# EFFECT OF PLANT GROWTH REGULATORS AND FERTILIZER MANAGEMENT PRACTICES ON THE FLOWERING, GROWTH AND YIELD OF SNAKE GOURD (*Tricosanthes anguina* L.)

**MD. ABDUL WAZED**




**DEPARTMENT OF HORTICULTURE AND POSTHARVEST TECHNOLOGY**
**SHER-E-BANGLA AGRICULTURAL UNIVERSITY**
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**BY**
**MD. ABDUL WAZED**
**Registration No. 27570/00731**

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**Approved by:**

| | |
|---|---|
| **Prof. Dr. Md. Nazrul Islam** | **Md. Hasanuzzaman Akand** |
| **Supervisor** | **(Associate professor)** |
| | **Co-supervisor** |

**Prof. Md. Ruhul Amin**
**Chairman**
**Examination Committee**

JUNE 2007

# *CERTIFICATE*

This is to certify that thesis entitled, "**EFFECT OF PLANT GROWTH REGULATORS AND FERTILIZER MANAGEMENT PRACTICES ON THE FLOWERING, GROWTH AND YIELD OF SNAKE GOURD** " submitted to the Department of Horticulture & Postharvest Technology, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE in HORTICULTURE**, embodies the result of a piece of bonafide research work carried out by **MD. ABDUL WAZED, Registration No. 27570/00731** under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.

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

Dated:
Dhaka, Bangladesh.

**(Prof. Dr. Md. Nazrul Islam)**
**Supervisor**

DEDICATED TO
MY BELOVED GRANDPARENTS

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The Author

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## ABSTRACT

A field experiment was conducted in the Horticultural Farm of Sher-e-Bangla Agricultural University, Dhaka-1207 during the period of April to August 2007 to study the effect of plant growth regulators and fertilizer management practices on flowering, growth and yield of snake gourd. The experiment was consisted of two factors. Factor A: Different plant growth regulators viz. control ($H_0$), Ripen-15 ($H_1$), IAA ($H_2$) and Ripen-15 + IAA ($H_3$) and Factor B: Fertilizer management practices viz. control ($F_0$), organic manure ($F_1$) and inorganic fertilizer ($F_2$). The experiment was laid out in two factors Randomized Complete Block Design (RCBD) with three replications. The tallest plant at 1st flowering time (169.3 cm), the lowest ratio of male and female flower (3.21), the maximum fruit weight (225.5 gm) and the highest yield (20.47 t/ha) were recorded from the application of Ripen-15 + IAA ($H_3$) and the minimum was recorded in control condition. The tallest plant at 1st flowering (167.3 cm), the lowest ratio of male and female flower (3.65), the maximum number branches per plant (7.67), the maximum fruit weight (213.6 gm) and the highest yield (18.25 t/ha) were recorded from the application of inorganic fertilizer ($F_2$) and the minimum was recorded in control condition. Interaction effect between plant growth regulators and fertilizer management practices showed statistically significant variation in consideration of all the recorded characters. The combination of Ripen-15 + IAA and inorganic fertilizer ($H_3F_2$) gave the highest gross return (Tk. 458,000/ha) and the lowest gross return (Tk. 152,000/ha) was obtained in the control condition where no plant growth regulator as well as no fertilizer was applied. The combination of Ripen-15 + IAA and inorganic fertilizer ($H_3F_2$) gave highest benefit cost ratio (2.36).

## ABBREVIATIONS AND ACRONYMS

| | | |
|---|---|---|
| BADC | = | Bangladesh Agricultural Development Corporation |
| BARC | = | Bangladesh Agricultural Research Council |
| BARI | = | Bangladesh Agricultural Research Institute. |
| BAU | = | Bangladesh Agricultural University |
| BCR | = | Benefit cost ratio |
| DAT | = | Days after transplanting |
| FAO | = | Food and Agricultural Organization |
| LSD | = | Least Significant Difference |
| Max | = | Maximum |
| Min | = | Minimum |
| MP | = | Muriate of Potash |
| NS | = | Not Significant |
| Ppm | = | Parts per million |
| Rh | = | Relative humidity |
| t/ha | = | Ton per hectare |
| TSP | = | Triple Super Phosphate |

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# CHAPTER I

## INTRODUCTION

Vegetables are the important sources of nutrition for human being. The production of vegetables in Bangladesh is less than the requirement as per nutritional standard. In Bangladesh, vegetables are grown in 0.2 million hectares of land which is about 1% of the cultivated area (BBS, 2005). Winter vegetables are usually grown in 58.96% of the total land area while 41.04% area is covered by summer vegetables (BBS, 2005). Vegetables become rare during summer season. Besides, there are lean periods at the end of winter and summer seasons when there is always a scarcity of vegetables in this country. The nutritional problems and vegetable scarcity in Bangladesh during that gap period can be reduced to some extent through improvement of production technology of cucurbitaceous crops like snake gourd.

Snake gourd (*Tricosanthes anguina* L.) belongs to the family Cucurbitaceae having chromosome number, 2n= 22 (Chakrabarti, 1982), sub-family Cucurbitoidae, tribe Tricosantheae. The members of this tribe are almost entirely confined to old world. Two genera, *Tricosanthes* and *Edgaria* have been studied in detail cytologically (Tsuchiya and Gupta, 1991). There are about 44 species under the *Tricosanthes,* primarily originated in Indo-Malayan region. Out of these species *T. anguina* and *T. dioica* are cultivated and others are wild.

Snake gourd is usually grown as a summer vegetable. But at present it is also being grown as commercial crop near the urban areas. Moreover, it can also be grown in any type of soil having good drainage system. From nutritional point of view, snake gourd can be considered as nutrition rich fruit vegetable. It contains considerable amount of protein (0.5%), fat (0.3%), minerals (0.5%), fibre (0.5%) and carbohydrates (3.3%) (Gopalan *et*

*al.*, 1982). Ripe fruits are rich in vitamin A. Due to high keeping quality (Banerjee and Mangal, 1986), it has also export potentiality.

The role of growth regulators in various physiological and biochemical process in plant is well known from its identification. Growth regulators are known to have an effect on the production of earliest flower, yield (Gedam *et al.*, 1998), ratio of male/female flower (Bisaria, 1974), number of fruits, weight of fruit (Gopalkrishman and Choudhury, 1978). Initiation of flower bud, development of flowers and fruits are controlled by physiological process. In many agricultural plants, these processes can often be used to alter by proper application of plant growth substances. Exogenous application of growth regulators has sifted the sex expression towards femaleness by increasing the production of female flower and suppressing that of male flowers in bitter gourd (Prakash, 1974). Ethephon has been found most effective early female flowering at lower nodes and on suppressing the male flower production in bitter gourd (Kalia and Dhillon, 1964).

The cultivation of snake gourd requires an ample supply of plant nutrient. Use of organic manures 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. Recently organic farming is appreciated by vegetable consumers as it enhances quality of the produce.

However, very limited research was conducted to improve the fruit set and yield by hormone application and fertilizer management practices in snake gourd.

Considering the above facts, the present experiment has been undertaken with the following objectives:

1. To find out effect of growth regulator Ripen-15(organonapthalene compound, flowering agent) as flowering hormone on the flowering, growth and yield of snake gourd.
2. To find out effect of growth regulator Indole 3-Acetic Acid (IAA) as growth hormone on the flowering, growth and yield of snake gourd.
3. To find out the interaction of Ripen-15 and IAA on the flowering, growth and yield of snake gourd.
4. To find out the effect of fertilizer on the flowering, growth and yield of snake gourd.
5. To asses the interaction effect of growth regulators and fertilizer management practices on the flowering, growth and yield of snake gourd.

# CHAPTER II

## REVIEW OF LITERATURE

Studies on snake gourd are very limited. However, research works on snake gourd and other members of the Cucurbitaceae family and other related crops in respect of fertilizer management, plant growth regulators, time of sowing, plant spacing, vine pruning, fruit retention, etc. have been carried out in different parts of the world. Literatures related to the present study have been reviewed below.

### 2.1 Effect of Plant Growth Regulators

Gedam *et al.* (1998) conducted an experiment in 1992 where bitter gourd plants were sprayed 40, 55, 70, 80 and 100 days after sowing with 15, 25 and 35 ppm $GA_3$, 50, 100 and 150 ppm NAA, 50, 100 and 150 ppm Ethephon, 100, 200, 200 and 300 ppm Maleic Hydrazide, 2, 4 and 6 ppm boron and with water (control). $GA_3$ at 35 ppm produced the earliest female flower and NAA at 50 ppm produced the earliest male flower. Fruit maturity was the earliest in plants treated with 50 ppm NAA or 4 ppm boron. Fruit and seed yields were also the highest in these treatments.

The ratio of male and female flower reduced when maleic hydrazide at 150 ppm was sprayed on the plant of bitter gourd reported by Prasad and Tyagi, 1963.

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.

Pandey and Singh (1973) found that soil application of up to 100 kg/N increased the number of pistillate and staminate flower and the yield; the sex ratio was not affected in bottle gourd. Maleic hydrazide approximately doubled the proportion of female flowers and also increased yield. Combined application of N and maleic hydrazide gave a further increased in the proportion of female flowers and the highest yield.

Choudhury and Pahatak (1959) reported the effects of growth regulators on sex expression of cucumber. They observed that MH 200 ppm and NAA 100 ppm significantly increased number of female flowers and MH 600 and 800 ppm, NAA 100 ppm and IAA 200 ppm greatly suppressed the number of male flower over control. All treatments increased the female to male flower ratio when compared with the control.

Choudhury *et al.* (1967) reported that NAA 100 ppm, IAA 100 ppm and 200 ppm and MH 50 ppm and 200 ppm 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.

Suresh and Pappiah (1991) conducted a trial with bitter gourd cv. MDU 1, where N and $P_2O_5$ were applied at 0, 40 and 80 and 0, 30 and 60 kg/ha, respectively and maleic hydrazide 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.

The effects of NAA (25 and 100 ppm) and Maleic hydrazide (50 and 100 ppm), applied at the 2-true leaf stage, and sowing date (15 day intervals

from 10 September to 25 October) on the growth of *Lagenaria siceraria* (cv. Kiyari Lao) was investigated by Baruah and Das (1997) during rabi 1994-95 in India. They observed that plants sprayed with NAA at 25 ppm and MH at 50 ppm produced the best yields (5.48 and 4.86 kg/plant, respectively. Yield decreased with later sowing dates from 5.49 to 2.62 kg/plant.

Irving *et al.* (1968) found that TIBA at 25 ppm was particularly effective in promoting the femaleness in cucumber. The increased TIBA stimulation of female flowers ranged from 100 to 200 percent. TIBA also increased the number of female flowers but lowered the male and female ratio.

McMurray 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. But 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.

Islam (1995) conducted a trial with different concentrations of $GA_3$ like 0, 10, 25, 50 and100 ppm. He stated that application of $GA_3$ was effective in improving the yield and yield components of bitter gourd when applied at low concentration of 10 ppm. The inhibitory effect of $GA_3$ applied at the rate of 100 ppm was observed on production of fruits with lesser number of filled seeds, dry matter of seeds, weight of 100 seeds, seed yield and percent seed vigor index. Irrespective of concentration, the application of $GA_3$ reduced the total number of staminate flowers. The ratio between the staminate and pistillate flowers as well as fruit setting was low. The number, length, diameter and weight of fruits were not influenced by $GA_3$ application.

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.

Bisaria (1974) found that foliar spray of NAA 100 ppm increased the number of female flower per plant and the sex ratio is reduced in cucurbits.

Gopalkrishman and Choudhury (1978) reported that in contrast with TIBA, GA in general produced the largest number of male flowers; GA at the lowest concentration of 10 ppm produced more number of female flowers in first year. In the first year MH 100 ppm to 600 ppm as well as NAA and IAA at 50 ppm to 150 ppm induced a reduction in the mean number of female flowers. Treatment with TIBA at 50 ppm, 100 ppm and 200 ppm excelled all the other treatments in producing a favorable female to male flower ratio. TIBA from 50 ppm to 200 ppm gave a significant increased in the number of fruits and weight of fruits of water melon.

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.

Patnaik *et al.* (1974) reported that application of Cycocel in 1000 ppm concentration produced maximum number of pistillate flowers, while 500 ppm produced the maximum number of staminate flowers. Fruit yield was observed to be highest in the treatment of 100 ppm Cycocel followed by 2000 ppm and 500 ppm. Ethrel was found to be toxic to the plants and yield was markedly reduced with its application.

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.

Pandey *et al.* (1976) stated that the effects were compared of seed soaking for 24 hrs in solutions of 2, 4-D at 1.5 ppm, MH and NAA, each at 200 ppm and $GA_3$ at 50 ppm and foliar spraying with 2, 4-D at 0.5-1.0 ppm, applied at the 2 true leaf and 4-5 true leaf stages. The number of pistillate flowers of *Lagenaria cylindrica (Lagenaria aegyptiaca)* was increased by seed treatment with MH and NAA at 200 ppm and by spraying with NAA at 100 and 150 ppm, MH at 100-200 ppm and $GA_3$ at 10 ppm; staminate flower numbers were decreased by MH at 200 ppm, NAA at 100 ppm and $GA_3$ at 10 ppm. The ratio of pistillate: staminate flower numbers was increased by all treatments except 2, 4-D and $GA_3$ at 25 and 50 ppm. Fruit set was enhanced by all treatments except $GA_3$ at 50 ppm and 2, 4-D. Yields were increased by seed treatment with NAA at 200 ppm and by spraying with NAA and MH at 150 and 200 ppm respectively.

Saleh and Abdul (1980) conducted an experiment with $GA_3$ (25 and 50 ppm), which were applied 3 times in June to early July. They reported that $GA_3$ stimulated plant growth. It reduced the total number of flowers per plant, but increased the total yield compared to the control. $GA_3$ also improved fruit quality.

In India, Kaushik *et al.* (1974) carried out an experiment with the application of $GA_3$ at 1, 10 or 100 mg/l on tomato plants at 2 leaf stage and then at weekly interval until 5 leaf stage. They reported that $GA_3$ increased the number and weight of fruits per plant at higher concentration.

Irshad Ahmad and Gupta (1981) found that the minimum ratio of male to female flower was reached at 1000 ppm of cycocel in case of smooth gourd and at 1500 ppm in bottle gourd and snake gourd. Nodes per female flower as well as days to flower were minimum at 1000 ppm in snake gourd and 1500 ppm in smooth gourd and bottle gourd. Earliest node for first female flower was observed at 1000 ppm in smooth gourd and snake gourd but at 1500 ppm in bottle gourd.

Tomar and Ramgiry (1997) conducted an experiment and found that plants treated with $GA_3$ showed significantly greater plant height, number of branches/plant, number of fruit/plant and yield than untreated controls. $GA_3$ treatment at the seedling stage offered valuable scope for obtaining higher commercial tomato yields.

Singh and Upadhaya (1967) studied the effect of IAA and NAA on tomato and reported that the regulators activated growth, increased the fruit set, size and yield of fruit and induced parthenocarpic fruit. The chemicals could be applied on seeds, roots, whole plants or flowers, but foliar application was very effective for increasing the size of fruit and the yield.

An investigation to study the influence of various chemicals (Ethrel, NAA, Cycocel, MH, PCPA, Ascorbic acid and Boron) on the growth, flowering and yield of bitter gourd was conducted. PCPA at 100 ppm improved plant growth significantly. The treatment of CCC at 250 and 500 ppm produced female flowers about 12 days earlier in comparison to control plant. Maximum fruit yield per plant (3123 gm) was produced under Cycocel 250 ppm followed by Ascorbic acid 25 ppm and Cycocel 250 ppm (Mangal *et al.*, 1981)

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

**2.2 Effect of Fertilizers**

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 $P_2O_5$/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, $P_2O_5$ and $K_20$/rai, respectively.

The response of bitter gourd cultivars, Tarnab selection and Balsam pear to the application of 0, 60, 80, 100 and 120 kg N/ha was studied by Ali *et al.* (1995) near Peshawar, Pakistan. They 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.

Catedral (1974) found that ampalaya (bitter gourd) is very responsive to nitrogen fertilization applied as high as 480 kg/ha. The most significant effect was on the significant increase in the number of pistillate flowers. In that study, the increase was as high as 6 times when the rate of the level of N was increased from 0 to 480 kg/ha. It was also shown that fruit number per plant increased with increasing levels of N, where as phosphorus had no effect.

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.

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.

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.

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.

With other cucurbits, nitrogen fertilization has been reported to increase the number of pistillate and perfect flowers in muskmelons (Brantley and Warren, 1960).

Lingle and Wight (1964) obtained the yield increases of 20 to 30 percent after application of nitrogen in cantaloupes.

In cucumber, Matzusaki and Hayase (1963) reported that when all the nitrogen was applied before planting, early vegetative growth was retarded by higher levels. They said that the number of flowers was not affected by different levels but the higher N level increased fruit set and length of ovary at flowering time.

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%).

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 (Seshadri, 1986).

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

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).

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.

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.

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.

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.

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.

# CHAPTER III

# MATERIALS AND METHODS

The experiment was undertaken to examine the effect of plant growth regulators (Ripen-15 & IAA) and fertilizer management practices on the flowering, growth and yield of snake gourd.

## 3.1 Experimental Site

The research was conducted at the Horticultural Farm of Sher-e-Bangla Agricultural University, Dhaka-1207 during the period from April to August 2007. The experimental field was located at $90^0$ 22' E longitude and $23^0$ 41' N latitude at an altitude of 8.6 meters above the sea level. The land was in Agro-Ecological Zone of Madhupur tract (AEZ No. 28). It was deep red brown terrace soil and belonged to "Nodda" cultivated series. The soil was sandy loam in texture having pH 5.47 to 5.63. The physical and chemical characteristics of the soil have been presented in appendix I.

## 3.2 Climate

The experimental area was under the sub-tropical monsoon climate, which is characterized by heavy rainfall during Kharif season (April to August) and scanty of rainfall during the rest of the year. The monthly total rainfalls, average sunshine hour, temperature during the study period are shown in appendix II.

## 3.3 Planting materials used for experiment

Seeds of snake gourd were collected from the Bangladesh Agricultural Development Corporation (BADC), Sher-e-Bangla Nagar, Dhaka and used in the experiment.

### 3.4 Experimental Treatment

Experiment was consisted of two factors

**Factor A: Plant growth regulators**

There were four treatments of growth regulators (Ripen-15 and IAA) in the experiment. The treatments were-

1. $H_0$: Control (No Hormone)
2. $H_1$: Ripen-15 (200 ppm)
3. $H_2$: Indole 3-acetic acid(IAA) (200 ppm)
4. $H_3$: Ripen-15 +IAA (mixture of 200 ppm of each)

**Factor B: Fertilizer management**

There were three fertilizer treatments in the experiment. The treatments were-

1. $F_0$: Control (No fertilizer)
2. $F_1$: Organic fertilizer (Cowdung)
3. $F_2$: Inorganic fertilizer (Urea, TSP and MP)

### 3.5 Application of growth regulator

The selected growth regulators were applied at three times, first at 7 days after transplanting (DAT) at the 8 leaves stage, second after 27 DAT and third at 47 DAT (just or before the flower initiation stage) with the help of hand sprayer.

Total 12 treatment combinations were as follows:

| | | | |
|---|---|---|---|
| $H_0F_0$ | $H_1F_0$ | $H_2F_0$ | $H_3F_0$ |
| $H_0F_1$ | $H_1F_1$ | $H_2F_1$ | $H_3F_1$ |
| $H_0F_2$ | $H_1F_2$ | $H_2F_2$ | $H_3F_2$ |

### 3.6 Experimental design and layout

The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The experiment was divided into three blocks and each consisted of 12 plots. Each unit plot was 3 × 1.8m in size. Altogether there were 36 unit plots in experiment and required 307.5 $m^2$ land. Both row to row and plot-to-plot distances were 0.5 m. The treatments were randomly assigned to each of the block. Each unit plot had 2 rows and each with 3 plants. So there were 6 plants per unit plot.

### 3.7 Land preparation

The land was opened on 15$^{th}$ April by disc plough. After opening the land with a tractor it was ploughed and cross-ploughed six times with a power tiller and laddering was done to break up the soil clods to obtain level the land followed each ploughing.

### 3.8 Manures and fertilizer application

As per recommendation of Rashid (1995) following doses per hectare of manures and fertilizer were applied-

| Fertilizer | Dose (per ha) |
|---|---|
| Cowdung | 15 ton |
| Urea | 150 kg |
| TSP | 125 kg |
| MP | 100 kg |

Incase of $F_1$ treatment (Organic) recommended dose of cowdung plus recommended dose of urea was converted to Cowdung (according to supply of nutrient by urea and cowdung) and the total amount of cowdung was applied. In $F_2$ treatment (Inorganic) recommended dose of urea plus recommended dose of cowdung was converted to urea (according to supply of nutrient by urea and cowdung) and the total amount of urea was applied.

| Levels of manure and fertilizer | Dose per hectare | Dose per plot |
|---|---|---|
| **$F_0$ (Control)** | | |
| | | |
| **$F_1$ (Organic)** | | |
| Cowdung | 15 + 10 = 25 t | 13.5 kg |
| | | |
| **$F_2$ (Inorganic)** | | |
| Urea | 150 + 228 = 378 kg | 204 g |
| TSP | 125 + 188 = 313 kg | 169 g |
| MP | 100 + 175 = 275 kg | 148.5 g |

As per three levels of fertilizer management practices, the dose of N for the $F_1$ and $F_2$ treatment should have been the same. But slighter deviation could not be avoided due to practical reasons.

### 3.9 Sowing of seeds and transplanting of seedling

Seeds were sown in polybags having compost mixed soil on 15th April, 2007 for germination and seedling raising. Two seeds were sown in each polybag. The polybags were kept in shady place. They were watered regularly during the seedling raising period. When the seedlings (11 days old) attained 4 leaves and hard enough, they were transplanted in the main field on 25 April, 2007.

### 3.10 Intercultural operations

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

#### 3.10.1 Gap filling

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

### 3.10.2 Weeding

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

### 3.10.3 Irrigation

Irrigation was done whenever it was necessary.

### 3.10.4 Vine management

For proper growth and development of the plants the vines were managed by hand to spread them over the net of trellis.

### 3.10.5 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.

### 3.10.6 Trellis

Six bamboo poles were set slantingly keeping 5 feet high from the ground level in every plot. The poles were connected to one another tightly by iron rope 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.

## 3.11 Harvesting

Total 6 times harvesting was done. Harvesting was done at seven days interval.

### 3.12 Collection of experimental data

Data were recorded on the following parameters.

#### 3.12.1 .Plant height (cm)

Plant height was recorded at first flower and at last harvest stages of crop growth for all treatments. The height of every plant were measured from the ground to the longest end of the stem and expressed in centimeter (cm).

#### 3.12.2 Number of nodes per plant at first flower

Number of nodes per plant was counted at first flower stage and total number of nodes was counted by adding number of nodes of main shoot and nodes of branches.

#### 3.12.3 Number of branches per plant at first flower

Number of branches per plant was counted at first flower stage and average was calculated.

#### 3.12.4 Time of first flower (days)

Number of days from sowing to time required to first flower was recorded for every plant and the average was calculated

#### 3.12.5 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 ten days interval after first flowering to ensure all flowers to be counted.

#### 3.12.6 Ratio of Male and female flower

Ratio of male and female flower was counted by dividing of male flower by female flower.

### 3.12.7 Number of fruits per plant

The number of fruits in every plant of snake gourd was counted at every harvest and thus the total number of fruits per plant was recorded and average number of fruits was recorded.

### 3.12.8 Length and diameter of fruit (cm)

Length of 10 randomly selected fruits per plot was measured after each harvest and then the average was taken. A total of 8 times measurement was taken during the total experiment period. Diameter of the same 10 randomly selected fruits as harvested was measured and the average was calculated.

### 3.12.9 Weight per fruit (g)

After each harvest, the weight of randomly selected 10 fruits per plot was recorded and then the average weight per fruit was calculated.

### 3.12.10 Fruit yield

To estimate yield, all the six plants in every plot and all the fruits in every harvest were considered. Thus the average yield per plot was measured. The yield per hectare was calculated considering the area covered by the six plants.

### 3.12.11 Statistical analysis

The recorded data on different parameters were statistically analyzed using MSTAT software to find out the significance of variation resulting from the experimental treatments. The mean for the treatments was calculated and analysis of variance for each of the characters was performed by F (variance ratio) test. The differences between the treatment means were evaluated by LSD test at 1% or 5% probability.

# CHAPTER IV

# RESULTS AND DISCUSSION

The present experiment was conducted to determine the effect of plant growth regulators and fertilizer management practices on flowering, growth and yield of snake gourd. The analyses of variance (ANOVA) of the data on different components are given in Appendix III to V. The results have been presented, discussed, and possible interpretations have been given under the following headings:

## 4.1 Plant height (cm)

A statistically significant variation was recorded in terms of plant height at 1st flowering and last harvest for different plant growth regulators. The tallest (169.3 cm) plant at 1st flowering time was recorded for the application of Ripen 15 + IAA ($H_3$) (Table 1) which was statistically identical with Ripen-15 and IAA (166.7 cm and 164.9 cm respectively) and the shortest (152.2 cm) plant was recorded in control condition where no plant growth regulator was applied. At last harvest tallest (531.1 cm) plant was recorded for the application of Ripen + IAA ($H_3$) which was closely followed by ripen-15 + IAA (482.3 cm) and the shortest (403.9 cm) plant at harvest was recorded in control condition ($H_0$) which was statistically identical (410.6 cm) with the application of Ripen-15 ($H_1$). The results indicated that tallest plant at 1st flowering and last harvest was produced by the application of plant growth regulators compared to control.

In terms of plant height at 1st flowering and last harvest in relation with different fertilizer management practices results were varied significantly under the trial. The tallest (167.3 cm) plant at 1st flowering was recorded by the application of inorganic fertilizer (Table 1) and the shortest (158.8 cm) plant at 1st flowering was recorded in control condition where no organic nor inorganic fertilizer was applied. At last harvest the tallest (488.4 cm) plant was recorded by the application of inorganic fertilizer ($F_2$) which was closely followed by (457.8 cm) the application of organic fertilizer ($F_1$) and

**Table 1. Effect of plant growth regulators and fertilizer management practices on plant height, no. of nodes and branches per plant of snake gourd**

| Treatment | Plant height at 1st flowering | No. of nodes per plant at | | No. of branches per plant |
|---|---|---|---|---|
| | | 1st flowering | last harvest | |
| **Plant growth regulators** | | | | |
| Control | 152.2 b | 15.73 b | 118.52 | 4.21 d |
| Ripen-15 | 166.7 a | 17.16 a | 120.71 | 6.11 c |
| IAA | 164.9 a | 18.27 a | 125.86 | 8.57 a |
| Ripen-15 + IAA | 169.3 a | 17.90 a | 123.70 | 7.91 b |
| $LSD_{(0.05)}$ | 5.461 | 1.242 | -- | 0.631 |
| Significant level | ** | ** | NS | ** |
| **Fertilizer management practices** | | | | |
| Control | 158.8 b | 15.95 c | 112.69 b | 5.81 c |
| Organic | 163.9 a | 17.33 b | 124.72 a | 6.63 b |
| Inorganic | 167.3 a | 18.52 a | 129.18 a | 7.67 a |
| $LSD_{(0.05)}$ | 4.729 | 1.075 | 7.575 | 0.546 |
| Significant level | ** | ** | ** | ** |

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

**: Significant at 0.01 level of significance.

*: Significant at 0.05 level of significance

the shortest (424.7 cm) plant was recorded in control condition where no fertilizer was applied. The results indicated that tallest plant was produced at 1st flowering and last harvest by the application of inorganic fertilizer than the control condition with ensuring the better growth and development. Ali *et al.* (1995) recorded the highest plant height for inorganic fertilizer. Similar results were also found by Arora and Satish (1989) and Islam (1995).

Interaction effect between plant growth regulators and fertilizer management practices showed a statistically significant variation in consideration of plant height at 1st flowering. The tallest (171.2 cm) plant at 1st flowering was recorded in the treatment combination of IAA and inorganic fertilizer ($H_2F_2$) management practices and the shortest (138.6 cm) was recorded in the treatment combination of control condition (Table 2). At last harvest, the tallest (575.2 cm) plant was recorded in the treatment combination of IAA and inorganic fertilizer management practices ($H_2F_2$) and the shortest (387.5 cm) was recorded in the treatment combination of control condition i.e. no plant growth regulator and no fertilizer application. The results indicated that combination of plant growth regulators and fertilizer ensures the optimum condition for the growth and development of snake gourd and the ultimate result is the longest plant at both the time of 1st flowering and at last harvest.

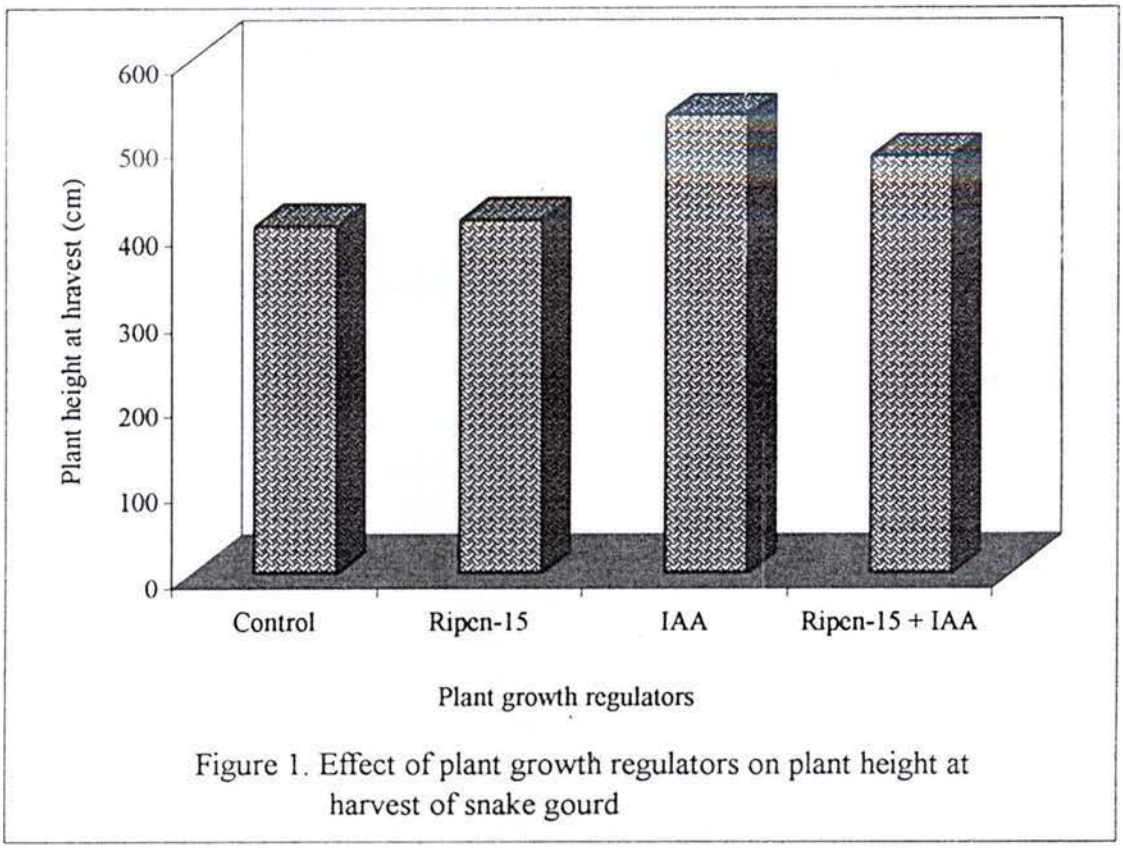


Figure 1. Effect of plant growth regulators on plant height at harvest of snake gourd

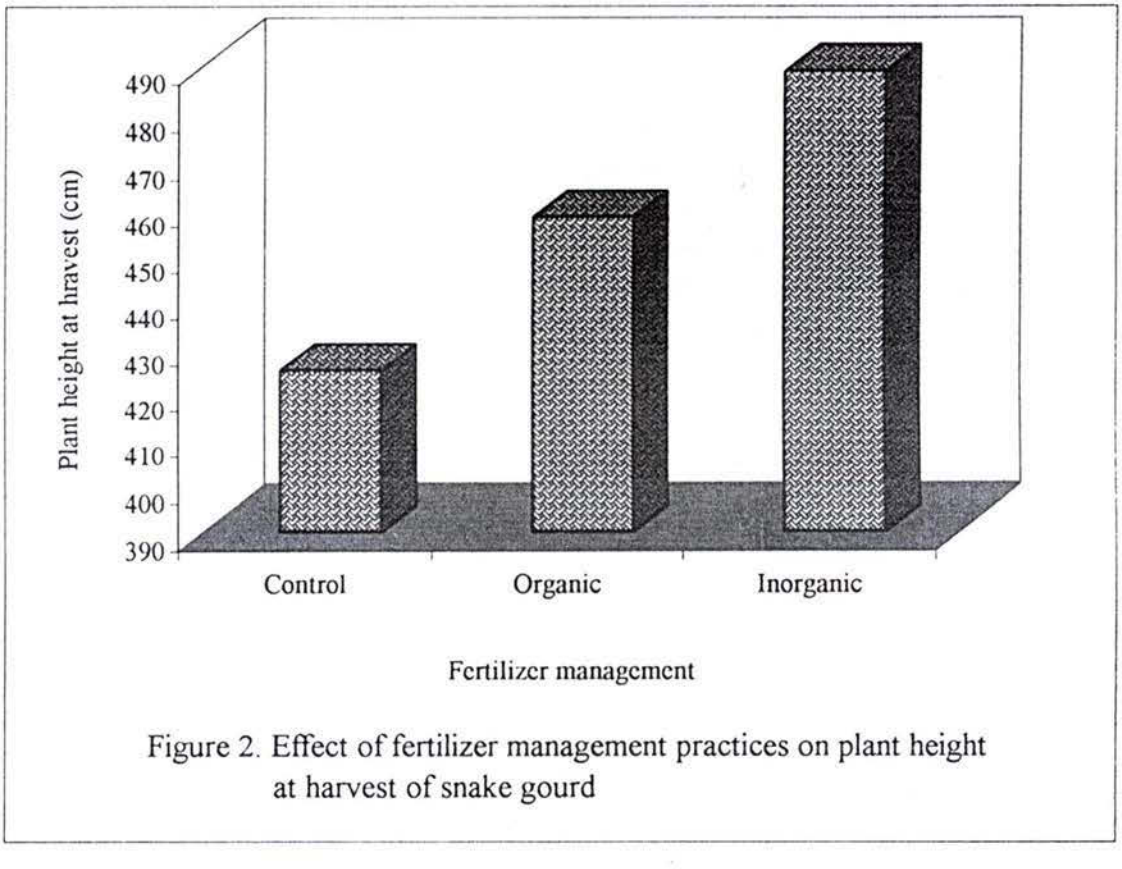


Figure 2. Effect of fertilizer management practices on plant height at harvest of snake gourd

**Table 2. Interaction effect of plant growth regulators and fertilizer management practices on plant height, no. of nodes and branches per plant of snake gourd**

| Treatment | | Plant height (cm) at | | No. of nodes per plant at | | No. of branch per plant |
|---|---|---|---|---|---|---|
| | | 1st flowering | last harvest | 1st flowering | last harvest | |
| Control | Control | 138.6 c | 387.5 d | 15.50 e | 99.27 d | 4.03 f |
| | Organic | 157.4 b | 406.9 d | 15.90 cde | 127.1 ab | 4.30 f |
| | Inorganic | 160.6 ab | 417.3 d | 15.80 de | 129.2 ab | 4.30 f |
| Ripen-15 | Control | 167.7 ab | 400.3 d | 16.10 cde | 116.5 bc | 5.07 f |
| | Organic | 165.4 ab | 411.1 d | 17.10 bcde | 121.1 bc | 6.20 e |
| | Inorganic | 167.1 ab | 420.3 d | 18.27 bc | 124.5 ab | 7.07 de |
| IAA | Control | 160.7 ab | 495.7 c | 19.10 b | 129.6 ab | 7.20 cde |
| | Organic | 162.8 ab | 522.4 bc | 18.10 bcd | 126.4 ab | 8.30 bc |
| | Inorganic | 171.2 a | 575.2 a | 17.60 bcde | 121.6 bc | 10.20 a |
| Ripen-15 + IAA | Control | 168.1 ab | 415.3 d | 13.10 f | 105.4 cd | 6.93 de |
| | Organic | 169.8 a | 490.9 c | 18.20 bcd | 124.3 ab | 7.70cd |
| | Inorganic | 170.1 a | 540.7 ab | 22.40 a | 141.3 a | 9.10 b |
| $LSD_{(0.05)}$ | | 9.459 | 39.97 | 2.151 | 15.15 | 1.092 |
| Significant level | | * | * | ** | ** | * |
| CV (%) | | 3.42 | 5.17 | 7.36 | 7.32 | 9.62 |

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

** : Significant at 0.01 level of significance.

* : Significant at 0.05 level of significance.

### 4.2 No. of nodes per plant

Plant growth regulators showed a statistically significant difference for number of nodes per plant at 1st flowering and last harvest. Nodes per plant showed a gradual increasing trend for different plant growth regulators comparing the control. The maximum (18.27) nodes per plant at 1st flowering was recorded for the application of IAA (Table 1) which was statistically identical by Ripen-15 + IAA and Ripen-15 (17.90 and 17.16 respectively) and the minimum (15.73) nodes per plant at that period was recorded in control condition. At last harvest the maximum (125.86) nodes per plant was recorded for the application of IAA ($H_2$) and the minimum (118.52) number of nodes at last harvest was recorded in control condition. The results indicated that maximum nodes per plant at 1st flowering and last harvest were produced by the application of plant growth regulators compared to the control.

Statistically significant difference was recorded for number of nodes per plant at 1st flowering and last harvest for different fertilizer management practices under the trial. At 1st flowering, the maximum (18.52) nodes per plant was recorded by the application of inorganic fertilizer ($F_2$) which was closely followed by (17.33) with organic fertilizer ($F_1$) and the minimum (15.95) nodes per plant was recorded in control condition where no fertilizer was applied (Table 1). At last harvest maximum (129.18) number of nodes was recorded in application of inorganic fertilizer which was statistically identical (124.72) with organic fertilizer and the minimum (112.69) number of nodes at last harvest was recorded in control condition (Table 1). The results indicated that maximum nodes per plant at 1st flowering and last harvest were produced by the application of inorganic fertilizer than the control condition with ensuring the better growth and development of snake gourd. Pelaez *et al.* (1984) reported the similar results.

Interaction effect between plant growth regulators and fertilizer management practices showed a statistically significant variation in consideration of

nodes per plant at 1st flowering and last harvest. The maximum (22.40) nodes per plant was recorded in the treatment combination of Ripen-15 + IAA and inorganic fertilizer management practices ($H_3F_2$) and the minimum (15.50) was recorded in the treatment combination of control condition (Table 2). At last harvest, the maximum (141.3) number of nodes was recorded in the treatment combination of Ripen-15 + IAA and inorganic fertilizer management practices ($H_3F_2$) and the minimum (99.27) was recorded in the treatment combination of control condition i.e. no plant growth regulators and no fertilizer (Table 2). The results indicated that combination of plant growth regulators and fertilizer ensure the optimum condition for the growth and development of snake gourd and the ultimate result is the maximum nodes per plant.

**4.3 No. of branches per plant**

Number of branches per plant for different plant growth regulators showed a statistically significant variation. The maximum (8.57) number of branches per plant was recorded for the application of IAA (Table 1) which was closely followed (7.91) by Ripen-15 + IAA ($H_3$) and the minimum (4.21) branches per plant were recorded in control condition. The results indicated that maximum branches per plant were produced by the application of plant growth regulators comparing with the control.

Statistically significant variation was recorded for number of branches per plant for different fertilizer management practices. The maximum (7.67) number of branches per plant was recorded in application of inorganic fertilizer ($F_2$) which was closely followed by (6.63) with organic fertilizer (Table 1) and the minimum (5.81) number of branches per plant was recorded in control condition ($F_0$). The results indicated that maximum branches per plant were produced by the application of organic or inorganic fertilizer than the control condition with ensuring the better growth and development of snake gourd.

Interaction effect between plant growth regulators and fertilizer management practices showed a statistically significant variation in consideration of number of branches per plant. The maximum (9.10) number of branches per plant was recorded in the treatment combination of Ripen-15 + IAA and inorganic fertilizer management practices ($H_3F_2$) and the minimum (4.03) were recorded in the treatment combination of control condition (Table 2). The results indicated that combination of plant growth regulators and fertilizer ensure the optimum condition for the growth and development of snake gourd and the ultimate result is the maximum number of branches per plant.

### 4.4 Time to first flower

Different plant growth regulators showed a statistically significant variation on time of first flowering. Time of first flowering showed a gradual increasing trend for different plant growth regulators comparing the control. The minimum (41.84 days) time of first flower was recorded for the application of Ripen-15 (Table 3) which was closely followed by Ripen-15 + IAA (42.52 days) and the maximum (52.32 days) time of first flower was recorded in control condition. The results indicated that minimum time of first flower were produced by the application of plant growth regulators comparing with the control.

Table 3. Effect of plant growth regulators and fertilizer management practices on number of male and female flower and ratio and fruits per plant of snake gourd

| Treatment | No. of male flower | No. of female flower | Ratio of male and female flower | No. of Fruits per plant |
|---|---|---|---|---|
| **Plant growth regulators** | | | | |
| Control | 78.13 ab | 15.73 c | 5.03 a | 6.76 bc |
| Ripen-15 | 81.50 a | 20.40 a | 4.01 b | 7.81 a |
| IAA | 75.91 b | 17.87 b | 4.24 b | 7.11 b |
| Ripen-15 + IAA | 67.97 c | 21.80 a | 3.21 c | 6.59 c |
| $LSD_{(0.05)}$ | 4.614 | 1.693 | 0.438 | 0.417 |
| Significant level | ** | ** | ** | ** |
| **Fertilizer management practices** | | | | |
| Control | 86.19 a | 17.88 b | 4.92 a | 6.03 c |
| Organic | 66.10 c | 17.75 b | 3.80 b | 7.36 b |
| Inorganic | 75.35 b | 21.23 a | 3.65 b | 7.81 a |
| $LSD_{(0.05)}$ | 3.996 | 1.466 | 0.380 | 0.361 |
| Significant level | ** | ** | ** | ** |

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

** : Significant at 0.01 level of significance.

* : Significant at 0.05 level of significance.

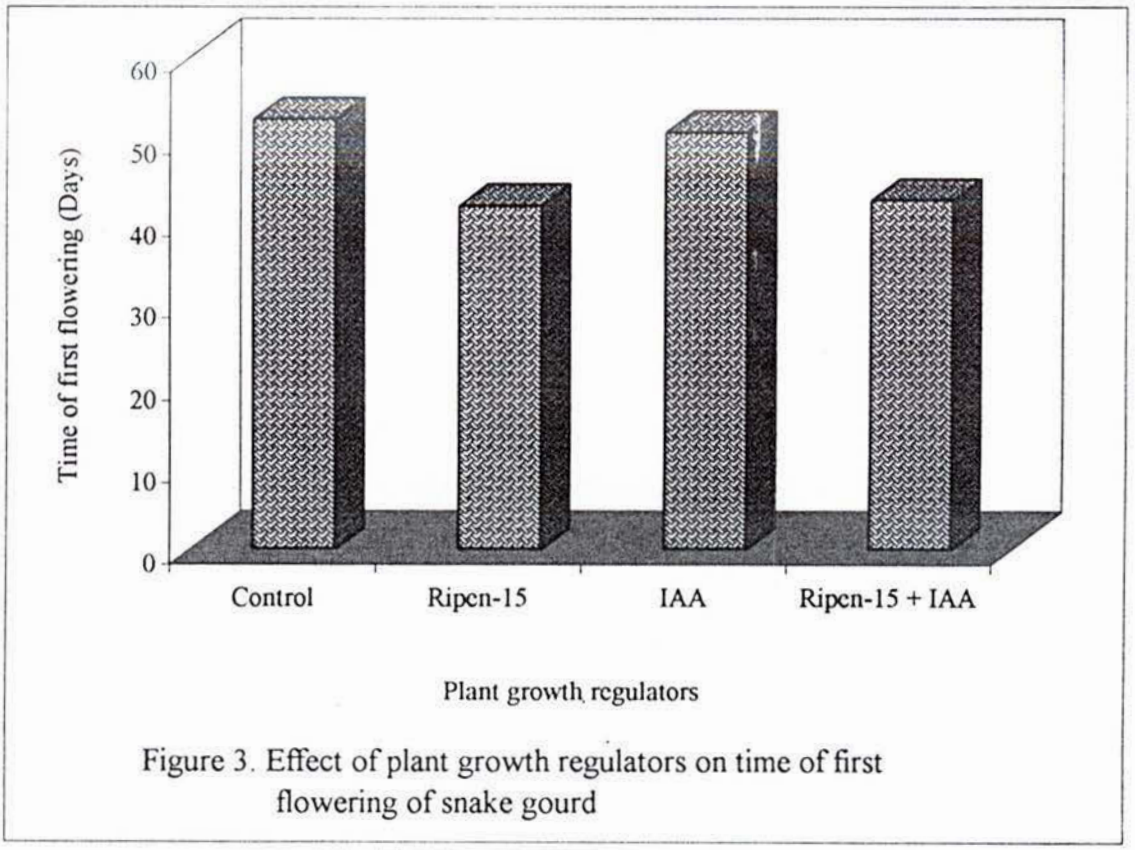


Figure 3. Effect of plant growth regulators on time of first flowering of snake gourd

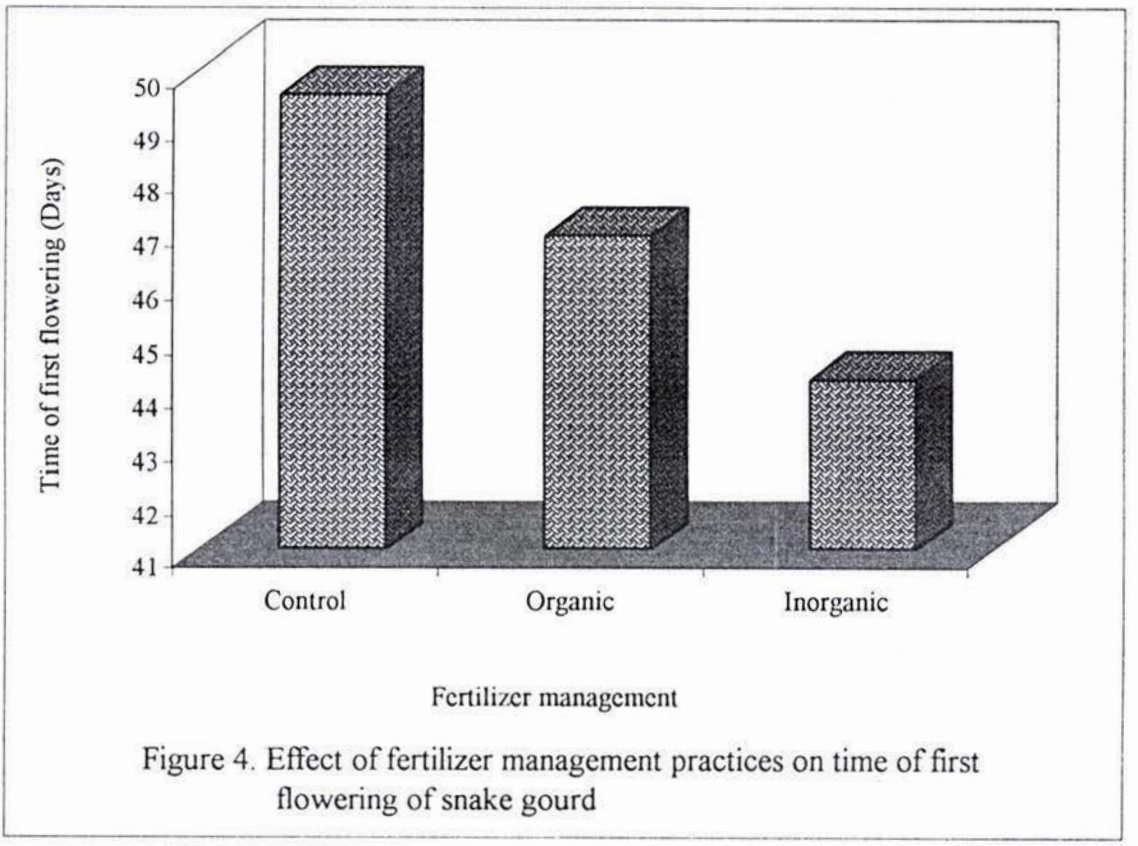


Figure 4. Effect of fertilizer management practices on time of first flowering of snake gourd

Different fertilizer management practices showed a statistically significant variation on time of first flower. The minimum (44.17 days) time of first flower was recorded in application of inorganic fertilizer ($F_2$) which was closely followed by (46.84 days) with organic fertilizer (Table 3) and the maximum (49.52 days) time of first flower was recorded in control condition where no fertilizer was applied. The results indicated that minimum time of first flower was recorded by the application of organic or inorganic fertilizer than the control with ensuring the better growth and development of snake gourd. Olivira *et al.* (2005) reported the similar results from their earlier experiments.

Interaction effect between plant growth regulators and fertilizer management practices showed a statistically significant variation in consideration of time of first flowering. The minimum (38.0 days) time to first flower was recorded in the treatment of Ripen-15 + IAA and inorganic fertilizer management practices ($H_3F_2$) and the maximum (53.30 days) time to first flower was recorded in the treatment combination control condition (Table 4). The results indicated that combination of plant growth regulators and fertilizer ensures the optimum condition for the growth and development of snake gourd and the ultimate result is the minimum time to first flower.

**4.5 No. of male flower**

Different plant growth regulators showed a statistically significant variation on number of male flower. The minimum (67.97) male flower in number was recorded for the application of Ripen-15 + IAA (Table 3) which was closely followed (75.91) by IAA ($H_2$) and the maximum (81.50) male flower in number was recorded in Ripen-15 ($H_1$). The results indicated that minimum male flower was produced by the application of plant growth regulators comparing with the control. In terms of male flower in number for different fertilizer management practices a statistically significant variation was recorded under the trial. The minimum (66.10) male flower in number

**Table 4. Interaction effect of plant growth regulators and fertilizer management practices on time to first flower, number of male and female flower and ratio and fruits per plant of snake gourd**

| Treatment | | Time to first flower (days) | No. of male flower | No. of female flower | Ratio of male and female flower | No. of Fruits per plant |
|---|---|---|---|---|---|---|
| Control | Control | 53.30 a | 94.47 ab | 15.40 ef | 6.17 a | 5.10 f |
| | Organic | 52.93 a | 68.53 ef | 14.30 f | 4.83 bc | 7.25 bc |
| | Inorganic | 50.73 ab | 71.40 de | 17.50 cde | 4.10 cd | 7.94 ab |
| Ripen-15 | Control | 45.70 cd | 77.43 de | 19.30 bcd | 4.02 cd | 6.80 cd |
| | Organic | 41.83 de | 79.63 cd | 20.10 bc | 3.97 d | 8.40 a |
| | Inorganic | 38.00 f | 87.43 bc | 21.80 b | 4.02 cd | 8.23 a |
| IAA | Control | 53.70 a | 98.33 a | 18.10 cde | 5.45 ab | 5.91 e |
| | Organic | 50.50 ab | 55.57 g | 16.30 def | 3.41 de | 7.40 bc |
| | Inorganic | 47.87 bc | 73.83 de | 19.20 bcd | 3.86 d | 8.00 ab |
| Ripen-15 + IAA | Control | 45.37 cd | 74.53 de | 18.70 bcd | 4.03 d | 6.30 de |
| | Organic | 42.10 de | 60.65 fg | 20.30 bc | 3.00 ef | 6.40 de |
| | Inorganic | 40.10 ef | 68.71 ef | 26.40 a | 2.61 f | 7.07 cd |
| $LSD_{(0.05)}$ | | 3.578 | 7.992 | 2.933 | 0.759 | 0.722 |
| Significant level | | * | ** | * | ** | ** |
| CV (%) | | 4.51 | 6.22 | 9.14 | 10.89 | 6.03 |

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

** : Significant at 0.01 level of significance.

* : Significant at 0.05 level of significance.

was recorded in application of organic fertilizer ($F_1$) which was closely followed by (75.35) with inorganic fertilizer (Table 3) and the maximum (86.19) male flower in number was recorded in control condition where no organic nor inorganic fertilizer was applied. The results indicated that minimum male flower in number were produced by the application of organic or inorganic fertilizer than the control with ensuring the better growth and development of snake gourd.

Interaction effect between plant growth regulators and fertilizer management practices showed a statistically significant variation in consideration of male flower in number. The minimum (60.65) male flower in number was recorded in the treatment combination of Ripen-15 + IAA and organic fertilizer management practices ($H_3F_1$) and the maximum (94.47) was recorded in the treatment combination of IAA and control condition ($H_2F_0$) which is given in Table 4. The results indicated that combination of plant growth regulators and fertilizer ensures the optimum condition for the growth and development of snake gourd and the ultimate result is the minimum male flower in number.

**4.6 No. of female flower**

Different plant growth regulators showed a statistically significant variation in number of female flower. The maximum (21.80) female flower in number was recorded for the application of Ripen-15 + IAA (Table 3) which was statistically similar by Ripen-15 (20.40) and the minimum (15.73) female flower in number was recorded in control condition ($H_0$). The results indicated that maximum female flower in number were produced by the application of plant growth regulators compared with the control. Al Masoum and Al Masri (1999) reported similar trends from their experiments. Choudhury *et al.* (1967) reported that NAA 100 ppm, IAA 100 ppm and 200 ppm and MH 50 ppm and 200 ppm were equally effective in suppressing the male flowers and increasing the number of female flowers in cucumber.

A statistically significant variation was recorded in number of female flower for different fertilizer management practices. The maximum (21.23) female flower in number was recorded in application of inorganic fertilizer (Table 3) and the minimum (17.75) female flower in number was recorded in application of organic fertilizer ($F_1$). The results indicated that minimum female flower in number were produced by the application of organic or inorganic fertilizer than the control with ensuring the better growth and development of snake gourd. Olivira *et al.* (2005) reported the similar results from their earlier experiments.

Interaction effect between plant growth regulators and fertilizer management practices showed a statistically significant variation in consideration of female flower in number. The maximum (26.40) female flower in number was recorded in the treatment combination of Ripen-15 + IAA and inorganic fertilizer management practices and the minimum (14.30) was recorded in the treatment combination control and organic fertilizer application ($H_0F_1$) which is given in Table 4. The results indicated that combination of plant growth regulators and fertilizer ensures the optimum condition for the growth and development of snake gourd and the ultimate result is the maximum female flower in number. Pandey and Singh (1973) reported the similar results of fertilizer and maleic hydrazide hormone application.

**4.7 Ratio of male and female flower**

Ratio of male and female flower for different plant growth regulators showed a statistically significant variation. The minimum (3.21) ratio of male and female flower was recorded for the application of Ripen-15 + IAA (Table 3) which was closely followed by Ripen-15 and IAA (4.01 and 4.24, respectively) and the maximum (5.03) ratio of male and female flower was recorded in control condition. The results indicated that minimum ratio of male and female flower were produced by the application of plant growth regulators compariing with the control.

Different fertilizer management practices showed a statistically significant variation for ratio of male and female flower. The minimum (3.65) ratio of male and female flower was recorded in application of inorganic fertilizer (Table 3) which was statistically identical with organic fertilizer (3.80) and the maximum (4.92) ratio of male and female flower was recorded in control condition ($F_0$). The results indicated that minimum ratio of male and female flower were produced by the application of organic or inorganic fertilizer than the control with ensuring the better growth and development of snake gourd.

Interaction effect between plant growth regulators and fertilizer management practices showed a statistically significant variation in consideration of ratio of male and female flower. The minimum (2.61) ratio of male and female flower was recorded in the treatment combination of Ripen-15 + IAA and inorganic fertilizer management practices ($H_3F_2$) and the maximum (6.17) was recorded in the treatment combination control condition i.e. no plant growth regulators and no fertilizer application (Table 4). The results indicated that combination of plant growth regulators and fertilizer ensures the optimum condition for the growth and development of snake gourd and the ultimate result is the minimum ratio of male and female flower.

**4.8 No. of fruits per plant**

Different plant growth regulators showed a statistically significant variation on number of fruits per plant. Fruits per plant showed a gradual increasing trend for different plant growth regulators comparing the control. The maximum (7.81) fruits per plant in number were recorded for the application of Ripen-15 (Table 3) which was closely followed by IAA (7.11) and the minimum (6.76) fruits per plant were recorded in control condition.

Different fertilizer management practices showed a statistically significant variation on number of fruits per plant. The maximum (7.81) number of

fruits per plant was recorded in application of inorganic fertilizer ($F_2$) which was closely followed (7.36) by organic fertilizer (Table 3) and the minimum (6.03) fruits per plant in number were recorded in control condition ($F_0$). 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 growth and development of snake gourd. Olivira *et al.* (2005) reported the similar results from their earlier experiments.

Interaction effect between plant growth regulators and fertilizer management practices showed a statistically significant variation in consideration of fruits per plant in number. The maximum (8.40) number of fruits per plant was recorded in the treatment combination of Ripen-15 and organic fertilizer management practices ($H_1F_1$) and the minimum (5.10) was recorded in the treatment combination control condition i.e. no plant growth regulator and no fertilizer application (Table 4). The results indicated that combination of plant growth regulators and fertilizer ensures the optimum condition for the growth and development of snake gourd and the ultimate result is the maximum fruits per plant.

**4.9 Fruit length**

Plant growth regulators showed no statistically significant variation on fruit length. Fruit length showed a gradual increasing trend for different plant growth regulators comparing the control. The maximum (41.04 cm) fruit length was recorded for the application of IAA (Table 5) and the minimum (39.69 cm) fruit length was recorded in Ripen-15 ($H_1$).

Different fertilizer management practices showed no statistically significant variation on fruit length. The maximum (40.99 cm) fruit length was recorded in application of organic fertilizer (Table 5) and the minimum (38.73 cm) fruit length was recorded in case of inorganic fertilizer application ($F_2$).

Interaction effect between plant growth regulators and fertilizer management practices showed no statistically significant variation for fruit length. The maximum (43.69 cm) fruit length was recorded in the treatment combination

**Table 5. Effect of plant growth regulators and fertilizer management practices on fruit- length, diameter, weight and yield per plot of snake gourd**

| Treatment | Fruit length (cm) | Fruit diameter (cm) | Fruit weight (g/fruit) | Yield (kg/plot) |
|---|---|---|---|---|
| **Plant growth regulators** | | | | |
| Control | 39.90 | 2.53 | 184.6 b | 5.41 c |
| Ripen-15 | 39.69 | 2.55 | 192.3 ab | 8.62 b |
| IAA | 41.04 | 2.85 | 224.3 a | 8.62 b |
| Ripen-15 + IAA | 38.88 | 2.84 | 225.5 a | 11.06 a |
| $LSD_{(0.05)}$ | -- | -- | 33.20 | 0.660 |
| Significant level | NS | NS | * | ** |
| **Fertilizer management practices** | | | | |
| Control | 39.91 | 2.78 | 194.3 | 6.88 c |
| Organic | 40.99 | 2.70 | 212.0 | 8.53 b |
| Inorganic | 38.73 | 2.60 | 213.6 | 9.88 a |
| $LSD_{(0.05)}$ | -- | -- | -- | 0.572 |
| Significant level | NS | NS | NS | ** |

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

** : Significant at 0.01 level of significance.

* : Significant at 0.05 level of significance.

of IAA and organic fertilizer management practices ($H_2F_1$) and the minimum (38.08 cm) was recorded in the treatment combination of control and inorganic fertilizer ($H_0F_2$) which is shown in Table 6.

### 4.10 Fruit diameter

Plant growth regulators showed no statistically significant variation on fruit diameter. Fruit diameter showed a gradual increasing trend for different plant growth regulators comparing the control. The maximum (2.85 cm) fruit diameter was recorded from the application of IAA (Table 5) and the minimum (2.53 cm) fruit diameter was recorded in control condition.

No statistically significant variation was recorded under the trial for fruit diameter for different fertilizer management practices. The maximum (2.78 cm) fruit diameter was recorded in control condition (Table 5) and the minimum (2.60 cm) fruit diameter was recorded in inorganic fertilizer application ($F_2$). Olivira *et al.* (2005) reported the similar results from their earlier experiments.

Interaction effect between plant growth regulators and fertilizer management practices showed no statistically significant variation in consideration of fruit diameter. The maximum (3.20 cm) fruit diameter was recorded in treatment combination of control condition ($H_0F_0$) and the minimum (1.86 cm) was recorded in the treatment combination no plant growth regulator and organic fertilizer ($H_0F_1$) which is given in Table 6.

### 4.11 Fruit weight

Fruit weight for different plant growth regulators showed a statistically significant variation. The maximum (225.5 g) fruit weight was recorded for the application of Ripen- 15 + IAA (Table 5) which was closely followed by Ripen-15 and IAA (224.3 g and 192.3 g respectively) and the minimum (184.6 g) fruit weight were recorded in control condition. The results indicated that the maximum fruit weight was produced by the application of plant growth regulators compared with the control. Baruah and Das (1997)

**Table 6. Interaction effect of plant growth regulators and fertilizer management practices on fruit- length, diameter, weight and yield per plot and hectare of snake gourd**

| Treatment | | Fruit length (cm) | Fruit diameter (cm) | Fruit weight (g/fruit) | Yield (kg/plot) |
|---|---|---|---|---|---|
| Control | Control | 39.72 | 3.20 | 181.4 | 4.10 f |
| | Organic | 41.89 | 1.86 | 206.3 | 5.93 e |
| | Inorganic | 38.08 | 2.54 | 166.1 | 6.20 e |
| Ripen-15 | Control | 40.70 | 2.55 | 189.4 | 6.00 e |
| | Organic | 38.90 | 2.64 | 173.1 | 8.80 cd |
| | Inorganic | 39.47 | 2.47 | 214.4 | 11.06 b |
| IAA | Control | 40.21 | 2.84 | 207.7 | 7.80 d |
| | Organic | 43.69 | 3.15 | 219.5 | 8.20 d |
| | Inorganic | 39.21 | 2.54 | 245.8 | 9.87 c |
| Ripen-15 + IAA | Control | 39.00 | 2.54 | 198.8 | 9.60 c |
| | Organic | 39.47 | 3.14 | 249.3 | 11.20 b |
| | Inorganic | 38.17 | 2.85 | 228.3 | 12.38 a |
| $LSD_{(0.05)}$ | | -- | -- | -- | 1.143 |
| Significant level | | NS | NS | NS | ** |
| CV (%) | | 9.22 | 18.37 | 16.43 | 8.02 |

In a column means having similar letter(s) are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability

** : Significant at 0.01 level of significance.

* : Significant at 0.05 level of significance.

observed that plants sprayed with NAA at 25 ppm and MH at 50 ppm produced the best yields (231 and 242 g respectively). Different fertilizer management practices showed no statistically significant variation on fruit weight. The maximum (213.6 g) fruit weight was recorded in application of inorganic fertilizer (Table 5) and the minimum (194.3 g) fruit weight was recorded in control condition where no fertilizer was applied. 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 snake gourd.

Interaction effect between plant growth regulators and fertilizer management practices showed no statistically significant variation in consideration of fruit weight. The maximum (249.3 g) fruit weight was recorded in the treatment combination of Ripen-15 + IAA and inorganic fertilizer management practices ($H_3F_2$) and the minimum (166.1 g) was recorded in the treatment combination of control condition i.e. no plant growth regulator and inorganic fertilizer (Table 6). The results indicated that combination of plant growth regulators and fertilizer ensures the optimum condition for the growth and development of snake gourd and the ultimate result is the maximum fruit weight.

**4.12 Yield (kg/plot)**

Yield per plot for different plant growth regulators showed a statistically significant variation. Yield per plot showed a gradual increasing trend for different plant growth regulators comparing with the control. The maximum (11.06 kg) yield per plot was recorded for the application of Ripen-15 + IAA (Table 5) which was closely followed by Ripen-15 and IAA (8.62 kg both) and the minimum (5.41 kg) yield per plot was recorded in control condition. The results indicated that maximum yield per plot was produced by the application of plant growth regulators compared with the control.

Different fertilizer management practices showed statistically significant variation on yield per plot. The maximum (9.88 kg) yield per plot was

recorded in application of inorganic fertilizer (Table 5) which was closely followed by (8.53 kg) by organic fertilizer application and the minimum (6.88 kg) yield per plot was recorded in control condition where no fertilizer was applied. The results indicated that maximum yield per plot was produced by the application of organic or inorganic fertilizer than the control with ensuring the better growth and development of snake gourd.

Interaction effect between plant growth regulators and fertilizer management practices showed statistically significant variation in consideration of yield per plot. The maximum (12.38 kg) yield per plot was recorded in the treatment combination of Ripen-15 + IAA and inorganic fertilizer management practices ($H_3F_2$) and the minimum (4.10 kg) was recorded in the treatment combination of control condition i.e. no plant growth regulator and inorganic fertilizer application ($H_0F_2$) which is given in Table 6. The results indicated that combination of plant growth regulators and fertilizer ensures the optimum condition for the growth and development of snake gourd and the ultimate result is the maximum yield per plot.

**4.13 Yield (t/ha)**

A statistically significant variation was recorded in terms of yield per hectare for different plant growth regulators. Yield per hectare showed a gradual increasing trend for different plant growth regulators comparing with the control. The maximum (20.47 ton) yield per hectare was recorded for the application of Ripen-15 + IAA (Table 5) which was closely followed by IAA and Ripen-15 (15.94 and 15.92 ton respectively) and the minimum (10.00 ton) yield per hectare was recorded in control condition. The results indicated that maximum yield per hectare was produced by the application of plant growth regulators compared with the control. Chudhury *et al.* (1967) reported that NAA 100 ppm, IAA 100 ppm and 200 ppm and MH 50 ppm and 200 ppm were equally effective in suppressing the male flowers and increasing the number of female flowers in cucumber. The effects

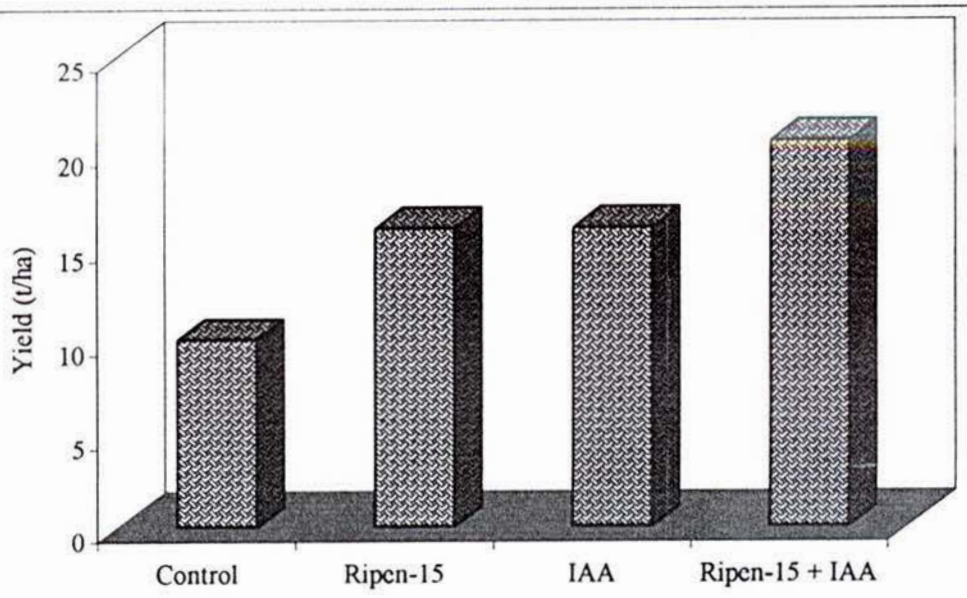


Figure 5. Effect of plant growth regulators on yield per hectare of snake gourd

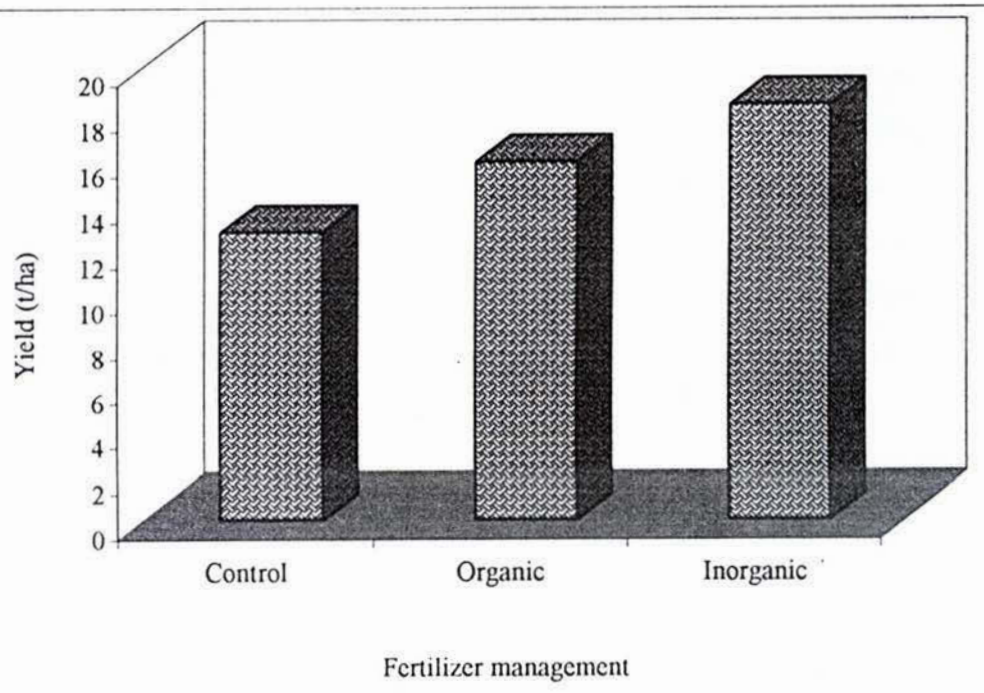


Figure 6. Effect of fertilizer management practices on yield per hectare of snake gourd

subsequently increased the percentage of fruit set and ultimately the yield per hectare increased.

Different fertilizer management practices showed statistically significant variation on yield per hectare. The maximum (18.25 ton) yield per hectare was recorded in application of inorganic fertilizer (Table 5) which was closely followed by (15.77 ton) by organic fertilizer application ($F_1$) and the minimum (12.72 ton) yield per hectare was recorded in control condition where no fertilizer was used. The results indicated that maximum yield per hectare was produced by the application of organic or inorganic fertilizer than the control with ensuring the better growth and development of snake gourd. Olivira *et al.* (2005) reported the similar results from their earlier experiments.

Interaction effect between plant growth regulators and fertilizer management practices showed statistically significant variation in consideration of yield per hectare. The maximum (22.90 ton) yield per hectare was recorded in the treatment combination of Ripen-15 + IAA and inorganic fertilizer management practices ($H_3F_2$) and the minimum (7.60 ton) was recorded in the treatment combination of control condition i.e. no plant growth regulator and inorganic fertilizer (Table 6). The results indicated that combination of plant growth regulators and fertilizer ensures the optimum condition for the growth and development of snake gourd and the ultimate results is the minimum yield per hectare.

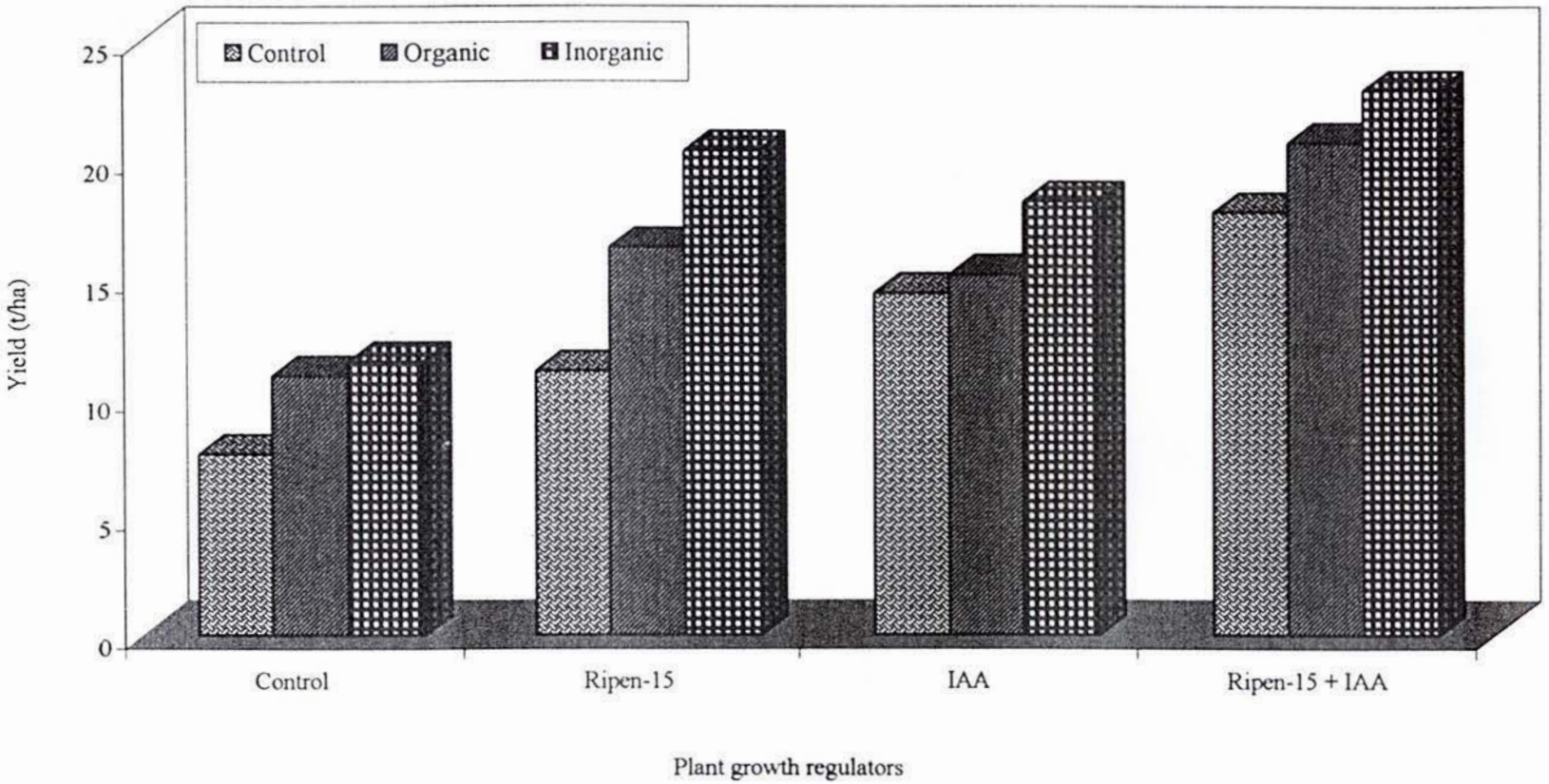


Figure 7. Interaction between plant growth regulators and fertilizer management practices on yield per hectare of snake gourd

## 4.14 Cost benefit analysis

### 4.14.1 Gross return

In the combination of plant growth regulators and fertilizer management practices maximum gross return (Tk. 458,000) was obtained from the treatment combination of Ripen-15 +IAA and inorganic fertilizer application ($H_3F_2$)and the second highest gross return (Tk. 414,000) was obtained in Ripen-15 +IAA and organic fertilizer ($H_3F_1$). The lowest gross return (Tk. 152,000) was obtained in the combination of control conditions i.e. no plant growth regulator and no fertilizer application (Table 7).

### 4.14.2 Net return

In case of net return different treatment combination showed different types of net return. In combination of plant growth regulators and fertilizer management practices highest net return (Tk. 321,556) was obtained from the treatment combination of Ripen-15 +IAA and inorganic fertilizer application ($H_3F_2$)and the second highest net return (Tk. 287,933) was obtained in Ripen-15 +IAA and organic fertilizer application ($H_3F_1$). The lowest net return (Tk. 34,041) was obtained in the combination of control conditions ($H_0F_0$) in this trial.

### 4.14.3 Benefit cost ratio

In combination of plant growth regulators and fertilizer management practices the highest benefit cost ratio (2.36) was attained from the treatment combination of Ripen-15 + IAA and inorganic fertilizer application and the second highest benefit cost ratio (2.28) was acquired in Ripen-15 +IAA and organic fertilizer application. The lowest benefit cost ratio (0.29) was obtained in the combination of controlled conditions i.e. no plant growth regulator and no fertilizer application (Table 7).

**Table 7. Cost and return of snake gourd as influenced by plant growth regulators and fertilizer management practices**

| Treatment | | Cost of production (Tk./ha) | Yield of snake gourd (t/ha) | Price of snake gourd (Tk.) | Gross return (Tk./ha) | Net return (Tk./ha) | Benefit cost ratio |
|---|---|---|---|---|---|---|---|
| Control | Control | 117959 | 7.60 | 152000 | 152000 | 34041 | 0.29 |
| | Organic | 124948 | 10.90 | 218000 | 218000 | 93052 | 0.74 |
| | Inorganic | 135326 | 11.50 | 230000 | 230000 | 94674 | 0.70 |
| Ripen-15 | Control | 118407 | 11.10 | 222000 | 222000 | 103593 | 0.87 |
| | Organic | 125396 | 16.30 | 326000 | 326000 | 200604 | 1.60 |
| | Inorganic | 135773 | 20.37 | 407400 | 407400 | 271627 | 2.00 |
| IAA | Control | 118630 | 14.40 | 288000 | 288000 | 169370 | 1.43 |
| | Organic | 125619 | 15.19 | 303800 | 303800 | 178181 | 1.42 |
| | Inorganic | 135997 | 18.24 | 364800 | 364800 | 228803 | 1.68 |
| Ripen-15 + IAA | Control | 119078 | 17.80 | 356000 | 356000 | 236922 | 1.99 |
| | Organic | 126067 | 20.70 | 414000 | 414000 | 287933 | 2.28 |
| | Inorganic | 136444 | 22.90 | 458000 | 458000 | 321556 | 2.36 |

Market price of snake gourd @ Tk. 20000/t

# CHAPTER V

## SUMMARY AND CONCLUSION

A field experiment was conducted in the Horticulture Farm of Sher-e Bangla Agricultural University, Dhaka, Bangladesh during the period from April to August 2007 to study the effect of different plant growth regulators and fertilizer management practices on flowering, growth and yield of snake gourd. The experiment considered of two factors, Factor A: Different plant growth regulators (4 levels): No hormone (control), Ripen-15 ($H_1$), IAA ($H_2$) and Ripen-15 + IAA ($H_3$); and Factor B: Fertilizer management practices: No fertilizer ($F_0$), organic fertilizer ($F_1$) and inorganic fertilizer ($F_2$). There were on the whole 12 (4 × 3) treatment combinations. The experiment was laid out in the two factors Randomized Complete Block Design (RCBD) with three replications. After emergence of seedlings, various intercultural operations were accomplished for better growth and development of the plant. Data were collected in respect of the snake gourd growth characters and yield and yield contributing characters. The data obtained for different characters were statistically analyzed to find out the significance of the difference plant growth regulators and fertilizer management practices.

The tallest (169.3 cm) plant at 1$^{st}$ flowering was recorded for the Ripen-15+ IAA application ($H_3$) and at last harvest, the tallest (531.1 cm) was recorded for the application of IAA and the shortest plant at both stages (152.2 cm and 403.9 cm respectively) was recorded in control condition. The maximum (8.57) branches per plant were recorded for the application of IAA and the minimum (4.21) branch per plant was recorded in control condition. The minimum (41.84 days) time of first flower was recorded for the application of Ripen-15 and the maximum (52.32 days) time of first flower was recorded in control condition. The minimum (3.21) ratio of male and female flower was recorded for the application of Ripen-15 + IAA and the maximum (5.03) ratio of male and

female flower were recorded in control. The maximum (7.81) fruits per plant in number were recorded for the application of Ripen-15 and the minimum (6.76) fruits per plant were recorded in control condition. The maximum (41.04 cm) fruit length was recorded for the application of IAA and the minimum (38.88 cm) fruit length was recorded in Ripen-15+ IAA ($H_3$). The maximum (2.85 cm) fruit diameter was recorded for IAA and the minimum (2.53 cm) fruit diameter was recorded in control condition. The maximum (225.5 g) fruit weight was recorded for the application of Ripen-15 + IAA and the minimum (184.6 g) were recorded in control condition. The maximum (20.47 ton) yield per hectare was recorded for the application of Ripen-15 + IAA and the minimum (10.00 ton) yield per hectare was recorded in control condition.

The tallest (167.3 cm and 488.4 cm) plant at 1$^{st}$ flowering and last harvest was recorded in application of inorganic fertilizer and the shortest (158.8 cm and 424.7 cm) plant at both stages were recorded in control condition. The maximum (7.67) branch per plant was recorded in application of inorganic fertilizer and the minimum (5.81) branch per plant was recorded in control condition. The minimum (44.17 days) time of first flower was recorded in application of inorganic fertilizer and the maximum (49.52 days) time of first flower was recorded in control condition. The minimum (3.65) ratio of male and female flower was recorded in application of inorganic and the maximum (4.92) ratio of male and female flower was recorded in control condition. The maximum (7.81) number of fruits per plant was recorded in application of inorganic fertilizer and the minimum (6.03) fruits per plant in number were recorded in control condition. The maximum (40.99 cm) fruit length was recorded in application of organic fertilizer and the minimum (38.73 cm) fruit length was recorded in inorganic fertilizer were applied. The maximum (2.78 cm) fruit diameter was recorded in control condition and the minimum (2.60 cm) fruit diameter was recorded in inorganic fertilizer application. The

maximum (213.6 g) fruit weight was recorded in application of inorganic fertilizer and the maximum (194.3 g) fruit weight was recorded in control condition where neither organic nor inorganic fertilizer was application. The maximum (18.25 ton) yield per hectare was recorded in application of inorganic fertilizer and the minimum (12.72 ton) yield per hectare was recorded in control condition.

In treatment combination of Ripen-15 + IAA and inorganic fertilizer ($H_3F_2$), the ratio of male and female flower was smallest which was 2.61 and the maximum yield was recorded which was 22.90 t/ha.

In combination of Ripen-15 + IAA and inorganic fertilizer ($H_3F_2$) gave the highest gross return (Tk. 458,000) and the lowest gross return (Tk. 152,000) was obtained in the combination of control conditions ($H_0F_0$). In combination of Ripen-15 + IAA and inorganic fertilizer ($H_3F_2$) gave highest benefit cost ratio (2.36). The lowest befit cost ratio (0.29) was obtained in the combination of control condition ($H_0F_0$).

Considering the situation of the present experiment, further studies in the following areas may be suggested:

1. Different concentration of plant growth regulators may be used.
2. Different doses of fertilizer and another types may be included in the future program

# CHAPTER VI

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# CHAPTER VII

# APPENDICES

**Appendix I: Soil characteristics of horticulture farm analyzed by Soil Resources Development Institute (SRDI), Farmgate, Dhaka.**

**A. Morphological characteristics of the experimental field**

| Morphological features | Characteristics |
|---|---|
| Location | Horticulture garden, SAU, Dhaka |
| AEZ | Modhupur tract (28) |
| General Soil type | Shallow red brown terrace soil |
| Land type | High land |
| Soil series | Tejgaon |
| Topography | Fairly leveled |
| Flood level | Above flood level |
| Drainage | Well drained |
| Cropping pattern | N/A |

Source: SRDI, Dhaka.

**B. Physical and chemical properties of the initial soil**

| Characteristics | Value |
|---|---|
| Partical size analysis | |
| % Sand | 27 |
| % Silt | 43 |
| % Clay | 30 |
| Textural class | Silty-clay |
| pH | 5.6 |
| Organic carbon (%) | 0.45 |
| Organic matter (%) | 0.78 |
| Total N (%) | 0.03 |
| Available P (ppm) | 20.00 |
| Exchangeable K (me/100g soil) | 0.10 |
| Available S (ppm) | 45 |

Source: SRDI, Dhaka.

**Appendix II: Monthly record of air temperature, rainfall, relative humidity and sunshine hours during the period from April 2007 to August 2007**

| Year | Month | Average air temperature (°C) | | | Total rainfall (mm) | Average humidity (%) | Total sunshine hours |
|---|---|---|---|---|---|---|---|
| | | Maximum | Minimum | Mean | | | |
| 2007 | April | 33.74 | 23.87 | 28.81 | 185 | 69.41 | 234.6 |
| | May | 33.2 | 24.2 | 28.7 | 291 | 73 | 241.8 |
| | June | 33.4 | 26.8 | 30.1 | 259 | 79 | 96.0 |
| | July | 31.4 | 25.8 | 28.6 | 542 | 81 | 127.1 |
| | August | 32.0 | 26.6 | 29.3 | 361 | 82 | 108.5 |

Source: Dhaka meteorology center

**Appendix III. Analysis of variance of the data on plant height, no. of nodes and branches per plant of snake gourd as influenced by growth regulators and fertilizer management practices**

| Source of variation | Degrees of freedom | Mean square | | | | |
|---|---|---|---|---|---|---|
| | | Plant height (cm) at | | No. of nodes per plant | | No. of branch per plant |
| | | 1st flowering | last harvest | 1st flowering | last harvest | |
| Replication | 2 | 0.111 | 305.368 | 0.340 | 40.650 | 0.093 |
| Plant growth regulator (A) | 3 | 520.276** | 33308.6** | 11.294** | 94.108 | 34.478** |
| Fertilizer management (B) | 2 | 219.244** | 12179.1** | 19.797** | 872.887** | 10.411** |
| Interaction (A × B) | 6 | 102.008* | 1895.873* | 16.894** | 343.138** | 1.070* |
| Error | 22 | 31.202 | 557.140 | 1.613 | 80.040 | 0.416 |

** : Significant at 0.01 level of significance.

* : Significant at 0.05 level of significance.

**Appendix IV. Analysis of variance of the data on time to first flower, male and female flower and ratio and fruits per plant of snake gourd as influenced by growth regulators and fertilizer management practices**

| Source of variation | Degrees of freedom | Mean square | | | | |
|---|---|---|---|---|---|---|
| | | Time to first flower (days) | No. of male flower | No. of female flower | Ratio of male and female flower | No. of Fruits per plant |
| Replication | 2 | 4.622 | 54.959 | 3.000 | 0.012 | 0.106 |
| Plant growth regulator (A) | 3 | 265.402** | 297.904** | 65.237** | 5.045** | 2.618** |
| Fertilizer management (B) | 2 | 85.600** | 1214.08** | 46.627** | 5.768** | 10.302** |
| Interaction (A × B) | 6 | 3.818* | 334.149** | 7.384* | 0.867** | 0.862** |
| Error | 22 | 4.466 | 22.277 | 3.000 | 0.201 | 0.182 |

** : Significant at 0.01 level of significance.

* : Significant at 0.05 level of significance.

**Appendix V. Analysis of variance of the data on fruit length, diameter, fruit weight and yield kg per plot and hectare of snake gourd as influenced by growth regulators and fertilizer management practices**

| Source of variation | Degrees of freedom | Mean square | | | | |
|---|---|---|---|---|---|---|
| | | Fruit length (cm) | Fruit diameter (cm) | Fruit weight (g/fruit) | Yield (kg/plot) | Yield (t/ha) |
| Replication | 2 | 31.426 | 0.605 | 3340.787 | 0.019 | 0.121 |
| Plant growth regulator (A) | 3 | 7.154 | 0.271 | 4078.227* | 48.311** | 165.795** |
| Fertilizer management (B) | 2 | 15.254 | 0.101 | 1377.914 | 27.129** | 91.955** |
| Interaction (A × B) | 6 | 5.371 | 0.605 | 1412.260 | 1.837** | 5.988** |
| Error | 22 | 13.508 | 0.245 | 1153.171 | 0.456 | 1.263 |

** : Significant at 0.01 level of significance;

* : Significant at 0.05 level of significance

**Appendix VI. Production cost of snake gourd per hectare**

**A. Input cost**

| Treatment | | Labour cost | Ploughing cost | Seed Cost | Plant growth regulators cost | Irrigation Cost | Pesticides | Fertilizer | | Sub Total (A) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Organic | Inorganic | |
| Control | Control | 20000.00 | 4000.00 | 1200.00 | 0.00 | 3000.00 | 3000.00 | 0.00 | 0.00 | 31200.00 |
| | Organic | 20000.00 | 4000.00 | 1200.00 | 0.00 | 3000.00 | 3000.00 | 6250.00 | 0.00 | 37450.00 |
| | Inorganic | 20000.00 | 4000.00 | 1200.00 | 0.00 | 3000.00 | 3000.00 | 0.00 | 15530.00 | 46730.00 |
| Ripen-15 | Control | 20000.00 | 4000.00 | 1200.00 | 400.00 | 3000.00 | 3000.00 | 0.00 | 0.00 | 31600.00 |
| | Organic | 20000.00 | 4000.00 | 1200.00 | 400.00 | 3000.00 | 3000.00 | 6250.00 | 0.00 | 37850.00 |
| | Inorganic | 20000.00 | 4000.00 | 1200.00 | 400.00 | 3000.00 | 3000.00 | 0.00 | 15530.00 | 47130.00 |
| IAA | Control | 20000.00 | 4000.00 | 1200.00 | 600.00 | 3000.00 | 3000.00 | 0.00 | 0.00 | 31800.00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Organic * | 20000.00 | 4000.00 | 1200.00 | 600.00 | 3000.00 | 3000.00 | 6250.00 | 0.00 | 38050.00 |
| | Inorganic | 20000.00 | 4000.00 | 1200.00 | 600.00 | 3000.00 | 3000.00 | 0.00 | 15530.00 | 47330.00 |
| Ripen-15 + IAA | Control | 20000.00 | 4000.00 | 1200.00 | 1000.00 | 3000.00 | 3000.00 | 0.00 | 0.00 | 32200.00 |
| | Organic | 20000.00 | 4000.00 | 1200.00 | 1000.00 | 3000.00 | 3000.00 | 6250.00 | 0.00 | 38450.00 |
| | Inorganic | 20000.00 | 4000.00 | 1200.00 | 1000.00 | 3000.00 | 3000.00 | 0.00 | 15530.00 | 47730.00 |

Labour 250 @ Tk. 80/capita/day Bullock 50 pairs @ Tk. 80/pair/day

**Appendix VI. Contd.,**

**B. Overhead cost (Tk./ha)**

| Treatment | | Cost of lease of land for 6 months (13% of value of land Tk. 600000/year | Miscellaneous cost (Tk. 5% of the input cost) | Interest on running capital for 12 months (Tk. 13% of cost/year) | Sub total (Tk) (B) | Total cost of production (Tk./ha) [Input cost (A) + overhead cost (B)] |
|---|---|---|---|---|---|---|
| Control | Control | 78000 | 1560 | 7199 | 86759 | 117959 |
| | Organic | 78000 | 1873 | 7626 | 87498 | 124948 |
| | Inorganic | 78000 | 2337 | 8259 | 88596 | 135326 |
| Ripe n-15 | Control | 78000 | 1580 | 7227 | 86807 | 118407 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Organic | 78000 | 1893 | 7653 | 87546 | 125396 |
| | Inorganic | 78000 | 2357 | 8287 | 88643 | 135773 |
| IAA | Control | 78000 | 1590 | 7240 | 86830 | 118630 |
| | Organic | 78000 | 1903 | 7667 | 87569 | 125619 |
| | Inorganic | 78000 | 2367 | 8300 | 88667 | 135997 |
| Ripen-15 + IAA | Control | 78000 | 1610 | 7268 | 86878 | 119078 |
| | Organic | 78000 | 1923 | 7694 | 87617 | 126067 |
| | Inorganic | 78000 | 2387 | 8328 | 88714 | 136444 |