCBD)

Spacing :

S_1 = 60 x 60 cm

S_2 = 80 x 80 cm

S_3 = 100 x 100 cm

Pruning :

P_0= Without pruning

P_1 = Pinching off of the lateral bud

P_2= Pinching off of the terminal bud

Block to block distance = 0.75 m

Border = 0.5 meter

Total plot = 27

Treatment = 27

Replication = 3

Plot to plot distance = 0.5 meter

Size of the block = 20 x 75 m

Size of the plot = 3 m x 1.8 m

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 t/ha and MP @ 250 kg/ha were applied to the plots (Rashid, 1993). Urea @ 250 kg/ha and TSP @ 200 kg/ha were applied for this experiment. Two thirds 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 rind 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 to minimize the damage of roots. 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 20 April, 2006. The seedlings were transplanted maintaining 3 types of spacing such as 60 cm x 60 cm, 80 cm x 80 cm and 100 cm x 100 cm. So 15 plants were transplanted in S_1, 8 plants were S_2 and 6 plants were in S_3. In S_2 and S_3 the number of rows/plants were adjusted by reducing the border spacing.

Planting was done in the evening. Light irrigation was given immediately after transplanting around each seedling for their better establishment and continued for several days for their early establishment. Seedling 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 seedling were replaced by new healthy seedlings from the same stock. Excess plants were transplanted in border area at the same date of plants. Those seedlings were retransplanted with a high mass of soil with roots to minimize transplanting shock.

3.14.2 Pruning operation:

Pruning was done on the 5th April, when the plants were 45 days old. The two types of pruning were side pruning and top running. Lateral buds were pinched off in the case of side pruning and the terminal bud was eliminated in the case of terminal pruning. The plants that were to go without pruning were left to grow without any interference. Pruning was done with the help of forceps and sharp blade by hand.

3.14.3 Weeding:

The plants were kept under careful observation. Weeding was done as when as necessary. It was done at every 15 days interval after planting followed upto 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.

3.14.4 Irrigation:

Irrigation was given as when as 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. Each plants was irrigated by a watering cane.

3.14.5 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. Ripcord 10 EC was applied at the rate of 2 ml/litre. The insecticide applications were done weekly as a routine work from a week after transplanting to early growth stage of fruit and then applications were done every fortnightly after upto mature stage of the fruit.

3.15.2 Diseases:

Precautionary measures against diseases infestation especially Phomopsis fruit rot of brinjal was taken by spraying Bavistin fortnightly @ 2 g/l.

3.16 Harvesting:

Harvesting was started on the 25 June 2006 and was continued till the 20 September 2006. At each harvest, the weight of the fruits, number of fruits and individual weight of fruit, yield/plant was taken plotwise with the unit scale which was gratitude in gram and kilogram.

3.17 Methods of Data Collection:

The data pertaining to following characters were recorded from 9 plants of 60 cm × 60 cm spacing, 8 plants of 80 cm × 80 cm spacing and 6 plants of 100 cm × 100 cm spacing. Data on plant height was collected on the heaviest flowering time.

Data were collected on the following parameters:

i) Average plant height in centimeter

ii) Average number of branches per plant

iii) Average branch length in centimeter

iv) Average number of leaves per plant

v) Average lamina length of the leaf in centimeter

vi) Average number of flowers per plant

vii) Average number of fruits per plant

viii) Average diameter of fruit

ix) Weight of individual fruit (g)

x) Yield per plant (g)

3.18 Collection of Data:

3.18.1 Average plant height (cm):

The height of the selected sample plants was measured in centimeter from the ground level to the tip of the longest stem.

3.18.2 Average number of leaves/ plant:

The number of leaves of selected plant was counted at the time of heavy flowering stage and the average number of leaves are recorded.

3.18.3 Average number of branches per plant:

The number of branches of selected sample plant was counted at the time of heavy flowering stage and the average number of branches was calculated.

3.18.4 Average length of branch (cm):

Branch length was calculated from selected sample at the heavy flowering stage and then the average is calculated.

3.18.5 Average length of lamina of leaf (cm):

Length of lamina was recorded from selected length of lamina and the average of lamina length of leaf was recorded.

3.18.6 Average 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 Average number of fruits per plant:

It was recorded on the basis of average number of fruits of selected plants from each plot.

3.18.8 Average diameter of fruit:

Diameter of each fruit was calculated in gm and then average value is calculated.

3.18.9 Weight of individual fruit (g):

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

3.18.10 Yield per plant (g):

It is calculated by counting the fruits of all plants and the average number of fruits per plant was recorded.

3.19 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 treatments means was evaluated by the least significant difference (LSD) test at 5% and 1% level of probability.

CHAPTER IV

Result and Discussion

RESULT AND DISCUSSION

The experiment was conducted to investigate the effect of different spacing and bud pruning on the growth and yield of brinjal. The data have been presented in different tables (1-5) and Figures (1-19) and a summary of the analysis of variance in respect of all the parameters have been shown in Appendix (IV to VI). The results of each parameter have been presented and discussed under the following headings.

4.1 Plant height (cm):

Spacing had no significant effect (Appendix IV) on plant height. S_1 gave 54.50 cm, S_2 gave 54.20 cm and S_3 gave 55.73 cm. Pruning also had no significant effect (Appendix IV) on plant height. P_0 gave 54.00 cm, P_1 gave 55.60 cm, P_2 gave 54.83 cm. Interaction effect of plant spacing and pruning had no significant effect (Appendix IV) on the plant height. Data of plant height are not shown in any tables and figures because there was no significant effect on plant height. The average plant height in case of interaction between spacing and pruning were 54.81 cm.

Incase of spacing, similar results were reported by Huelson (1954) from a spacing trial of sweet corn varieties, where he found no significant differences in plant height due to spacing when the varieties were planted in both check and drill rows. However, this ineffectiveness of spacing on the plant height of brinjal was perhaps due to the increase in the number of branches, leaves, flowers and slight increase in the branch length as the spacing was increase.

4.2 Number of leaves

Number of leaves were significantly (Appendix IV) influenced by spacing. S_3 produced maximum number of leaves (100.22) followed by S_2 (93.22) and the minimum (77.67) number of leaves was recorded in S_1 (Figure 2). As the

spacing was increased number of leaves was found to be increased. This might have been due to the absorption of more nutrients, getting off more sunlight on larger leaf area and better aeration influenced by the gradual increase in the spacing.

Number of leaves was significantly (Appendix IV) influenced by pruning. The maximum number (101.80) of leaves was found in P_2 followed by P_0 (95.67) and the minimum number (73.67) of leaves was found in P_1 (Figure 3). P_1 produced lowest number of leaves due to the production of the longest lamina and the emergence of a fairly long, strong and stout branch almost equal to the main stem in thickness.

Interaction effect of different spacing and types of pruning had a significant variation (Appendix IV) on number of leaves. The highest number of leaves per plant (110.00) was observed in S_2P_2. The lowest number of leaves (57.67) was observed in S_1P_1 (Table 1).

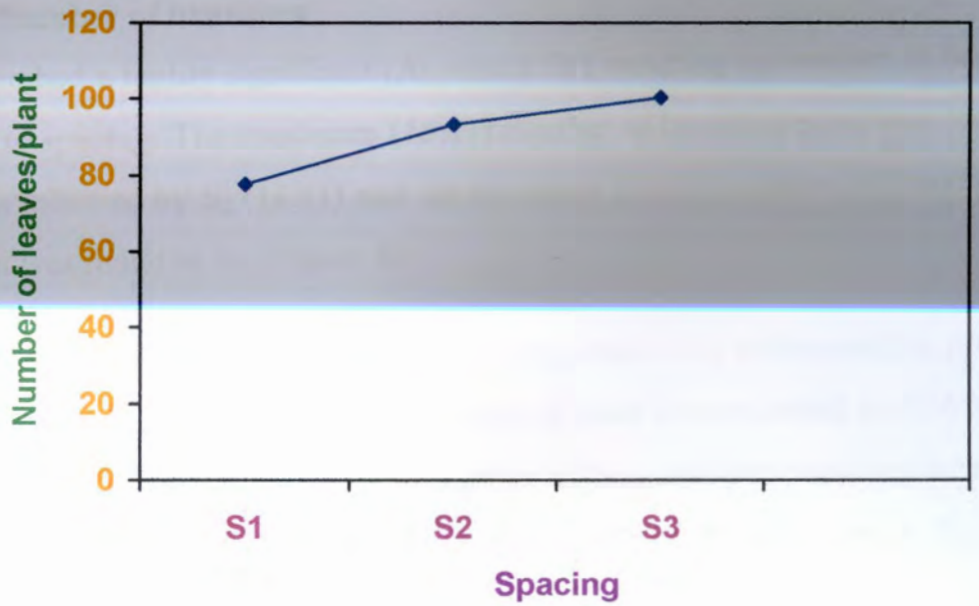


Figure 2. Effect of spacing on the number of leaves of brinjal.

S_1= 60 cm x 60 cm

S_2= 80 cm x 80 cm

S_3 = 100 cm x 100 cm

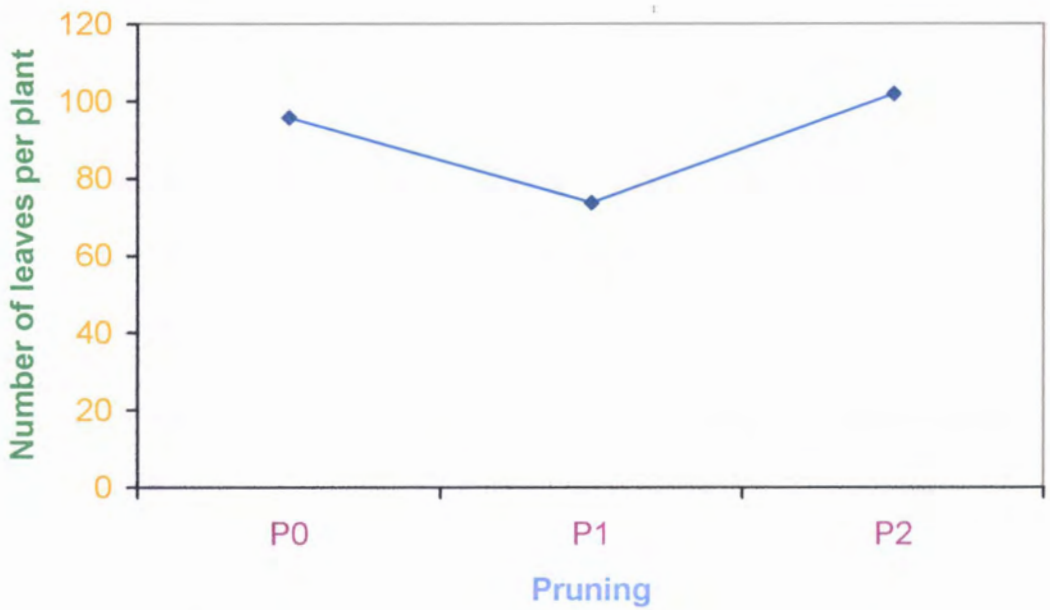


Figure 3. Effect of pruning on the number of leaves of brinjal.

P_0= without pruning

P_1= Pinching off of the lateral bud

P_2= Pinching off of the terminal bud

4.3 Number of branches

There had a highly significant (Appendix IV) variation on number of branches due to spacing. The maximum (15.11) number of branches/plant was recorded in S_3 followed by S_2 (14.11) and the minimum (12.33) number of branches per plant was found in S_1 (Figure 4)

Number of branches had significantly (Appendix IV) influenced by pruning. The highest (17.78) number of branches of plant was recorded in P_2 followed by P_1 (13.78) and the lowest (10) number of branches per plant was measured in P_1 (Figure 5). P_2 produced the highest number of branches due to the check given to the growth of the stem by pruning done at early stage. P_1 produced the lowest number of branches due to the production of the longest lamina and the emergence of a fairly long, strong and stout branch, almost equal to the main stem in thickness.

The interaction effects of different types of spacing and pruning had a highly significant variation (Appendix IV) on number of branches. The maximum (19) and the minimum (9) number of branches were obtained from the combination of S_3P_1 and S_1P_1 treatments respectively (Table 1).

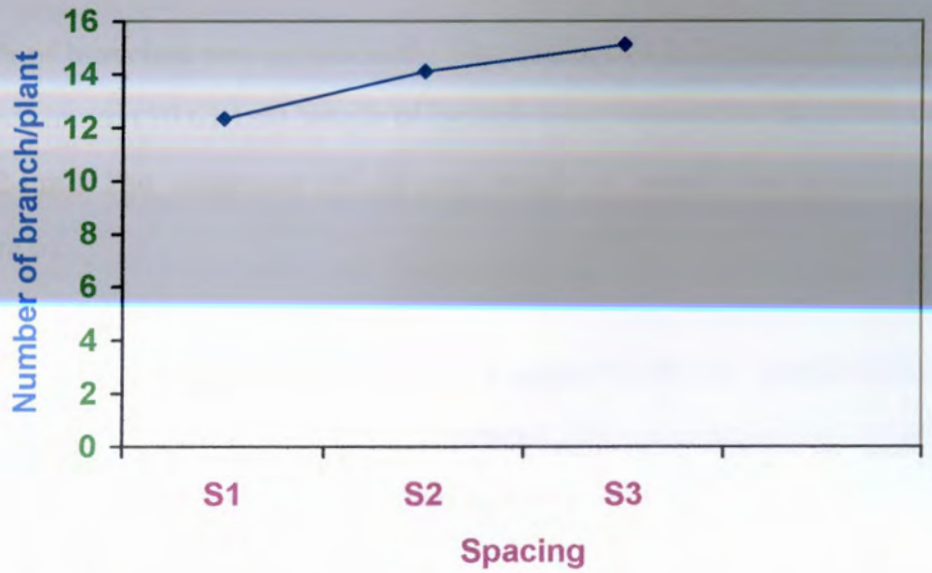


Figure 4. Effect of spacing on the number of branches/plant of brinjal.

S_1= 60 cm x 60 cm

S_2= 80 cm x 80 cm

S_3 = 100 cm x 100 cm

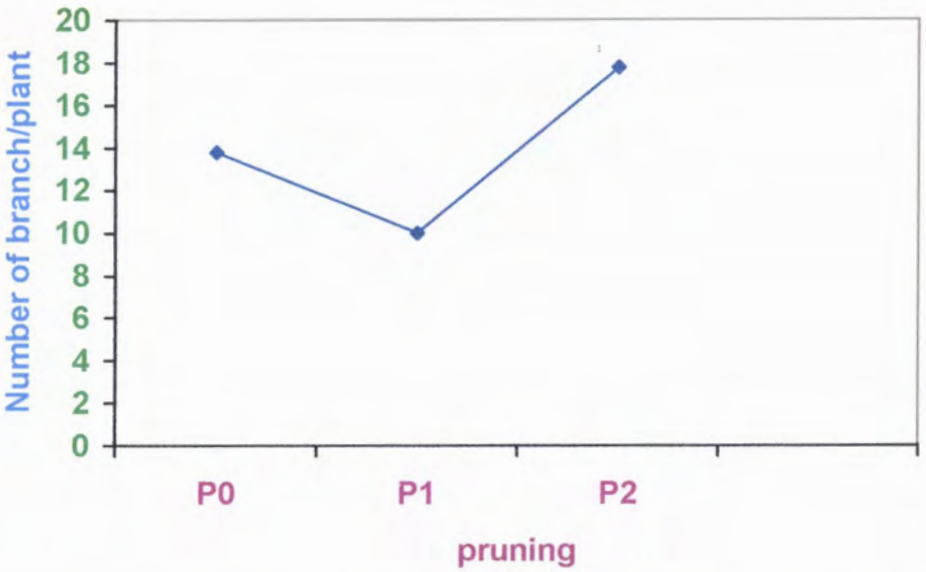


Figure 5. Effect of pruning on the number of branches/plant of brinjal.

P_0= without pruning

P_1= Pinching off of the lateral bud

P_2= Pinching off of the terminal bud

4.4 Length of branch (cm)

Length of branches was significantly (Appendix IV) influenced due to spacing. The maximum (50.61 cm) length of branch was produced by S_3 followed by S_2 (49.92 cm). The minimum (48.20 cm) length of branch was produced by S_1 (Figure 6).

Pruning also had significant influenced (Appendix IV) on length of branch. It was found that P_2 gave the longest branches (52.4 cm) followed by P_1 (49.3 cm) and the shortest (47.03 cm) branches was measured in P_0 (Figure 7). P_2 produced the longest branches and the effect of P_0 and P_1 followed that of the former in succession. The reason may be the check in the growth of main stem after the removal of the terminal bud and the diversion of reserve food materials to the production of long branches.

Interaction of different spacing and types of pruning had a significant variation (Appendix IV) on length of branch. The highest length of branch (53.10 cm) was found in S_2P_2 and the lowest length of branch 45.50 cm was found in S_1P_0 (Table 1).

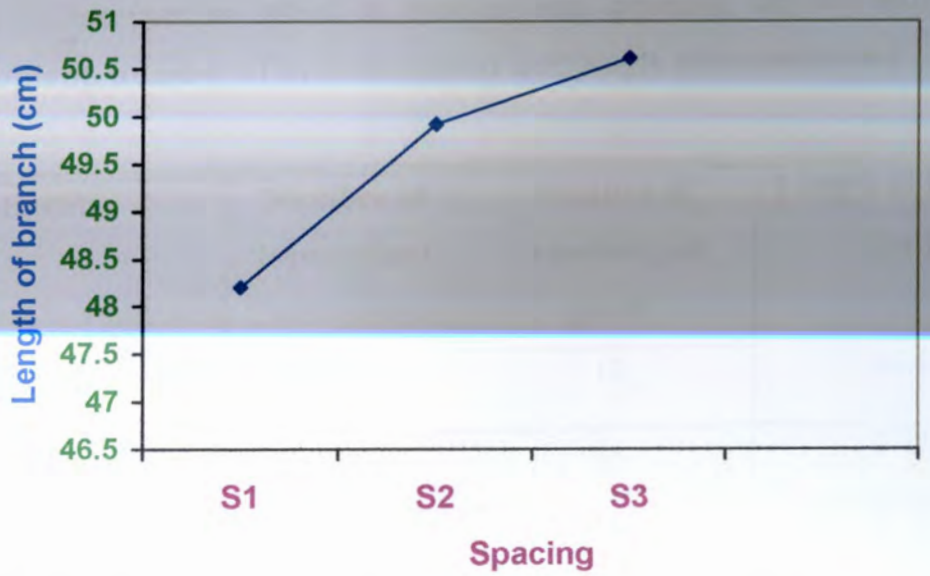


Figure 6. Effect of spacing on the length of branches/plant of brinjal.

S_1= 60 cm x 60 cm

S_2= 80 cm x 80 cm

S_3 = 100 cm x 100 cm

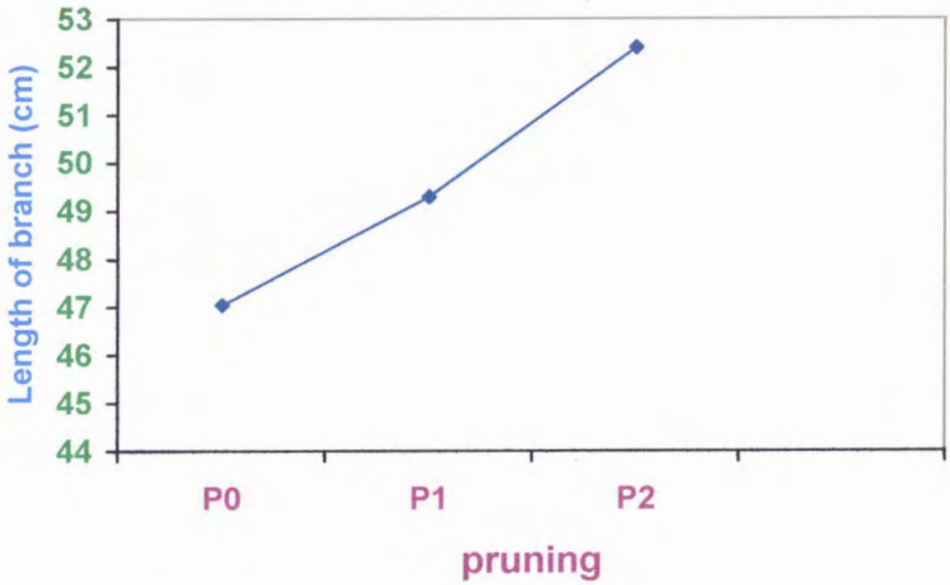


Figure 7. Effect of pruning on the length of branches/plant of brinjal.

P_0= without pruning

P_1= Pinching off of the lateral bud

P_2= Pinching off of the terminal bud

Table 1. Interaction effect of spacing and pruning on the number of leaves/plant, number of branches/plant and length of branch (cm)

Treatments	Number of leaves/plant	Number of branches per plant	Length of branch (cm)
S_1P_0	82.3	12	45.5
S_1P_1	87.3	9	47.7
S_1P_2	93.0	16	51.4
S_2P_0	96.6	14	47.0
S_2P_1	73.0	10	49.6
S_2P_2	110.0	18.3	53.1
S_3P_0	108.0	15.3	48.6
S_3P_1	90.3	11	50.5
S_3P_2	102.3	19	52.7
LSD (0.05)	2.407	2.277	1.692
CV(%)	2.67	9.5	1.97

S_1= 60 cm x 60 cm

S_2= 80 cm x 80 cm

S_3= 100 cm x 100 cm

P_0= Without pruning

P_1= Pinching off of the lateral bud

P_2= Pinching off of the terminal bud

4.5 Length of lamina (cm)

Length of lamina was significantly (Appendix IV) influenced by spacing. S_3 produced the longest (19.20 cm) lamina followed by S_2 (17.90 cm) and the lowest was found in S_1 (17.50 cm). S_1 and S_2 were as statistically similar (Figure 8).

Length of lamina was significantly was not significantly (Appendix IV) varied due to pruning. The highest length of lamina (18.70 cm) was measured in P_1 followed by P_2 (18.20 cm) and the shortest (17.70 cm) lamina length was measured in P_0 (Figure 9).

Interaction of different spacing and types of pruning had a significant variation (Appendix IV) on length of lamina. The highest length of lamina (19.80 cm) was measured in S_3P_1 followed by S_3P_2 (19.30 cm) and the shortest (17.0 cm) length of lamina was measured in S_3P_0 (Table 2).

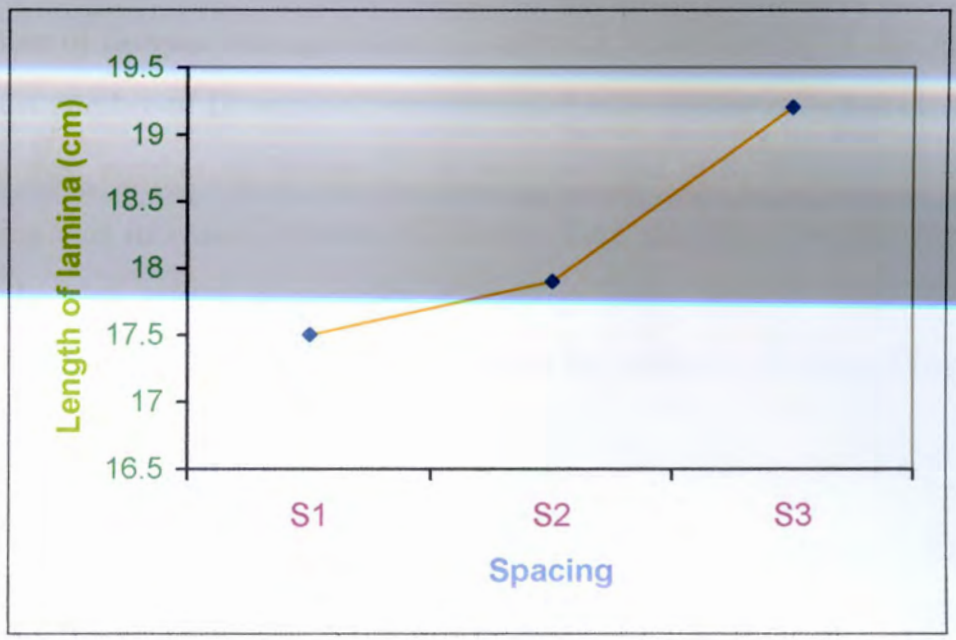


Figure 8. Effect of spacing on the length of lamina (cm) of brinjal.

S_1= 60 cm x 60 cm

S_2= 80 cm x 80 cm

S_3 = 100 cm x 100 cm

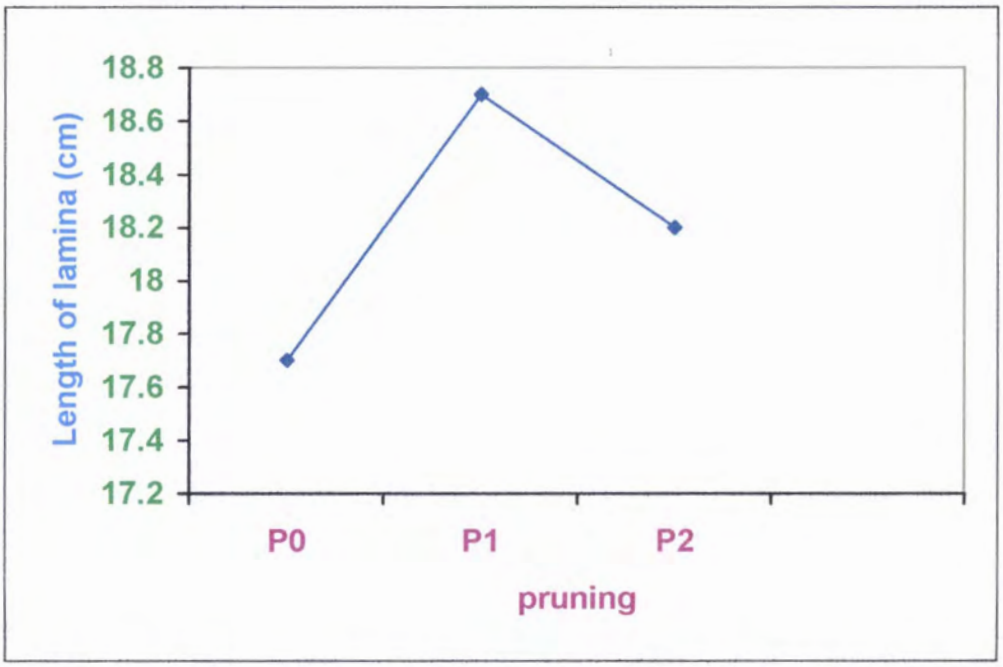


Figure 9. Effect of pruning on the length of lamina (cm) of brinjal.

P_0= without pruning

P_1= Pinching off of the lateral bud

P_2= Pinching off of the terminal bud

4.6 Number of flowers

Number of flowers was significantly (Appendix V) influenced by spacing. The highest number of flowers (12) was recorded in S_3 followed by S_2 (11.78) and the lowest number of flowers (9.00) was recorded in S_1 (Figure 10). As the spacing was increased, number of flowers were increased considerably. This may be due to the opportunity of getting more nutrients from the soil, manufacturing of more carbohydrates from the exposure of more leaf area to the sunlight and better aeration.

Pruning also caused significant variation (Appendix V) on number of flowers. The maximum number of flowers (13) was recorded P_2 followed by P_0 (10.56) and the lowest number of flowers (9.22) was recorded in P_1 (Figure 11). P_0 and P_1 were also statistically similar. Terminal bud-pruned plants gave higher and much higher number of flowers than that was given by the unpruned and lateral bud-pruned plants respectively. The stunted growth of the main stem resulted from the removal of the terminal bud might account for this, as the removal of the terminal bud gave maximum number of flowers also.

Number of flowers was significantly (Appendix V) influenced by interaction of spacing and pruning. The maximum number (15.33) of flowers were produced by the plants of S_2P_2 and the lowest (8.00) number of flowers per plant was recorded in S_1P_1 (Table 2).

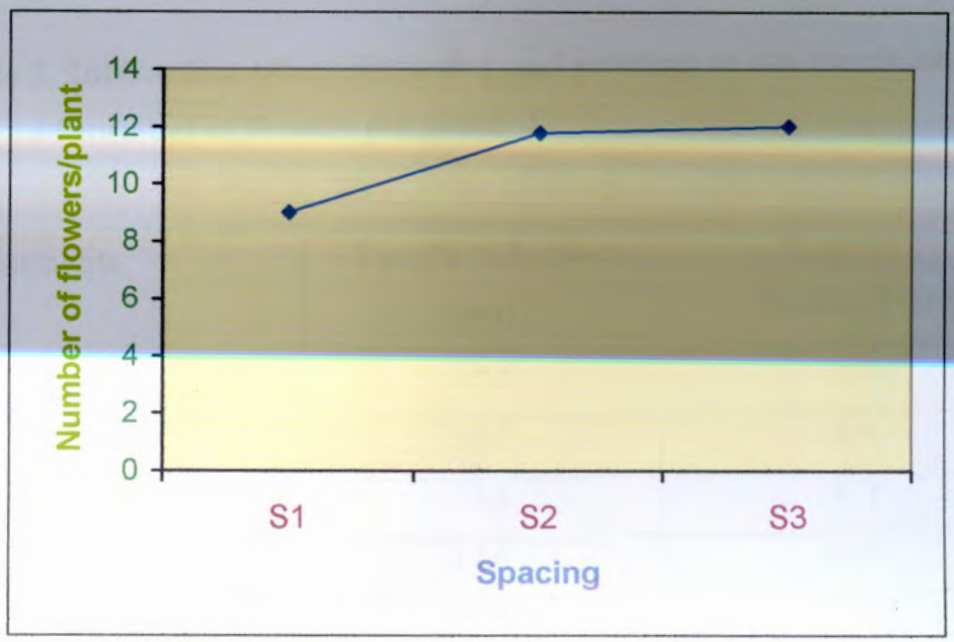


Figure 10. Effect of spacing on the number of flowers/plant of brinjal.

S_1= 60 cm x 60 cm

S_2= 80 cm x 80 cm

S_3 = 100 cm x 100 cm

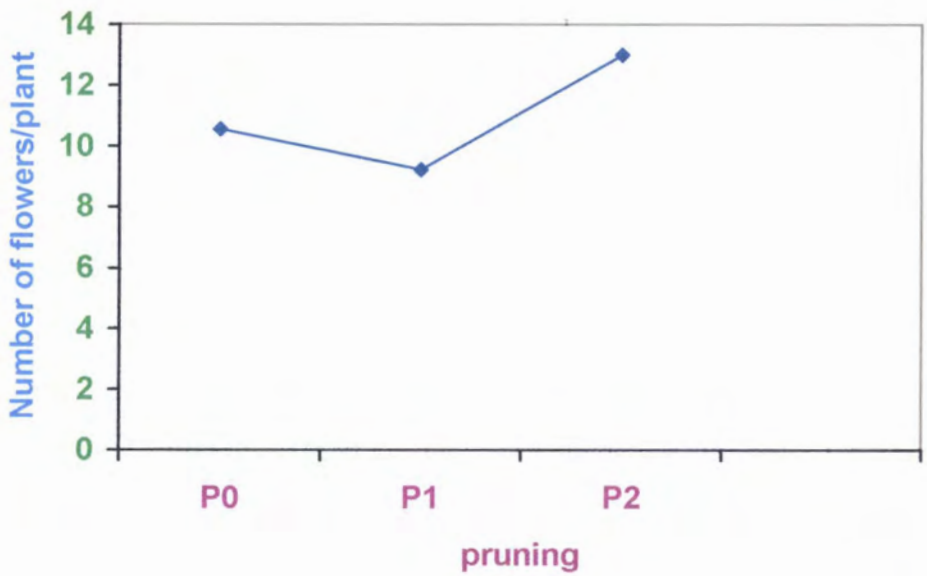


Figure 11. Effect of pruning on the number of flowers/plant of brinjal.

P_0= without pruning

P_1= Pinching off of the lateral bud

P_2= Pinching off of the terminal bud

Table 2. Interaction effect of spacing and pruning on the length of lamina (cm) and number of flowers per plant.

Treatments	Length of lamina (cm)	Number of flowers/plant
S_1P_0	17.0	10.0
S_1P_1	18.2	8.0
S_1P_2	17.3	9.0
S_2P_0	17.6	11.0
S_2P_1	18.1	9.0
S_2P_2	18.0	15.3
S_3P_0	18.5	10.6
S_3P_1	19.8	10.6
S_3P_2	19.3	14.6
LSD (0.05)	1.615	2.649
CV (%)	5.13	9.5

S_1= 60 cm x 60 cm

S_2= 80 cm x 80 cm

S_3= 100 cm x 100 cm

P_0= Without pruning

P_1= Pinching off of the lateral bud

P_2= Pinching off of the terminal bud

4.7 Number of fruits per plant

Spacing had significant variation (Appendix V) on number of fruits per plant. As the spacing was increased the average number of fruits per plant was increased due to the opportunity of getting more nutrients from the soil and getting more sunlight and better aeration. S_3 gave the highest number (18.47) of fruits followed by S_2 (16.7) and the lowest (13.7) number of fruits was counted in S_1 (Figure 12). S_2 and S_1 were statistically similar in the view of production of number of fruits. The result are in conformity with Vittum and Tapley (1957) and M. R. Uddin *et al.* (1997).

Pruning had no significant difference (Appendix V) on the number of fruits per plant. P_1 produced 17.87 number of fruits, P_2 produced 16.6 and P_0 produce 14.4 number fruit per plant due to the main effect of pruning (Figure 13).

Interaction of different spacing and types of pruning had significant variation (Appendix V) on the number of fruits. S_3P_1 gave the maximum (20.50) number of fruits and the minimum (12.10) number of fruits was recorded from S_1P_2 (Table 3).

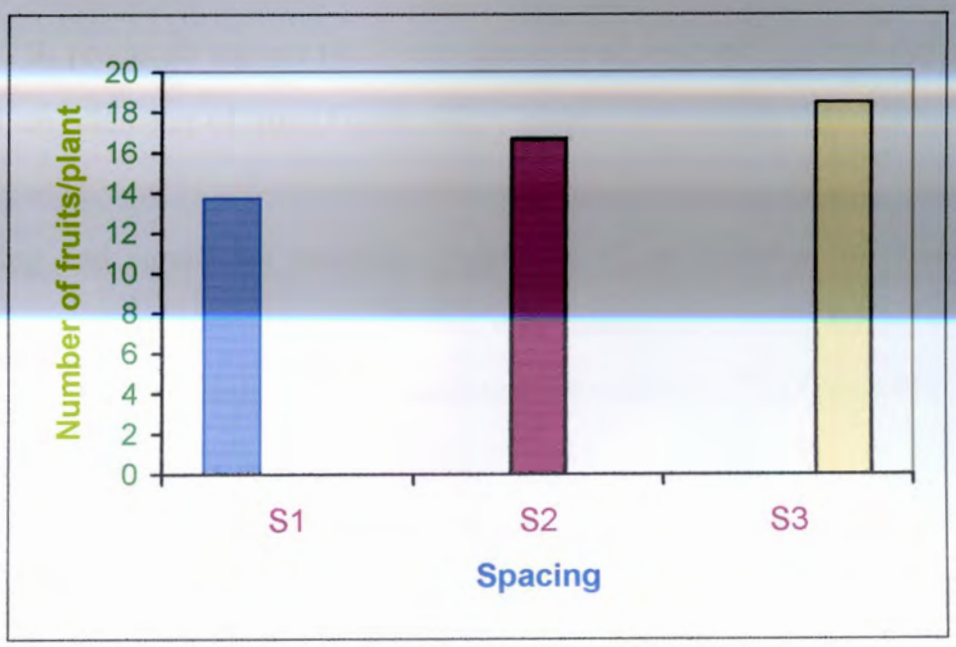


Figure 12. Effect of spacing on the number of fruits/plant of brinjal.

S_1= 60 cm x 60 cm
S_2= 80 cm x 80 cm
S_3 = 100 cm x 100 cm

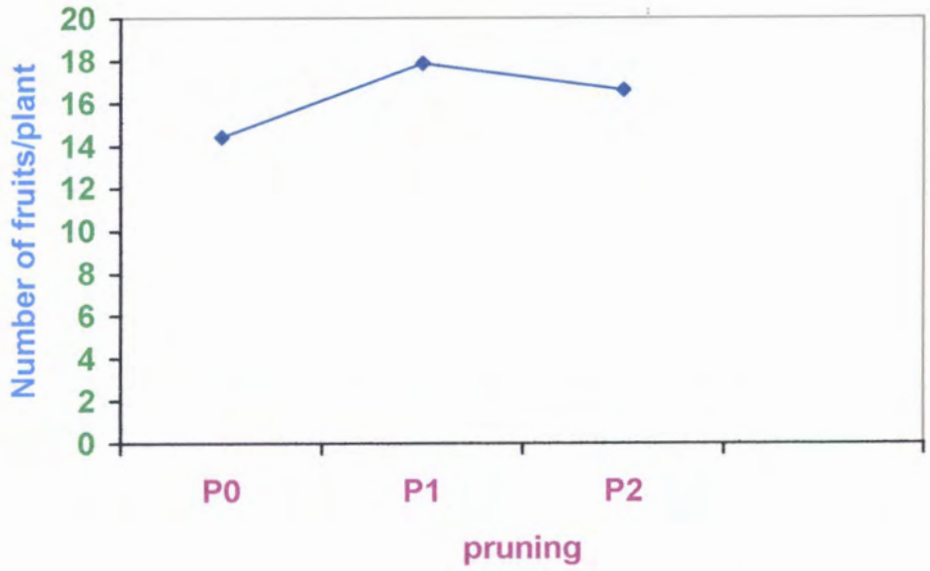


Figure 13. Effect of pruning on the number of fruits/plant of brinjal.

P_0= without pruning

P_1= Pinching off of the lateral bud

P_2= Pinching off of the terminal bud

4.8 Diameter of fruit (cm)

Diameter of fruit was significantly (Appendix V) influenced on diameter of fruits. S_3 produced highest (4.17 cm) diameter of fruit and S_1 produced lowest (3.23 cm) diameter of fruit (Figure 14).

Pruning had significant variation (Appendix V) on diameter of fruits. The maximum (4.00 cm) diameter of fruit was measured from P_1 followed by P_2 (3.80 cm) and the minimum (3.36 cm) was recorded from P_0 (Figure 15).

Interaction of different spacing and types of pruning had a significant variation (Appendix V) on diameter of fruits. The highest (4.6 cm) diameter is found in S_3P_1 and the lowest (3.00 cm) is found in S_1P_0 (Table 3).

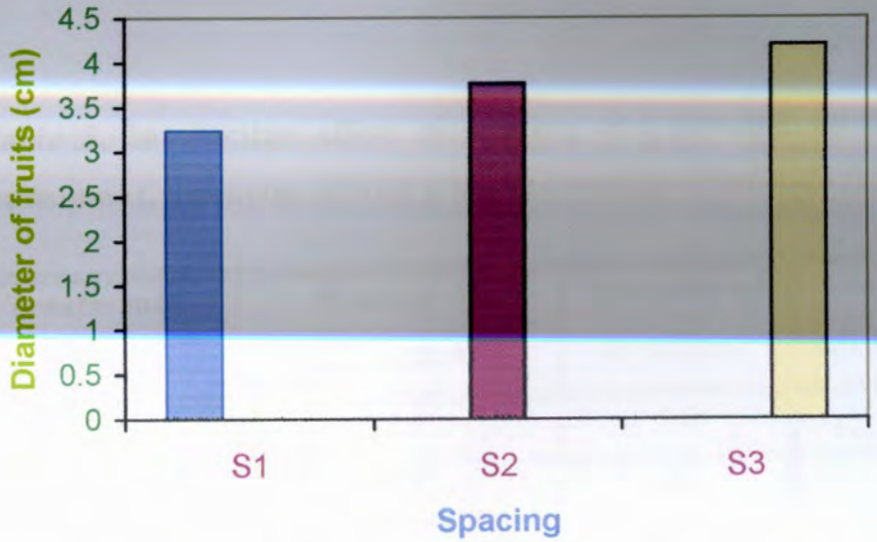


Figure 14. Effect of different spacing on the diameter of fruits (cm) of brinjal

S_1= 60 cm x 60 cm

S_2= 80 cm x 80 cm

S_3 = 100 cm x 100 cm

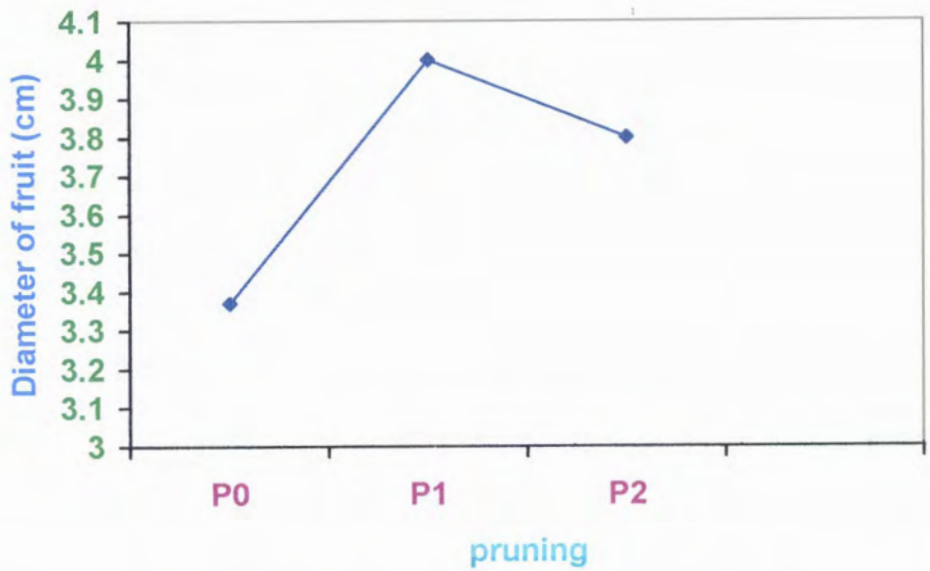


Figure 15. Effect of pruning on the diameter of fruits (cm) of brinjal

P_0= without pruning

P_1= Pinching off of the lateral bud

P_2= Pinching off of the terminal bud

Table 3. Interaction effect of spacing and pruning on the number of fruits/plant, diameter of fruit (cm) and weight of individual fruit (g).

Treatments	Number of fruits/plant	Diameter of fruit (cm)	Weight of individual fruit (g)
S_1P_0	12.1	3.0	84.7
S_1P_1	15.1	3.4	95.9
S_1P_2	13.9	3.3	90.1
S_2P_0	15.4	3.5	89.2
S_2P_1	18.0	4.0	100.6
S_2P_2	16.7	3.8	95.5
S_3P_0	15.7	3.6	97.4
S_3P_1	20.5	4.6	108.3
S_3P_2	19.2	4.3	103.2
LSD (0.05)	0.9761	0.3631	1.521
CV (%)	3.46	5.64	1.06

S_1= 60 cm x 60 cm

S_2= 80 cm x 80 cm

S_3= 100 cm x 100 cm

P_0= Without pruning

P_1= Pinching off of the lateral bud

P_2= Pinching off of the terminal bud

4.9 Weight of individual fruit (g)

Spacing had a significant variation (Appendix VI) on the weight of individual fruit. S_3 (90.24) produced best size of fruits followed by S_2 (84.47 g) and the lowest (77.57 g) was found in S_1 (Figure 16). Hossain *et. al.* (1996) from a spacing trial of Tomato F_1 variety, found that increase of spacing increase the individual fruit weight.

Weight of individual fruit was significantly (Appendix V) influenced by pruning. P_1 produced best sized fruits (88.84 g) followed by P_2 (84.47 g) and lowest (78.57 g) was found in P_0 (Figure 17).

Weight of individual fruit was significantly (Appendix V) influenced by pruning. (Appendix VI) on weight of individual fruit. S_3P_1 gave the best size of fruit 96.13 g and S_1P_0 gave the lowest size of the fruit (72.70 g) (Table 3).

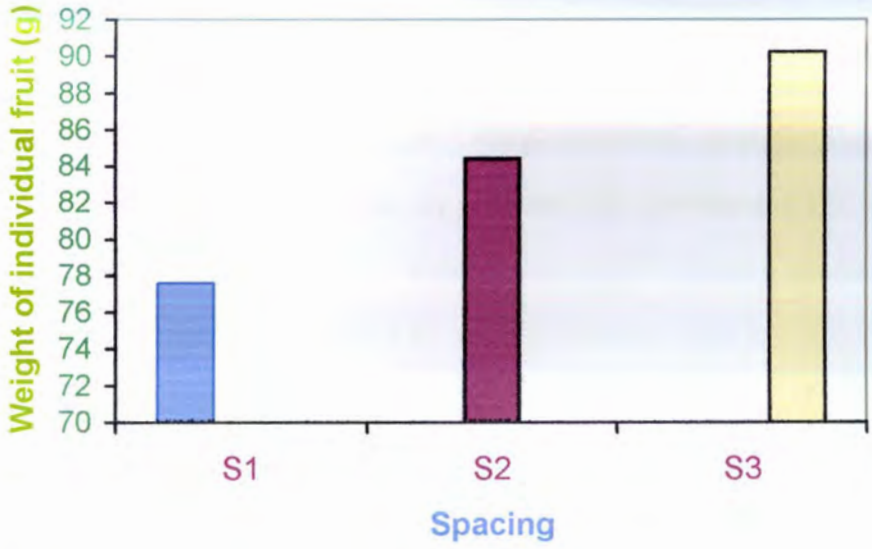


Figure 16. Effect of spacing on the weight of individual fruit (g) of brinjal

S_1= 60 cm x 60 cm

S_2= 80 cm x 80 cm

S_3 = 100 cm x 100 cm

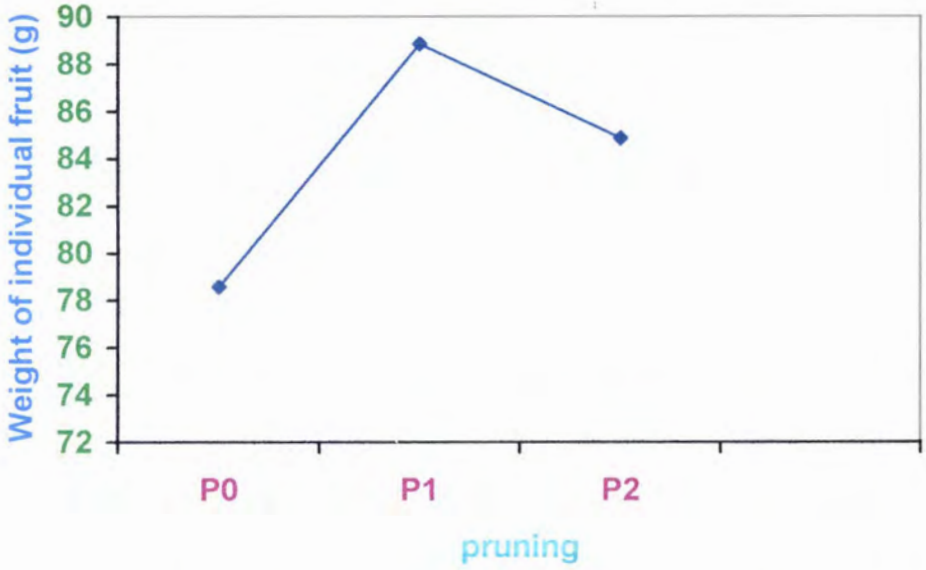


Figure 17. Effect of pruning on the weight of individual fruit (g) of brinjal

P_0= without pruning

P_1= Pinching off of the lateral bud

P_2= Pinching off of the terminal bud

4.10 Yield/plant (g)

Yield per plant was significantly (Appendix VI) influenced by spacing. S_3 produced the highest number of fruits per plant and best size of fruit. So fruit weight was the highest in S_3 (1677.01 g) followed by S_2 (1415.16). The lowest (1067.02 g) was recorded in S_1 (Figure 18). Similar results were also found by Vittum and Tapely (1957), Uddin *et al.* (1997) from a spacing trial of tomato varieties. Roy et al. (1954) in an experiment with Marglobe Sobour variety of tomato observed that the yield/plant was highest at 4'x4' spacing (wider spacing) and lowest at the spacing of 4'x2'.

Yield per plant was significantly (Appendix VI) influenced by pruning. The maximum (1601.3 g) yield per plant was obtained from P_1. The lowest (1139.2 gm) yield per plant was recorded from P_0 (Figure 19).

Yield per plant was significantly (Appendix VI) influenced by interaction of spacing and pruning. The highest (1971.20 g) weight of fruit recorded from S_3P_1. The lowest (879.9 g) weight of fruit per plant was found in S_1P_0(Table 4).

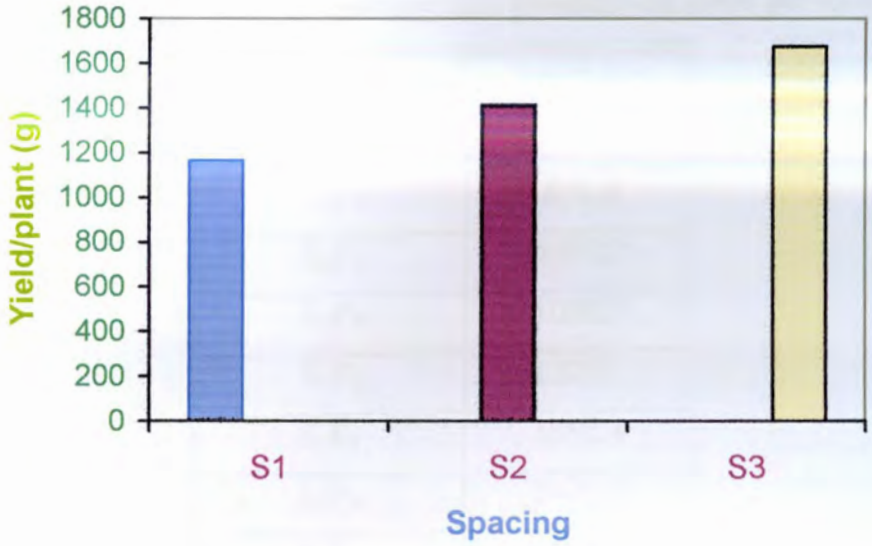


Figure 18. Effect of spacing on yield/plant (g) of brinjal

S_1= 60 cm x 60 cm

S_2= 80 cm x 80 cm

S_3 = 100 cm x 100 cm

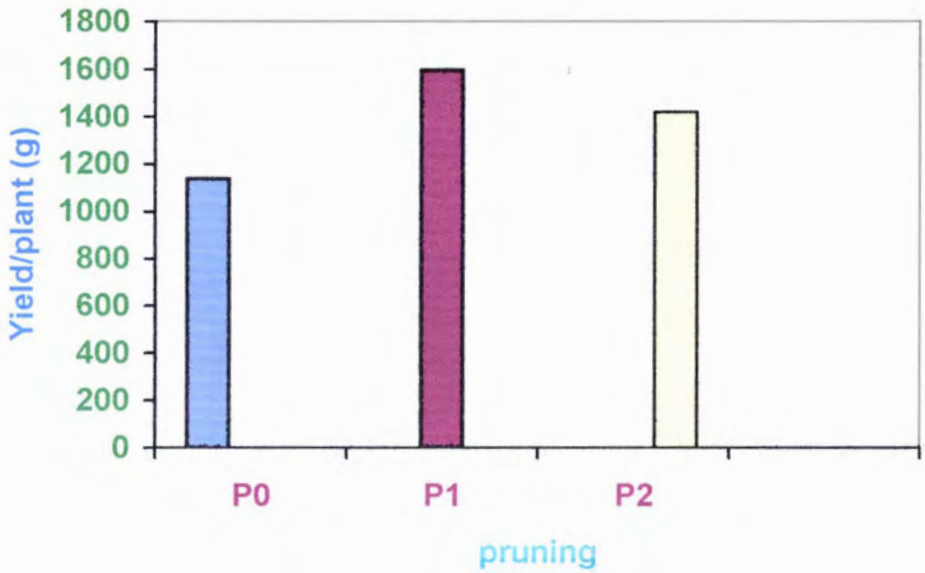


Figure 19. Effect of pruning on the yield/plant (g) of brinjal

P_0= without pruning

P_1= Pinching off of the lateral bud

P_2= Pinching off of the terminal bud

Table 4. Interaction effect of spacing and pruning on yield per plant (g)

Treatments	Yield per plant (g)
S_1P_0	879.9
S_1P_1	1237.2
S_1P_2	1086.3
S_2P_0	1225.1
S_2P_1	1995.4
S_2P_2	1426.2
S_3P_0	1311.2
S_3P_1	1971.5
S_3P_2	1750.2
LSD (0.05)	81.5
CV(%)	3.83

S_1= 60 cm x 60 cm

S_2= 80 cm x 80 cm

S_3= 100 cm x 100 cm

P_0= Without pruning

P_1= Pinching off of the lateral bud

P_2= Pinching off of the terminal bud

Table 5. Effect of spacing on yield (ton/ha)

Treatments	Yield (ton/ha)
S_1	38.9
S_2	25.2
S_3	22.4
Average	28.8

S_1= 60 cm x 60 cm

S_2= 80 cm x 80 cm

S_3= 100 cm x 100 cm

CHAPTER V

Summary and Conclusion

SUMMARY AND CONCLUSION

This experiment was conducted at the Horticulture Farm, Sher-e-Bangla Agriculture University, Sher-e-Bangla Nagar, Dhaka-1207 during March to September, 2006 to investigate on the growth and yield of brinjal cv. 'Khotkhotia'.

In experiment, the treatments consisted of different spacing viz. S_1 (60 cm x 60 cm), S_2 (80 cm x 80 cm), S_3 (100 cm x 100 cm) and three types of pruning viz. P_0 (without pruning), P_1 (pinching off of the lateral bud) and P_2 (pinching off of the terminal bud).

The two factor experiments were laid out in a randomized complete block design (RCBD) with three replications. Seeds of Khotkhotia variety were collected from the Bangladesh Agricultural Development Corporation (BADC) and sales Centre Narsingdi. The Collected seeds were sown in three seed beds of 3m x 1m size on 20 March, 2006. Healthy and uniform sized seedling of thirty days old seedlings were transplanted on the experimental plots on 20 April, 2006 maintaining 3 spacing of 60 cm x 60 cm, 80 cm x 80 cm and 100 cm x 100 cm.

A significant variation was observed among the treatments with respect to majority of the observed parameters. The collected data were statistically analyzed for evaluation of the treatment effect.

Pruning and spacing had no significant influence on the height of brinjal plant. Tallest plants were expected from those plants whose lateral buds were pinched off and lateral bud pruned (P_1) plants produced the tallest plants (55.60). Increasing the spacing increased the number of branches per plant and was maximum in the widest spacing S_3 (15.11) and minimum in the closest spacing

S_1 (12.33). The interaction effect of spacing and pruning S_3P_1 gave (19) the highest number of branches.

P_2 produced the highest number of branches (17.78) which was found to give highly significant result over lateral bud pruned plants P_1, which produced lower number of branches (10).

In case of length of branch spacing S_3 produced the longest branches (50.61). The branch length as affected by pruning was found highly expressive. P_2 plant produced the highest length of branch (52.4 cm) due to the interaction effect of spacing and pruning S_2P_2 gave the highest (53.10 cm) length of branch.

Spacing and pruning had a tremendous effect on the number of branches and leaves. As the spacing was increased the number of branches and leaves were found to increase.

Spacing had a significant variation on the length of lamina. The highest length of lamina was found in S_3 (19.20 cm). Interaction effect of spacing and pruning S_3P_1 (19.80 cm) gave the highest length of lamina.

Both spacing and pruning were found fairly effective on the number of flowers per plant. S_3 produced the highest number of flowers. P_2 produced (13) the highest number of flower.

Number of fruits increased as the spacing increased. S_3 gave the highest number of fruits (18.47) per plant than S_2 (16.70) and S_1 (13.70). Pruning had no significant difference on number of fruits. P_1 produced 17.87 number of fruits. S_3P_1 gave the highest (20.50) number of fruit.

Increasing of spacing increased the individual fruit weight and the highest was found in S_3 (90.24 g). The highest weight of individual fruit was found in S_3P_1 (96.13 g). Pruning was found fairly effective on the individual fruit weight and

Increase in spacing increased the total weight of fruit and the highest was found in total weight of fruit was found in S_3 (1677.01 g). The highest total weight of fruit was found in P_1 (1601.3 g). P_1 gave the highest number of fruit /plant.

S_3P_1 gave (20.50) the highest number of fruit/plant and yield/plant (1971.2 g). It may be concluded that widest spacing (100 cm x 100 cm) and lateral bud pruning (P_1) can be practiced in brinjal for successful crop production.

Further study could be undertaken with the higher than S_3 (100 cm x 100 cm) with pinching off of the lateral bud. For successful crop production of brinjal cultural practices such as pinching off of the lateral bud can be practiced in every Agro-Ecological Zones in Bangladesh

References

REFERENCES

Abutiates, W.S. (1988). Effects of spacing on the yield of marketable fruits of eggplant (*Solanum menlongena* L.) type 'Oguannwoa'. Tropical Agriculture, U.K. **65**(2): 188-189.

Akkas, S.S. (1992). Effects of spacing and support on the growth and yield of Lablab bean (*Lablab purpurea* L). (sweet). M.S. Thesis, Dept. of Horticulture. Bangladesh Agricultural University, Mymensingh. pp.1-4.

Anonymous, (1987). Effect of plant spacing and harvesting interval on the growth and yield of okra cv. BARI Dharash-1. Hill Agriculture. pp. 238-249.

Anonymous, (1987). Effect of plant spacing and starter solution on the growth and yield of cabbage. Hill Agriculture. Pp.244-245.

Bail, L.H. and L.C. Corbett. 1892. Tomato notes for 1892. Cornnell University Bull. 45.

Barbieri, G and Deveronica. (1989). Yield response of aubergine (*Solanum melongena* L.) to irrigation and plant density, *Irrigazione-e-Branaggio,* **36**(4), 121-125.

BARC. (1997). Fertilizer Recommendation Guide. (1997). Bangladesh Agricultural Research Council, Farmgate, Dhaka pp. 95.

BBS. (2003-2004). Year Book of Agricultural Statistics of Bangladesh. Bangladesh Bureau of Statistics, Ministry of Planning, Govt. of the People's Republic of Bangladesh. pp. 100.

BBS. (2004-2005). Year Book of Agricultural Statistics of Bangladesh. Bangladesh Bureau of Statistics, Ministry of Planning, Govt. of the People's Republic of Bangladesh. Pp. 112.

Bose, T. K. and Som, M.G. (1986). Vegetable crops in India. B. Mitra, Naya Prokash, 206, Bidhansarani, Calcutta-700006, India. pp.293.

Bose, T.K and Som, M.G. (1986). Brinjal vegetable crops in India. Naya prokash Calcutta- six pp: 293-309

Brayan, A.A., Eckhardt, R.C. and Sprague, G.F. (1946). Spacing experiment with corn. *Jour. Amer. Soc. Agro.* **38**:707-714.

Butter, R.E. 1961. A tomato spacing trial under Guernsey conditions. (Grower, 56:208-9 illus.). *Hort. Abs.* March, 1962. **147**:1082.

Campbell, J.S. (1961). The effect of staking and pruning of field grown indeterminate tomatoes in Trinidad. *Trop. Agri.* **38**(3) : 261.

Campbell, J.S. and G.E. Hodnett. 1961. The effect of spacing on the yield of egg-plant (Tropical Agriculture, Trin. 38:83-6. Bible. 6. *Hort. Abs.* **31**(3) 590:4635.

Cawthorn Institute. (1954). Effect of pruning on the yield and quality of tomato. (A.R. Cawthorn Inst., pp. 26-7). *Hort. Abs.* **26**(1) 105:711.

Chandha, A., Naidu, A. Amarchand, V. (1997). Effect of levels of N,P,K and plant spacing on yield and economics of brinjal. *Recent Horticulture,* **4**(1): 156-157.

Chipman, F.W. 1961. The effect of time of seedling and plant topping on the production of early and total yields of ripe tomatoes. (*Proc. Amer. Soe. Hort. Sci.* 77:483-6, bible 4.) *Hort. Abs.* March 1962. **147**:1081.

Chowdhury. B.C. (1976). Phashaler Krimi Rog. Krishi Katha. **36**: 141.

FAO and UNDP. 1988. Agro-ecological Region of Bangladesh. Land Resources Appraisal of Bangladesh for agricultural Development BGD/81/035. Tech. Rep. 2. FAO and UNDP, Rome, pp. 106-107.

FAO. (1993). FAO Production Year Book. Vol. 47. pp. 129-130.

Gupta, A. and V. Shukla. (1977). Response of tomato (*Lycopersicon esculentum* Mill.) to plant spacing, nitrogen, phosphorus and potassium fertilization. *Indian J. Hort.* **34**(3): 270-76.

Harminder, S., Saimbhi, M.S. Bals, S. Singh, H. (1997) A note on effect of plant population density on growth and yield of brinjal hybrids. *Vegetable Science*, **24**: 2, 164-166.

Hassan, M.S. (1978). Effect of nitrogen fertilization and plant density on yield and quality of tomatoes in the Sudan Gezira, *Acta Hort*, **84**: 78-90.

Hassan, M.N.M. (1993). Effect of plant density and additional dose of nitrogen after the first harvest on eggplant cv. "Black Beauty".24: 133-148.

Hawthorn, L.R. 1939. Pruning unstaked tomatoes. *Proc. Amer. Soc. Hort. Sci.* **37**:930-934.

Hawthorn, L.R., and Pollard, L.H. (1953). Vegetable and Flower seed Production. New York-Toronto. 470-476.

Huelsen, Walter, A. 1954. Sweet Corn. Interscience Publishers, Inc. New York. Interscience Publisher Ltd., London. **4**: 251-252.

Islam, M.A. and Islam, W. (1956). Nutrient Status of East Pakistan Soil. Bull No. 1.

Islam. M. M. 2005. Management of phomopsis blight and fruit rot of eggplant through chemicals and plant extracts. An M.S. thesis submitted to the Dept.of Plantpathology,Sher-e-bangla Agricultural University, Dhaka. pp. 60.

Kumar, A. (1997). Studies on the characteristics and performance of nine varieties of brinjal. M.S. Thesis, Dept. of Hort. Bangladesh Agricultural University, Memensingh. pp. 10-33.

Lim, E.S. and S.T. Chen. (1989). Hydroponic production studies on lowland tomato in Malaysia: The effect of pruning system and CHPA application on yield. In : Tomato and Pepper production in the Tropics. Proc. Intern. Symp, Intergrated Management Practices. March 21-26. AVRDC, Shanhua, Tainan, Taiwan. pp. 358-64.

Lloyd, J.W. and Brooks, I.S. (1910). Growing tomatoes for early market. Illions Bull. 144.

Opena, R.T. (1985). Development of tomato and Chinese cabbage cultivars adapted to the hot, humid tropics. *Acta Hort.* **153**: pp. 421-36.

Paksoy, M., Cockshull, A.M., Tuzel, K.E. (1994). The effects of different prunings on the yield and quality of brinjal cultivars grown in greenhouse conditions. *Acta Hort. pp.* 366: 287-292.

Pandit, M.K.; Som, M. G. Maity, T.K. (1997). Effect of plant densities on growth and yield of pointed gourd. *Horticultural Journal.* **10** (2):89-92.

Paturde, J.T. Wankhade, Khode, S.G., Khan, A. (2002). Performance of Arka mahima (Tetraploid) against Arka Samkeevomo) (Diploid) varieties of wild brinjal under different plant spacings and fertility levels. *Agric. Sci. Digest.* **22**(1): 67-68.

Rahman, M. I. , Evans, A.A. and Miah, S.A. (1990). Plant damage and yield loss caused by rice root nematode *Meloidogyne graminicola* in water rice. *Bangladesh J. Bot.* **19**(2): 107-116.

Rashid, M. (1993). Sabjee bighan.Published by Bangla Academy, Dhaka. 137-144pp.

Reddy, Madalageri, P.N., Abbashussen, B.B. (1988). Investigation on varietal performance, spacing and fertization on brinjal. *Mysore Journal of Agric. Sci.* **22**(4):490-492.

Richharia, R.S. (1944). Brinjal in Bihar. *Ind. Jour. Hort.* **6**(3):30-41.

Rossa, J.T. (1922). Better methods of tomato production. Missouri. Pp.194.

Roy, R.S., Singh, R.K. and Beri, M.F. (1954). Effect of spacing on growth and fruiting of tomato var. Marglobe. *Ind. J. Hort.* **11**: 131-37.

Roy, R.S., Singh, R.K. and Beri, M.F. (1954). Effect of spacing on the growth and fruiting on tomato variety Marglobe Sabour. *Ind. Jour. Hort.* 11:131-7 bible. 3. *Hort. Abstr.* **23**(3). 436: 2956.

Shukla, V., Prabhakar, B.S. (1987). Effect of plant density on yield and losses caused by fungus and insects in brinjal. *Agric. Sci. Digest.* India. **7**(3): 148-150.

Singh, D.R., Sharma, R.N., Kumar, S. (1999). Effect of leaf pruning on growth and yield of brinjal. *Indian Agriculture.* **43**:3-4, 139-141;2.

Singh, V. Saymal, M. (1995). Effect of nitrogen and spacing on yield and quality attributes of brinjal (*Solanum melongena* L.), *Journal of Research,* Birsa Agricultural University, 1995, **7**(2): 137-139.

Singh, R.S. (1987). Disease of Eggplant and Chilli. Disease of vegetable crops. Second Edition Oxford & IBH publishing Co. PVT. Ltd. pp: 118-145.

Streck, N.A.; Buriol, G.A.; Andrialo, J.L.; Sandri, M.A. (1998). Effect of plant density and drastic pruning on tomato yield inside a plastic greenhouse. *Pesquisa Agropecuaria Brasileira*. **33**(7):1105-1112.

Tai C., Chen, Y. Chang, W. (2001). Influence of plant density on growth and yield of eggplant with V-type training. *Journal of the Chinese Society for Hort. Sci.* **47**(2): 157-164.

Thompson, H.C. and W.C. Kelly. (1957). Vegetable Crops. McGraw-Hill Book Company, Inc. New York. pp. 500-505.

Thompson, H.C. (1934). Pruning and training tomatoes. Cornell Bull. 580.

Uddin, M.R.; Hossain, M.A. and Mian M.A.K. (1997). Effect of stem pruning and spacing on the growth and yield of tomato **25** (1&2): 41-46.

Vadivel, E, Balasubramanian, S., (1988). A note on nitrogen fertilization and spacing for brinjal. *South Indian, Horticulture*. **36**(4): 10-13.

Verma, G. and B.S. Bhatngar. (1962). Fertilizer-spacing-variety studied in *Zea mays* L. in Uttar pradesh. *Ind. Jour. Agril. Sci.* **5**(3): 1-7.

Vijayakumar, A.; M. Arunachalam and R. Suthanthirapandian (1995). Influence of mother crop nutrition and spacing on seed yield and quality in brinjal. **43**: 152-153.

Villareal, R.L. (1980). Tomatoes in the tropics. Boulder, Colorado: USA, West View Press, 10P.

Vittum, M.T. and W.T. Tapley. (1957). Spacign and fertility level studies with a pastetype tomato. *Proc. Amer. Soc. Hort. Sci. Hort. Sci.* **69**: 323-26.

Watt, V.M. (1931). some factors which influence growth and fruiting of the tomatoes. Arkansas Bull. 267.

Wicks, W.H. (1913). Tomato culture in Idaho. Idaho Bull.76.

(www.agridept.gov.ik)

Zahara, M. (1970). Influence of plant density on yield process of tomatoes for mechanical harvest. *Proc. Amer Soc. Hort. Sci.* **95**(4): 510-12.

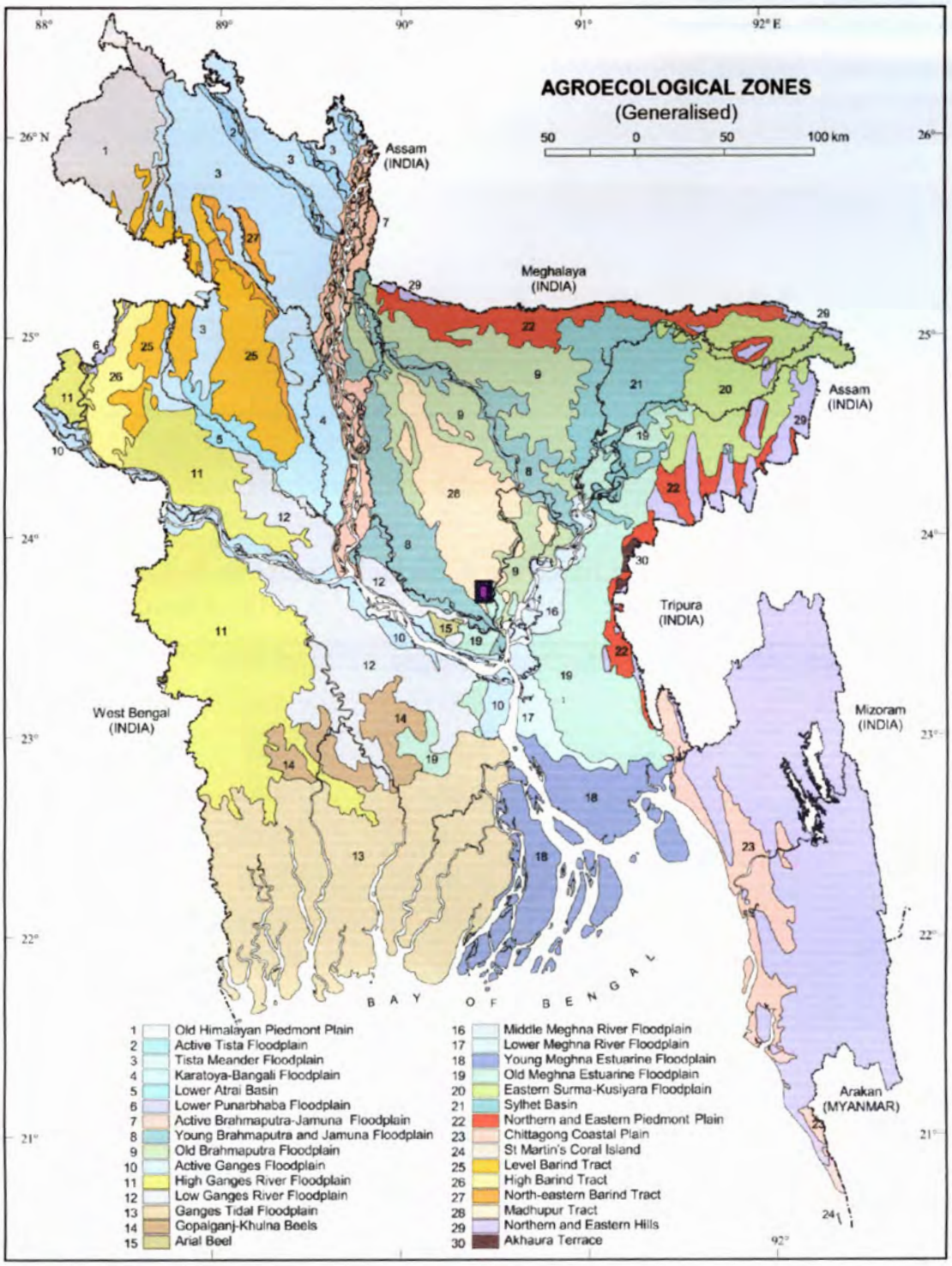
Zaman, M. A.K. (1992). Effect of planting time and spacing on the seed yield of cabbage. M.S. Thesis, Dept. of Hort. Bangladesh Agricultural University, Mymensingh. pp. 1-9.

Zeven, A.C. and Zhukivsky,P.M.1975. Dictionary of cultivated plants and their centres of diversity, Wageningen.P.219.

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	45
% Silt	32
% Clay	22
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

Appendix III. Weather data, 2006, Dhaka

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

Month	*RH (%)*	*Max. Temp. (c^o)*	*Min. Temp. (c^o)*	*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

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

Source of Variation	*Degree of Freedom*	*Mean Squares*			
		Plant height (cm)	*Number of branches/plant*	*Branch length (cm)*	*Leaves/plant*
Replication	2	12.276	3.815	54.184	8.259
Spacing (S)	2	5.916	17.815**	13.864**	1199.593**
Pruning (P)	2	5.763	136.148**	65.332*	1967.370*
Interaction (SxP)	4	2.409	0.537	1.010	157.759*
Error	16	2.15	1.731	0.956	5.801
CV (%)		2.68	9.50	1.97	2.57

** = Significant at 1% level

* = Significant at 5% level

NS= Non Significant

Appendix V. Mean squares for lamina length, number of flowers/plant, **average number of fruits/plant and diameter of fruit (cm).**

Source of Variation	*Degree of Freedom*	*Mean Squares*			
		Lamina length (cm)	*Number of flowers/plant*	*Average number of fruits/plant*	*Diameter of fruit (cm)*
Replication	2	19.841	1.593	804.354	0.068
Spacing (S)	2	7.110**	25.148**	52.263**	1.973
Pruning (P)	2	2.250	33.037**	27.693**	0.943**
Interaction (SxP)	4	0.210	8.704*	1.353*	0.083**
Error	16	0.871	2.343	0.318	0.044
CV(%)		5.13	7.52	3.46	5.64

** = Significant at 1% level

* = Significant at 5% level

NS = Non Significant

Appendix VI. Mean squares for yield/plant (g) and weight of individual fruit (g).

Source of Variation	*Degree of Freedom*	*Mean Squares*	
		Yield/plant (g)	*Weight of individual fruit (g)*
Replication	2	43401.482	3.683
Spacing (S)	2	842905.462**	362.578**
Pruning (P)	2	488562.275**	241.718**
Interaction (SxP)	4	24527.950**	3.230*
Error	16	2817.643	0.795
CV(%)		3.83	1241.59

** = Significant at 1% level

* = Significant at 5% level

NS = Non Significant