EFFECT OF FERTILIZERS AND RIPEN-15 ON THE FRUIT SET AND YIELD OF CUCUMBER (*Cucumis sativus* L.)

By

SANJAY KUMAR MONDAL
Reg. No. 27631/ 00768

A Thesis

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

MASTER OF SCIENCE (MS)
IN
HORTICULTURE

Semester: January – June, 2008

Approved By:

.....	.....
(Professor A. K. M. Mahtabuddin)	**(Professor Md Ruhul Amin)**
Dept. of Horticulture and Postharvest Technology	Dept. of Horticulture and Postharvest Technology
Sher-e-Bangla Agricultural University, Dhaka-1207	Sher-e-Bangla Agricultural University, Dhaka-1207
Supervisor	**Co-supervisor**

.....
(Professor Md Ruhul Amin)
Chairman
Examination committee

CERTIFICATE

This is to certify that the thesis entitled, **"*EFFECT OF FERTILIZERS AND RIPEN-15 ON THE FRUIT SET AND YIELD OF CUCUMBER*"** Submitted to the ***DEPARTMENT OF HORTICULTURE AND POSTHARVEST TECHNOLOGY***, Sher-e-Bangla Agricultural University, Dhaka in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE (MS) IN HORTICULTURE** embodies the result of a piece of *bona fide* research work carried out by **SANJAY KUMAR MONDAL,** Registration No. **27631/ 00768** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

I further certify that such help or source of information, as has been availed of during the course of this investigation has duly been acknowledged by him.

Dated :.....

Place: **Dhaka, Bangladesh**

(Professor A. K. M. Mahtabuddin)

Department of Horticulture and
Postharvest Technology
Sher-e-Bangla Agricultural University,
Dhaka-1207

Supervisor


Dedicated To My
Beloved Parents

ACKNOWLEDGEMENT

God, the merciful, who has created everything in this universe and kindly enabled the author to present this thesis for the degree of Master of Science in Horticulture.

The author expresses his sincere gratitude, hearty respect, immense indebtedness and profound appreciation to his research supervisor Professor ***A.K.M. Mahatab Uddin,*** *Department of Horticulture and Postharvest Technology, Shere-e-Bangla Agricultural University (SAU), Dhaka for his scholastic guidance and immense help in preparing the thesis.*

The author expresses his deepest sense of respect, gratitude and profound indebtedness to his reverend co-supervisor Professor Md Ruhul Amin, *Department of Horticulture and Postharvest Technology, Sher-e-Bangla Agricultural University, Dhaka for his constant co-operation, constructive criticism and technical help.*

The author feels to express his sincere appreciation and indebtedness to his esteemed teachers Professor. M.A. Mannan Miah, Professor Md. Ruhul Amin, and all other teachers in Department. of Horticulture and Postharvest Technology, Sher-e-Bangla Agricultural University, Dhaka for their valuable teaching, direct and indirect advice, encouragement and cooperation during the whole study period.

The author expresses his unfathomable tributes, sincere gratitude and heartfelt indebtedness from his core of heart to his parents, whose blessing, inspiration, sacrifice, and moral support opened the gate and paved to way of the author's higher study.

The author wants to say thanks, to his classmates and friends, for their active encouragement and inspiration.

The author

Dhaka

June, 2008

Effect of fertilizers and ripen-15 on the fruit set and yield of cucumber (*Cucumis sativus L.*)

By

Sanjay Kumar Mondal

ABSTRACT

A field experiment was conducted at the Horticultural Research Farm of Sher-e-Bangla Agricultural University, Dhaka, during April to July 2006 to study the effects of fertilizers and Ripen-15 on the fruit set and yield of cucumber. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The experiment consisted two factors viz. i) Fertilizers (control, 30 ton cow dung, 15 ton poultry litter, 150 kg Urea, 125 kg TSP and 100 kg MP per hectare, respectively) ii) Ripen-15 (0, 150, 300 and 450 ppm, respectively). The individual and combined effects of fertilizers and growth regulator (Ripen-15) on fruit set and yield of cucumber plants were studied. The individual and combined effects of fertilizer (organic and inorganic) and growth regulator (Ripen-15) on fruit set and yield of cucumber was found significant. Individually Inorganic fertilizer (Urea @ 150 kg/ha, TSP @ 125 kg/ha and MP @ 100 kg/ha) and 300 ppm "Ripen-15"gave the maximum number(male-59.47 and female-17.65) of flowers, highest number of fruits (15.34), highest fruit length(16.30cm), highest fruit diameter (5.69cm), highest fruit weight(412.90g), highest fruit weight per plant (4.78kg) and the highest yield (52.64t/ha). In case of plant growth regulators 300 ppm Ripen-15 the maximum number (male-59.47 and female-17.65) of flowers, highest number of fruits (11.33), highest fruit length (15.33cm), highest fruit diameter (4.80cm), highest fruit weight (302.90g), highest fruit weight per plant (3.27kg) and the highest yield (35.15t/ha) The treatment combination of inorganic fertilizer (Urea @ 150 kg/ha, TSP @ 125 kg/ha and MP @ 100 kg/ha) + 300 ppm "Ripen-15" gave the maximum (male-63.33 and female-20.33) number of flowers per plant, highest number of fruits per plant (18.24), highest (17.27 cm) fruit length highest fruit diameter (6.1 cm), highest fruit weight (433.3 g), highest fruit weight per plant (5.56 kg) and the highest yield (61.70 t/ha).

CONTENTS

CHAPTER	ITEMS	PAGE NO.
ABSTRACT		ii
LIST OF TABLES		iv
LIST OF FIGURES		v
LIST OF APPENDICES		vi
I.	INTRODUCTION	01
II.	REVIEW OF LITERATURE	04
III.	MATERIALS AND METHODS	17
IV.	RESULTS AND DISCUSSIONS	26
4.1.	Days of first male flower	26
4.2.	Days of first female flower	27
4.3.	Number of male flower	29
4.4	Number of female flower	30
4.5.	Ratio of male and female flower	33
4.6.	Number of fruit per plant	33
4.7.	Fruit length	34
4.8.	Fruit diameter	35
4.9.	Fruit weight	36
4.10.	Fruit weight per plant	39
4.11.	Fruit yield (t/ha)	42
V.	SUMMARY AND CONCLUSION	44
VI.	REFERENCES	48

LIST OF TABLES

TABLE NO.	ITEMS	PAGE NO.
1.	Effect of organic and inorganic fertilizers on flower characters of cucumber	31
2.	Effect of "Ripen-15" on flower characters of cucumber	31
3.	Combined effect of organic and inorganic fertilizer and "Ripen-15" on flower characters of cucumber	32
4.	Effect of organic and inorganic fertilizer on fruit characters of cucumber	38
5.	Effect of "Ripen-15" on fruit characters of cucumber	38
6.	Combined effect of organic and inorganic fertilizer and "Ripen-15" on fruit characters of cucumber	40

LIST OF FIGURES

Figure No.	ITEMS	Page No.
1.	Layout of the experimental plot	20
2.	Effect of organic and inorganic fertilizer on fruit yield of cucumber	41
3.	Effect of "Ripen-15" on fruit yield of cucumber	41

LIST OF APPENDIX

Appendix no.	ITEMS	PAGE NO.
I.	Morphological Characteristics of experimental field	55
II	Physical and chemical properties of the experimental soil	55
III	Monthly record of air temperature, rainfall, relative humidity and sunshine hours during the period from April to July 2006	56
IV	Analysis of variance of the data on plant characters of cucumber as influenced by fertilizer and "Ripen-15"	56
V	Analysis of variance of the data on fruit and yield characters of cucumber as influenced by fertilizer and "Ripen-15"	57

Chapter I

Introduction

Chapter-I

INTRODUCTION

Cucumber (*Cucumis sativus* L.) is a popular vegetable belongs to the family cucurbitaceous. There are 30 cucumis species found in Asia and Africa. Cucumber is a native to the tropics and is one of the oldest cultivated vegetable crops (Yawalkar, 1985). Cucumber is one of the important fresh fruit vegetables grown commonly throughout the world. In Bangladesh, it is available in all the year round. It is generally used as salad and pickle. In our country, young cucumber fruit is mainly used as Salad and fresh vegetables. It is also used as cooked vegetables like other cucurbits particularly in this country.

Cucumber contains 0.28 gm protein, 0.42 gm carbohydrate, 10 mg Ca, 17 mg P, 12 mg Mg and 105 mg K per 100 gms of edible portion. It also contains vitamin B (B_1- 0.03 mg and B_2-0.02 mg/100 gms of edible portion) and a considerable amount of Niacin and Vit-C (Yamaguchi, 1983). Nutritional council of Bangladesh recommended at least 235 g/day/person of vegetables for Bangladeshi adult but the availability is only 65.5 g/day/person.

Compared with the world agriculture, the average productivity of vegetables in Bangladesh is far lower than the average world productivity, though in cereals we are in better place especially in rice. In the year of 2003-04, total area under cucumber production was 5638 hectare (ha) and production was 25215 metric ton (MT). In the year of 2004-05, cucumber covered the area of 5560 ha and the production was 24350 MT, where as total vegetable production was 18.80 lakh MT (BBS, 2005).

The cultivation of cucumber requires an optimum supply of plant nutrient. Fertilizer exerts significant influence on yield, vigorous growth and yield attributes of legumes. Of the total nutrients used in the country, N alone constitutes about 80%, which may lead to

nutrient imbalance in the soil-plant ecosystem. To avert this potential danger, the limiting nutrients need to be identified and the soils should be enriched with those nutrients with additional application or checking the loss process. Use of organic manures and fertilizers is essential for its proper growth and development. Organic manure improves soil structure as well as increases its water holding capacity. Moreover, it facilitates aeration in soil. Vegetable consumers appreciate recently organic farming as it enhances quality of the produce. (Rashid, 2004)

Plant growth regulators are now widely used as a magic substance in modern farming. Recently, in our country the farmers or the commercial producer are being used different kinds of growth hormones under different trade name viz. Phyomone, Stik, Celmone, Florel, Cepha etc. to increase their production without knowing the functions, proper doses and active ingredients of it. They do not know at what stage the hormones have to apply and how to apply. They mainly use these under the suggestions of commercial traders or NGOs. But it is necessary for the growers to consult with their farm advisor or extension agent before using growth regulators, since recommendations are constantly changing and vary according to the local climate and soil and also according to endogenous hormone level of the plant.

Recently, "Ripen-15" (15% Ethephon) is used by the farmers to increase the yield of cucumber as per recommendation of National Agricare (a reputed NGO). "Ripen-15" is an organo phosphate compound and a growth regulating agent and the function of "Ripen-15" is to increase female flowers or the ratio of female parts, promote blossoming in some plants and accelerate maturation (National Agricare). Infact, the use "Ripen-15" had improved the production of cucumber including other vegetables in respect of better growth, quality and quantity, which ultimately led to generate interest among the scientist and farmers for commercial application of "Ripen-15".

However, very limited research was conducted to improve the yield and quality of cucumber by fertilizer management and hormone application. Farmers are asking for a package of production technology, appropriate time of planting, proper dose of fertilizer and hormone for improving flowering, fruit set and ultimate total yield.

In view of the above circumstances, the present experiment have been undertaken with the following objectives-

- to find out the effect of organic and inorganic fertilizers on better yield and quality of cucumber.
- to asses the response of "Ripen-15" on the improvement of flowering, fruit set and yield of cucumber.
- to determine the suitable combination of fertilizer and Ripen-15 for ensuring the maximum fruitset and yield of cucumber.

Chapter II
Review of Literature

Chapter-II

REVIEW OF LITERATURE

2.1 Effect of Fertilizers

Umamaheswarappa *et al.* (2005) conducted an experiment to study the effect of varying levels of nitrogen, phosphorus and potassium on flowering, fruit set and sex ratio of cucumber showed that, nitrogen levels had a significant effect on number of days required for initiation of first male and female flowers, number of male and female flowers per vine, number of days required for first fruit set, fruit set per cent and sex ratio during 2001 and 2002. Phosphorus levels also showed positive effect on number of male and female flowers per vine, fruit set per cent and sex ratio. Whereas, application of varying levels of potassium had no significant effect on flowering, fruit set per cent and sex ratio of cucumber cv. Poinsette during both the years.

Jasso *et al.* (2005) reported that Two greenhouse cucumber (*Cucumis sativus*) cultivars with differing fruit types [European ('Bologna') and Beit-alpha ('Sarig')] were grown during two seasons in a perlite medium in black plastic nursery containers in a passively ventilated greenhouse in northern Florida to evaluate fruiting responses to nitrogen (N) fertilization over the range of 75 to 375 $mg.L^{-1}$. Fruit production, consisting mostly of fancy fruits, increased quadratically with N concentration in the nutrient solution, leveling off above 225 mgL^{-1} for both cucumber cultivars. Fruit length and diameter were not affected by N concentration in the nutrient solution. Fruit firmness decreased with increasing N concentration. The fruit colour was darkest (lowest L* value) and most intense (highest chroma value) with intermediate to higher N concentrations.

N, P and K at different levels of application, alone and in all possible combinations (0:0:0, 75:0:0, 150:0:0, 0:150:0, 0:100:0, 0:0:25, 75:50:0, 150:50:0, 75:100:0, 150:100:0, 75:50:25, 150:50:25, 75:100:25 and 150:100:25 kg NPK/ha), was studied by Khan *et al.* (2005) on a heavy clay loam soil in Bannu, Pakistan, for their influence on the days to seed emergence, number of male and female flowers, number of branches, fruit length,

fruit weight and yield of cucumber. All the fertilizers significantly affected seed emergence. N at 150 kg/ha shortened the seed emergence time from 12 to 8 days. The best combination with respect to yield and number of flowers per plant was the 75:50:25 kg NPK/ha. The yield obtained with this level was 13.6 tonnes/ha, whereas the average number of male and female flowers was 26.8 and 28.0, respectively. Generally, all the treatments increased the number of both male and female flowers. NPK at 150:100:0 kg/ha increased the male to female flowers from 21.0:20.0 to 21.4:24.0. The longest fruit was observed with the application of 75:100:0 kg NPK/ha, and the greatest average fruit weight with the 75:100:0 kg NPK/ha treatment.

A study was conducted by Suojala *et al.* (2005) in Finland during 2001-03 to develop a fertilizer application programme for pickling cucumbers when grown using a drip irrigation system. The specific objectives were to determine: (1) which nutrients are needed in fertigation (N and K vs. all nutrients), (2) the optimal level of N in pre-planting fertilizer application and fertigation, (3) whether it is useful to provide a starter fertilizer high in P and (4) how much N, P and K is taken up by the plants. The cucumber cultivar used was Carine. A relatively low N level (120-140 kg/ha) was sufficient for a good yield under Finnish conditions. A higher N level may give a small increase in fruit yield, but only under warmer growing conditions. Moreover, 50-70% of fertilizer N and K should be added by fertigation, whereas other nutrients can be provided during pre-planting fertilizer application. Moderate pre-planting application is suggested because it enables a more flexible optimization of N application later in the season depending on other growth factors. Fertigation is not needed during the first 3-4 weeks after planting when nutrient uptake is still low. Addition of only N and K by fertigation was found to be sufficient if other nutrients were provided by pre-planting application and soil nutrient contents follow the recommendations. A starter fertilizer high in P is unlikely to be needed since cucumbers are usually planted in warm soil, which is kept moist. The N, P and K uptake per tone of fruit was 1.2-1.4, 0.28-0.35 and 2.2 g, respectively, which were slightly lower than reported in earlier studies.

Bacha, *et al.* (2005) conducted an Experiment on the effects of P rate (0, 30, 40, 50 or 60 kg/ha as P_2O_5) and sowing date (15 May, 30 May, 20 June and 5 July) on the growth and yield of bitter gourd (Momordica charantia cv. Land Race) were studied in Mingora, Pakistan. The increase in the rate of P_2O_5 rate resulted in early germination, flowering and harvesting, but had no effect on growth and yield. The lowest number of days to first picking was obtained with the application of 60 kg P/ha and sowing on 20 June (51.7). P at 0 kg/ha and sowing on 30 May gave the highest number of fruits per plant (40.0).

In experiments conducted by Swarappa, and Krishnappa (2004) in June 2001 and 2002, at Bangalore, Karnataka, India, application of nitrogen and phosphorus fertilizers increased the growth and yield of cucumber cv. Poinsette. Nitrogen improved most of the quality parameters, but phosphorus had no significant effect. Potassium had no significant effect on growth, yield or quality.

In a plot experiment carried out by Fuli *et al.* (2004) in a energy-saving solar greenhouse in northern Shaanxi (Loess Plateau), China, 7 treatments were compared to study the effects on NO< sub>2</ sub>--N and NO< sub>3</ sub>--N contents of cucumbers, NO< sub>3</ sub>--N in the soil and cucumber yield. Application of 400 kg N /ha + 250 kg P< sub>2</ sub>O< sub>5</ sub>/ha (NP) resulted in high levels of NO< sub>3</ sub>--N in the 0-20 and 20-40 cm soil layers before the fruiting stage, followed by a marked drop during the fruiting stage and an increase after harvest. NO< sub>3</ sub>--N accumulation and leaching in the 40-160 cm soil profile were the highest in the NP treatment, followed by the treatment with methane fertilizer (MF), and cattle urine and manure. Foliar spraying of urea and organic K during growth reduced the rates of fertilizer and manure required and, as a result, decreased the content of NO< sub>3</ sub>--N in the 0-200 cm soil layer. Higher cucumber yields were obtained in the MF and urea + organic K treatments than in the NP and non-fertilized control treatments.

Reddy and Rao (2004) was conducted field experiment with bitter gourd (M. charantia) in Hyderabad, Andhra Pradesh, India, consisting of 4 levels of vermicompost (0, 10, 20

and 30 t/ha) and 3 levels of N (20, 40 and 80 kg/ha). Application of vermicompost and N significantly increased the vine length, number of branches, number of fruits per vine and fruit yield/ha. Delayed flowering was observed with higher levels of N and Vermicompost. Application of 13.8-ton vermicompost and 34.18 kg N/ha (through urea) was found beneficial in improving the yield of bitter gourd.

Blum *et al.* (2003) reported that poultry manure and pine bark (*Pinus taeda*) are byproducts readily available in the State of Santa Catarina, Brazil. These byproducts can be used as soil amendments to improve soil fertility and soil physical and chemical properties. Interspecific cucumber (*Cucumis sativus*) cv. Caipira are one of the most cultivated cucurbits in Santa Catarina. The effects of the rates (0 to 50 g/kg soil) of poultry manure (2.82% N; 2.53% P; 1.2% K; 2.5% Ca; 0.5% Mg) and pine bark (0.30% N; 0.10% P; 0.12% K; 0.21% Ca; 0.03% Mg) incorporated into the soil on plant growth and yield of cucumber was evaluated. In the greenhouse, poultry manure at 30 g/kg soil (corresponding to ~3 kg/m2) increased the number (~15-50%) and the fresh mass (~90-200%) of emerging plants of Exposicao and Caipira. Soil pH and soil concentrations of Ca, K, Mg, Mn, N, P, and Zn increased with increasing poultry manure rates. In field trials, poultry manure increased the emergence of cucumber seedlings by ~15%. The fruit yields of Tetsukabuto and Caipira increased (by ~120%) with the incorporation of poultry manure to the soil at 30 g/kg (corresponding to ~3 kg/m2) .

An experiment was conducted by Tuzel *et al.* (2003) under greenhouse conditions for organic cucumber (cv. Sardes) production using 2 irrigation levels (30 and 50 cb soil water tensions) and 4 organic fertilizers (30 t farmyard manure/ha + E 2001 + Allgrow Bioplasma; 50 t farmyard manure/ha; 30 t chicken manure/ha + E 2001 + Allgrow Bioplasma; and 50 t farmyard manure/ha). Farmyard manure and chicken manure + E 2001 + Allgrow Bioplasma applied under 50 cb of soil water tension had the highest yield.

A field experiment was conducted by Ravikumar *et al.* (2003) in Karnataka, India, to study the effect of nutrients on seed yield and cost:benefit ratio in cucumber cv. Poinsette during kharif 1999. Treatments comprised: 60, 90 or 120 kg N/ha, 50 or 80 kg P/ha and 50, 80 or 110 kg K/ha. The application of 120:80:50 kg NPK/ha recorded a significantly higher number of fruits (3.28 per vine) compared to all other treatment combinations. Similarly, the treatment combination 90:50:110 kg NPK/ha recorded a higher fruit yield (168.9 q/ha) compared to all other treatment combinations. Application of 80 kg P/ha recorded a higher seed recovery (0.56%) and seed yield (72.6 kg/ha) than 50 kg P/ha (0.51% and 61.8 kg/ha, respectively). Among the treatment combinations, 120:80:50 kg NPK/ha recorded the highest seed yield (87.6 kg/ha) and benefit:cost ratio (1.92), followed by 90:80:110 (84.1 kg/ha and 1.78, respectively).

An experiment was conducted by Zambrano *et al.* (2002) in Venezuela, to determine the effect of three rates of NPK fertilizers (60:40:30, 120:80:60 and 240:160:120 kg NPK/ha) on the growth, yield and nutrient extraction of cucumber plants. The lowest fertilizer rate negatively affected the growth, dry weight, leaf area, yield and fruit size. The medium and high rates had comparable results, although the medium rate tended to be better. Nutrient extraction increased as the fertilizer levels increased. On average, nitrogen was the most extracted nutrient (35.6 kg/ha), and potassium and phosphorus were less extracted (20.0 and 4.2 kg/ha, respectively).

A study was conducted by Moniem *et al.* (2002) in plastic houses in Egypt during 1999 and 2000 to investigate the effect of organic fertilizers on the yield of cucumber cv. Hana, hybrid plants. Seedlings were transplanted in 25-litre pots containing sand and base organic manure. The treatments made when the plants reached the 5-leaf stages were: 100% compost manure; 75% compost manure + 25% inorganic fertilizer; 50% compost manure + 50% inorganic fertilizer; 100% chicken manure; 75% chicken manure + 25% inorganic fertilizer; and 50% chicken manure + 50% inorganic fertilizer. Higher early yield was obtained under compost than chicken manure treatment. Chicken manure at 75% produced the highest total yield. The lowest yield was obtained under 100%

compost treatment. A combination of 50% compost and 50% inorganic fertilizer increased the marketable yield of cucumber.

Fertilizer response trails comprising different doses of N + P + K i.e., 75 + 40 + 20, 125 + 50 + 40, 175 + 60 + 60 and 225 + 70 + 80 kg/ha were conducted by Singh *et al.* (2002) on off-season cultivation of cucumber crops in a low cost polyhouse during 1998-99 and 1999-2000, to ascertain the optimum dose of N + P + K for the maximum yield of good quality fruits. Results indicate that the application of the dose of N + P + K, 175 + 60 + 60 kg/ha produced significantly higher number of fruits (7.12-7.15), weight of fruits (329.65-340.90 g), weight of fruits per plant (2.41-2.44 kg), yield of fruits (17.8-18.04 kg/m2) and net income (Rs. 91.86/m2) compared to the other fertilizer doses.

The yield, fruit quality and nutritional status of cucumber cv. Aodai plants grown in nutrient solutions were evaluated by Fernandes *et al.* (2002) in a greenhouse. Two groups of nutrient sources were used to prepare the nutrient solutions for vegetative growth and two groups for the fruit production solutions. The nutrient solutions for vegetative growth were composed in mmol/litre of 8.0, 2.0, 4.0, 2.0, 1.0 and 1.0 of N, P, K, Ca, Mg and S; and 35.0, 19.0, 21.0, 4.0, 0.9 and 0.7 of Fe, Mn, B, Zn, Cu and Mo, respectively. The nutrient solutions for fruiting were composed in mmol/litre of 12.0, 3.0, 8.6, 3.0, 1.5 and 1.5 of N, P, K, Ca, Mg and S; and 59.0, 28.0, 31.0, 4.0, 1.3, and 0.7 Fe, Mn, B, Zn, Cu and Mo, respectively. The yield, fruit quality and plant nutritional status were determined, as well as the partition of Ca, Mg and K in the fruits. There were no significant differences between treatments. The average yield was 3.46 kg/plant, with an average crop cycle of 87 days, corresponding to a yield of 123 t ha^{-1} $year^{-1}$ when considering the adopted spacing.

Rekha and Gopalakrishnan (2001) conducted a field experiment with bitter gourd (*Momordica charantia* L.) cv. Preethi in Thrissur, Kerala, India during kharif 1999. Considering the total yield, marketable yield and size of fruits, the treatment T_7 which

received a basal application of 20 tones of dry Cowdung, 2.5 tones of poultry manure, fortnightly drenching of 2.5 tones of cowdung and a fertilizer dose of 70:25:25 kg NPK/ha was found superior to all other treatments. More or less equal fruit yield and fruit size were also recorded in T_5, which received same manures but lacked inorganic fertilizers. This was clearly revealed the possibility of achieving a reasonably good yield by basal application of dry cowdung, top dressing with poultry manure and by drenching cowdung slurry at fortnightly interval.

The influences of N, P and K fertilizers on seed yield and seed quality of bitter gourd were studied by Boonmanop (1997). Bitter gourd was grown and treated with the combination of 3 rates of nitrogen (0, 15 and 30 kg N/rai), 3 rate of phosphorus (0, 10 and 20 kg P_20_5/rai) and 2 rates of potassium (0 and 10 kg K_20/rai) fertilizers. The results showed that N, P and K fertilizers had no significant effects on the first bloom of male and female flower (earliness), total number of fruits, weight per fruit, number of seeds per 7 square meter (6 plants), number of seeds per fruit, total seed weight and 100 seeds weight. However, the high rates of N, P and K gave the highest germination (92.9 %) and germination index (23.2) and the best combination was 30, 20 and 10 kg N, P_20_5 and K_20/rai, respectively.

Isaac and Pushpakumari (1997) conducted a field trial at Department of Agronomy, College of Agriculture, Vellayani, India in 1994-95, where okras were grown with 6 t/ha FYM + chemical fertilizers and 12 t/ha FYM + chemical fertilizers or vermicompost or poultry manure. The effect of picking no, 2, 4 or 6 green fruits/plant was also examined. Fruit and seed yields were highest with FYM + chemical fertilizers, but there was only a marginal benefit in applying the higher rate of FYM. Seed yield declined as more fruits were picked.

Ali *et. al.* (1995) found that the highest number of female flowers (36.13) and fruit set (34.49) was recorded with 120 kg N/ha. Individual fruit weight was greater (55.26 g) with 80 kg N but the difference was not significant. The highest yield (24.90 t/ha) was

recorded with 80 kg N/ha. The control plants yielded 17.13 t/ha. Differences between cultivars were not significant except for the number of female flowers, fruit per plant and yield per hectare. Tarnab selection produced 35.05 female flowers per plant, 33.98 fruits per plant and 24.77-ton fruit/ha compared with 30.05, 28.66 and 18.85 t/ha, respectively, in Balsam Pear.

Islam (1995) conducted an experiment with five levels of NPK such as 0-0-0, 120-0-0, 120-120-60, 240-0-0 and 240-120-60 kg/ha on bitter gourd seed production. He observed that plots treated with N alone at the rate of 240 kg/ha improved the vegetative growth of bitter gourd as manifested by an increase number and length of vines, diameter of stem, length and diameter of leaves. The inclusion of P and K to N significantly reduced the above parameters, except the number of lateral vines and diameter of stem, which remains unaffected. However, application of NPK significantly increased the number of fruits per plant, size and weight of fruits and the fruit yield compared to plots treated with N alone. The increase in fruit yield due to the application of P and K was 11.35 t/ha at 240 kg N/ha. The same trend of result was noted for seed yield and quality where plants fertilized with 240-120-60 kg/ha produced the highest yield due to greater number of filled seeds per fruit which were bigger and heavier than the seeds produced from other treatments. Moreover, the above treatment produced seeds with the highest percentage of germination (99.00) and seed vigor index (20.03%).

Naik and Srinivas (1992) in trials conducted at the Division of Vegetable Crops, Indian Institute of Horticultural Research, Bangalore, Karnataka, India with cv. Pusa Sawani to observe the influence of nitrogen and phosphorus fertilization on seed crop of okra in the rainy seasons of 1985 and 1986 on a sandy loam soil with low available N and P. N was applied at 50, 100, 150 and 200 kg/ha and P at 30, 60 and 90 kg P_2O_5/ha. Half of the N, all the P and 40 kg K_2O/ha were applied before sowing; the rest of the N was applied as a top dressing 30 days after sowing. The highest seed yields were obtained with 200 kg N/ha (13.00 and 11.25 q/ha in 1985 and 1986 respectively) and 90 kg P_2O_5/ ha (11.89 and 10.71 q/ha during 1985 and 1986 respectively). Other parameters (fruit length,

number of fruits/plant, number of seeds/fruit and 1000 seed weight) were also highest with the highest rates of fertilizer application.

Suresh and Pappiah (1991) conducted a trial with bitter gourd cv. MDU 1, where N (0, 40 and 80 kg/ha) P_2O_5 (0, 30 and 60 kg/ha) were applied and Maleic Hydrazide (MH) was sprayed at 0, 100 and 200 ppm solution. The highest yield was obtained with 80 kg N/ha, 30 kg P_2O_5/ha and 200 ppm MH.

Arora and Satish (1989) observed that N and P increase the number of female flower of sponge gourd (*Luffa aegyptiaca*) cv. Pusa Chikni during the summer and rainy seasons. The plants received N at 0-75 Kg/ha and P at 40 Kg/ha. Then highest number of female flower was obtained with N at 50+ P at 20 Kg/ha in summer season and with N at 25 + P at 40 Kg/ha in winter season.

Lingaiah *et al.* (1988) stated that the highest yield of bitter gourd was obtained in coastal region at N: P2O5: K2O at 80:30:20 kg/ha.

Satish *et al.* (1988) stated that in 2 season trials, N at 0, 25, 50 and 75 kg/ha and P at 0, 20, and 40 kg/ha were applied to the cv. Pusa Chikni. Half of the N dose and all P were applied before sowing on 9 March and 9 July and the remaining N was used for top dressing in 2 equal doses at 25 and 50 days after sowing. In both seasons, 50 kg N+20 kg P/ha gave the maximum number of fruits and the greatest weight/plant in the early and total yields. Maximum fruit dry matter content was obtained by applying 25 kg N + 40 kg P/ha in the summer season crop and 40 kg P/ha in the rainy season (July).

Vishnu *et al.* (1987) studied the effect of plant spacing and fertilizers on yield of bottle gourd. It was reported that the average yield was 38537 kg/ha with the full dose of NPK (180:100:100 kg/ha) and 30074 kg/ha with the reduced dose (one third of the full dose).

In a field experiment during 1981-83, application of 3 levels of N, P and K, each at O, 40 and 80 kg/ha, was evaluated by Mishra (1987). It was observed that N did not show a significant effect in increasing the height and number of the main branches and of 100 seed weight, however, P increased plant height significantly. Increased K doses reduced the height and number of main branches. The seed yield increased with increasing doses by N and P but K beyond 40 kg/ha did not show any significant effect.

Pelaez *et al.* (1984) studied the effect of NPK and organic matter on yield and marketable fruits of squash (*Cucurbita pepo* L.). According to their investigations plots receiving 10 t/ha poultry manure gave the highest followed by plots receiving 100 kg N, 300 kg P_2O_5 and 75 kg K_2O per hectare, which yielded 21.24 t/ha and 3.2 fruits/plant.

All gourds respond well to manures and fertilizer application. The doses of fertilizers depend upon the soil type, climate and system of cultivation. In cucurbits, excessive nitrogen and consequently enormous vine growth require to be avoided. In general, high N under high temperature conditions promote maleness in flowering and number of female/perfect flowers per vine gets reduced resulting in low fruit set and low yield (Seshardi, 1986).

Ogunremi (1978) reported that the fruit size and numbers were the highest when applied with N at 48 kg/ha in melon.

Makal *et al.* (1977) studied the effect of NPK on yield of tinda. It was reported that N, P_2O_5 and K_2O at the rate of 75, 50 and 100 kg/ha enhanced the yield from 3207.7 kg/ha to 3697.7 kg/ha.

2.1 Effect of Plant Growth Regulator "Ripen-15"

Al-Masoum and Al-Masri (1999) reported that Cucumber cv. Beit Alpha was grown in a greenhouse in 1996-97 and ethephon applied at 250 ppm, 350 ppm and 450 ppm at the seedling stage (2-4 true leaves). Data were collected on the total yield, early yield, late yield, number of female flowers, number of male flowers, days to the first male flowers, days to first female flowers, number of nodes to the first female flower, number of nodes to the first male flower and plant height. All the cases positive result was found from ethephon treated plants. Ethephon induced femaleness (pistillate flowers) on the main stem that led to greater fruit production.

Arora *et al.*, (1988) stated that in 2 season field trials with cv. *Lagenaria cylindrica (Lagenaria aegyptiaca)* Pusa Chikni, the plants were sprayed with 5 different growth regulators at the 2 and 4 true leaf stages. The total yield (av. 2.39 kg/plant) was the highest in plants treated with Ethrel (ethephon) at 100 ppm. The average control yield was 0.69 kg/plant.

Sreeramulu (1987) found that ethrel 100 g/l increased the number of pistillate flowers and also hastened the appearance of the female flower compared to the control in sponge gourd. It also delayed the appearance of the first staminate flower and also decreased the total number of male flowers.

Verma *et al.* (1984) found that ethrel 100 ppm delayed the appearance of first male and female flowers. MH 200 ppm and Boron 3 ppm and 4 ppm produced the earliest female flowers but at a higher node, while ethrel 100 ppm induced the first staminate and pistillate flower at the lowest nodes at 6.5 and 9.5 respectively. Boron 4 ppm also proved superior to all the other chemicals in producing the maximum fruits and yield. Ethrel and MH 100 ppm did not response much. One local and exotic varieties of snake gourd was treated with 0.1% and 0.2% of potassium naphthalene (knap). The number of fruits per plant and average weight of fresh fruit increased significantly following treatment with 0.1% knap in both varieties.

Augustine et al.(1973) found that MCEB (5-methyl, 7-chloro, 4-ethoxycarbonylmethoxy, 2,1,3-benzothiadiazole) had no effect on the andriecious phenotype of cucumber while ethaphon 500 ppm induced pistillate flowers. The effect of MCEB and ethaphon treatment was a marked reduction in the number of ethylene induced pistillate flowers except when there was a 48-hour period between application of ethaphon and MCEB. In gynoecious phenotype, MCEb 75 ppm induced staminate flowers, ethaphon had no effect and the effect of MCEB and ethaphon treatment was to induce staminate flowers at relatively high concentrations of MCEB 150 ppm.

Cantliffe *et al.* (1972) observed the response of cucumber to soil application of (2-chloroethyl) phospfonicacid (ethaphon). At maturity, the transplants at 250 and 500 ppm were stunted, but still capable of supporting a normal fruit load. Almost all of their flowers opening within 60 days of planting were pistillate. The period in which only pistillate flowers were produced, of critical importance in the production of hybrid seed, was longer for the soil treatments than for foliar treatments with 125 and 250 ppm.

Ravindran (1971) reported that bitter gourd seedlings were sprayed with ethral at concentrations ranging from 200 ppm to 600 ppm. Stunting, growth retardation and pollen sterility were induced in proportion to the dose applied and the production of male flowers was significantly reduced.

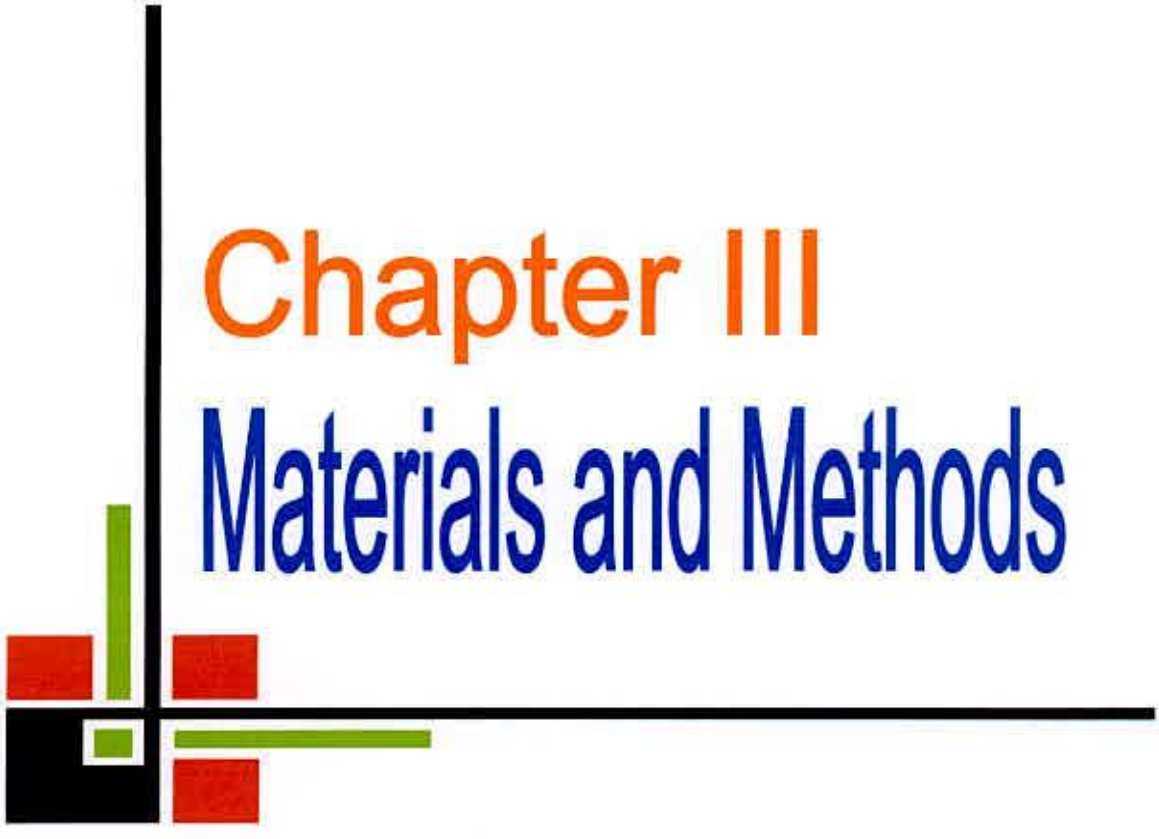
Treatment of plants of the cultivar of cucumber 'Galaxy' with ethaphon at the concentration of 120 ppm at the one-leaf stage or at subsequent leaf stages increased pistillate flower formation (Lower *et al.*, 1970)

Murray and Miller (1969) found that cucumber seedlings treated with ethephon at concentrations of 120 ppm, 180 ppm and 240 ppm increased the number of pistillate flowers. The staminate to pistillate flower ratio was approximately 10:1. However, in

case of ethephon treated plants, the staminate to pistillate flower ratio ranged from 1:6 to 1:14, depending on the concentration of ethephon used.

Application of ethaphon at concentrations of 50-250 ppm at the fully expanded true leaf stage induced femaleness in the hybrid 'Piccadilly' and reduced the size of the plants by shortening the internodes (Sims and Gledhill, 1969).

From the above review of literature, it was revealed that different concentration of plant growth regulator "Ripen-15" and fertilizer management practices significantly affectes the flowering, fruit set, growth and yield of different cucurbits. The treatments of the present work justify the singale and combained effect of "Ripen-15" with fertilizer management to identify most suitable treatment for cucumber production.



Chapter III
Materials and Methods

Chapter-III

MATERIALS AND METHODS

3.1 Experimental site

The experimental field was located at $23^{0}77'$ N latitude and $90^{0}3'$ E longitude at the Horticultural farm of Sher-e- Bangla Agricultural University, Dhaka.

3.2 Soil

The soil of the experimental field belongs to the Tejgaon soil series of the Madhupur Tract (AEZ – 28). The General Soil Type of the experimental field is Deep Red Brown Terrace Soil. Topsoil is silty clay loam in texture. Organic matter content is very low (0.98 %) and soil pH varies from 5.8 – 6.00. The land is above flood level and well drained. The initial morphological, physical and chemical characteristics of soil are presented in Appendix I, II.

3.3 Climate

The experimental area was under the sub-tropical monsoon climate, which is characterized by heavy rainfall during Kharif season (April to July) and scantly of rainfall during the rest of the year. The monthly total rainfalls, average sunshine hour, temperature during the study period (April to July 2006) were recorded which are shown in Appendix III.

3.4 Collection of seed

The variety of cucumber used in the experiment was Summer queen. The seeds were collected from Kushtia Seed Store, Mirpur-11. Dhaka

3.5 Experimental treatment

The experiment was undertaken to study the effect of 4 levels of Nitrogen fertilizer (organic and inorganic) and 4 levels of Ripen-15 on the fruit set and yield of cucumber. The study comprised the following treatments:

A. Fertilizer level: 4

1) Control (F_0) : 0

2) Cow dung (F_1) : 30 ton/ha

3) Poultry litter (F_2) : 15 ton/ha

4) Inorganic fertilizer (F_3) : Urea, TSP and MP 80, 65 and 55 g/plot, respectively.

B. Ripen-15 level: 4

1) "Ripen-15" (R_0) :0 ppm (control)

2) "Ripen-15" (R_1) : 150 ppm

3) "Ripen-15" (R_2) : 300 ppm

4) "Ripen-15" (R_3) : 450 ppm

There were 16 treatment combinations of fertilizer and "Ripen-15" levels used in the experiment as followings:

$F_0 R_0$= 0 ppm "Ripen-15" + no fertilizer (Control)

F_0R_1 = 150 ppm "Ripen-15" + no fertilizer

F_0R_2 = 300 ppm "Ripen-15" + no fertilizer

F_0R_3 = 450 ppm "Ripen-15" + no fertilizer

F_1R_0 = 0 ppm "Ripen-15" + cow dung (30 ton/ha)

F_1R_1 = 150 ppm "Ripen-15" + cow dung (30 ton/ha)

F_1R_2 = 300 ppm "Ripen-15" + cow dung (30 ton/ha)

F_1R_3 = 450 ppm "Ripen-15" + cow dung (30 ton/ha)

F_2R_0 = 0 ppm "Ripen-15" + poultry litter (15 ton/ha)

F_2R_1 = 150 ppm "Ripen-15" + poultry litter (15 ton/ha)

F_2R_2 = 300 ppm "Ripen-15" + poultry litter (15 ton/ha)

F_2R_3 = 450 ppm "Ripen-15" + poultry litter (15 ton/ha)

F_3R_0 = 0 ppm "Ripen-15" + Inorganic fertilizer

F_3R_1 = 150 ppm "Ripen-15" + Inorganic fertilizer

F_3R_2 = 300 ppm "Ripen-15" + Inorganic fertilizer

F_3R_3 = 450 ppm "Ripen-15" + Inorganic fertilizer

Inorganic fertilizer: Urea, TSP and MP 150, 125 and 100 kg/ha, respectively.

3.6 Design and layout of the experiment

The experiment was laid out with randomized completely block design (RCBD) with three replications. The experimental plot was first divided into three blocks. Each block consisted of 16 units of plots. Different combination of fertilizer and "Ripen-15" were used at randomly to each block as per design of the experiment.

Total number of plot = 48

Individual plot size = 2.7 m × 2 m (5.4 m^2)

Block to block distance = 1.0 m

Plot to Plot distance = 0.5 m

Row to row distance = 90 cm

Plant to plant distance =1.0 m

Number of plants/ plot =30

The layout of the experimental plot is shown in Fig. 1.

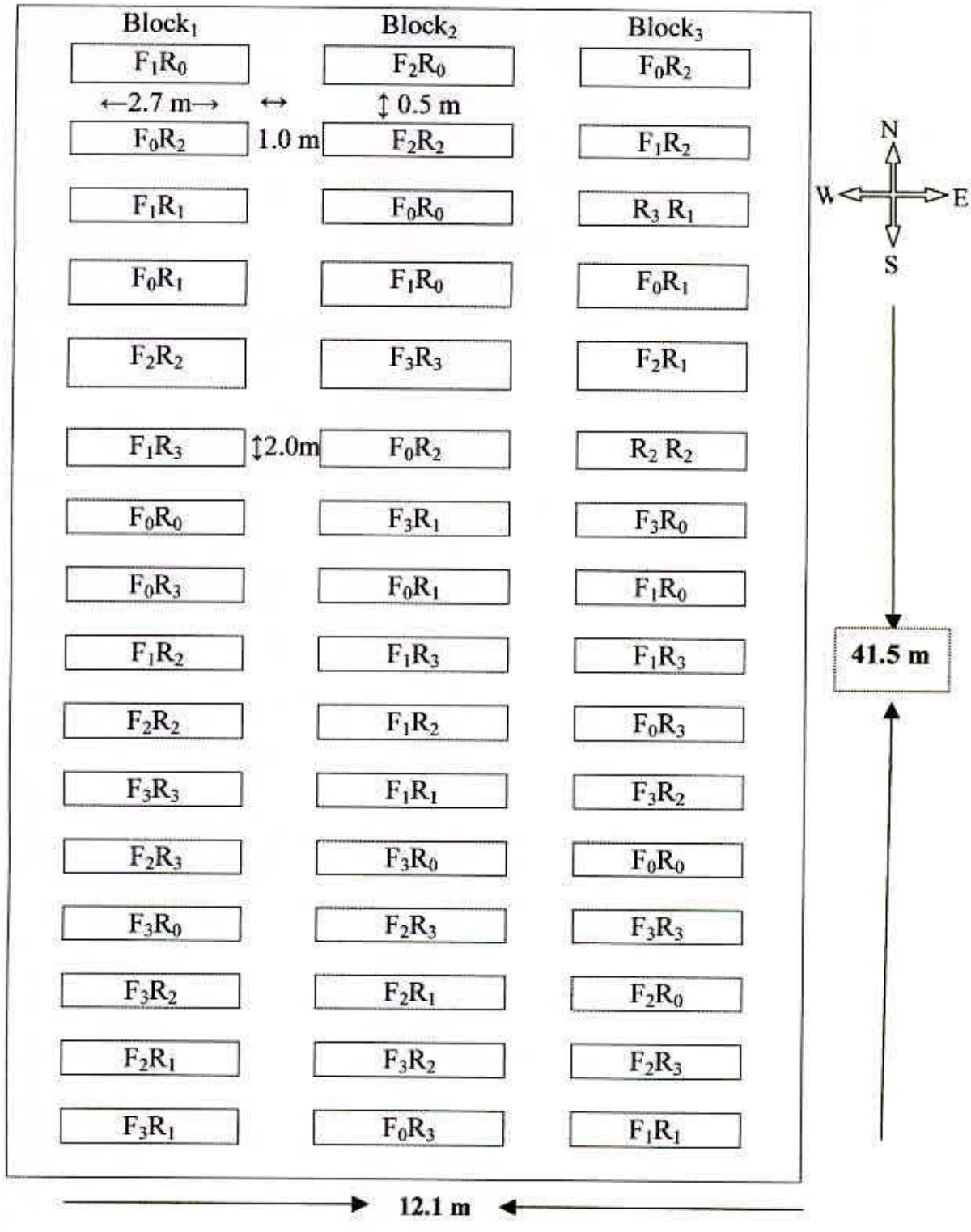


Fig. 1. Layout of the experimental plot

3.7 Land preparation

The land was first opened on 15 April, 2006, with the help of a power tiller, later the land was prepared by deep and cross ploughing with the tractor followed by harrowing and alternate laddering up to a good tilth. Weeds, stubbles and crop residues were removed from the field. Field layout was done on 18 April, 2006 according to the design adopted. Finally, individual plots were prepared with spade on 20 April, 2006. Drains were made around each plot and the excavated soil was used for raising the plots to about 5 cm high from the soil surface.

3.8 Manures and fertilizer application

As per recommendation of Sabji Biggan(2004) following doses per hectare of fertilizers were applied:

Fertilizer	Unit/ha	Unit/plot
Cowdung	30 ton	16 kg
Poultry litter Chemical	15 ton	8 kg
Chemical Fertilizer 1. Urea 2.TSP 3.MP	 150 kg 125 kg 100 kg	 81 g 68 g 54 g

Recommended dose of Cow dung, Poultry litter, Urea, TSP and Muriate of potash were applied in the experimental plot. All the fertilizers, except urea were added to the soil during individual plot preparation as per treatment. Urea was applied in three equal splits. The first split was applied during land preparation, the second split after 30 days of transplanting i.e. at active vegetative stage and the third split after 60 days of transplanting i.e. at fruiting stage. The fertilizer was thoroughly mixed with the soil by hand.

3.9 Sowing of seeds and transplanting of seedling

Seeds were sown in polybags having compost mixed sandy loam soil on 07 April 2006 for germination and seedling rising. There were two holes at the lower side of the polybag for drainage of excessive water. Three seeds were sown in each polybag. The polybags were kept in shady place. They were watered regularly during the seedling-raising period. Complete germination of the seeds took place within 5 days. After 7 days of emergence only one seedling was allowed to grow in each polybag. Intensive care was taken to protect the seedlings from the attack of insects. When the seedlings (10 days old) attained 4 leaves and hard enough, they were transplanted in the main field on 21 April 2006.

3.10 Application of growth regulator

The selected growth regulator "Ripen-15" was applied at three times, first at 15 days after transplanting (DAT) at 8 leaves stage on 05 May, 2006, second after 30 DAT on 05 June, 2006 and third at 45 DAT on 20 June, 2006 (just or before the flower initiation stage) with the help of hand sprayer.

3.11 Intercultural operations

The crop was kept free from weeds by regular weeding and irrigated as when required.

3.11.1 Gap filling

Injured and weak seedlings were replaced by new vigor seedling from the same stock of the experiment.

3.11.2 Weeding

Weeding was done whenever it was necessary to keep the plots free from weeds.

3.11.3 Irrigation

Irrigation was done whenever it was necessary.

3.11.4 Vine management

Stormy weather may cause the tender vine of the plants fell down from the supports (Trellis). For proper growth and development of the plants, the vines were managed upward with the help of rope by hand.

3.11.5 Pest control

There was a plan to protect the plant from the attack of insects-pests specially fruit flies and fruit borer by spraying of pesticides. Since there was no incidence of disease, no fungicide was applied in the crop field during the experimental period.

3.11.6 Trellis

Six bamboo poles were set slantingly keeping 5 feet high from the ground level in each plot. The poles were connected to one another tightly by wire in such a way that they make opposite "V" shaped. A net from rope were placed on iron rope. Thus, a trellis for each plot was made for creeping the vines of crop.

3.12 Harvesting

Total 6 times harvesting was done. Harvesting was done at seven days interval from every plant of each plot for collecting data. First harvesting was done on 20 June, 2006.

3.13 Collection of experimental data

Data were recorded on the following parameters.

3.13.1 Days to first male and female flower initiation

Number of days from sowing to time required to first male and female flower was recorded from each plant and the average was calculated.

3.13.2 Number of male and female flowers

Total number of male and female flowers was counted from three randomly selected plants per plot. It was done at seven days interval after first flowering to ensure all flowers to be counted.

3.13.3 Ratio of Male and female flower

Ratio of male and female flowers were counted by dividing of male flowers by female flowers.

3.13.4 Number of fruits per plant

The number of fruits each plant of cucumber was counted at every harvest and thus the total number of fruits per plant was recorded and average number of fruits was recorded.

3.13.5 Length and diameter of fruit

Length of 5 randomly selected fruits per plot was measured after each harvest and then the average was taken. A total of 6 times measurement was taken during the total experiment period. Diameter was taken from the same 5 randomly selected fruits as harvested was measured and the average was calculated in cm.

3.13.6 Weight per fruit

After each harvest, the weight of randomly selected five fruits per plot was recorded and then the average weight per fruit was calculated in g.

3.13.7 Weight of fruit per plant

After each harvest, the weight of all fruits per plot was recorded and then the average fruit weight per plant was calculated in kg.

3.13.8 Fruit yield

To estimate yield (t/ha), the six plants in each plot and all the fruits in each harvest were considered. Thus, the average yield per plot was measured. The yield per hectare was calculated to convert considering the area covered by the six plants.

3.14 Statistical Analysis

The collected data were statistically analyzed by using the ANOVA. The test of significance of all parameters was done. The Duncan's Multiple Range Test (DMRT) with Least Significant Difference value was determined with appropriate levels of significance and the means were tabulated. The significance of the difference among the treatment combinations means was estimated by DMRT (Duncan's Multiple Range Test) at 5% level of probability (Gomez and Gomez, 1984).

Chapter IV
Results and Discussion

Chapter-IV

RESULTS AND DISCUSSIONS

The present experiment was conducted to determine the effect of plant growth regulators and fertilizer management practices on flowering, growth and yield of cucumber. This chapter includes the experimental results on effects of organic and inorganic fertilizer and "Ripen-15" on the days of first male and female flower, number of male and female flower, ratio of male and female flower, number of fruits per plant, fruit length, diameter of fruit, weight of single fruit, fruit weight per plant and fruit yield of cucumber. The analyses of variance (ANOVA) of the data on different components are given in Appendix IV to V. The results presented in tables are discussed character wise under the following heads.

4.1 Days to first male flower

There was significant variation due to application of organic and inorganic fertilizer on the days of first male flower of cucumber. The days to first male flower ranged from 46.76 to 52.37. The maximum (52.37) days to first male flower was required in the control treatment, which was statistically similar to the treatment of cow dung and poultry litter and the minimum (46.76) days to first male flower of cucumber plants was found in the treatment of NPK fertilizer. So, early flower was obtained with inorganic fertilizer compare to organic fertilizer (Table 1). Umamaheswarappa *et al.* (2005) stated that N fertilizer had a significant effect on number of days required for initiation of first male flower of cucumber.

Days to first male flower of cucumber influenced significantly by the application of different levels of "Ripen-15" (Table 2). The days to first male flower of cucumber ranged from 47.73 to 52.52. The maximum (52.52) days of first male flower of cucumber was obtained in control treatments, where no "Ripen-15" was applied, which was statistically similar to that of 150 ppm "Ripen-15". The minimum (47.73) days of

first male flower of cucumber was obtained in the treatment of 450 ppm "Ripen-15", which was statistically similar to the application of 300 ppm "Ripen-15". The result also showed that earlier flower initiation was obtained with increasing level of "Ripen-15" concentration. Al- Masoum and Al- Masri (1999) found a similar trend of days of first male flowering in cucumber with ethephon application.

The treatments combination of fertilizer and growth regulator "Ripen-15" had significant effect on the days of first male flower of cucumber (Table 3). The days of first male flower of cucumber ranged from 44.92 to 55.53. The maximum (55.53) days of first male flower of cucumber was found from the control treatment, which was statistically similar to that of treatment combination of (cow dung-30 ton/ha + no "Ripen-15"), (cowdung - 30 ton/ha + 150 ppm "Ripen-15") and (poultry litter- 15ton/ha + no "Ripen-15"). The lowest (44.92) days of first male flower of cucumber was obtained from the treatment F_3R_3 (inorganic fertilizer:urea@150kg/ha,TSP@125kg/ha and MP@100kg/ha) + 450 ppm "Ripen-15"), which was statistically similar with F_3R_2 (Inorganic fertilizer + 300 ppm "Ripen-15"), F_3R_1 (Inorganic fertilizer + 150 ppm "Ripen-15") and F_2R_3 (poultry litter + 450 ppm "Ripen-15") treatments.

4.2 Days to first female flower

Organic and inorganic fertilizer significantly influenced the days to the initiation of first female flower of cucumber (Table 1).The days of first female flower ranged from 49.09 to 54.58. The maximum days of first female flower initiation (54.58) was found in the control treatment, which was statistically different with other treatments and the minimum days of first female flower initiation of cucumber plants (49.09) was found in the treatment of NPK fertilizer. So, early female flower was obtained with inorganic fertilizer compare to organic fertilizer. Umamaheswarappa *et al.* (2005) stated that N

fertilizer had a significant effect on number of days required for initiation of first male flower of cucumber.

Days of first female flower initiation of cucumber influenced significantly by the application of different levels of "Ripen-15" (Table 2). The days of first female flower initiation of cucumber ranged from 50.65 to 53.71. The maximum days of first female flower initiation of cucumber (53.71) was obtained in control treatments, where no "Ripen-15" was applied, which was statistically similar with that of 150 ppm "Ripen-15". The minimum days of first female flower initiation of cucumber (47.73) was obtained in the treatment of 450 ppm "Ripen-15", which was statistically similar with the application of 300 ppm "Ripen-15". The result also showed that earlier female flower initiation was obtained with increasing level of "Ripen-15" concentration up to higher level. Al- Masoum and Al- Masri (1999) found a similar trend of days of first female flowering in cucumber with ethephon application.

The treatment combinations of fertilizer and growth regulator "Ripen-15" had significant effect on the days of first female flower initiation of cucumber (Table 3). The days of first female flower initiation of cucumber ranged from 47.33 to 55.03. The maximum days of first female flower initiation of cucumber (55.03) was found from the treatment T_5 (cow dung + no "Ripen-15"), which was statistically similar with control, F_1R_1 (cow dung + 1.0 ml "Ripen-15"), F_1R_2 (cow dung + 300 ppm "Ripen-15"), F_1R_3 (cow dung + 450 ppm "Ripen-15"), T_9 (poultry litter + no "Ripen-15") and T_{10} (poultry litter + 150 ppm "Ripen-15"). The lowest days of first female flower initiation of cucumber (47.33) was obtained from the treatment F_3R_3 (inorganic fertilizer + 450 ppm "Ripen-15"), which was statistically similar to F_3R_2 (NPK fertilizer + 300 ppm "Ripen-15") and F_3R_1 (NPK fertilizer + 150 ppm "Ripen-15").

4.3 Number of male flower

The effect of fertilizer on number of male flower per plant of cucumber was statistically significant (Table 1). The number of male flower per plant ranged from 50.30 to 59.47. The highest number of male flower per plant (59.47) was recorded from the treatment of inorganic fertilizer (NPK fertilizer), which was statistically similar with the treatment of poultry litter. The lowest number of male flower per plant (50.30) was found in the control treatment (no fertilizer), which was significantly different from other treatments. Khan *et al.* (2005) found 26.8 number of male flower with 75:50:25 kg NPK/ha.

Number of male flower per plant of cucumber varied significantly with different levels of "Ripen-15" treatment (Table 2). The number of male flower per plant ranged from 52.56 to 58.09. The highest number of male flower per plant (58.09) was found from the treatment of 300 ppm "Ripen-15", which was closely related to 450 ppm "Ripen-15". The lowest number of male flower per plant (52.56) was obtained in the control treatment (0 ppm "Ripen-15"). These results are similar with Cantliffe *et al.* (1972).

Number of male flower per plant was significantly influenced by the interaction effects of fertilizer and "Ripen-15". The combined effect of fertilizer and "Ripen-15"on the number of male flower per plant was highly significant (Table 3). The number of male flower per plant ranged from 45.0 to 63.33. The maximum number of male flower per plant (63.33) was obtained from the treatment combination of F_3R_2 (NPK fertilizer + 300 ppm "Ripen-15"), which was statistically similar with F_2R_2 (poultry litter + 300 ppm "Ripen-15") treatment combination. The minimum number of male flower per plant (45.0) was observed from control treatment combination.

4.4 Number of female flower

The effect of fertilizer on number of female flower per plant of cucumber was statistically significant (Table 1). The number of male flower per plant ranged from 8.58 to 17.65. The highest number of female flower per plant (17.65) was recorded from the treatment of inorganic fertilizer (NPK fertilizer), which was significantly different with other treatments. The lowest number of female flower per plant (8.58) was found in the control treatment (no fertilizer), which was also significantly different with other treatments. Khan *et al.* (2005) observed 28.0 number of female flower with 75:50:25 kg NPK/ha.

Different levels of "Ripen-15" treatment significantly varied the number of female flower per plant of cucumber (Table 2). The number of female flower per plant ranged from 10.34 to 14.20. The highest number of female flower per plant (14.20) was found from the treatment of 450 ppm "Ripen-15", which was closely related to 300 ppm "Ripen-15". The lowest number of female flower per plant (10.34) was obtained in the control treatment (0 ppm "Ripen-15"). These results are similar with the results of the experiment conducted by Murary and Miller (1969).

The number of female flower per plant was significantly influenced by the interaction effects of fertilizer and "Ripen-15". The combined effect of fertilizer and "Ripen-15"on the number of female flower per plant was highly significant (Table 3). The number of female flower per plant ranged from 7.25 to 20.33. The maximum number of female flower per plant (20.33) was obtained from the treatment combination of F_3R_2 (NPK fertilizer + 300 ppm "Ripen-15"), which was significantly different with other treatment combinations. The minimum number of female flower per plant (7.25) was observed from control treatment combination, which was statistically similar to F_0R_1 (7.80) treatment (no fertilizer + 150 ppm "Ripen-15") combination.

Table 1. Effect of organic and inorganic fertilizer on flower characters of Cucumber

Treatments	Days of first flowering		Number of flower		Ratio of male and female flower
	Male	Female	Male	Female	
Control (F_0)	52.37 a	54.58 a	50.30 c	8.58 d	5.86 : 1
Cow dung (F_1)	51.16 a	52.89 b	54.72 b	10.89 c	5.02 : 1
Poultry litter(F_2)	49.35 ab	52.21 b	56.41 ab	14.21 b	3.97 : 1
NPK fertilizer(F_3)	46.76 b	49.09 c	59.47 a	17.65 a	3.37 : 1
C.V (%)	3.34	3.89	4.69	5.01	-
LSD	3.327	2.013	3.007	1.286	-
Level of significance	**	**	**	**	-

In a column figures having similar letter(s) do not differ significantly.
**significant at 1% level of significance

Table 2. Effect of "Ripen-15" on flower characters of cucumber

Level of "Ripen-15"	Days of first flowering		Number of flower		Ratio of male and female flower
	Male	Female	Male	Female	
Control (R_0)	52.52 a	53.71 a	52.56 c	10.34 c	5.08 : 1
150 ppm(R_1)	50.50 ab	53.03 ab	55.07 b	13.24 b	4.16 : 1
300 ppm(R_2)	48.89 b	51.36 b	58.09 a	13.50 ab	4.30 : 1
450 ppm(R_3)	47.73 b	50.65 b	57.37 ab	14.20 a	4.04 : 1
C.V (%)	3.34	3.89	4.69	5.01	-
LSD	3.327	2.013	2.555	0.750	-
Level of significance	**	**	**	**	-

In a column figures having similar letter(s) do not differ significantly.
**significant at 1% level of significance

Table 3. Combined effect of organic and inorganic fertilizer and "Ripen-15" on flower Characters of cucumber

Treatments	Days of first flowering		Number of flower		Ratio of male and female flower
	Male	Female	Male	Female	
F_0R_0	55.53 a	53.30 abc	45.00 e	7.25 i	6.21 : 1
F_0R_1	52.10 bc	53.00 abc	50.20 d	7.80 hi	6.44 : 1
F_0R_2	49.00 d-g	50.80 d	50.55 e	8.50 gh	5.95 : 1
F_0R_3	48.20 fg	50.50 d	55.44 cd	10.80 f	5.13 : 1
F_1R_0	53.66 ab	55.03 a	50.67 d	9.50 g	5.33 : 1
F_1R_1	52.50 abc	53.50 ab	55.50 cd	11.00 ef	5.05 : 1
F_1R_2	52.00 bcd	53.40 ab	56.00 cd	11.25 ef	4.98 : 1
F_1R_3	51.33 b-e	53.25 abc	56.70 c	11.80 def	4.80 : 1
F_2R_0	52.33 abc	53.60 ab	55.33 cd	12.00 de	4.60 : 1
F_2R_1	50.25 c-f	53.35 abc	60.00 b	15.15 c	3.96 : 1
F_2R_2	48.35 efg	51.25 bcd	62.80 ab	15.00 c	4.18 : 1
F_2R_3	46.45 gh	51.10 cd	58.07 bc	14.70 c	3.95 : 1
F_3R_0	48.75 efg	50.45 d	53.67 d	12.60 d	4.25 : 1
F_3R_1	47.15 fgh	49.36 de	60.47 b	19.00 b	3.18 : 1
F_3R_2	46.20 gh	49.20 de	63.33 a	20.33 a	3.12 : 1
F_3R_3	44.92 h	47.33 e	59.17 bc	18.67 b	3.17 : 1
C.V (%)	3.34	3.89	4.69	5.01	-
LSD	2.777	2.515	2.510	1.073	-
Level of significance	*	**	**	**	-

In a column figures having similar letter(s) do not differ significantly.
**significant at 1% level of significance, * significant at 5% level of significance

F_0R_0 = 0 ppm R-15 + no fertilizer, F_0R_1 = 150 ppm R-15 + no fertilizer
F_0R_2 = 300 ppm R-15 + no fertilizer, F_0R_3 = 450 ppm R-15 + no fertilizer
F_1R_0 = 0 ppm R-15 + cow dung (15 t/ha), F_1R_1 = 150 ppm R-15 + cow dung
F_1R_2 = 300 ppm R-15 + cow dung (15 t/ha), F_1R_3 = 450 ppm R-15 + cow dung
F_2R_0 = 0 ppm R-15 + poultry litter (12 t/ha), F_2R_1 = 150 ppm R-15 + poultry litter
F_2R_2 = 300 ppm R-15 + poultry litter (12 t/ha), F_2R_3 = 450 ppm R-15 + poultry litter
F_3R_0 = 0 ppm R-15 + Inorganic fertilizer, F_3R_1 = 150 ppm R-15 + Inorganic fertilizer
F_3R_2 = 300 ppm R-15 + Inorganic fertilizer, F_3R_3 = 450 ppm R-15 + Inorganic fertilizer

4.5 Ratio of male and female flower

It was revealed from the experiment that fertilizer had a great effect on maleness and femaleness of cucumber (Table 1). Inorganic fertilizer increased femaleness and decreased maleness compared to organic fertilizers and control. Therefore, the ratio of male and female flowers was the fewest (3.37:1) incase of inorganic fertilizer application and the highest male and female flower ratio (5.86:1) was found in control treatment, where no fertilizer was applied. Khan *et al.* (2005) observed NPK at 150:100:0 kg/ha increased the ratio of male and female flowers from 21.0:20.0 to 21.4:24.0.

Growth regulators (Ripen-15) also influenced the ratio of male and female flower per plant of cucumber (Table 2). The maleness was increased up to a certain level of "Ripen-15" then it was decreased and femaleness was increased with increasing different levels of "Ripen-15" concentration. The lowest (4.04:1) ratio of male and female flower was observed in 300 ppm of "Ripen-15" and the highest (5.08:1) ratio of male and female flower was observed in control treatment. Sreeramalu (1987) found that ethephon (100 g/l) decreased male flower and increased female flower.

The combined effect of fertilizer and "Ripen-15" significantly influenced on the ratio of male and female flowers per plant (Table 3). The ratio of male and female flower per plant ranged from 3.12:1 to 6.44:1. The lowest (3.12:1) ratio of male and female flower per plant was observed in (F_3R_2) (NPK fertilizer + 300 ppm "Ripen-15") treatment combination and the highest (6.44:1) ratio of male and female flower per plant was observed in T_2 (no fertilizer + 150 ppm of "Ripen-15").

4.6 Number of fruit per plant

Different fertilizer showed a statistically significant variation on the number of fruits per plant (Table 4). The maximum (15.34) number of fruits per plant was recorded due to the application of inorganic fertilizer (NPK fertilizer) followed by organic fertilizer and the minimum (5.76) fruits per plant in number were recorded in control condition (no

fertilizer), which was significantly different from other treatments. The results indicated that maximum fruits per plant were produced by the application of organic or inorganic fertilizer than the control with ensuring the better yield of cucumber and inorganic fertilizer was more effective than organic fertilizer. Olivira *et al.* (2005) reported the similar results from their earlier experiments with bitter gourd. Ravikumar *et al.* (2003) recorded highest number of fruits per plant of cucumber with the application of 120:80:50 kg NPK/ha.

Different levels of plant growth regulator ("Ripen-15") showed a statistically significant variation on number of fruits per plant. Fruits per plant showed a gradual increasing trend for different levels of "Ripen-15" up to a certain level (300 ppm). The maximum (11.33) fruits per plant in number were recorded for the application of 300 ppm of "Ripen-15" that was closely followed by the application of 450 ppm of "Ripen-15" (10.86) and the minimum (7.87) fruits per plant were recorded in control condition (Table 5). These results are related to the results of the experiment conducted by Verma *et al.* (1984)

Combined effect between fertilizer and "Ripen-15" showed statistically significant variation in consideration of fruits per plant in number of cucumber. The maximum (18.24) number of fruits per plant was recorded from the treatment combination of F_3R_2 and the minimum (4.77) was noted from the treatment combination of control condition i.e. no fertilizer and no "Ripen-15" application (Table 6). The results indicated that combination of fertilizer, "Ripen-15" ensures the optimum condition for the growth, and development of cucumber and the ultimate result is the maximum fruits per plant.

4.7 Fruit length

Application of different fertilizer (organic and inorganic) showed statistically significant variation on fruit length of cucumber (Table 4). The maximum (16.30 cm) fruit length was recorded in application of inorganic fertilizer (NPK fertilizer) and the minimum

(12.37 cm) fruit length was recorded in case of control condition (no fertilizer). Khan *et al.* (2005) observed highest fruit length with NPK at 75:100:0 kg/ha.

Plant growth regulator, "Ripen-15" showed a statistically significant variation on fruit length (Table 5). Fruit length showed a gradual increasing trend for different levels of "Ripen-15" comparing the control and higher level of "Ripen-15". The maximum (15.33 cm) fruit length was recorded for the application of 300 ppm of "Ripen-15", further addition of "Ripen-15" decreased fruit length and the minimum (12.43 cm) fruit length was recorded from control (no "Ripen-15") treatment.

Combined effect of fertilizer and growth regulator, "Ripen-15" management practices showed a statistically significant variation on fruit length of cucumber (Table 6). The maximum (17.27 cm) fruit length was recorded in the treatment combination of inorganic fertilizer and 300 ppm of "Ripen-15" (F_3R_2), which was identical with the treatment combination of inorganic fertilizer and 150 ppm of "Ripen-15" (F_3R_1) and the minimum (10.31 cm) was recorded in the treatment combination of control. Susmita, *et al.* (1998) found similar results from their earlier experiment with bitter gourd.

4.8 Fruit diameter

Statistically significant variation was recorded on fruit diameter of cucumber for different fertilizer (organic and inorganic) management practices (Table 4). The maximum (5.69 cm) fruit diameter was recorded with the application of inorganic fertilizer and the minimum (3.73 cm) fruit diameter was observed in control condition (no fertilizer). Olivira *et al.* (2005) reported the similar trends of results from their earlier experiments with bitter gourd. The results also showed that poultry litter was more influential for fruit diameter than cow dung.

Plant growth regulator, "Ripen-15" showed significant variation on fruit diameter of cucumber (Table 5). Fruit diameter showed a gradual increasing trend up to a certain level (300 ppm) of "Ripen-15". The maximum (4.80 cm) fruit diameter was recorded

from the application of 300 ppm of "Ripen-15", further addition of "Ripen-15" decreased fruit diameter and the minimum (4.19 cm) fruit diameter was found from in control condition (no "Ripen-15").

Combined effect between fertilizer and "Ripen-15" showed statistically significant variation in consideration of fruit diameter of cucumber (Table 6). The fruit diameter was ranged from 3.45 to 6.10 cm. The maximum (6.10 cm) fruit diameter was recorded from the treatment combination of inorganic fertilizer and 300 ppm of "Ripen-15" management practices (F_3R_2), which was not identical with any other treatment combinations and the minimum (3.45 cm) was noted from the control treatment combination, where no fertilizer and no "Ripen-15" was applied.

4.9 Fruit weight

Weight of single fruit of cucumber was significantly varied by the application of different fertilizers (organic and inorganic). The maximum (412.90 g) fruit weight was recorded with the application of inorganic fertilizer (NPK fertilizer) and the minimum (161.40 g) fruit weight was recorded from control treatment, where no fertilizer was applied (Table 4). The results indicated that maximum fruit weight was produced by the application of organic or inorganic fertilizer than the control with ensuring the better growth and development of cucumber. Further, inorganic fertilizer showed significantly better performance than organic fertilizer. Khan *et al.* (2005) observed greatest average fruit weight with NPK at 75:100:0 kg/ha.

Fruit weight of cucumber for different concentrations of "Ripen-15" showed a statistically significant variation. The maximum (302.90g) fruit weight was recorded for the application of 300 ppm "Ripen- 15" that was closely followed by 450 ppm "Ripen-15" and the minimum (248.80 g) fruit weight were recorded in control condition, which was statistically similar with 150 ppm "Ripen-15 (Table 5). These results are similar with Verma *et al.* (1984).

The treatment combinations of fertilizer and growth regulator "Ripen-15" had significant effect on fruit weight of cucumber (Table 6 and appendix). The fruit weight due to fertilizer and growth regulator "Ripen-15" ranged from 145.00 to 443.30 g. The maximum (443.30 g) fruit weight was recorded from the treatment combination of inorganic fertilizer and 300 ppm of "Ripen-15" (F_3R_2), which was identical to inorganic fertilizer and 450 ppm of "Ripen-15" (F_3R_3) and the minimum (145.00 g) was recorded in the treatment combination of control condition i.e. no fertilizer and no "Ripen-15" was applied. The results indicated that combination of plant growth regulators and fertilizer ensures the optimum condition for the growth and development of cucumber and the ultimate result was the maximum fruit weight.

Table 4. Effect of organic and inorganic fertilizer on fruit characters of cucumber

Treatments	Number of fruit/plant	Length of fruit (cm)	Diameter of fruit (cm)	Weight of fruit (g)	Weight of fruit/plant (kg)
Control	5.76 d	12.37 c	3.73 d	161.40 d	1.53 d
Cow dung	7.67 c	13.61 b	4.09 c	245.40 c	2.25 c
Poultry litter	11.93 b	13.81 b	4.73 b	298.80 b	3.57 b
NPK fertilizer	15.34 a	16.30 a	5.69 a	412.90 a	4.75 a
C.V (%)	4.70	4.09	4.55	5.84	9.07
LSD	0.956	1.148	0.23	32.62	0.622
Level of significance	**	**	**	**	**

In a column figures having similar letter(s) do not differ significantly.
**significant at 1% level of significance

Table 5. Effect of "Ripen-15" on fruit characters of cucumber

Level of "Ripen-15"	Number of fruit/plant	Length of fruit (cm)	Diameter of fruit (cm)	Weight of fruit (g)	Weight of fruit/plant (kg)
Control	7.87 c	12.43 c	4.19 b	248.80 b	2.20 b
150 ppm	10.64 b	13.74 b	4.55 b	270.60 ab	2.86 b
300 ppm	11.33 a	15.33 a	4.80 a	302.90 a	3.27 a
450 ppm	10.86 ab	14.61 ab	4.75 ab	296.30 a	3.05 ab
C.V (%)	4.70	4.09	4.55	5.84	9.07
LSD	0.556	1.148	0.236	32.62	0.222
Level of significance	**	**	**	**	**

In a column figures having similar letter(s) do not differ significantly.
**significant at 1% level of significance

4.10 Fruit weight per plant

Weight of fruit per plant of cucumber was significantly influenced by the application of different fertilizers (organic and inorganic). The maximum (4.78 kg) fruit weight per plant was recorded in application of inorganic fertilizer (NPK fertilizer), which was significantly different from other treatments and the minimum (1.53 kg) fruit weight was recorded in control treatment, where no fertilizer was applied (Table 4). The results indicated that maximum fruit weight was produced by the application of organic or inorganic fertilizer than the control with ensuring the better growth and development of cucumber. Further, inorganic fertilizer showed significantly better performance than organic fertilizer. Satish *et al.* (1988) found maximum fruit weight per plant with inorganic fertilizers.

Fruit weight per plant of cucumber for different levels of "Ripen-15" showed a significant variation. The maximum (3.27 kg) fruit weight per plant was recorded for the application of 300 ppm "Ripen- 15" that was closely related to 450 ppm "Ripen-15" and the minimum (2.20 kg) fruit weight were recorded in control condition, which was statistically similar 150 ppm "Ripen-15 (Table 5). Arora *et al.* (1988) stated that highest fruit weight per plant 2.39 kg was obtained with the application of 100 ppm ethophon.

The combined effect of fertilizer and "Ripen-15" had significant effect on fruit weight per plant of cucumber (Table 6). The maximum (5.55 kg) fruit weight was recorded in the treatment combination of inorganic fertilizer and 300 ppm of "Ripen-15" (F_3R_2), which was significantly different with other treatments and the minimum (0.95 kg) was recorded in the treatment combination of control condition i.e. no fertilizer and no "Ripen-15" was applied. The results indicated that combination of plant growth regulators "Ripen-15" and fertilizer ensures the optimum condition for the growth and development of cucumber and the ultimate result is the maximum fruit weight per plant.

Table 6. Combined effect of organic and inorganic fertilizer and "Ripen-15" on fruit characters of cucumber

Treatments	Number of fruit/plant	Length of fruit (cm)	Diameter of fruit (cm)	Weight of fruit (g)	Weight of fruit/plant (kg)	Yield (ton/ha)
F_0R_0	4.77 k	10.31 h	3.45 h	145.00 j	0.95 f	10.56 i
F_0R_1	5.41 k	11.47 g	3.72 g	157.30 ij	1.02 f	11.33 hi
F_0R_2	6.22 j	13.98 cde	3.82 fg	165.00 ij	1.02 f	11.33 hi
F_0R_3	6.66 ij	13.74 de	3.95 ef	178.30 hi	1.18 f	13.11 gh
F_1R_0	6.31 j	12.52 f	4.05 e	200.00 gh	1.26 f	14 g
F_1R_1	7.22 hi	13.02 ef	4.07 e	221.70 g	2.03 e	22.56 f
F_1R_2	8.00 h	14.88 bc	4.11 e	273.30 ef	2.18 de	24.22 f
F_1R_3	9.13 g	14.04 cde	4.14 e	286.70 ef	2.62 d	29.11 e
F_2R_0	9.84 fg	12.02 fg	4.17 e	273.30 f	2.68 d	29.78 e
F_2R_1	13.08 d	13.93 cde	4.71 d	298.30 def	3.90 c	43.33 d
F_2R_2	12.85 d	15.30 b	4.98 c	303.30 de	3.90 c	43.33 d
F_2R_3	11.97 e	14.12 cd	5.08 c	320.00 d	3.85 c	42.78 d
F_3R_0	10.57 f	14.87 bc	5.10 c	376.70 c	4.15 bc	46.11 c
F_3R_1	16.85 b	16.35 ab	5.72 b	405.00 b	4.67 b	51.89 a
F_3R_2	18.24 a	17.27 a	6.10 a	443.30 a	5.55 a	61.67 b
F_3R_3	15.69 c	16.23 b	5.85 b	426.70 ab	4.55 b	50.56 a
C.V (%)	4.70	4.09	4.55	5.84	9.07	8.07
LSD	0.798	0.958	0.197	27.22	0.519	2.16
Level of significance	**	*	**	*	**	

In a column figures having similar letter(s) do not differ significantly.
**significant at 1% level of significance, *significant at 5% level of significance

F_0R_0 = 0 ppm R-15 + no fertilizer, F_0R_1= 150 ppm R-15 + no fertilizer
F_0R_2 = 300 ppm R-15 + no fertilizer, F_0R_3 = 450 ppm R-15 + no fertilizer
F_1R_0 = 0 ppm R-15 + cow dung (15 t/ha), F_1R_1 = 150 ppm R-15 + cow dung
F_1R_2 = 300 ppm R-15 + cow dung (15 t/ha), F_1R_3 = 450 ppm R-15 + cow dung
F_2R_0 = 0 ppm R-15 + poultry litter (12 t/ha), F_2R_1 = 150 ppm R-15 + poultry litter
F_2R_2 = 300 ppm R-15 + poultry litter (12 t/ha), F_2R_3 = 450 ppm R-15 + poultry litter
F_3R_0 = 0 ppm R-15 + Inorganic fertilizer, F_3R_1 = 150 ppm R-15 + Inorganic fertilizer
F_3R_2 = 300 ppm R-15 + Inorganic fertilizer, F_3R_3 = 450 ppm R-15 + Inorganic fertilizer
R-15 = Ripen-15

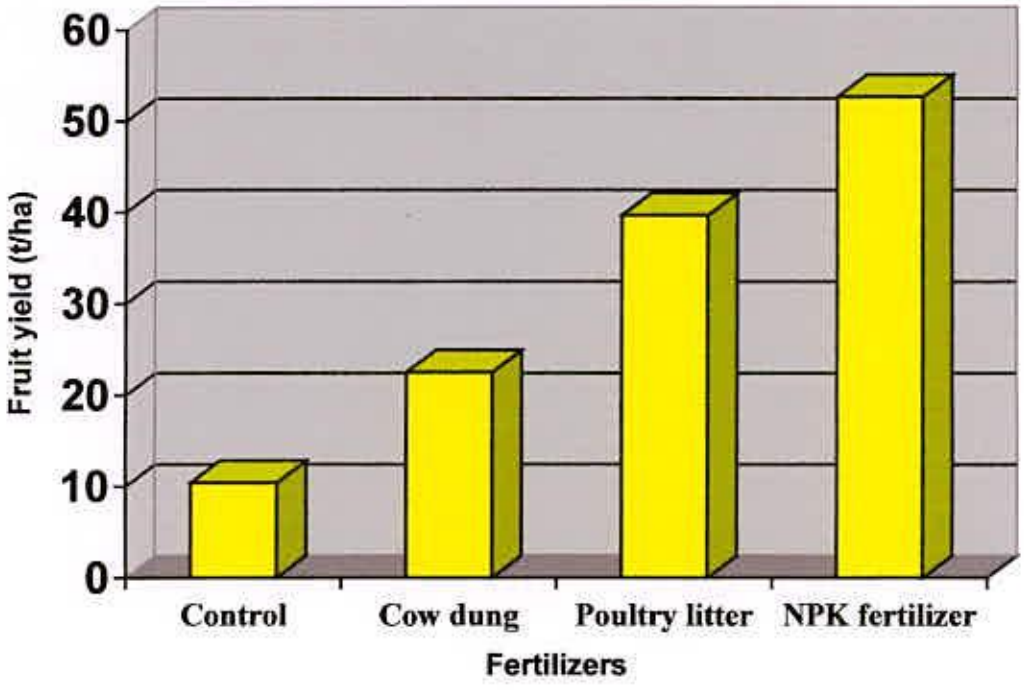


Fig. 2. Effect of organic and inorganic fertilizer on fruit yield of cucumber

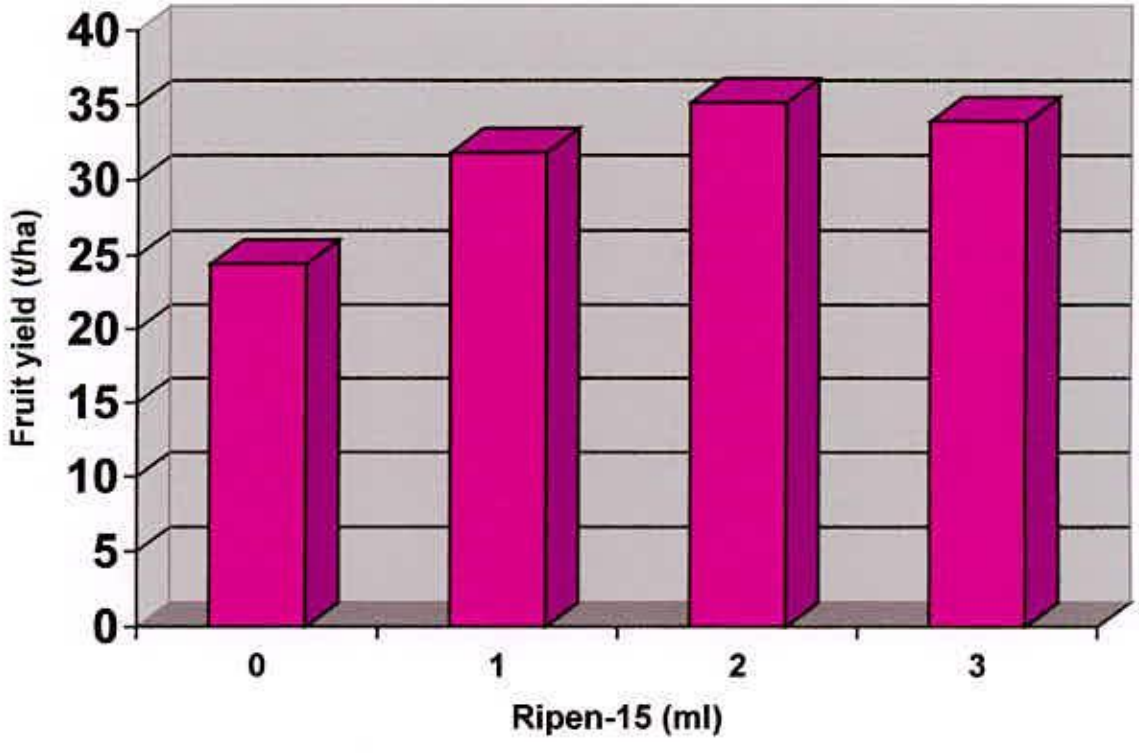


Fig. 3. Effect of "Ripen-15" on fruit yield of cucumber

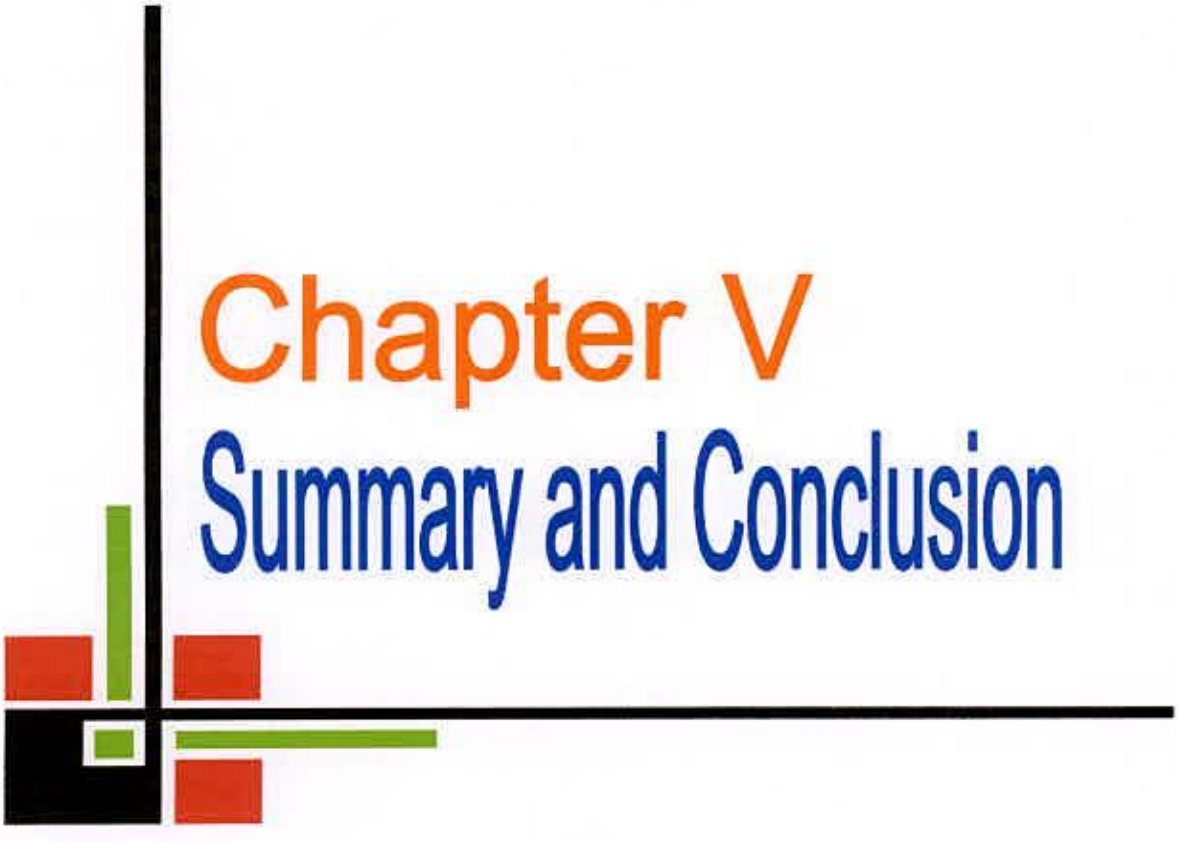
4.11 Fruit yield (t/ha)

Different fertilizer (organic and inorganic) showed statistically significant variation on fruit yield per hectare (Fig. 2). The maximum (52.64 t/ha) fruit yield was recorded from the application of inorganic (NPK) fertilizer, which was highly significant with other treatments. The second highest (39.68 t/ha) fruit yield was recorded from poultry litter treated plant, which was also significant compare to cow dung and control treatment and the minimum yield (10.42 t/ha) was recorded in control condition where no fertilizer was used. The results indicated that maximum yield per hectare was produced by the application of inorganic fertilizer than the organic fertilizer and control with ensuring the better growth and development of cucumber. Olivira *et al.* (2005) reported the similar results from their earlier experiments with bitter gourd. Ravikumar *et al.* (2003) recorded highest fruit yield of cucumber with the application of 90:50:110 kg NPK/ha. Moniem *et al.* (2002) showed that poultry litter increased 75% total yield compare to other organic fertilizers.

Significant variation was recorded in terms of fruit yield per hectare for different levels of "Ripen-15". Yield per hectare showed a gradual increasing trend for different levels of "Ripen-15" up to a certain level. Further addition of "Ripen-15" decreased fruit yield. The maximum (35.15 t/ha) fruit yield was recorded for the application of 300 ppm Ripen-15, which was closely related to 450 ppm "Ripen-15" and the minimum (24.41 t/ha) fruit yield was recorded in control condition (Fig. 3). Chudhury *et al.* (1967) were equally effective in suppressing the male flowers and increasing the number of female flowers in cucumber. The effects subsequently increased the percentage of fruit set and ultimately the yield per hectare increased.

Combined effect of between fertilizer and plant growth regulator "Ripen-15" showed statistically significant variation in consideration of yield per hectare. The maximum (61.67 t/ha) fruit yield was recorded in the treatment combination of 300 ppm "Ripen-15" and inorganic fertilizer management practices (F_3R_2), which was highly significant compare to all other treatments and the minimum (10.56 t/ha) was recorded in the

treatment combination of control condition i.e. no fertilizer and no "Ripen-15". The results indicated that combination of plant growth regulator "Ripen-15" and fertilizer ensures the optimum condition for the growth and development of cucumber and the ultimate results is the maximum fruit yield per hectare.



Chapter V

Summary and Conclusion

Chapter-V

SUMMARY AND CONCLUSION

A field experiment was conducted at the Horticultural Research Farm of Sher-e Bangla Agricultural University, Dhaka, Bangladesh during the period from April to July 2007 to study the effect of different fertilizer (organic and inorganic) and plant growth regulator "Ripen-15" on fruit set and yield of cucumber. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications of each treatment. The unit plot size was 5.40 m^2 (2.7 m x 2.0 m). There were 16 treatments combinations in the experiment comprising 4 levels of fertilizer (0, cow dung, compost & NPK fertilizer) and 4 levels of "Ripen-15" (0, 150 ppm, 300 ppm & 450 ppm). The individual and combined effects of fertilizer (organic and inorganic) and growth regulator (Ripen-15) on fruit set and yield of cucumber plants were studied.

Different fertilizer (organic and inorganic) individually influenced flower and fruit characters of cucumber. The minimum(46.76) days of first male flower and female flower (49.09 days) was recorded in application of inorganic fertilizer and the maximum (52.37 days) of first male flower and first female flower (54.58 days) was recorded in control condition. The minimum (3.37:1) ratio of male and female flower was recorded in application of inorganic fertilizer and the maximum (5.86:1) ratio of male and female flower was recorded in control condition. The maximum (15.34) number of fruits per plant was recorded in application of inorganic fertilizer and the minimum (5.76) fruits per plant number were recorded in control condition. The maximum (16.30 cm) fruit length was recorded in application of inorganic fertilizer and the minimum (12.37 cm) fruit length was recorded in control condition. The maximum (5.69 cm) fruit diameter

was recorded with the application of inorganic fertilizer and the minimum (3.73 cm) was recorded in control. The maximum (412.90 g) fruit weight was recorded due to application of inorganic fertilizer and the minimum (161.40 g) was found from control condition. The maximum (4.75 kg) fruit weight per plant was recorded from inorganic fertilizer and the minimum (1.53 kg) was obtained from control condition. The maximum (52.64 t/ha) fruit yield was recorded from application of inorganic fertilizer and the minimum (10.42 t/ha) fruit yield was found from control condition.

Different levels of "Ripen-15" significantly influenced the fruit set and yield parameters of cucumber. The minimum (47.73 days) time to first male flower and first female flower (50.65 days) initiation was recorded with the application of 450 ppm "Ripen-15" and the maximum (52.52 days) days to first male flower and female flower (53.71 days) initiation was observed in control condition. The minimum (4.04:1) ratio of male and female flower was recorded for the application of 450 ppm "Ripen-15" and the maximum (5.08:1) ratio of male and female flower were recorded from control. The maximum (11.33) fruits per plant in number were recorded with the application of 300 ppm "Ripen-15" and the minimum (7.87) fruits per plant were found from control condition. The maximum (15.33 cm) fruit length was recorded for the application of 300 ppm "Ripen-15" and the minimum (12.43 cm) was obtained from control condition. The maximum (4.80 cm) fruit diameter was recorded from 300 ppm "Ripen-15" and the minimum (4.19 cm) fruit diameter was recorded in control condition. The maximum (302.90 g) fruit weight was recorded with the application of 300 ppm "Ripen-15" and the minimum (248.80 g) was observed in control condition. The maximum (3.27 kg) fruit weight per plant was recorded in application of 300 ppm "Ripen-15" and the minimum (2.20 kg) was found from control condition. The maximum fruit yield (35.15 t/ha) was noted with the application of 300 ppm "Ripen-15" and the minimum (24.41 t/ha) was found from control condition.

The combined effect of fertilizer (organic and inorganic) and growth regulator (Ripen-15) was significant on the fruit set and yield parameters of cucumber. In combination of inorganic fertilizer and 450 ppm "Ripen-15" (F_3R_3) performed the minimum (44.92 days) days of first male flower and first female flower (47.33 days) and the maximum time (55.33 days) to first male flower was recorded from control treatment (F_0R_0) and female flower (55.03 days) was found from in the treatment combination of cow dung with no "Ripen-15". In combination of 300 ppm "Ripen-15" and inorganic fertilizer (F_3R_2) gave the highest (63.33) number of male flowerand female flower (20.33) and lowest ratio (3.12:1) of male and female flower. The lowest (45.0) number of male flower and female flower (7.25) was obtained from the treatment combination of control condition (F_0R_0). The highest ratio (6.44:1) of male and female flower was obtained in the treatment combination of 150 ppm "Ripen-15" with no fertilizer (F_0R_1). The combined of inorganic fertilizer and 300 ppm "Ripen-15" gave the maximum (18.24) number of fruits per plant, fruit length (17.27 cm), fruit diameter (6.1 cm), fruit weight (443.30 g), fruit weight per plant (5.5 kg) and fruit yield (61.70 t/ha). The lowest number (4.77) of fruits per plant, fruit length (10.31 cm), fruit diameter (3.45 cm), fruit weight (145.0 g), fruit weight per plant (0.95 kg) and fruit yield (7.67 t/ha) was recorded from control treatment combination (F_0R_0).

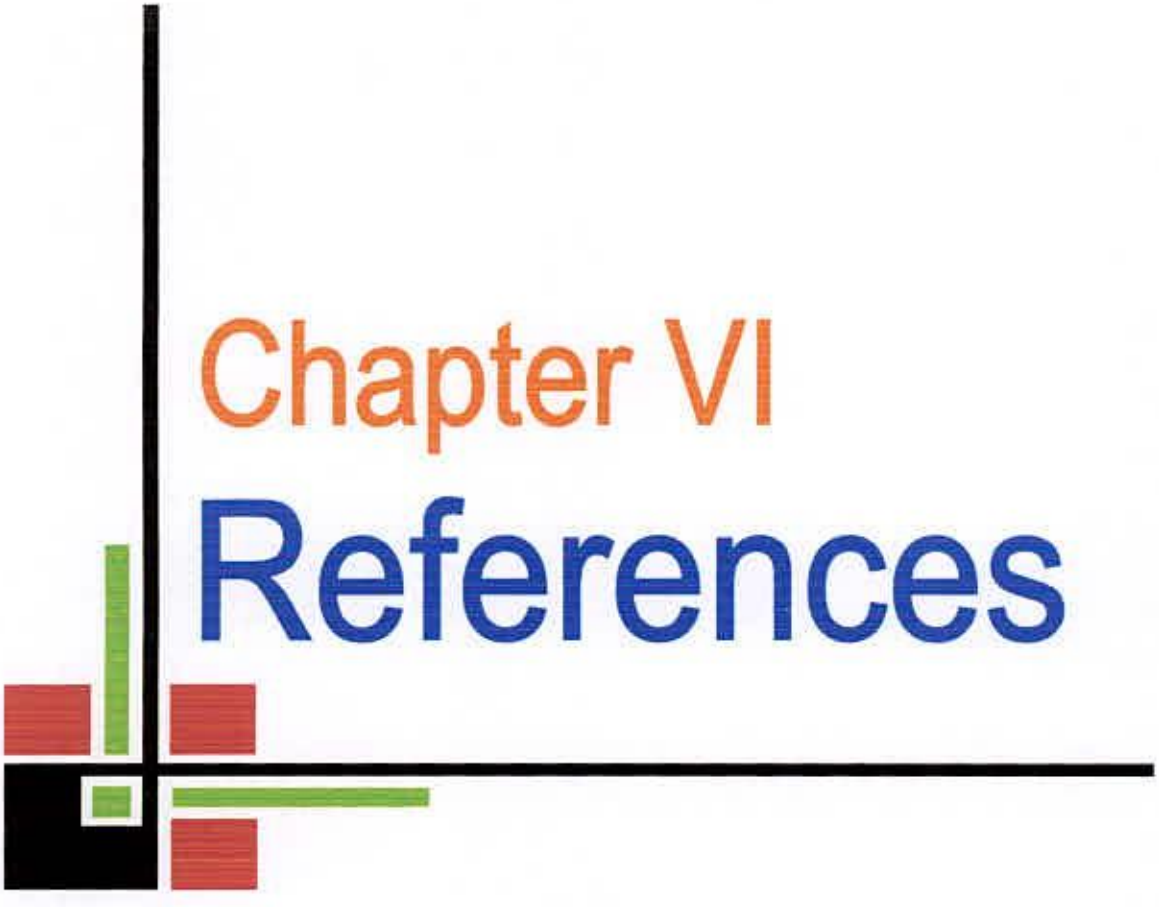
From the present study, the following conclusion may be drawn –

Individual effect of fertilizer (organic and inorganic) and growth regulator (Ripen-15) on the fruit set and yield of cucumber was found positive and significant.

The combined effect of fertilizer (organic and inorganic) and growth regulator (Ripen-15) enhanced flower and fruit characters and yield of cucumber.

Application of recommended dose inorganic (NPK) fertilizer and 2.0 ml "Ripen-15" was the most suitable combination to give the highest fruit yield of cucumber.

Further research works at different regions of the country are needed to be carried out for the confirmation of the present findings.



Chapter VI
References

Chapter-VI

REFERENCES

Ali, N., Rehman, M. and Hussain, S.A. 1995. Response of *Momordica charantia* L. (Bitter gourd) cultivars to nitrogen levels. *Sarhad J. Agric.*, **11** (5): 585-589.

Al-Masoum, A. A. and Al-Masri, H. 1999. Effect of ethephon on flowering and yield of monoecious cucumber. *Egyptian J. of Hort.* **26**: 229-236.

Augustine, J. J., Baker, L. R. and Sell, H. M. 1973. Chemical reversion of sex expression on dioecious cucumber with ethaphon and a benzothiadiazole. *Hort. Sci.*, **8** : 218-219.

Arora, S. K. and Satish, S. 1989. Effect of N and P on growth, flowering and sex expression of sponge gourd. *Horyana Journal of Horticultural Sciences,* **18** (1-2): 106-112

Arora, S. K., Paudita M. L andPartap P. S. 1988. Effect of plant growth regulators on vegetative growth, flowering and yield of sponge gourd (*Lagenaria cylindrical* L.). Res. Dev. Reporter, **5**(1-2): 95-98[Cited from Hort. Abst. **60** (5): 390, 1990]

Bacha, M.R., Hussain, S.A, Rab, A. and Wadan, D. 2005. Effect of phosphorus levels and sowing dates on the growth and production of bitter gourd. Department of Horticulture, NWFP Agricultural University, Peshawar, Pakistan. *Sarhad J.Agric.* **21** (4): 591-594

BBS. 2005. Bangladesh Bureau of Statistics. Yearbook of Agricultural Statistics of Bangladesh. Planning Division. Ministry of Planning. Gogt. of the Peoples Republic of Bangladesh.

Blum, L. E. B., Amarante, C. V. T., Guttler, G. Macedo, A. F., Kothe, D. M , Simmler, A. O.; Prado, G. and Guimaraes, L. S. 2003. Production of squash and cucumber in soil amended with poultry manure and pine bark. Horticultura-Brasileira. **21**(4): 627-631.

Boonmanop, S. 1997. Influences of nitrogen, phosphorus and potassium fertilizers on seed yield and seed quality of bitter gourd. Bull, Kasetsart Univ. Bangkok, Thailand. Pp. 711-729.

Cantliffe, D. J. Robinson, R. W. and Basodorfe, R. S. 1972. Influence of growth regulators on sex expression on sponge gourd. *Hort. Sci.*, 7 : 285-286.

Choudhury, B. Pahatak, S. C. and Patil, A. V. 1967. Effect of plant regulator sprays on sex, fruits set and fruit development in cucumber (*Cucumis sativus* L.). Proceedings Bihar academy of Agric. Sciences, **11**: 251-257.

Fernandes, A. A., Martinez, .H. E. P. and Oliveira, L. R. 2002. Effect of nutrient sources on yield, fruit quality and nutritional status of cucumber plants, cultivated in hydroponics. Horticultura-Brasileira. UFV, Depto. Fitotecnia, 36.571-000 Vicosa, MG, Brazil. **20** (4): 571-575.

Fuli, X., Liang, Y., Zhang, C.E., SheNi, D.and ZhiJie, C. 2004. Effects of fertilizer application on nitrate contents in the soil and in sunlight greenhouse-grown cucumber. Plant-Nutrition-and-Fertilizer-Science. Northwest Science and Technology University of Agriculture and Forestry, Yangling 712100, Shaanxi, China. **10** (1): 68-72.

Islam, M. S. 1995. Seed production studies on bitter gourd (*Momordica charantia* L.) Ph. D Thesis, CLSU, Munoz, Nueva Ecija, the Philippines.

Issac, S.R. and Pushpakumari, R. 1997. Effect of green fruit picking and nutrient sources on the seed production of okra (*Abelmoschus esculentus* (L.) Monech.). Seed Research, **25** (1): 83-85.

Jasso, C., Hochmuth,G. J., Hochmuth, R. C. and Sargent, S. A. 2005. Fruit yield, size, and color responses of two greenhouse cucumber types to nitrogen fertilization in perlite soilless culture. Hort. Technology. University of Florida, Live Oak, Florida, USA. **15** (3): 565-571.

Khan, A. U., Muhammad, S. and Khan, B. 2005. Effect of NPK alone and in combination on the growth and yield of cucumber. Agricultural Research Station, Serai Naurang Bannu, NWFP, Pakistan. **4** (4): 428-431.

Lingaiah, H. B., Uthaiah, B. C., Herle, P. S. and Rao, K. B. 1988. Influence of nitrogen and phosphorus on the yield of bitter gourd in the coastal region of Karnataka. Current Res. Univ. Agri. Sci. Bagalore, India, **17** (9): 116.

Lower, R. L., Miller, C. H., Baker, F. H. and McCombs, C. L. 1970. Effect of 2-chloroethylphosphonic acid treatment at various stages of cucumber development. Hort. Sci., **5** : 433-434.

Makal, K. G., A. T. Joshi, P. O. Deshmukh and P. R. Pawar. 1977. Effect of N, P and K on tinda (*Citrullus vulgaris* var. *fistulosus*). Orissa J. Hort., **5**(1/2): 62-63. [Cited from hort. Abst. **50** (7): 5167, 1980]

Mishra, H. P. 1987. Effect of NPK on growth seed yield and quality of radish cv. Puna radish grow in the calcareous oils of North Bihar. *Indian J. Hort.*, **44** (1/2): 69-73.

Moniem, A. E, Kawy, M. A. E., Behairy, T. F. and Hadid, U. A. 2002. Influence of some organic fertilizers on the yield of cucumber plants under plastic houses.

Egyptian Journal of Horticulture. publ. Faculty of Agriculture, Ain Shams University, Cairo, Egypt. **29** (3/4): 499-511.

Murray, A. L. and C. H. Miller. 1969. The effect of 2-chloro ethane phosphonic acid (ethrel) on the sex expression and yields of *Cucumis sativus*. *American J. Hort. Sci.*, **94**: 400-402.

Naik, L. B. and Srinivas, K. 1992. Influence of nitrogen and phosphorus fertilization on seed crop of okra (*Hibiscus esculentus*). *Indian J. Agron.*, **37** (4):769-771.

Ogunremi, E. A. 1978. Effect of nitrogen on melon (*Citrullus lanatus*) at Ibadan *Nigeri. Hort.*, **32**(1): 11-14.

Olivira, P. P., Ranjit, C. and Satya, P. 2005. Sex expression and phenotypic performance of local pumpkin cultivars as influenced by ethrep application. *Revista de Ciencias Agrarias*., **43**: 77-81.

Pelaez, R. J., Calero C. and Jaramillo, V. 1984. Response of squash (*Cucurbita pepo* L.) and organic matter. *Acta Agronomica*, **34**(3): 86-95.

Rashid, M. 2004. Sabji Biggan. University press, Dhaka.Pp-99.

Ravikumar, G. H., Shekhargouda, M., Reddy, M. and Gowda, B. 2003. Influence of fertilizer on yield parameters, seed yield and benefit cost ratio in cucumber during kharif season. *Journal-of-Maharashtra-Agricultural-Universities*. Regional Research Station, Raichur - 584 101, India. **28**(3): 258-261

Ravindran, D. N. 1971. Effect of photoperiod and growth substances on sex expression in bitter gourd (*Trichosanthes anguina* L.) *South Indian J. Hort.*, **15**:1-21.

Rekha, C. R. and Gopalakrishnan, T. R. 2001. Effect of levels and frequencies of organic manures and inorganic fertilizers on growth and productivity of bitter gourd (*Momordica charantia* L.). *South Indian J.Hort.*, **49**(Special): 137-139.

Reddy, P.K and Rao, P. V. 2004. Growth and yield of bitter gourd (Momordica charantia L.) as influenced by vermicompost and nitrogen management practices. *Indian J. Res.* **32**(3): 15-20

Satish, S. S., Arora, K. and Siyag, S. 1988. Effect of nitrogen and phosphorus on fruit yield and quality of sponge gourd (*Lagenaria aegytiaca*). *Indian J. Agril. Sci.*, **58**(11): 860-861. [Cited from Hort. Abst. 60(3): 202, 1990]

Seshardi, V. S. 1986. Cucurbits. In: Vegetable Crops in India, edited by T. K. Bose and M. G. Som. 1986. Naya Prokash, Calcutta, India, Pp. 91-166.

Sims, W. L. and Gledhill, B. L. 1969. Ethereal effects on sex expressipn, growth and development in pickling cucumbers. *Calif. Agr.* **23** : 4-6.

Singh, A. K., Gupta, M. J. and Pitam, C. 2002 Effect of fertilizer dose on fruit yield and economics of off season cucumber cultivation under low cost polyhouse. New-Botanist. Plasticulture Development Centre, Division of Agricultural Engineering, I.AR.I., New Delhi - 110 012, India. **29** (1/4): 67-73.

Sreeramulu, N. 1987. Effect of ethrel on sex expression and endogenous auxin content in sponge gourd (*Luffa cylindrica*). *Indian J. Hort.*, **44**: 85-87.

Suojala, A. T. Salo, T. Pulkkinen, J. and Tikanmaki, E. (2005). Nutrient demand and uptake by pickling cucumber under drip irrigation in a northern climate. *Journal-of-Horticultural-Science-and-Biotechnology.* MTT Agrifood Research. Finland. **80**(4): 498-502.

Suresh, J. and Pappiah, C. M. 1991. Growth and yield of bitter gourd as influenced by nitrogen, phosphorus and maleic hydrazide. *South Indian J.Hort.*, **38**(3).

Susmita, D.; Basu, P.S. and.Das, S. 1998. Effect of silver nitrate on flowering, fruit setting and development of Momordica charantia L. Department of Botany, Burdwan University, Gopalbag, Burdwan, India. **25**: 2, 140-143.

Swarappa, U. P. and Krishnappa, K. S. 2004. Effect of nitrogen, phosphorus and potassium on cucumber cv. Poinsette grown in dry region of Southern India. Tropical-Science. University of Agricultural Sciences, Bangalore 560 065, India. **44**(4): 174-176.

Tuzel, Y. Gul, A. Tuzel, I. H. and Ongun, A. R. 2003. Organic cucumber production under greenhouse conditions. Acta-Horticulturae. Dept. of Horticulture, Ege Univ. Fac. of Agric, Bornova, Izmir, Turkey. 608: 149-157.

Umamaheswarappa, P. Gowda, V. N. Murthy, P. V. and Muthu, M. P. 2005. Effect of varied levels of nitrogen, phosphorus and potassium on flowering, fruit set and sex ratio of cucumber. *Karnataka-Journal-of-Agricultural-Sciences.* Department of Horticulture, University of Agricultural Sciences, Bangalore - 560 065, India. **18** (3): 744-747.

Verma, V. K., Sirohi, P. S. and Choudhury, B. 1984. Note on the response of chemicals treatment on sex expression and fruiting in bitter gourd. *Indian J. Hort.*, **41**: 113-115.

Vishnu, S. H., Prabhakar, B. S and Sukla, V. 1987. Effect of plant spacing and fertilizer on yield of bottle gourd. *South Indian J. hort.*, **35**(6): 453

Yamagochi, M. 1983. Cucurbits, world vegetables : Principles, production and nutritive values. AVI Publishing Company Inc. pp. 312-345.

Yawalkar, K. S. 1985. Cucurbitaceous or vine crops. *In* : Vegetable crops of India. Agri. Horticultural Publishing House, Nagpur, India. pp. 150-158.

Zambrano, J. C., Rodriguez, E. and Pire, R. 2002. Growth, yield and N-P-K extraction by cucumber (Cucumis sativus L.) plants with different rates of fertilizer.Proceedings-of-the-Interamerican-Society-for-Tropical-Horticulture. Barquisimeto, Lara, Venezuela. publ. 2003; 46: 85-88.

APPENDICES

Appendix I. Morphological Characteristics of experimental field

Morphological Features	Characteristics
Location	Sher-e Bangla Agril. University Farm, Dhaka
AEZ No. and name	AEZ-28, Madhupur Tract
General Soil Type	Deep Red Brown Terrace Soil
Soil Series	Tejgaon
Topography	Fairly leveled
Depth of inundation	Above flood level
Drainage condition	Well drained
Land type	High land

Source: SRDI

Appendix II. Physical and chemical properties of the experimental soil

Soil properties	Value
A. Physical properties	
1. Particle size analysis of soil.	
% Sand	29.04
% Silt	41.80
% Clay	29.16
2. Soil texture	Silty clay loam
B. Chemical properties	
1. Soil pH	5.8
2. Organic carbon (%)	0.78
3. Organic matter (%)	1.34
4. Total N (%)	0.08
5. C : N ratio	9.75 : 1
6. Available P (ppm)	31.15
7.Exchangeable K (me/100g soil)	0.18

Source: SRDI

Appendix III: **Monthly record of air temperature, rainfall, relative humidity and sunshine hours during the period from April to July 2006**

Month	Average air temperature (°C)			Total rainfall (mm)	Average humidity (%)	Total sunshine hours
	Maximum	Minimum	Mean			
April	32.8	23.2	28.0	145	68.5	255.6
May	33.1	22.5	27.8	205	72.3	248.5
June	34.2	24.4	29.3	320	80.6	182.8
July	33.6	25.6	29.6	480	85.4	146.7

Source: Bangladesh meteorological Department (climate and weather division) Agargoan, Dhaka-1212.

Appendix IV. Analysis of variance of the data on plant characters of cucumber as influenced by fertilizer and "Ripen-15"

Source of variation	Degrees of freedom	Mean square			
		Days of 1st flowering		No. of flowers per plant	
		Male	Female	Male	Female
Replication	2	2.64	42.78	3.15	3.43
Fertilizer (A)	3	71.553**	63.24**	231.12**	187.69**
"Ripen-15" (B)	3	51.853**	24.32**	72.54**	34.46**
Interaction (A×B)	9	3.215*	1.58**	25.09**	5.98**
Error	30	2.773	2.27	2.266	0.414

** Significant at 0.01 level of significance.

* Significant at 0.05 level of significance.

Appendix V. Analysis of variance of the data on fruit and yield characters of cucumber as influenced by fertilizer and "Ripen-15"

Source of variation	Degrees of freedom	Mean square					
		Fruit per plant	Fruit length (cm)	Diameter of fruit	Weight of fruit (g)	Weight of fruit/ plant	Fruit yield (t/ha)
Replication	2	0.320	0.329	0.055	451.75	0.077	8.75**
Fertilizer (A)	3	222**	32.54**	8.85**	133103**	33.59**	4153**
"Ripen-15" (B)	3	29.30**	18.68**	0.843**	7415.6**	2.237**	2778**
Interaction (A×B)	9	5.76**	0.840*	0.114**	628.97*	0.334**	40.5**
Error	30	0.229	0.330	0.014	266.52	0.097	11.99

** Significant at 0.01 level of significance.

* Significant at 0.05 level of significance.