EFFECT OF MALE FLOWER PRUNING AND DIFFERENT DOSES OF NITROGEN ON GROWTH AND YIELD OF SQUASH (*Cucurbita pepo* L.)

MD. ABDUL MATIN

DEPARTMENT OF HORTICULTURE
SHER-E-BANGLA AGRICULTURAL UNIVERSITY
DHAKA- 1207, BANGLADESH

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BY

MD. ABDUL MATIN
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Approved by:

Assoc. Prof. Khairul Kabir	**Prof. Dr. Md. Jahedur Rahman**
Supervisor	Co-Supervisor

Prof. Dr. Md. Jahedur Rahman
Chairman
Examination Committee

Dedicated to

My

Beloved Parents

Khairul Kabir
Associate Professor
Department of Horticulture
Sher-e-Bangla Agricultural University
Dhaka-1207, Bangladesh
Email: khairulkabirhort@gmail.com
Mobile: +8801913919663

CERTIFICATE

This is to certify that the thesis entitled, ***"EFFECT OF MALE FLOWER PRUNING AND DIFFERENT DOSES OF NITROGEN ON GROWTH AND YIELD OF SQUASH (Cucurbita pepo L.)"*** *submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfillment of the requirements for the degree of* ***MASTER OF SCIENCE*** *in* ***HORTICULTURE****, embodies the result of a piece of bonafide research work carried out by* ***MD. ABDUL MATIN****, Registration No. 18-09235 under my supervision and guidance. No part of the thesis has been submitted for any other degree or diploma.*

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

Dated: December, 2020
Place: Dhaka, Bangladesh

Khairul Kabir
Associate Professor
Supervisor

LIST OF ABBREVIATIONS

FULL WORD		ABBREVIATION
Agro-Ecological Zone	=	AEZ
Bangladesh Bureau of Statistics	=	BBS
Bangladesh Council of Scientific Research Institute	=	BCSRI
Centimeter	=	cm
Percent Coefficient of Variation	=	CV %
Days After Sowing	=	DAS
Duncan’s Multiple Range Test	=	DMRT
And others	=	*et al.,*
exempli gratia (L), for example	=	e.g.
Etcetera	=	etc.
Food and Agricultural Organization	=	FAO
Gram (s)	=	g
id est (L), that is	=	i.e.
Kilogram (s)	=	Kg
Least Significant Difference	=	LSD
Meter squares	=	m^2
MiliLitre	=	ml
Master of Science	=	M.S.
Number	=	No.
Sher-e-Bangla Agricultural University	=	SAU
Variety	=	var.
Degree Celceous	=	^oC
Percentage	=	%
Sodium hydroxide	=	NaOH
Geometric mean	=	GM
Miligram	=	mg
Phosphorus	=	P
Potassium	=	K
Calcium	=	Ca
Litre	=	L
Microgram	=	µg
United States of America	=	USA
World Health Organization	=	WHO

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ABSTRACT

A field experiment was carried out at the Horticulture Farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka-1207 to study the effect of male flower pruning and different doses of nitrogen on growth and yield of squash (*Cucurbita pepo* L.) during the period from December 2019 to March 2020. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. Three male flower pruning treatments *viz*., P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT and P_2= Male flower pruning at 35 DAT and three nitrogen levels *viz*., N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1} and N_2= 90 kg N ha^{-1} were considered for the present study. Different male flower pruning treatments and nitrogen doses and also their combinations showed significant influence on growth, yield contributing parameters and yield of squash. Considering pruning treatments, P_2 gave highest number of fruits $plant^{-1}$ (3.93), single fruit weight (576.70 g), fruit weight $plant^{-1}$ (2.28 kg) and fruit yield (25.36 t ha^{-1}) whereas, the lowest number of fruits $plant^{-1}$ (3.69), single fruit weight (526.00 g), fruit weight $plant^{-1}$ (1.96 kg) and fruit yield (21.79 t ha^{-1}) were recorded from control treatment P_0. Similarly, regarding N treatments, the highest number of fruits $plant^{-1}$ (4.12), single fruit weight (620.70 g), fruit weight $plant^{-1}$ (2.56 kg) and fruit yield (28.49 t ha^{-1}) were recorded from the treatment N_2 whereas, control treatment N_0 showed lowest number of fruits $plant^{-1}$ (3.46), single fruit weight (474.90 g), fruit weight $plant^{-1}$ (1.64 kg) and fruit yield (18.26 t ha^{-1}). Treatment combination of male flower pruning and nitrogen application, P_2N_2 gave the highest number of fruits $plant^{-1}$ (4.26), single fruit weight (648.20 g), fruit weight $plant^{-1}$ (2.76 kg) and fruit yield (30.70 t ha^{-1}) was found from the treatment combination of whereas the lowest number of fruits $plant^{-1}$ (3.32), single fruit weight (451.60 g), fruit weight $plant^{-1}$ (1.50 kg) and fruit yield (16.68 t ha^{-1}) was found from P_0N_0. So, it can be concluded that the treatment combination of P_2N_2 (male flower pruning at 35 DAT with 90 kg N ha^{-1}) have significant positive effect on growth and yield of squash and this treatment combination can be considered as the best compared to all other treatment combinations.

CHAPTER I

INTRODUCTION

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INTRODUCTION

Agriculture is a fundamental part of a natural legacy sustaining a healthy economy, society, and environment. Vegetables play an important role in the daily life of human beings for their impact on nutritional value. Vegetables are considered as one of most efficient suppliers of nutrition in the Southeast Asia including Bangladesh (Thakur *et al*., 2018). Most vegetables require short duration for the yield and can be grown all the year round. In Bangladesh, agricultural sector has a great contribution to its economy and also affect the stability of Bangladesh (Lutfa *et al*., 2018).

Squash (*Cucurbita pepo* L.) is a very popular crop grown in different regions of Bangladesh. They are native to Central America and Mexico**.** Various cultivars of *Cucurbita pepo* are called summer squash, pumpkin, vegetable marrow, zucchini, and spaghetti squash (Purseglove, 1968). It is a member of the Cucurbitaceae family which is supplying humans with edible products and useful fibers. It has been regarded as highly polymorphic vegetable grown during summer in tropical and subtropical conditions and harvested when the fruits are physiologically immature (Kathiravan *et al*., 2006). It is eaten as a vegetable, either boiled or fried or stuffed. It is affluent in nutrients and bioactive compounds contents such as phenolics, flavonoids, vitamins (including β-carotene, vitamin A, vitamin B_2, α- tocopherol, vitamin C, and vitamin E), amino acids, carbohydrates and minerals (especially potassium), and it is low in energy content (about 17 Kcal/100 g of fresh pumpkin) and has large amount of fiber (Tamer *et al*., 2010). It has various medicinal effects comprising anti-diabetic, anti-hypertensive, anti-tumor, anti-mutagenic, immunomodulating, anti-bacterial, anti-hypercholestero-lemic, intestinal anti-parasitic and anti-inflammation effects, and utilization possibilities of various Cucurbitaceae species have been reported (Kostalova *et al*., 2009). Caili *et al*. (2006) reported that squash is rich in carotenoids, beta carotene (a precursor to vitamin A), lutein, zeaxanthin, protein, vitamin C, vitamin B_6, fiber, magnesium, potassium.

Pruning can encourage faster growth of new shoots, which has the potential to bloom (Thakur *et al*., 2018). Male flower pruning is very effective for increased growth and number of female flowers of squash. Male flower pruning can also improve air circulation and help to prevent the powdery mildew that squash is susceptible too. The application of male flower pruning technique is still a few due to the limited knowledge and poor information obtained by farmers. Pruning of male flower is needed as the effort to increase the growth and yield of squash. Some farmers who embark on large scale production of squash lack cultural practices like pruning in its production. Pruning is an act of cutting off plant branches or leaves or male flowers so as to encourage flowering or fruiting (George, 2004). Shoots, flowers and fruits are pruned to maintain a proper balance between the vegetative growth and fruit load. This will maximize production (Vandre, 1990). Plant growth and other factors can be modified by pruning to suit human needs and desires.

The key constraints to sustainable vegetable production are low moisture content, emergence of multiple nutrient deficiencies, low use and unbalanced use of fertilizers (Shaheen *et al*., 2010). In this case, many farmers have resorted to the use of inorganic fertilizers such as Urea (46% N) is important factor for vigorous growth due to its immediate availability to the plant roots and hence high yields (Mohamed *et al*., 2012). Nitrogen is an essential nutrient which is a determining factor in crop production and is absorbed primarily in the form of nitrate (Tisdale and Nelson, 1990). It constitutes about 1.5-6% of the dry weight of many crops apart from being a constituent many organic compounds, nucleic acids and protein compounds (Sanjuan *et al.*, 2003). Nitrogen also plays a role in chlorophyll synthesis and hence the process of photosynthesis and carbon dioxide assimilation (Jasso-Chaverria *et al*., 2005) and occurs in soil in organic and inorganic forms (Jones, 2003). Plants absorb nitrogen mainly in the nitrate (NO_3^-) and ammonium (NH_4^+) forms, both of which are metabolized by plants. It stimulates vegetative growth resulting in large stems and leaves. It also influences crop quality. Whereas, Alscher *et al.* (1997) added that every plant like any other organism needs certain components for growth and the basic components of living cells are proteins. The main source of protein in plant tissues is urea as a source of nitrogen and/or amino acids. Moreover, nitrogen is the fundamental ingredients for process of protein synthesis. Al-Said and Kamal (2008) reported that the importance of nitrogen came from widely use for the biosynthesis of large variety of non-protein nitrogenous materials, i.e. pigments, vitamins, coenzymes pyrine and pyrimidine bases. Nitrogen also mediates the utilization of potassium, phosphorus and other elements in plants and the optimum amounts of these elements in the soil cannot be utilized efficiency if nitrogen is deficient in plants (Brady and Ray, 2016). Under nitrogen deficiency, plants exhibit stunted growth and small leaves while excess nitrogen results in lush plants with soft tissue and lateness in maturity (Wolf, 1999). Swiader *et al*. (1994) and Abdel-Fattah and Sorial (1988) reported that squash is a crop responded strongly to fertilizer, and nitrogen fertilizer has been shown to increase the yield due to an increase in number of fruits per plant. However, the use of excess nitrogenous fertilizers in production of vegetables leads to accumulation of nitrates beyond safe limits which have been shown to be detrimental to human health (Musa *et al*., 2010).

Therefore, this study aimed to determine the effect of male flower pruning and nitrogen on the growth and yield of squash. Considering above factors, the present study was undertaken with the following objectives:

- To find out the effect of male flower pruning on growth and yield of squash
- To find out the effect of different doses of nitrogen on growth and yield of squash
- To find out the combined effect of male flower pruning and different doses of nitrogen on growth and yield of squash.

CHAPTER II

REVIEW OF LITERATURE

CHAPTER II
REVIEW OF LITERATURE

At present squash (*Cucurbita pepo* L.) is considered as a popular vegetable crop of the world and also in Bangladesh. Limited research works have been done in different parts of the world to study the effect of male flower pruning and nitrogen on growth and yield of squash. However, some of the literatures relevant to effect of male flower pruning and nitrogen on squash production are reviewed in this chapter.

2.1 Effect of pruning

Removing squash flowers helps to control the productivity of a plant. Squash plants tend to produce more male flowers than female, but excess male blooms can be removed so the plants can focus on fruit development. The blossoms are also edible. The bright yellow flowers supply a delicacy for the table, often served lightly breaded and fried or stuffed with a cream cheese filling. Summer squash (*Cucurbita pepo*) and pumpkin (*Cucurbita maxima*) provide the best choices for eating because winter squash blossoms have a bitter flavor (Harrington, 2020).

Johannes *et al*. (2016) studied the combined effects of shoot pruning (one or two stems) and inflorescence thinning (five or ten flowers per inflorescence) on greenhouse tomato yield and fruit quality during the dry season (DS) and rainy season (RS). Poor fruit set, development of undersized (mostly parthenocarpy) fruits, as well as the physiological disorders blossom-end rot (BER) and fruit cracking (FC) turned out to be the prevailing causes deteriorating fruit yield and quality. The proportion of marketable fruits was less than 10% in the RS and around 65% in the DS. In both seasons, total yield was significantly increased when plants were cultivated with two stems, resulting in higher marketable yields only in the DS. While the fraction of undersized fruits was increased in both seasons when plants were grown with a secondary stem, the proportions of BER and FC were significantly reduced. Restricting the number of flowers per inflorescence invariably resulted in reduced total yield. However, in neither season did fruit load considerably affect quantity or proportion of the marketable yield fraction. Inflorescence thinning tended to promote BER and FC, an effect which was only significant for BER in the RS. In conclusion, for greenhouse tomato production under climate conditions as they are prevalent in

Central Thailand, the cultivation with two stems appears to be highly recommendable whereas the measures to control fruit load tested in this study did not proof to be advisable.

Mir *et al*. (2019) conducted a research to observe the effect of pruning on the Bangladeshi local cucumber variety “Baromashi”. Three pruning treatments (control: no pruning, P_1: pruning to three primary branches, P_2: pruning to five primary branches) were used to see the vegetative growth, flowering pattern and yield-related characters of cucumber plants. Pruning increased the number of primary and secondary branches of cucumber plants however; pruning had negative effect on the stem elongation. It was also found that intensive pruning (P_2: pruning to five primary branches) enhanced the number of primary and secondary branches than the light pruning. Adversely, pruning decreased the number of nodes for 1st female flower. Time requirement for flowering had negative effect with pruning but pruning showed positive effect on the total male and female flowers. Although pruning had no effect on the green cucumber fruits harvesting, fruit characteristics like individual fruit length, fruit girth and fruit weight were increased in P_2 treatment compare to the P_1 and control treatment. These results were also reflected the total yield of cucumber fruits and significantly increased after pruning.

Tripti (2017) conducted a field experiment from November 2015 to February 2016 to study the effect of leaf pruning and vermicompost on growth and yield of squash (*Cucurbita pepo*). Three different pruning practices; Control (No pruning, P_0), P_1 (First and second leaf pruning at 20 DAT), P_2 (Third and fourth leaf pruning at 30 DAT) and four different doses of vermicompost; Control (No vermicompost, V_0), V_1 (5 t/ha), V_2 (10 t/ha) and V_3 (15 t/ha) were applied in the experiment. Maximum stem length (64.74 cm at harvest), leaf per plant (20.33), the highest (318.67 gm) individual fruit weight, the highest (21.35 cm) fruit length, the highest yield (21.07 t/ha) was found in P_1 treatment. The maximum stem length (68.26 cm), the leaf per plant (21.56), the female flower (8.11), the total number of fruit (5.11), the individual fruit weight (383.67 gm), the length of fruit (21.61 cm), the diameter of fruit (5.19 cm) and the yield (39.20 t/ha) were found in V_2 treatment. First pruning at 20 DAT and 10 t/ha vermicompost combination gave the highest yield (48.33 t/ha) and the lowest yield was recorded from P_0V_0 treatment combination. So, P_1V_2 is a suitable combination for the better growth and yield of squash.

Mardhiana *et al*. (2017) conducted the study aimed to determine the effect of pruning on the growth and yield of cucumbers in acid soil. The study was conducted using the treatment of without pruning (P_0), the shoot of pruning's on the main stem (P_1), pruning of whole lateral branches above the third section (P_2), and pruning of 2 lateral branches that emerged first above the third section (P_3). The results showed that plant height was 16.17% (P_1) and 2.26% (P_2) lower also 0.13% higher (P_3) than the control (P_0). The highest number of leaves was found in treatment P_1 (16.19%) compared to P_0. The best fruit diameter was also found in P_1 treatment with 4.93% difference compared to P_0. Furthermore, a highly significant and the best result on weight per fruit were also obtained by P_1 treatment. The results showed that the fruit weight of P_1 treatment (11.39%) was higher than P_0. This study provided new information that the pruning treatment of shoots on the main stem of cucumber variety Mercy in acid soil could increase the diameter and weight of cucumber.

Oga and Umekwe (2016) conducted the experiment to evaluate the effects of pruning and plant spacing on the growth and yield of watermelon (*Citrullus lanatus* L.). The treatment comprised of two pruning methods (pruning and non-pruning) and three different plant spacing (50 cm × 40 cm, 50 cm × 50 cm and 50 cm × 60 cm). Spacing at 50 cm × 60 cm was the adequate measurement for minimizing days to 50% flowering (37.19 days) and maximizing a total number of fruits (2.94), the weight of fruits (3.03 kg) and total yield (7.57 kg/ha). The pruned plants produced the longest vine (90.14 cm) number of leaves (15.78), number of flowers (10.31) and number of fruits (2.63). It is recommended that farmers should use the spacing 50 cm × 60 cm and adopt pruning as one of the cultural practices in raising the crop for maximum production.

Alam *et al*. (2016) carried out the study with BARI hybrid tomato 4, planted in BARI Gazipur, Bangladesh to find out the response of plants to some staking and pruning treatments on yield, fruit quality and cost of production of summer tomato. Plants were staked on inverted 'V' shaped staking, high platform and string. The plants were pruned to two stems, three stems, four stems and no pruning as control. Results showed that significantly the highest total number of fruits per plant (37.1), marketable fruits per plant (33.7), yield per plant (1.68 kg) and total yield (44.6 t/ha) were produced by the plants having the treatment string staking with four stems. The highest fruit set (43.50%) was found in the plants staking with a string having three stems. Plants were grown on string staking allowing two stems gave the maximum length (4.71 cm), diameter (4.83 cm) and weight (53.4 g) of single fruit as well as maximum fruit firmness (3.43 kg-f cm^{-2}). From the economic point of view, it was apparent that summer tomato produced by string staking with four stem pruning exhibited better performance compared to other treatment combinations in relation to net return and BCR (2.10).

Zarei *et al*. (2016) conducted an experiment to evaluate the effect of head pruning and different nutritional systems (chemical, biological and integrated) on yield and seed oil content in medicinal pumpkin (*Cucurbita pepo* L.). The experimental treatments consisted of two levels- no head pruning, control (C_0) and head pruning (C_1) allocated to the main plots. Four levels of different fertilizing systems- control (without fertilizer) (T_0), chemical (T_1), biological (a combination of nitrogen-fixing bacteria, *Azospirillum brasilense* and *Glomus mosseae*) (T_2), and integrated fertilizing system (biological fertilizer + 50% chemical fertilizer) (T_3) were assigned to the sub-plots. The highest grain yields of 53 and 50 g per square meter were obtained in integrated and chemical fertilizing systems, respectively while no pruning was applied. The highest fruit yields of 3,710 and 3,668 kg per hectare were produced by chemical and integrated fertilizing systems, respectively.

Ekwu et *al*. (2012) conducted an experiment and with comparing the performance of pruning bushes with no pruning and saw that the factors such as the number of leaves, number of flowers, Days to 50% flowering on the main axis, the pruning treatments were performed better on it. The factors such as the number of fruits, fruit length, fruit diameter, fruit weight, fruit number of non-market-friendly and also more marketable fruits were obtained with pruning treatment.

Gholipouri and Nazarnejad (2007) carried out an experiment to evaluate the effects of planting methods (seed sowing and transplanting) and head pruning (no pruning, pruning after 12^{th} node and pruning after 16^{th} node) on yield and yield components such as number of branches (sub-branches) per plant, fruits per plant, growth, fruit size, weight of fresh fruit, weight of seeds per fruit, number of seeds per fruit and seed yield of medicinal pumpkin. Seedlings were grown in heated greenhouse and seedlings were at the four leaves stage, both seeds and seedlings were planted at the same time in the farm. Maintenance operations were done during the growing season. Head pruning treatments were done in the forecast time. The results showed that the planting methods had a significant effect on the number of ripening fruits per plant, fruits diameter, the weight of seeds per fruit, the weight of 1000 seeds and seed yield had no significant effect on the other traits. Also, the results indicated that head pruning treatments had significant effects on the number of branches per plant, growth and seed yield and no sign on the other traits. In this experiment the most seed yield 997.8 kg ha^{-1} obtained from the transplanting method with head pruning after 12^{th} node and the least seed yield obtained from control.

2.2 Effect of nitrogen

Refai and Hassan (2019) carried out two field experiments during spring and autumn of 2017 and 2018. The investigation amid to study the effect of irrigation regimes and partially substitution of inorganic N fertilizer with biofertilizer on growth, flowering, yield and yield attributes as well as water productivity of squash under different plantation seasons using drip irrigation system. The treatments were three irrigation regimes (1.0, 0.8 and 0.6 IW: CPE) and four N fertilization application (P_1: 100% inorganic N, P_2: 25% inorganic N + Biogein, P_3: 50% inorganic N + Biogein and P_4: 100% inorganic N + Biogein). Squash (*Cucurbita pepo* L.) cv. "Eskandarany" seeds were sown in holes on 1^{st} April at spring season and 1^{st} September in autumn season. The results indicated that autumn sown surpassed spring sown in most studied traits, except growth traits, number of female flowers and fruit diameter. Irrigation squash plants at 1.0 IW: CPE and fertilized with 100% inorganic N + biofertilizer (Biogein) recorded the highest values of growth traits such as plant height and number of leaves $plant^{-1}$. Applying 1.0 or 0.8 IW: CPE enhanced the response of squash plants to the nitrogen fertilization treatments that containing 100% inorganic N + biofertilizer (Biogein), consequently, increasing the yield of squash. Data also show that medium irrigation regime (0.8 IW: CPE) gave the maximum values of physical and economic irrigation water productivity (PIWP and EIWP). Physical irrigation water productivity values were ranged from 2.64 to 3.17 kg m^{-3} at spring season, whereas, they ranged from 4.73 to 5.31 kg m^{-3} at autumn season under the same irrigation treatment. The same irrigation regime was surpassed the other irrigation regimes on EIWP values, where they were 8.99 and 10.76 L.E. m^{-3} at spring season; 16.08 and 18.06 L.E. m-3 at autumn season. It could be concluded that planting squash plants in autumn season saved 30.65 to 34.53% of irrigation water compared with spring season. Irrigating squash plants with 0.8 IW: CPE plus fertilizing with 100% inorganic N + biofertilizer (Biogein) to save about 20% of irrigation water and improve squash productivity.

Wahocho and Maitlo (2017) carried out a study to evaluate the effect of various nitrogen applications on the economic performance of muskmelon. Nitrogen fertilization at higher rates enhances the yield of crop plants; however, overuse of N in cultivation of crop not only decreased nitrogen use efficiency of crop plants but caused severe environmental pollution. Hence, the optimum use of N is prerequisite for sustainable development of agriculture. This research work was laid out at experimental site of Horticulture Orchard, Sindh Agriculture University, Tandojam in Pakistan with three replications in RCBD. The growth and yield performance of muskmelon was assessed by using six nitrogen (N) levels viz., 0, 30, 60, 90, 120 and 150 kg ha^{-1}. Two varieties including Chandny and Golden Tumbro were used in the current study. The result showed that effect of different nitrogen doses on the economic important parameters of muskmelon was significant for all the studied traits. The crop fertilized with maximum level of N had positive effect on vegetative traits and produced the tallest plants with more branches. Nitrogen also showed significant effects on fruits characteristics and produced plants with more fruits, highest weight and maximum yield. The results further reflected that there was a significant reduction in all vegetative and fruit contributing characters with each reduction in N application rate. The cultivars revealed a highly significant response to various N doses. The variety Golden Tumbro showed maximum vine length (201.00 cm), more branches $vine^{-1}$ (3.4222), more fruit $vine^{-1}$ (6.7339), the highest fruits weight $vine^{-1}$ (3.0056 g), maximum single fruit weight (656.83 g), fruit yield $plot^{-1}$ (4.4450 kg) and fruit yield (24.635 t ha^{-1}).

Naderi *et al*. (2017) conducted a study to evaluate the growth and yield of pumpkin *(Cucurbita pepo* L.) under different nitrogen rates and to determine the nitrogen use efficiency (NUE) of pumpkin in two growing seasons (2013 and 2014). In both growing seasons, nitrogen fertilizer (at three rates including 50, 150, and 250 kg ha^{-1}) was band-dressed on the planted side of each furrow, coinciding with 4-6 leaves stage and flowering. Crop performance over 2 years was evaluated by measuring shoot dry matter, crop growth rate (CGR), leaf area index (LAI), leaf area duration (LAD), intercepted PAR, radiation use efficiency (RUE), shoot nitrogen uptake, water use efficiency (WUE), NUE, and fruit and seed yield. The results showed that in both growing seasons, the highest growth and yield of pumpkin were obtained by applying 250 kg N ha^{-1} (using urea fertilizer containing 46% nitrogen). Increased nitrogen rate from 50 to 250 kg ha^{-1} resulted in 87.3%, 27.0%, 62.1%, 87.5%, and 84.5% increase in shoot dry weight, RUE, WUE, fruit yield, and seed yield of pumpkin, respectively, across both growing seasons. However, higher application nitrogen rate decreased the NUE of pumpkin, i.e., the NUE decreased by 62.5% when the nitrogen rate increased from 50 to 250 kg ha^{-1}. The effect of nitrogen applied in 2014 growing season on growth and yield of pumpkin was higher than that in 2013 growing season, which might be due to more suitable weather condition. In conclusion, the nitrogen rate of 250 kg ha^{-1} produced the highest amount of fruit and seed yield in pumpkin.

Sabreen *et al*. (2015) carried out an experiment during two successive summer seasons of 2012/2013 and 2013/2014 at El-Khattara Experimental Farm, Faculty of Agriculture, Zagazig University, Sharkia Governorate, Egypt, to study the effect of nitrogen fertilization and foliar spray with chitosan on growth, yield and fruits quality of summer squash plants grown in sandy soil. This experiment included nine treatments which were the combinations between three rates of nitrogen (45, 60 and 75 kg /feddan) and three concentrations of chitosan (0.0, 0.05 and 0.10g/l). The results revealed that the fertilization of summer squash plants with N at 75 kg/feddan significantly enhanced plant growth characters, yield and its components, and nutrients (N, Fe, Cu, Mn and B). While, T.S.S. (%), P and K contents in fruits were not significantly affected. Moreover, spraying with chitosan at 0.10g/l significantly increased plant growth characters, yield and its components, T.S.S. (%), N and P. On the other hand, it decreased Fe, Zn, Cu and B content in fruits. In addition, the interaction treatments between N at 75 kg/feddan and spraying plants with chitosan at 0.10g/l gave the highest values of plant growth, yield and its components, N as well as P content in summer squash fruits.

Ngetich *et al*. (2013) stated that zucchini (*Cucurbita pepo* L.) is a newly introduced crop and is increasingly becoming an economically important vegetable crop in Rwanda despite of its low production due to insufficient or no fertilizer application. In view of this, they conducted a field research at Higher Institute of Agriculture and Animal Husbandry (ISAE), Northern Province, Rwanda with the aim of determining the optimum nitrogen rate (Urea 46%) that could maximize zucchini productivity. Two experiments in a Randomized Complete Block Design with five treatments (0, 40, 80, 120 and 160 kg N ha^{-1}) replicated four times were set up from September to November in 2011 and 2012. The parameters assessed were vegetative characteristics, yield and soil characteristics. The growth was significantly ($p<0.05$) affected by nitrogen nutrition. Plants subjected to 160 kg N ha^{-1} exhibited increase of about 22.9-55.9% in plant height; 28.0- 29.4% in stem diameter; 26.6- 39.7% number of leaves; 61.0- 204.1% leaf area and 103.2- 235.2% leaf area index compared to the control. Male and female flowers from plants subjected to 120 kg N ha^{-1} were more by between 13.9- 30.8% and 7.5- 63.5% respectively in contrast to the control. Biomass yield from 120 and 160 kg N ha^{-1} was 15.9 t ha^{-1} and about 99% higher than the control. Maximum yield was realized from plants subjected to 120 kg N ha^{-1} which averaged at 11.3 t ha^{-1} and 86.0% higher than the control.

Zaman *et al*. (2011) conducted experiments for two consecutive rabi seasons of 2005-06 and 2006-07 at the Regional Agricultural Research Station (RARS), Jamalpur to find out an optimum dose of nitrogen for the production of garlic (cv. Jamalpur local). There were six levels of nitrogen viz., 0, 50, 100, 150, 200, and 250 kg/ha. The experiment was laid out in randomized complete block design with three replications. Results revealed that nitrogen had significant effects on almost all the parameters studied. Nitrogen@ 150 kg/ha produced the highest bulb yield (6.75 t/ha in 2005-06 and 7.19 t/ha in 2006-07) and there was a reduction of yield with further increment of nitrogen level. The control treatment receiving no fertilizer produced the lowest bulb yield in both the years. The yield benefit for 150 kg N/ha was 40% than the yield obtained from nitrogen control treatment when average of two years' yield is considered.

Mohamed *et al*. (2010) conducted a field experiment during the two successive seasons of 2006 and 2007 at the experimental station of National Research Centre at Shalakan to study the response of squash plant to the foliar spraying (two and three times) of some nutrients (N + Ca, N + K, N + Zn and N only plus control treatments). The three times of foliar application with macro and/or microelements gained the vigour plant growth of squash expressed by length of plant and leaves, average vines and/or leaves per plant, whole fresh and dry weights of plants and their different organs. Also, the total and early fruits yield as well as its physical properties and chemical nutritional values gained when 3 times of foliar application of nutritional fertilizer were applied. The obtained results reveal that the best plant growth measurements of squash were recorded when nitrogen (urea 1.5 %) + potassium (potassium thio sulphate, 36.5 K_2O) and/or nitrogen + calcium (Calborate, 14 % Ca) were applied as a foliar application. Whereas, the differences within these two treatments were no great to be significant. Also, the total and early fruits yield of squash and its physical properties (fruit length, diameter and weight) as well as the nutritional values of fruits (protein, N, P, K, Fe, Zn Cu and Mn). All of these measurements recorded their the highest values when plants were sprayed by nitrogen + potassium and/or nitrogen + calcium.

Tlustos *et al*. (2002) investigated in pot experiment to know the effect of slow release N fertilizers and urea with three vegetables (radish cv. Duo, lettuce cv. Detenicka and carrot cv. Nantes) and two rates of applied N. Directly fertilized radish, subsequently grown unfertilized lettuce and third crop directly fertilized carrot were treated by urea as control treatment and by three samples of slow release fertilizers based on urea formaldehyde condensate of different solubility. Availability of N from slow release samples affected yield of growing vegetables and their nitrogen uptake. Lower availability of N caused lower yields of radish and subsequently grown lettuce mainly on treatments with lower rate of fertilizer compared with urea treatments. Carrot planted as a third vegetable and directly treated by nitrogen showed higher yield at treatments with less soluble samples due to longer growing period and continuing release of N from slow soluble samples. Yield of dry matter of individual vegetables correlated well with uptake of nitrogen determined by balance and isotope methods. Among both isotope techniques introduced, about twice lower utilization than the balance method probably caused by priming effect of N and by unsuitable conditions for plant growth at unfertilized zero treatment.

Salomez and Hofman (2009) carried out an experiment to examine the dependence of butterhead lettuce crops' nitrate concentration on soil mineral nitrogen (N) content. It was shown that the effect of the soil's mineral N content at harvest was strongly associated with the nitrate concentration of lettuce at a low to intermediate mineral N content (<100 kg N ha^{-1}). This demonstrates the importance of N fertilization practices. A lower N application at either recommendation resulted in 71% of the experiments (17/24) having a lower leaf nitrate concentration. The head weight was negatively affected in only 2 of these 17 experiments. Minimizing the N input and hence lowering the soil N content at harvest points to the possibility of further reducing the nitrate concentration level in greenhouse lettuce, while having no significant negative effect on economic yield.

Mohammad (2004) conducted a field experiment to evaluate squash yield and nutrient content in response to different nitrogen fertilization rates and method of N fertilizer application. Four treatments were studied in a randomized complete block design with four replications: zero N (N_0), 50 (N_1), 100 (N_2) and 150 (N_3) mg l^{-1} N concentration in the irrigation water as fertigation treatments and a soil application treatment equivalent to the N_2 treatment. Results showed that flowering was delayed with higher nitrogen doses. Compared to the control (N_0), shoot dry matter and yield were increased by all fertigation N rates and by the soil application treatment. However, soil application gave a lower yield than the equivalent fertigation N rate, indicating the comparative advantage of fertigation. The lowest fertigation N rate was adequate to give the highest yield in the first season, while in the second season a higher rate was necessary to achieve the maximum yield. The growth and fruit yield were higher in the second season as a result of the more favorable climatic conditions. The fruit yield was linearly related to both fruit number and fruit size in both seasons. N contents in shoots increased with N addition and were higher in both fruit and shoot during fruiting with the fertigation method. Soil salinity slightly increased with N application, especially in the top 15 cm, but remained low and acceptable for normal plant growth. Results indicated that fertigation is more effective than soil application in increasing the yield of squash and with fertigation lower nitrogen rates would be adequate to produce higher yield, thus lowering fertilization cost and minimizing environmental impact of over-fertilization.

Matsumoto *et al*. (2001) studied on comparing the nitrogen (N) uptake of four different kinds of vegetables, i.e., Pimento (*Capsicum annuum*), leaf lettuce, Chingensai (a kind of Chinese cabbage, *Brassica pekinensis*), and carrot, from soil to which rapeseed cake (RC) or ammonium sulfate (AS) had been applied at the same N concentration, different N uptake responses were observed. Chingensai and carrot took up more N from the soil with applied RC than with applied AS. On the other hand, Pimento and leaf lettuce grew better on the soil with applied AS than on that with applied RC. In xylem sap of chingensai grown in the soil with applied RC, a peak similar to the protein-like N compound in soil was detected on the HPLC chromatogram. Further, when Chingensai, carrot, and Pimento were cultivated in an N-free medium under aseptic conditions, the N uptake of Chingensai and carrot increased with the addition of protein like N compound extracted from the soil. These results strongly suggest that the superior N uptake response after application of organic material by Chingensai and carrot may be related to the direct uptake of organic N from the soil.

Rehman *et al*. (2001) studied the effect of sowing dates (8, 18 and 28 October and 8 November 1998) and nitrogen levels (0, 20, 40, 60 and 80 kg/ha) on the leaf yield of lettuce cv. Crinkle, an experiment was conducted at Horticulture Farm, NWFP Agricultural University Peshawar, Pakistan, during winter 1998- 99. Leaves per plant, leaf area and leaf yield per hectare were significantly affected by sowing dates. Maximum leaves per plant (13.66), leaf area (73.64 cm^2) and yield/ha (12.3 t) were recorded in plots sown on 18 October. Nitrogen application at the rate of 80 kg/ha significantly affected leaves per plant, leaf area, leaves weight and yield per hectare. Maximum number of leaves per plant (14.88), leaf area (83.83 cm^2), leaves weight (17.19 g/plant) and yield/ha (13.6 t) were noted in plots which received nitrogen at the rate of 80 kg/ha compared to other levels of nitrogen.

Grazia *et al*. (2001) evaluated the effect of light radiation and temperature on the growth patterns of a leafy lettuce cultivar and their interaction with fertilizer application through trials which combined three shade levels (65, 35, and 0%) with three fertilizer application rates (0, 75 and 150 kg N/ha) in a winter sowing date. The same fertilizer application rates were applied to unshaded crops sown in the spring season. Growth rate, yield and quality traits of lettuce were measured. The results showed that radiation level was the most important factor controlling growth in lettuce, whereas the effect of N fertilizer application was only observed in those treatments in which light intensity was not a limiting factor. Results indicated that N fertilizer application rates higher than 75 kg N/ha do not provide any significant benefit to leafy lettuce crops under open field conditions neither in winter nor in spring sowing dates.

CHAPTER III

MATERIALS AND METHODS

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MATERIALS AND METHODS

The experiment was conducted at the Horticulture Farm of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during the period from December 2019 to March 2020 to study the effect of male flower pruning and different doses of nitrogen on growth and yield of squash (*Cucurbita pepo* L.). The details of the materials and methods have been presented below:

3.1 Experimental Location

The present research work was conducted at the Horticulture Farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka, Bangladesh. The location of the site is 90°33´ E longitude and 23°77´ N latitude with an elevation of 8.2 m from sea level. Location of the experimental site presented in Appendix I.

3.2 Climate

The climate of experimental site was subtropical, characterized by three distinct seasons, the winter from November to February and the pre-monsoon period or hot season from March to April and the monsoon period from May to October (Edris *et al.*, 1979). Details on the meteorological data of air temperature, relative humidity, rainfall and sunshine hour during the period of the experiment was collected from the Weather Station of Bangladesh, Agargaon, Dhaka, presented in Appendix II.

3.3 Soil

The soil of the experimental area belongs to the Modhupur Tract (UNDP, 1988) under AEZ No. 28 and was dark grey terrace soil. The selected plot was medium high land and the soil series was Tejgaon (FAO, 1988). The characteristics of the soil under the experimental plot were analyzed in the Soil Testing Laboratory, SRDI, Khamarbari, Dhaka. The details of morphological and chemical properties of initial soil of the experiment plot were presented in Appendix III.

3.4 Planting material

The vegetable crop; squash was considered for the present study. Seeds of BARI squash-1 variety was used.

3.5 Experimental details

3.5.1 Treatments

Factor A: Male flower pruning

P_0= Control (No pruning)

P_1= Male flower pruning at 25 DAT

P_2= Male flower pruning at 35 DAT

Factor B: Nitrogen doses

N_0= Control (No nitrogen)

N_1= 45 kg N ha^{-1}

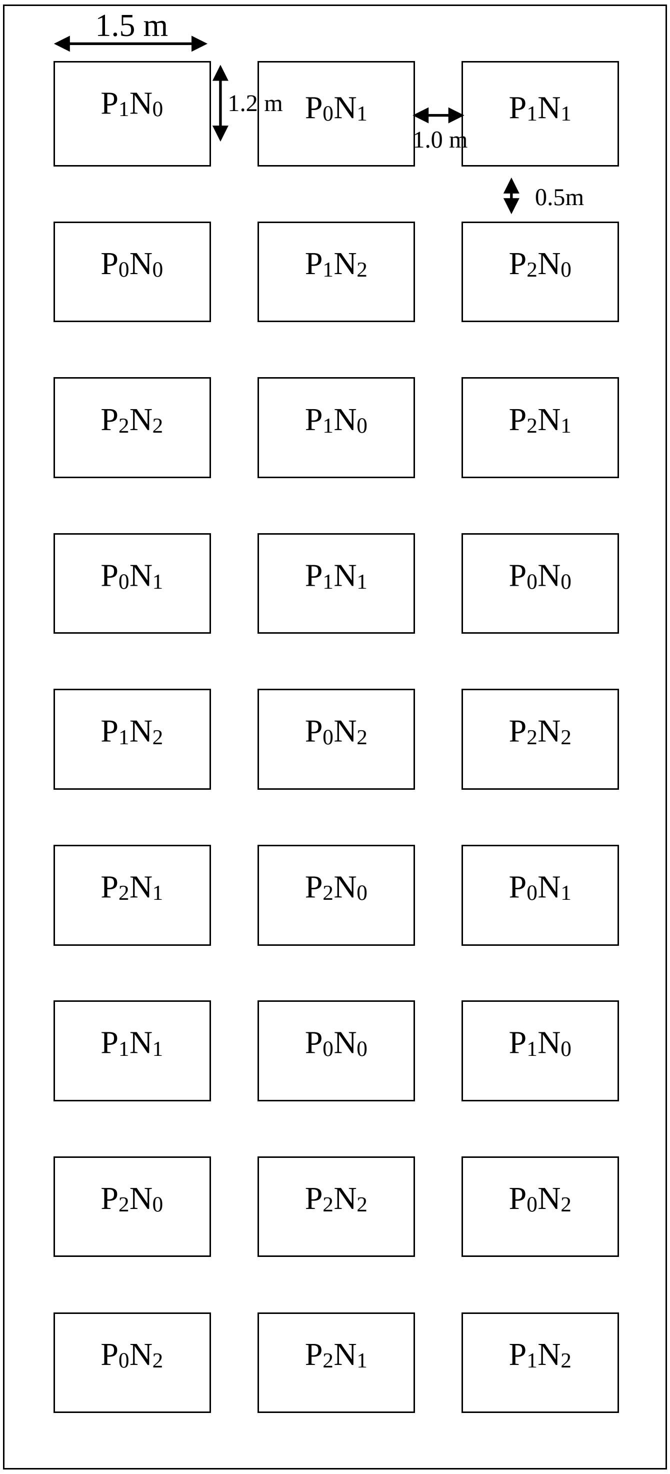
N_2= 90 kg N ha^{-1}

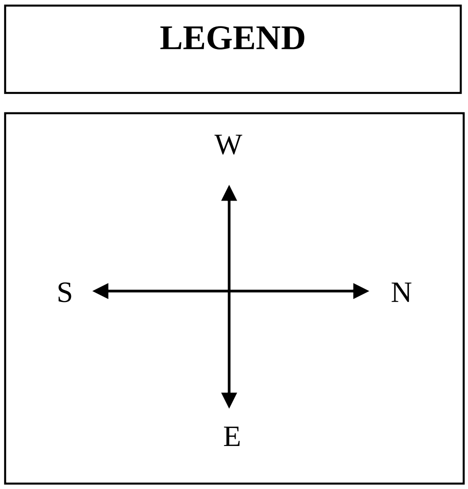
Treatment combinations: Nine treatment combinations were as follows:

P_0N_0, P_0N_1, P_0N_2, P_1N_0, P_1N_1, P_1N_2, P_2N_0, P_2N_1 and P_2N_2

3.5.2 Experimental design and layout

The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. The layout of the experiment was prepared for distributing the combination of male flower pruning and different nitrogen levels. The 9 treatment combinations of the experiment were assigned at random into 27 plots. The size of each unit plot was 1.5 m × 1.2 m (= 1.80 m^2). The distance between blocks and plots were 1.0 m and 0.5 m, respectively.





Plot Size: 1.5 m × 1.2 m
Block to block distance: 1 m
Plot to plot distance: 0.5 m

Treatments
Factor A: Male flower pruning
P_0= Control (No pruning)
P_1= Male flower pruning at 25 DAT
P_2= Male flower pruning at 35 DAT
Factor B: Nitrogen doses
N_0= Control (No nitrogen)
N_1= 45 kg N ha^{-1}
N_2= 90 kg N ha^{-1}

Figure 1. Layout of the experiment field

3.6 Raising of seedlings

3.6.1 Preparation of polybags

Seeds were sown in polybags which were filled with loose friable, dead roots free, sandy loam soil previously mixed with well decomposed cowdung. The soil was treated by Sevin 50WP@ 5kg/ha to protect the seed and young plants from the attack of ants. Size of the polybags was (8 × 8) inches.

3.6.2 Seed treatment

Seed treatment was done by Vitavax @ 3 g/kg seeds to prevent some seed borne diseases.

3.6.3 Seed sowing

The polybags were kept in the bed for raising the seedlings. Seeds were sown in the polybags on 7 December, 2019. Each polybag contained two seeds of squash. After sowing, the seeds were covered with light soil. Watering was done by water cane regularly. Complete germination of the seeds took place with 5 days after seed sowing. Necessary shading was made by white polythene to protect the seedlings from scorching sunshine or rain. No chemical fertilizer was used in the seedbed.

3.7 Preparation of the main field

The plot selected for the experiment was opened on 13 December, 2019 with a power tiller and was exposed to the sun for a few days, after which the land was harrowed, ploughed and cross-ploughed several times followed by laddering to obtain a good tilth. Weeds and stubble were removed and finally obtained a desirable tilth of soil for transplanting. The land operation was completed on 20 December 2019. The individual plots were made by raising soil (20 cm high) from the ground level.

3.8 Fertilizers and manure application

The N, P, K fertilizer were applied according to Krishi Projukti Hat Boi (BARI, 2019) through urea, triple super phosphate (TSP) and muriate of potash (MoP), respectively. Cowdung also used as organic manure. Nitrogen (N) was applied through urea as per treatment. Nutrient doses used through fertilizers under the present study are presented as follows:

Nutrients	Manures/fertilizers	Doses ha^{-1}
-	Cowdung	10 ton
N	Urea	As per treatment
P	TSP	175 kg
K	MoP	150
S	Gypsum	100 kg
Zn	$ZnSO_4$	12.50 kg
B	Borax	10 kg
MgO	Mg	12.50 kg

Full amount of TSP, MoP, well decomposed cowdung, gypsum, $ZnSO_4$, borax and MgO were applied at the time of final land preparation following some research work above squash was done in abroad and BARI recommendation for cucurbitaceous crop. Urea was applied in three equal installments at 15, 25 and 35 days after transplanting (DAT), respectively.

3.9 Application of male flower pruning

Two male flower pruning was done including control. First pruning was done at 25 days after transplanting (DAT) and second was at 35 DAT to keep female and male flower ratio of 5:1.

3.10 Transplanting of seedlings

Healthy and uniform sized 15 days old seedlings were taken separately from the seedbed and were transplanted in the experimental field on 27 December, 2019 maintaining plant spacing of 0.75 m × 0.75 m. The bags were cut with a sharp knife so that tender seedlings could be planted with adjacent root soil. This operation was carried out during late hours in the evening. The seedlings were watered after transplanting.

3.11 Intercultural operation

After establishment of seedlings, various intercultural operations were accomplished for better growth and development of squash.

3.11.1 Gap filling and weeding

When the seedlings were established, the soil around the base of each seedling was pulverized. A few gaps filling was done by healthy plants from the border whenever it was required. Weeds of different types were controlled manually as and when necessary.

3.11.2 Irrigation

Light irrigation was given immediately after transplanting around each seedling for their better establishment. Watering was done up to five days until they become capable of establishing on their own root system. Irrigation was given by observing the soil moisture condition.

3.11.3 Plant protection

The insects were controlled successfully by spraying Ripcord 10EC @ 1ml/L water and Confider 200SC @ 25 ml/100L water. To remove fungal diseases, Tilt 250EC @ 20 ml/100L water was sprayed as fungicide. The insecticide was sprayed fortnightly from a week after transplanting to a week before first harvesting.

3.11.4 Pollination

Pollination was done by hand manually as and when necessary.

3.12 Harvesting

Fruits were harvested during maturity stage. Harvesting was started from 13 February, 2020 and completed by 30 March, 2020.

3.13 Data collection

The following parameters were considered for data collection:

3.13.1 Growth parameters

1. Plant height (cm)
2. Stem length (cm)
3. Number of leaves plant^{-1}
4. Leaf length (cm)
5. Leaf breadth (cm)
6. Stem base diameter (cm)

3.13.2 Yield contributing parameters

1. Days to 1st flowering
2. Number of female flowers
3. Fruit length (cm)
4. Fruit diameter (cm)
5. % fruit dry weight

3.13.3 Yield parameters

1. Number of fruits plant^{-1}
2. Single fruit weight (g)
3. Fruit weight plant^{-1} (g)
4. Fruit yield (t ha^{-1})

3.13.4 Economic analysis

1. Total cost of production (Tk. ha^{-1})
2. Gross return (Tk. ha^{-1})
3. Net return (Tk. ha^{-1})
4. BCR

3.14 Procedure of recording data

3.14.1 Growth parameters

3.14.1.1 Plant height (cm)

The height of plant was recorded in centimeter (cm) at different days after transplanting of crop duration. Data were recorded as the average of 2 plants from each plot. The height was measured from the ground level to the tip of the leaves by meter scale. Data was taken at 25, 45, 70 and 90 days after transplanting (DAT).

3.14.1.2 Stem length (cm)

The stem length was recorded in centimeter (cm) at different days after transplanting of crop duration with a meter scale. Data were recorded from each plot. The length was measured from the ground level to the top of the stem using meter scale. Data were taken at 25, 45, 70 and 90 days after transplanting (DAT).

3.14.1.3 Number of leaves plant^{-1}

Number of leaves per plant was counted at different days after transplanting of crop. Leaves number per plant was recorded from each selected plant of each plot and mean was calculated. Data was taken at 25, 45, 70 and 90 days after transplanting (DAT).

3.14.1.4 Leaf length (cm)

Leaf length was measured by using a meter scale. The measurement was taken from base of leaf to tip of the petiole. Average length of leaves was taken from five random selected leaves from each plant from each plot. Data was recorded from 25, 45, 70 and 90 days after transplanting (DAT). Mean was expressed in centimeter (cm).

3.14.1.5 Leaf breadth (cm)

Leaf breadth was measured by using a meter scale. Average breadth of leaves was taken from five random selected leaves from each plant from each plot. Data was recorded at 25, 45, 70 and 90 days after transplanting (DAT). Thus, mean was recorded and expressed in centimeter (cm).

3.14.1.6 Stem base diameter (cm)

Diameter of stem base in centimeter (cm) was recorded from each plants of each plot at different days after transplanting (at 45, 70 and 90 DAT) at the base portion of the plant with a slide caliper. The average value is termed as stem base diameter.

3.14.2 Yield contributing parameters

3.14.2.1 Days to 1st flowering

Days to first (1st) flowering was recorded from the date of transplanting to when first flower is appeared in each plant and the average value was calculated.

3.14.2.2 Number of female flowers

Number of female flowers was counted from each plant of each plot and mean was calculated. Female flowers were selected based on the presence of initial oval shape fruit like structure at the base of flower.

3.14.2.3 Fruit length (cm)

The length of the fruit was measured with a meter scale in centimeter from the neck of the fruit to the bottom of the fruit. It was measured from each plot and their average was calculated in centimeter.

3.14.2.4 Fruit diameter (cm)

The diameter of individual fruit was measured in several directions from five selected fruits with slide calipers and the average of all directions was finally recorded and expressed in centimeter (cm).

3.14.2.5 Percent (%) fruit dry weight

Fresh 100 g sample of fruit from each plot were taken and placed in oven maintained at temperature 70^0C for 72 hours. The samples were then transferred into desiccators to dry them and allowed to cool down at room temperature. The average dry weight of the samples was taken and percent (%) dry matter of fruit was calculated by following formula:

$$\text{Percent (\%) dry matter of fruit} = \frac{\text{Dry weight of fruit (g)}}{\text{Fresh weight of fruit (g)}} \times 100$$

3.14.3 Yield parameters

3.14.3.1 Number of fruits plant^{-1}

Total number of fruits was counted from each plant of each plot from first harvest to last harvest and average number of fruits was calculated and termed as number of fruits per plant.

3.14.3.2 Single fruit weight (g)

From first harvest to last harvest total fruit number was counted and total fruit weight was measured from each plant of each plot to determine single fruit weight. Single fruit weight was calculated from total fruit weight dividing by total number of fruits.

3.14.3.3 Fruit weight plant^{-1} (kg)

Total fruit was collected from 1st harvest to last harvest from each plant of each plot and weighed and thus total fruit weight per plot was collected. Fruit weight plant^{-1} was calculated by the following formula:

$$\text{Fruit weight plant}^{-1}\text{ (kg)} = \frac{\text{Total fruit weight per plot}}{\text{Number of plants per plot}}$$

3.14.3.4 Fruit weight t ha^{-1}

After collection of fruit per plot, it was converted to ton per hectare by the following formula:

$$\text{Fruit yield per hectare (ton)} = \frac{\text{Fruit yield per plot (kg)} \times 10000\ \text{m}^2}{\text{Plot size (m}^2\text{)} \times 1\,000\ \text{kg}}$$

3.14.4 Economic analysis

Economic analysis was done to find out the cost effectiveness of different treatments and return was done in details according to the procedure of Alam *et al*. (1989).

3.14.4.1 Total cost of production (tk. ha^{-1})

All the material and non-material input cost, interest on fixed capital of land and miscellaneous cost were considered for calculating the total cost of production. Total cost of production (input cost, overhead cost), gross return, net return and BCR are presented in Appendix XVIII.

3.14.4.2 Gross income (tk. ha^{-1})

Gross income was calculated on the basis of mature fruit sale. The price of squash was assumed to be Tk. 10.00 kg^{-1} basis of current market value of farmer level, at the time of harvesting.

3.14.4.3 Net returns (tk. ha^{-1})

Net return was calculated by deducting the total production cost from gross income for each treatment combination.

$$\text{Net return (tk. ha}^{-1}\text{)} = \text{Gross return} - \text{Total production cost}$$

3.14.4.4 Benefit cost ratio (BCR)

The economic indicator BCR was calculated by the following formula for each treatment combination.

$$\text{Benefit cost ratio (BCR)} = \frac{\text{Gross income per hectare}}{\text{Total cost of production per hectare}}$$

3.15 Statistical analysis

The data obtained for different characters were statistically analyzed to observe the significant difference among the treatment by using the MSTAT-C computer package program. The mean values of all the characters were calculated and analysis of variance was performed. The significance of the difference among the treatments means was estimated by the Least Significant Difference (LSD) Test at 5% level of probability (Gomez and Gomez, 1984).

CHAPTER IV

RESULTS AND DISCUSSION

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RESULTS AND DISCUSSION

This study was carried out to find out the effect of male flower pruning and different doses of nitrogen on growth and yield of squash (*Cucurbita pepo* L.). Data on different growth, yield contributing characters and yield were recorded. The results of the analyses of variance (ANOVA) on different characters have been presented in Appendix IV-XVIII. The findings of the experiment have been presented and discussed with the help of table and graphs and possible interpretations were given under the following headings:

4.1 Growth parameters

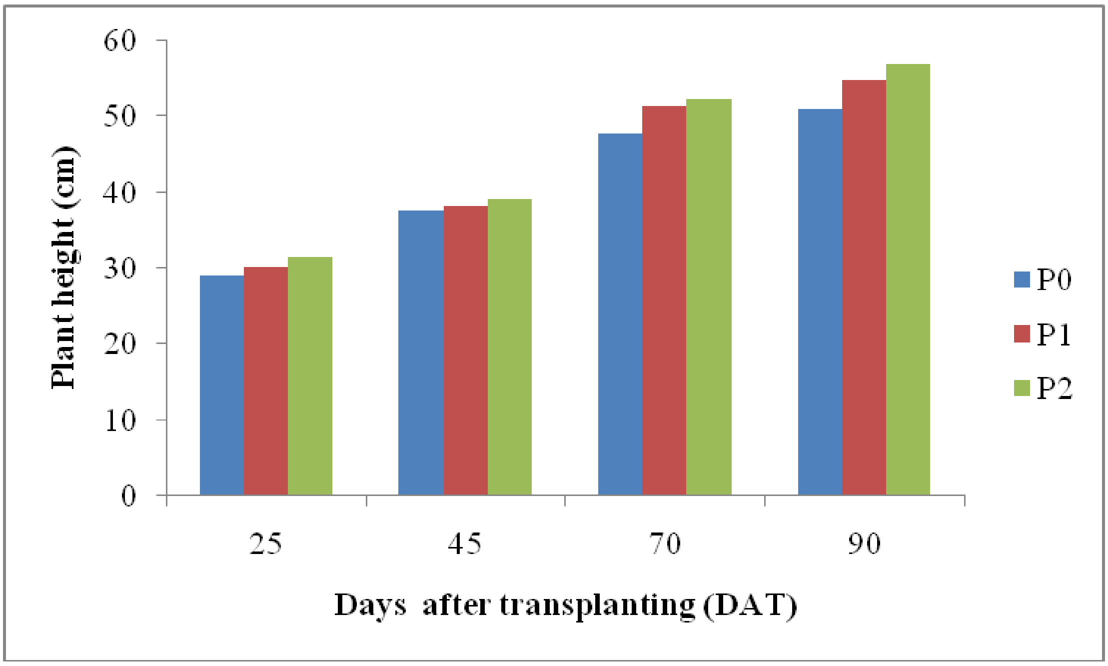
4.1.1 Plant height (cm)

Effect of male flower pruning

Significant variation was not found on plant height at different growth stages of squash influenced by different male flower pruning levels (Figure 2 and Appendix IV & V). However, the highest plant height (31.50, 39.22, 52.44 and 56.90 cm at 25, 45, 70 and 90 DAT, respectively) was found from the treatment P_2 (male flower pruning at 35 DAT) whereas, the lowest plant height (29.11, 37.61, 47.72 and 51.07 cm at 25, 45, 70 and 90 DAT, respectively) was found from the control treatment P_0 (no pruning).

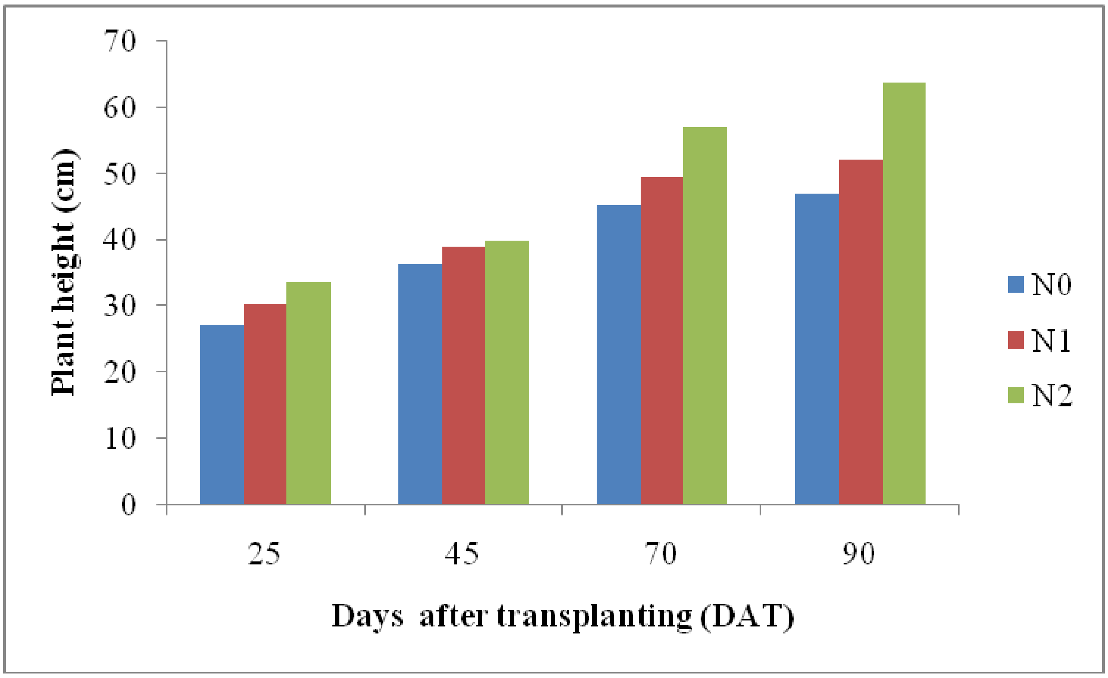
Effect of nitrogen (N)

Plant height at different growth stages of squash was influenced significantly by different nitrogen levels (Figure 3 and Appendix IV & V). Results revealed that the highest plant height (33.56, 39.83, 57.00 and 63.67 cm at 25, 45, 70 and 90 DAT, respectively) was found from the treatment N_2 (90 kg N ha^{-1}) followed by N_1 (45 kg N ha^{-1}) whereas the lowest plant height (27.11, 36.33, 45.22 and 46.96 cm at 25, 45, 70 and 90 DAT, respectively) was found from the control treatment N_0 (no nitrogen). Ngetich *et al*. (2013) found similar result with the present study who observed that plants subjected to 160 kg N ha^{-1} exhibited increase of about 22.9 - 55.9% in plant height compared to the control.



(Here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT and P_2= Male flower pruning at 35 DAT)

Figure 2. Plant height of squash as influenced by male flower pruning at different growth stages ($LSD_{0.05}$= 2.474^{NS}, 2.427^{NS}, 4.883^{NS} and 5.376^{NS} at 25, 45, 70 and 90 DAT)



(Here, N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1} and N_2= 90 kg N ha^{-1})

Figure 3. Plant height of squash as influenced by nitrogen at different growth stages ($LSD_{0.05}$= 1.051, 1.142, 1.016 and 1.483 at 25, 45, 70 and 90 DAT)

Combined effect of male flower pruning and nitrogen

Different combination of male flower pruning and nitrogen levels showed significant influence on plant height of squash at different growth stages (Table 1 and Appendix IV). It was recorded that the highest plant height (35.33, 40.50, 59.50 and 66.52 cm at 25, 45, 70 and 90 DAT, respectively) was found from the treatment combination of P_2N_2 which was statistically same with the treatment combination of P_1N_2 at 70 and 90 DAT. The lowest plant height (26.67, 38.33, 42.17 and 43.77 cm at 25, 45, 70 and 90 DAT, respectively) was found from the treatment combination of P_0N_0 which was significantly different from other treatment combinations.

Table 1. Plant height of squash as influenced by male flower pruning and nitrogen at different growth stages

Treatment	Plant height (cm)			
	25 DAT	45 DAT	70 DAT	90 DAT
P_0N_0	26.67 f	35.17 e	42.17 g	43.77 g
P_0N_1	28.83 de	38.33 cd	48.00 de	50.10 de
P_0N_2	31.83 c	39.33 bc	53.00 b	59.33 b
P_1N_0	27.17 f	35.67 e	46.00 f	47.72 f
P_1N_1	30.17 d	39.50 ab	49.83 cd	51.86 d
P_1N_2	33.50 b	39.67 ab	58.50 a	65.17 a
P_2N_0	27.50 ef	38.17 d	47.50 ef	49.38 ef
P_2N_1	31.67 c	39.00 bcd	50.33 c	54.83 c
P_2N_2	35.33 a	40.50 a	59.50 a	66.52 a
$LSD_{0.05}$	1.371	1.063	1.843	1.913
CV (%)	8.17	10.60	7.70	8.89

(In a column means having similar letter(s) is/ are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability; here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT, P_2= Male flower pruning at 35 DAT and N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1}, N_2= 90 kg N ha^{-1})

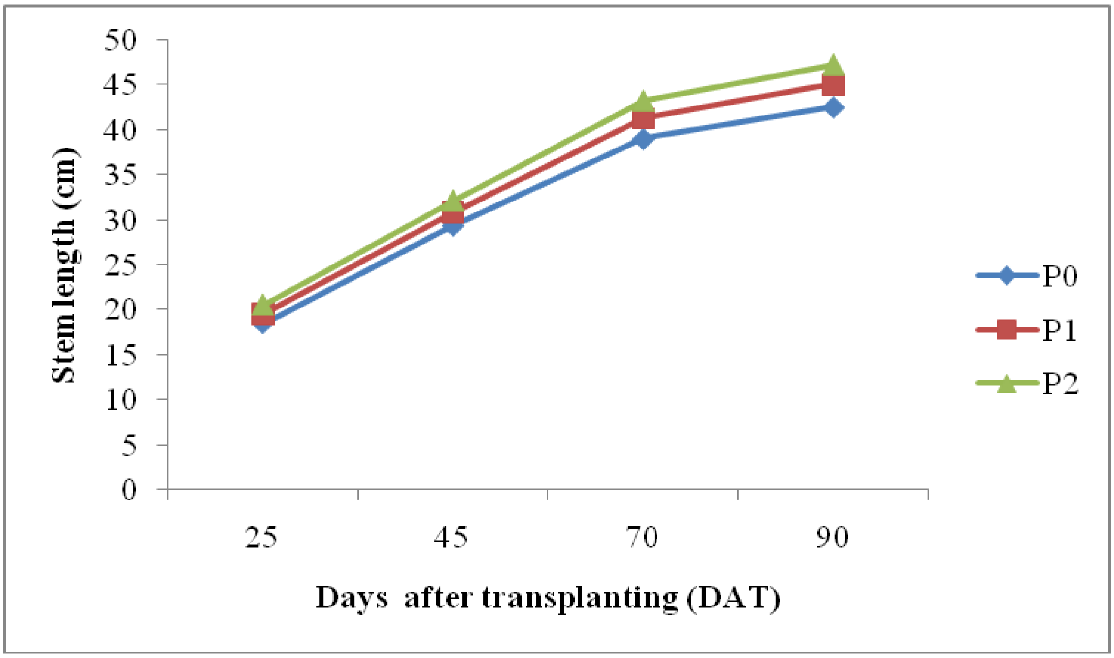
4.1.2 Stem length (cm)

Effect of male flower pruning

Significant difference among the treatments was recorded on stem length at different growth stages except at 25 DAT regarding different male flower pruning levels (Figure 4 and Appendix VI & VII). Results indicated that the highest stem length (20.55, 32.13, 43.2 and 47.24 cm at 25, 45, 70 and 90 DAT, respectively) was found from the treatment P_2 (Male flower pruning at 35 DAT) followed by P_1 (male flower pruning at 25 DAT). The lowest stem length (18.50, 29.34, 39.00 and 42.54 cm at 25, 45, 70 and 90 DAT, respectively) was found from the control treatment P_0 (no pruning). It was also observed the results that stem length was increased with increasing male flower pruning levels which might be due to cause of higher nutrients availability on account of reduced number of male flowers.

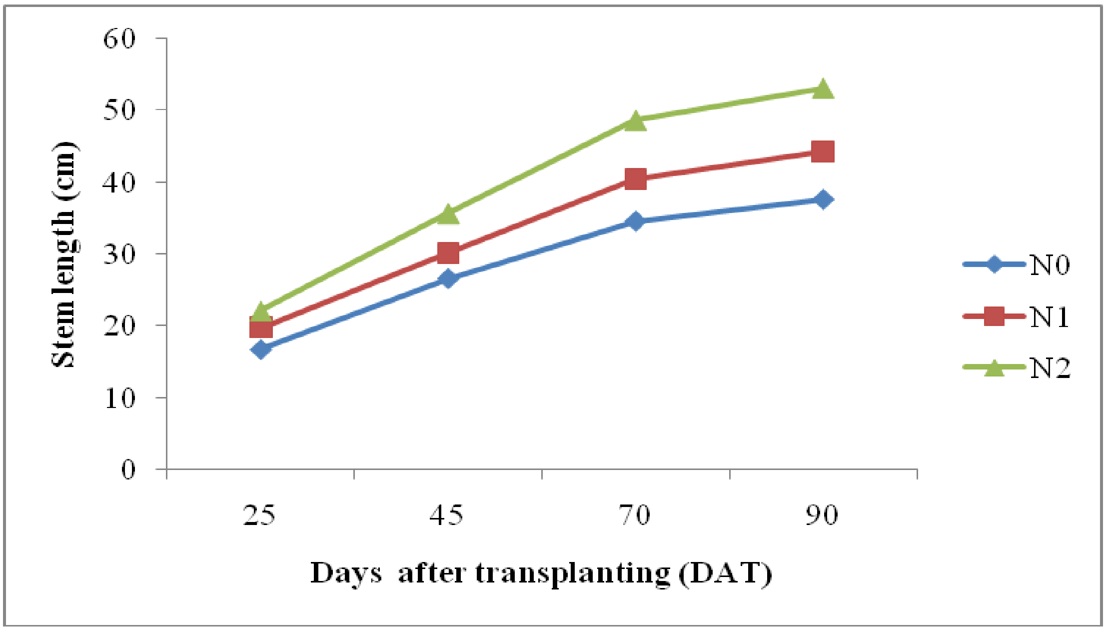
Effect of nitrogen (N)

Stem length at different growth stages was affected significantly due to different nitrogen levels (Figure 5 and Appendix VI & VII). It was observed that stem length was increased with the increasing levels of nitrogen and as a result N_2 (90 kg N ha^{-1}) treatment showed the highest stem length (22.08, 35.61, 48.57 and 53.05 cm at 25, 45, 70 and 90 DAT, respectively) compared to control treatment N_0 (no nitrogen) which gave the lowest stem length (16.81, 26.64, 34.60 and 37.62 cm at 25, 45, 70 and 90 DAT, respectively). The result obtained from the present study was consistent with the findings of Ngetich *et al*. (2013) in squash plant and Wahocho and Maitlo (2017) found the similar results in musk melon.



(Here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT and P_2= Male flower pruning at 35 DAT)

Figure 4. Stem length of squash as influenced by male flower pruning at different growth stages ($LSD_{0.05}$= 2.274^{NS}, 1.466, 1.549 and 2.006 at 25, 45, 70 and 90 DAT)



(Here, N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1} and N_2= 90 kg N ha^{-1})

Figure 5. Stem length of squash as influenced by nitrogen at different growth stages ($LSD_{0.05}$= 1.086, 1.774, 2.097 and 2.104 at 25, 45, 70 and 90 DAT)

Combined effect of male flower pruning and nitrogen

Stem length of squash at different growth stages was influenced significantly by the combined effect of male flower pruning and nitrogen (Table 2 and Appendix VI). At 25, 45, 70 and 90 DAT, the highest stem length (22.75, 36.67, 50.25 and 54.85 cm, respectively) was found from the treatment combination of P_2N_2 which was statistically identical with the treatment combination of P_1N_2 at all growth stages. The lowest stem length (15.67, 25.34, 33.25 and 35.98 cm at 25, 45, 70 and 90 DAT, respectively) was performed by the treatment combination of P_0N_0 which was significantly different from other treatment combination.

Table 2. Stem length of squash as influenced by male flower pruning and nitrogen at different growth stages

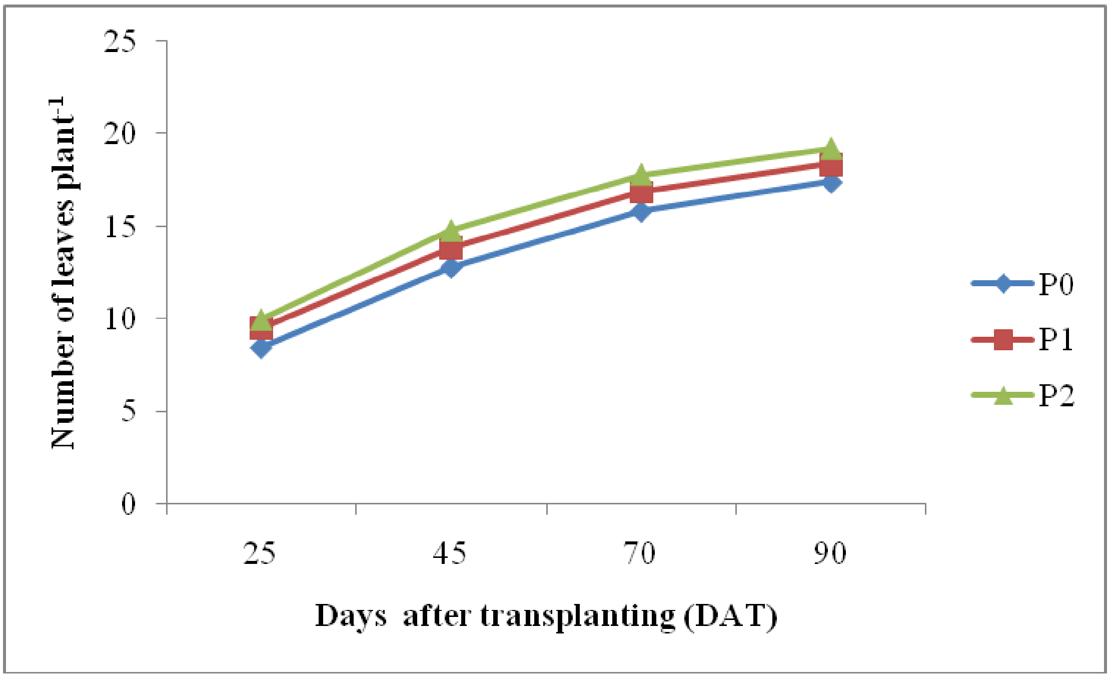
Treatment	Stem length (cm)			
	25 DAT	45 DAT	70 DAT	90 DAT
P_0N_0	15.67 f	25.34 f	33.25 f	35.98 f
P_0N_1	18.88 de	28.88 de	37.92 de	41.45 de
P_0N_2	20.96 b	33.79 b	45.84 b	50.17 b
P_1N_0	16.33 f	26.16 f	33.86 f	36.89 f
P_1N_1	19.76 cd	30.09 cd	40.48 cd	44.31 cd
P_1N_2	22.52 a	36.35 a	49.62 a	54.12 a
P_2N_0	18.42 e	28.42 e	36.68 e	39.98 e
P_2N_1	20.48 bc	31.31 c	42.75 c	46.88 c
P_2N_2	22.75 a	36.67 a	50.25 a	54.85 a
$LSD_{0.05}$	1.199	1.286	2.683	2.860
CV (%)	10.47	8.69	9.64	8.17

(In a column means having similar letter(s) is/ are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability; here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT, P_2= Male flower pruning at 35 DAT and N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1}, N_2= 90 kg N ha^{-1})

4.1.3 Number of leaves plant^{-1}

Effect of male flower pruning

Significant variation was not found on number of leaves plant^{-1} at different growth stages as influenced by different pruning levels (Figure 6 and Appendix VIII & IX). However, the highest number of leaves plant^{-1} (9.96, 14.76, 17.78 and 19.19 at 25, 45, 70 and 90 DAT, respectively) was found from the treatment P_2 (male flower pruning at 35 DAT) whereas the lowest number of leaves plant^{-1} (8.84, 12.81, 15.83 and 17.40 at 25, 45, 70 and 90 DAT, respectively) was found from the control treatment P_0 (no pruning).

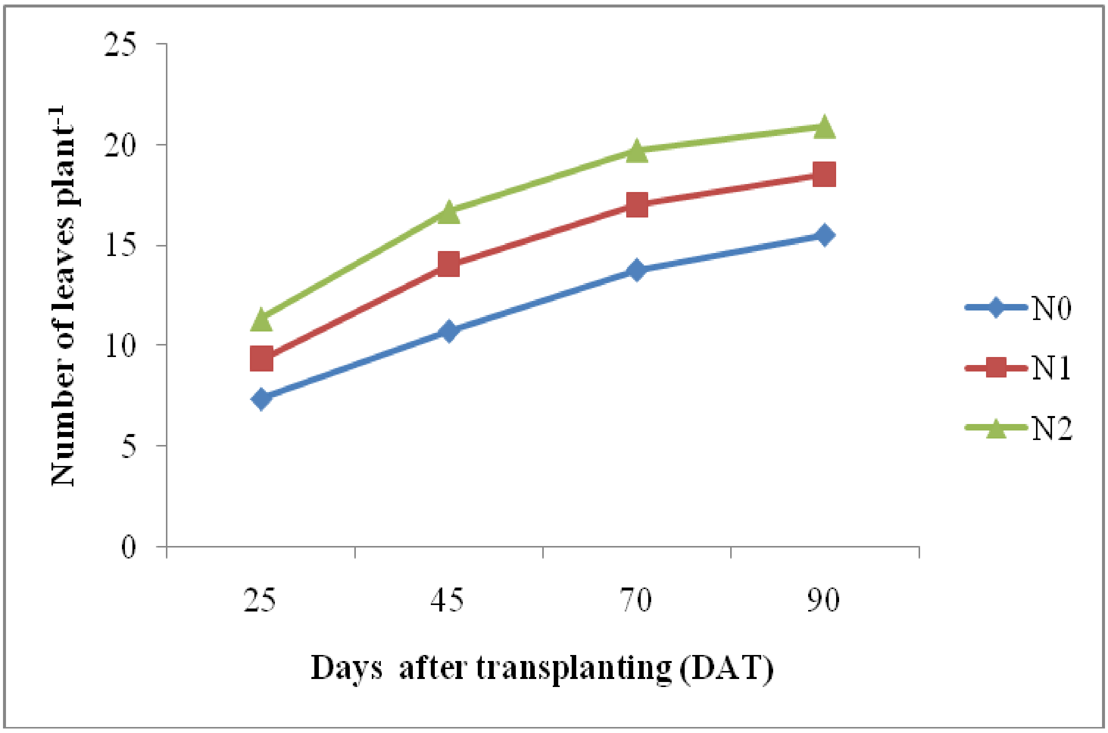


(Here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT and P_2= Male flower pruning at 35 DAT)

Figure 6. Number of leaves plant^{-1} of squash as influenced by male flower pruning at different growth stages ($LSD_{0.05}$= 1.79^{NS}, 2.324^{NS}, 2.529^{NS} and 2.341^{NS} at 25, 45, 70 and 90 DAT)

Effect of nitrogen (N)

Significant influence was recorded on number of leaves plant^{-1} at different growth stages influenced by different nitrogen levels (Figure 7 and Appendix VIII & IX). The highest number of leaves plant^{-1} (11.32, 16.68, 19.72 and 20.92 at 25, 45, 70 and 90 DAT, respectively) was found from the treatment N_2 (90 kg N ha^{-1}) followed by N_1 (45 kg N ha^{-1}) whereas the lowest number of leaves plant^{-1} (7.34, 10.72, 13.77 and 15.52 at 25, 45, 70 and 90 DAT, respectively) was found from the control treatment N_0 (no nitrogen). Similar result was also observed by Jha and Neupane (2018) and Santos *et al*. (2003). Ngetich *et al*. (2013) also found similar result who observed plants subjected to 160 kg N ha^{-1} exhibited increase of about 26.6 - 39.7% number of leaves compared to the control.



(Here, N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1} and N_2= 90 kg N ha^{-1})

Figure 7. Number of leaves plant^{-1} of squash as influenced by nitrogen at different growth stages ($LSD_{0.05}$= 0.459, 0.548, 1.184 and 0.84 at 25, 45, 70 and 90 DAT)

Combined effect of male flower pruning and nitrogen

At 25, 45, 70 and 90 DAT, number of leaves plant^{-1} was influenced significantly by the combined effect of male flower pruning and nitrogen (Table 3 and Appendix VIII). Results revealed that the highest number of leaves plant^{-1} (11.80, 17.41, 20.45 and 21.58 at 25, 45, 70 and 90 DAT, respectively) was found from the treatment combination of P_2N_2 which was statistically similar with the treatment combination of P_1N_2 at all growth stages. P_0N_2 also showed similar result with P_2N_2 at 70 and 90 DAT. The lowest number of leaves plant^{-1} (6.31, 9.37, 12.41 and 14.24 at 25, 45, 70 and 90 DAT, respectively) was found from the treatment combination of P_0N_0 which was statistically similar with the treatment combination of P_1N_0 at 45, 70 and 90 DAT.

Table 3. Number of leaves plant^{-1} of squash as influenced by male flower pruning and nitrogen at different growth stages

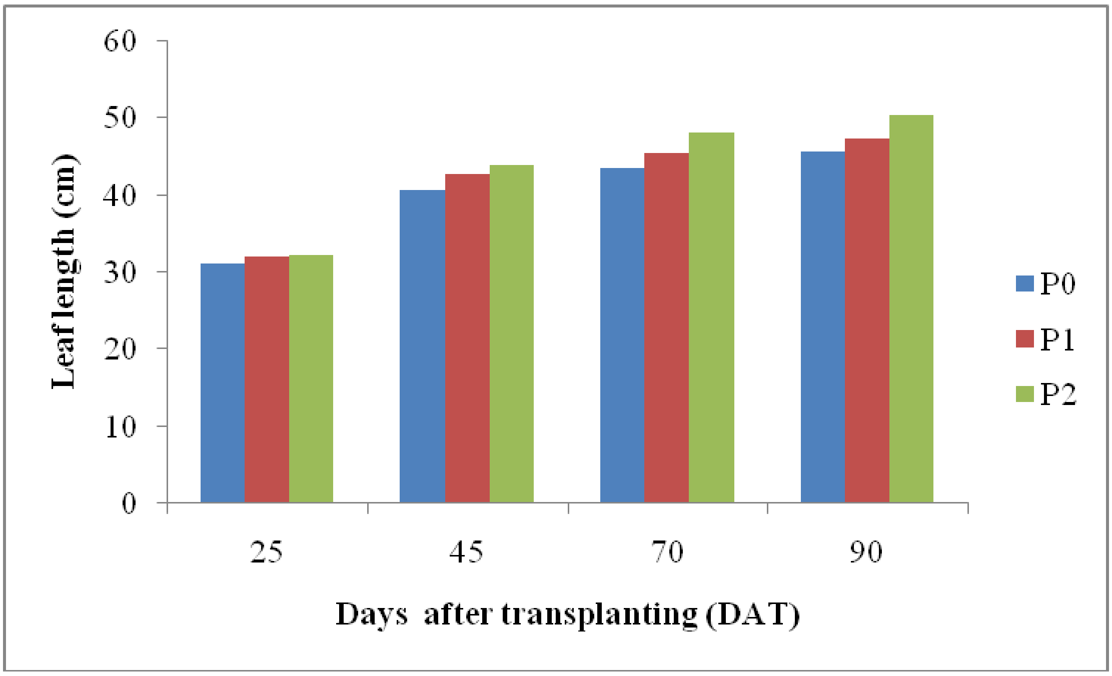
Treatment	Number of leaves plant^{-1}			
	25 DAT	45 DAT	70 DAT	90 DAT
P_0N_0	6.31 f	9.37 g	12.41 f	14.24 f
P_0N_1	8.29 e	13.30 e	16.27 cd	17.87 cd
P_0N_2	10.83 bc	15.76 bc	18.83 ab	20.09 ab
P_1N_0	7.94 e	10.85 f	13.88 ef	15.65 ef
P_1N_1	9.32 d	13.87 de	16.80 cd	18.33 c
P_1N_2	11.31 ab	16.87 ab	19.90 a	21.10 a
P_2N_0	7.76 e	11.95 f	15.01 de	16.68 de
P_2N_1	10.33 c	14.91 cd	17.87 bc	19.31 bc
P_2N_2	11.80 a	17.41 a	20.45 a	21.58 a
$LSD_{0.05}$	0.788	1.223	1.810	1.536
CV (%)	7.89	9.11	8.18	8.81

(In a column means having similar letter(s) is/ are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability; here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT, P_2= Male flower pruning at 35 DAT and N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1}, N_2= 90 kg N ha^{-1})

4.1.4 Leaf length (cm)

Effect of male flower pruning

At 25 and 45 DAT, no significant variation was found among the treatments but at 70 and 90 DAT, significant influence was recorded on leaf length of squash influenced by different male flower pruning levels (Figure 8 and Appendix X & XI). However, the highest leaf length (32.22, 43.89, 48.08 and 50.37 cm at 25, 45, 70 and 90 DAT, respectively) was found from the treatment P_2 (male flower pruning at 35 DAT) followed by P_1 (male flower pruning at 25 DAT). The lowest leaf length (31.22, 40.72, 43.61 and 45.62 cm at 25, 45, 70 and 90 DAT, respectively) was found from the control treatment P_0 (no pruning).

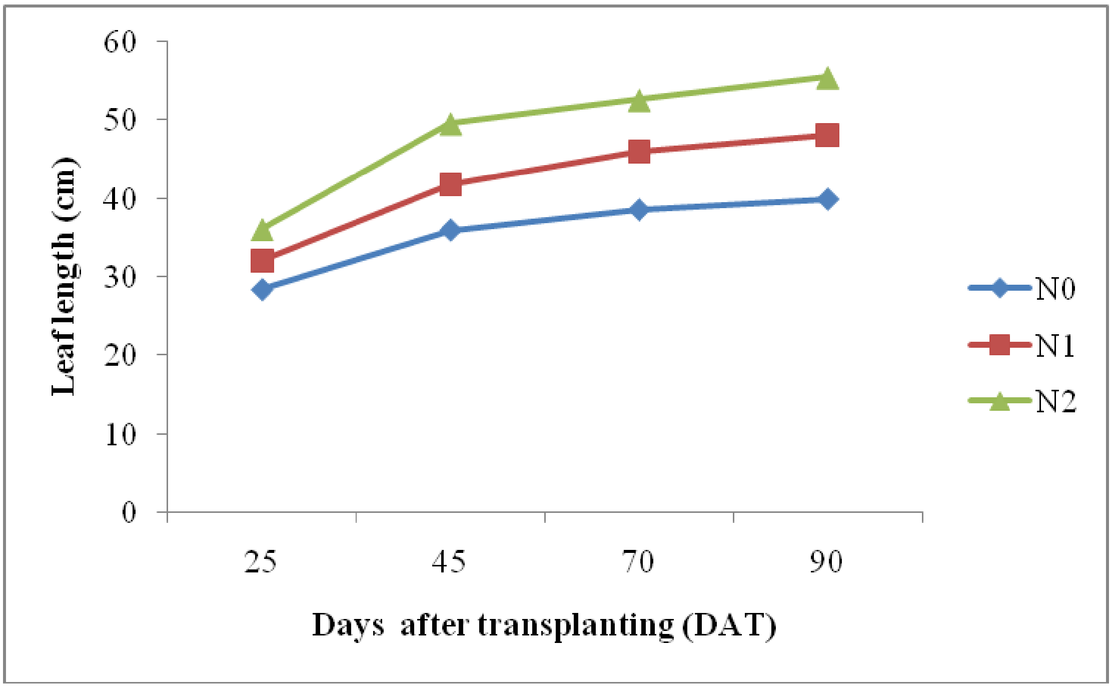


(Here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT and P_2= Male flower pruning at 35 DAT)

Figure 8. Leaf length of squash as influenced by male flower pruning at different growth stages ($LSD_{0.05}$= 2.098^{NS}, 3.2224^{NS}, 2.19 and 2.407 at 25, 45, 70 and 90 DAT)

Effect of nitrogen (N)

Leaf length at different growth stages was affected significantly due to different nitrogen levels (Figure 9 and Appendix X & XI). The highest leaf length (36.00, 49.56, 52.57 and 55.47 cm at 25, 45, 70 and 90 DAT, respectively) was found from the treatment N_2 (90 kg N ha^{-1}) followed by N_1 (45 kg N ha^{-1}) whereas the lowest leaf length (28.44, 36.00, 38.57 and 39.93 cm at 25, 45, 70 and 90 DAT, respectively) was found from the control treatment N_0 (no nitrogen). Ngetich *et al*. (2013) also found similar result who observed plants subjected to 160 kg N ha^{-1} exhibited increase of about 61.0 - 204.1% leaf area and 103.2 - 235.2% leaf area index compared to the control.



(Here, N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1} and N_2= 90 kg N ha^{-1})

Figure 9. Leaf length of squash as influenced by nitrogen at different growth stages ($LSD_{0.05}$= 1.844, 1.87, 2.19 and 1.749 at 25, 45, 70 and 90 DAT)

Combined effect of male flower pruning and nitrogen

At 25, 45, 70 and 90 DAT, number of leaves plant^{-1} was influenced significantly by the combined effect of male flower pruning and nitrogen (Table 4 and Appendix X). The highest leaf length (40.17, 50.50, 53.87 and 56.97 cm at 25, 45, 70 and 90 DAT, respectively) was found from the treatment combination of P_2N_2 which was statistically similar with the treatment combination of P_0N_2 and P_1N_2 at 45, 70 and 90 DAT. The lowest leaf length (25.83, 35.67, 37.17 and 38.47 cm at 25, 45, 70 and 90 DAT, respectively) was found from the treatment combination of P_0N_0 which was statistically similar with the treatment combination of P_1N_0 and P_2N_0 at 45, 70 and 90 DAT.

Table 4. Leaf length of squash as influenced by male flower pruning and nitrogen at different growth stages

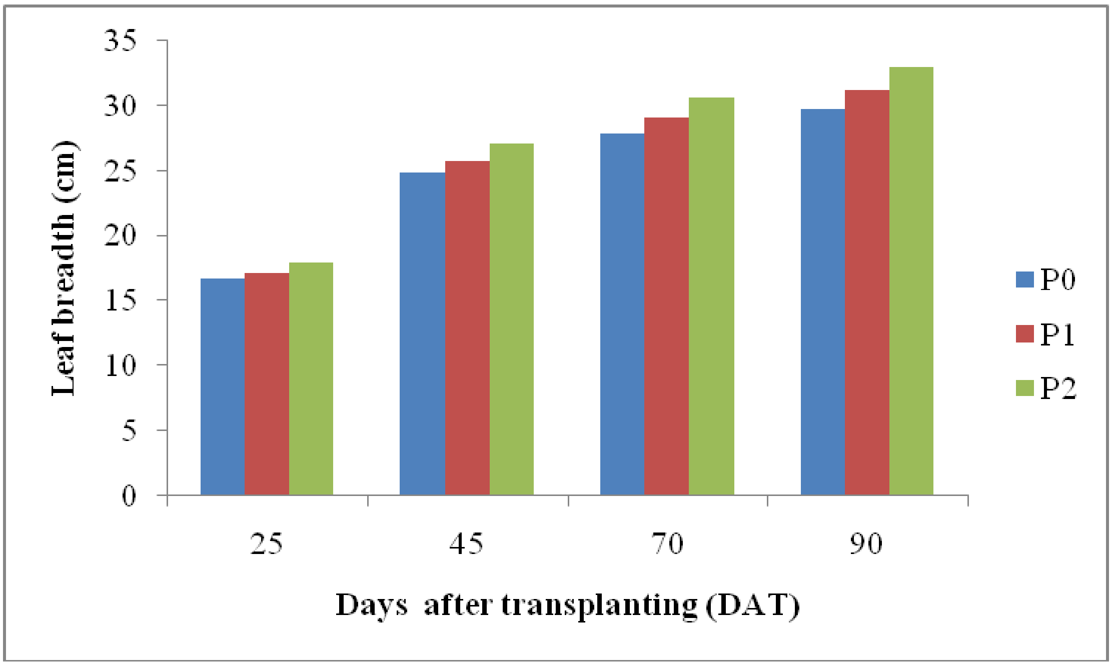
Treatment	Leaf length (cm)			
	25 DAT	45 DAT	70 DAT	90 DAT
P_0N_0	25.83 f	35.67 e	37.17 e	38.47 e
P_0N_1	31.67 d	38.17 d	42.53 cd	44.46 cd
P_0N_2	33.17 c	48.33 a	51.13 ab	53.93 ab
P_1N_0	29.67 e	36.17 de	38.50 e	39.83 e
P_1N_1	31.83 cd	42.17 c	45.09 c	47.02 c
P_1N_2	34.67 b	49.83 a	52.69 ab	55.49 ab
P_2N_0	29.83 e	36.17 de	40.04 de	41.48 de
P_2N_1	32.67 cd	45.00 b	50.32 b	52.65 b
P_2N_2	40.17 a	50.50 a	53.87 a	56.97 a
$LSD_{0.05}$	1.454	2.277	3.170	3.402
CV (%)	7.23	9.02	7.02	10.94

(In a column means having similar letter(s) is/ are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability; here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT, P_2= Male flower pruning at 35 DAT and N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1}, N_2= 90 kg N ha^{-1})

4.1.5 Leaf breadth (cm)

Effect of male flower pruning

Different male flower pruning levels showed significant variation on leaf breadth of squash plant at different growth stages except at 25 and 45 DAT (Figure 10 and Appendix XII & XIII). The highest leaf breadth (18.00, 27.06, 30.69 and 33.01 cm at 25, 45, 70 and 90 DAT, respectively) was found from the treatment P_2 (male flower pruning at 35 DAT) followed by P_1 (male flower pruning at 25 DAT). The lowest leaf breadth (16.67, 24.59, 27.87 and 29.80 cm at 25, 45, 70 and 90 DAT, respectively) was found from the control treatment P_0 (no pruning).

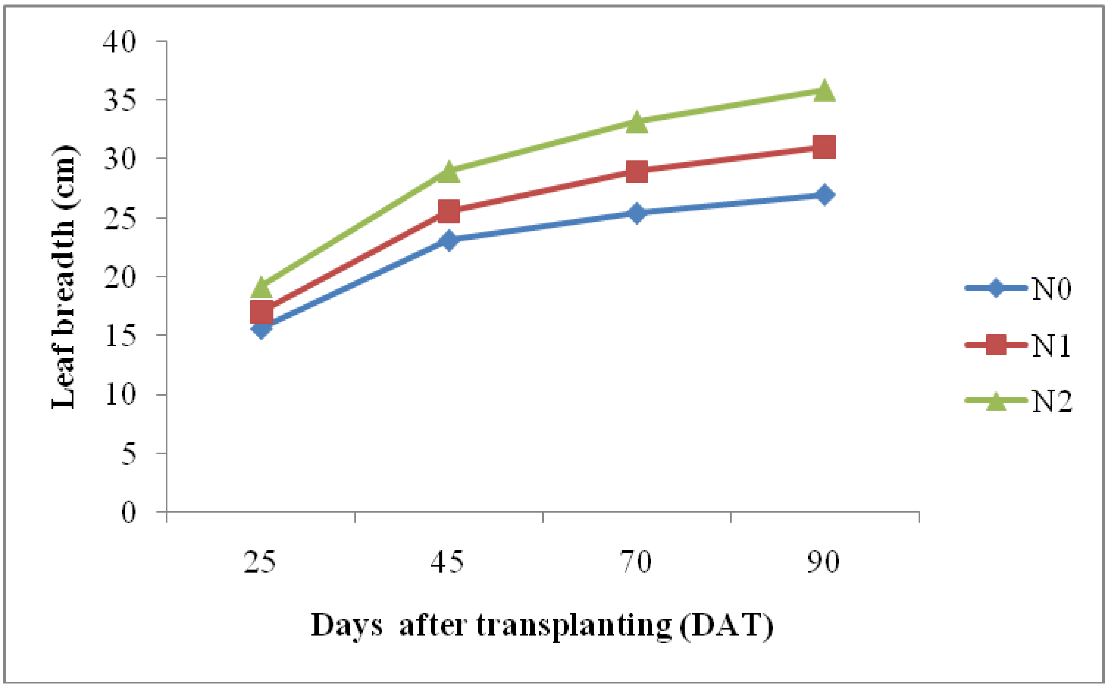


(Here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT and P_2= Male flower pruning at 35 DAT)

Figure 10. Leaf breadth of squash as influenced by male flower pruning at different growth stages ($LSD_{0.05}$= 2.03^{NS}, 3.265^{NS}, 0.752 and 1.044 at 25, 45, 70 and 90 DAT)

Effect of nitrogen (N)

At different growth stages, leaf breadth of squash plant was affected significantly due to different nitrogen levels (Figure 11 and Appendix XII & XIII). The highest leaf breadth (19.22, 29.00, 33.21 and 35.90 cm at 25, 45, 70 and 90 DAT, respectively) was found from the treatment N_2 (90 kg N ha^{-1}) followed by N_1 (45 kg N ha^{-1}) whereas the lowest leaf breadth (15.61, 23.11, 25.42 and 27.00 cm at 25, 45, 70 and 90 DAT, respectively) was found from the control treatment N_0 (no nitrogen). Similar result was also observed by Ngetich *et al*. (2013) who found plants subjected to 160 kg N ha^{-1} exhibited increase of about 61.0 - 204.1% leaf area and 103.2 - 235.2% leaf area index compared to the control.



(Here, N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1} and N_2= 90 kg N ha^{-1})

Figure 11. Leaf breadth of squash as influenced by nitrogen at different growth stages ($LSD_{0.05}$= 1.011, 1.451, 1.789 and 1.797 at 25, 45, 70 and 90 DAT)

Combined effect of male flower pruning and nitrogen

Leaf breadth at different growth stages (25, 45, 70 and 90 DAT), showed significant variation as influenced by the combined effect of male flower pruning and nitrogen (Table 5 and Appendix XII). Results revealed that the highest leaf breadth (20.00, 30.17, 34.73 and 37.60 cm at 25, 45, 70 and 90 DAT, respectively) was found from the treatment combination of P_2N_2 which was significantly different from other treatment combinations followed by P_1N_2 and P_0N_2. The lowest leaf breadth (15.17, 21.83, 23.80 and 25.13 cm at 25, 45, 70 and 90 DAT, respectively) was found from the treatment combination of P_0N_0 which was statistically similar with the treatment combination of P_1N_0 at all growth stages.

Table 5. Leaf breadth of squash as influenced by male flower pruning and nitrogen at different growth stages

Treatment	Leaf breadth (cm)			
	25 DAT	45 DAT	70 DAT	90 DAT
P_0N_0	15.17 g	21.83 g	23.80 g	25.13 f
P_0N_1	16.33 de	24.67 de	27.73 de	29.67 de
P_0N_2	18.50 bc	28.17 b	32.07 b	34.60 b
P_1N_0	15.50 fg	23.00 f	25.30 f	26.87 f
P_1N_1	17.00 d	25.67 cd	29.07 cd	31.17 cd
P_1N_2	19.17 b	28.67 b	32.83 b	35.50 b
P_2N_0	16.17 ef	24.50 e	27.17 e	29.00 e
P_2N_1	17.83 c	26.50 c	30.17 c	32.43 c
P_2N_2	20.00 a	30.17 a	34.73 a	37.60 a
$LSD_{0.05}$	0.8174	1.160	1.385	1.760
CV (%)	7.96	10.39	9.21	8.64

(In a column means having similar letter(s) is/ are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability; here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT, P_2= Male flower pruning at 35 DAT and N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1}, N_2= 90 kg N ha^{-1})

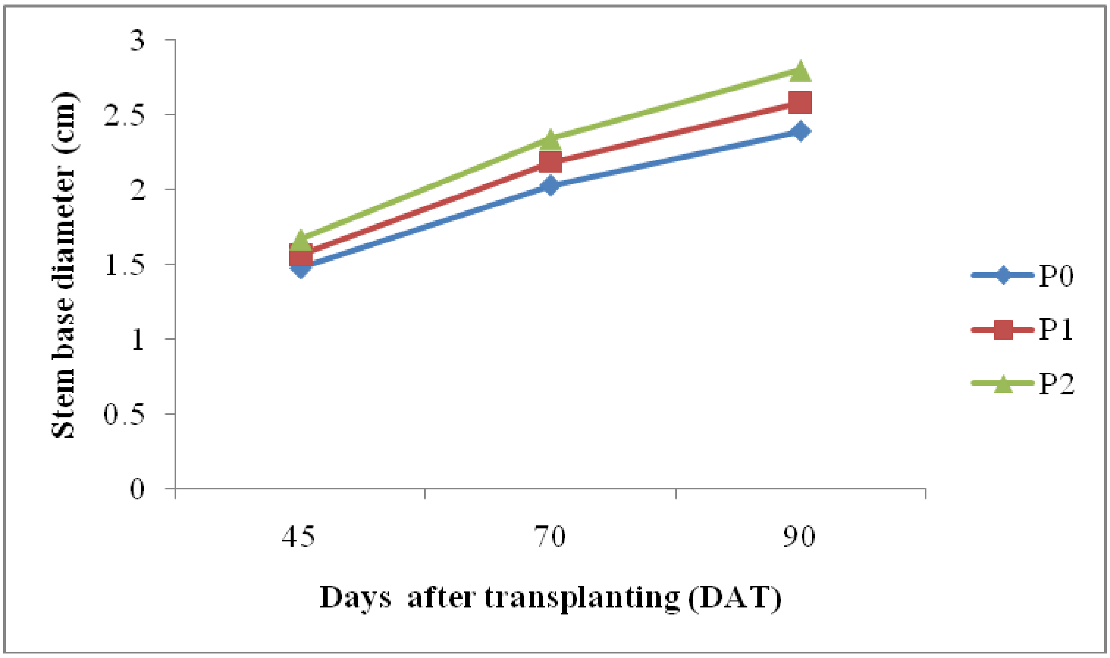
4.1.6 Stem base diameter (cm)

Effect of male flower pruning

Significant variation was not found on stem base diameter at different growth stages of squash influenced by different male flower pruning levels (Figure 12 and Appendix XIV & XV). However, the highest stem base diameter (1.67, 2.34 and 2.80 cm at 45, 70 and 90 DAT, respectively) was found from the treatment P_2 (male flower pruning at 35 DAT) whereas the lowest stem base diameter (1.48. 2.03 and 2.39 cm at 45, 70 and 90 DAT, respectively) was found from the control treatment P_0 (no pruning).

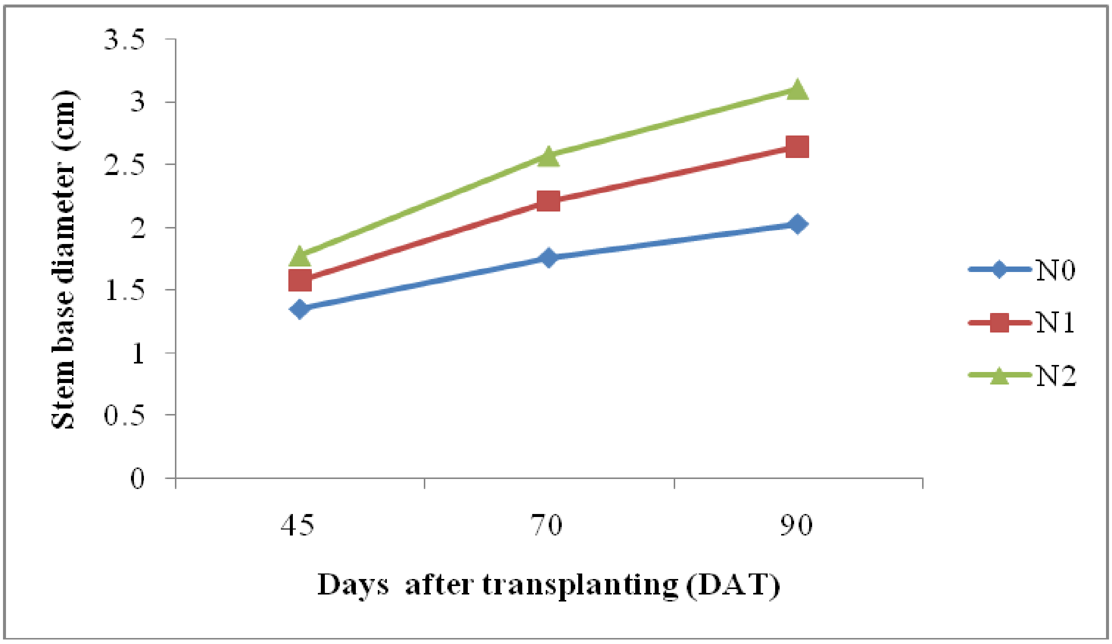
Effect of nitrogen (N)

Stem base diameter at different growth stages was affected significantly due to different nitrogen levels (Figure 13 and Appendix XIV & XV). The highest stem base diameter (1.78, 2.57 and 3.10 cm at 45, 70 and 90 DAT, respectively) was found from the treatment N_2 (90 kg N ha^{-1}) which was statistically identical with N_1 (45 kg N ha^{-1}) at all growth stages of squash. The lowest stem base diameter (1.35, 1.76 and 2.03 cm at 45, 70 and 90 DAT, respectively) was found from the control treatment N_0 (no nitrogen). Similar result was also observed by Ngetich *et al*. (2013) who found 28.0 - 29.4% increase in stem diameter with 160 kg N ha^{-1} compared to the control.



(Here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT and P_2= Male flower pruning at 35 DAT)

Figure 12. Stem base diameter of squash as influenced by male flower pruning at different growth stages ($LSD_{0.05}$= 0.294^{NS}, 0.473^{NS} and 0.615^{NS} at 45, 70 and 90 DAT)



(Here, N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1} and N_2= 90 kg N ha^{-1})

Figure 13. Stem base diameter of squash as influenced by nitrogen at different growth stages ($LSD_{0.05}$= 0.219, 0.451 and 0.556 at 45, 70 and 90 DAT)

Combined effect of male flower pruning and nitrogen

At 25, 45, 70 and 90 DAT, stem base diameter was influenced significantly by the combined effect of male flower pruning and nitrogen (Table 6 and Appendix XIV). It was observed that the highest stem base diameter (1.88, 2.71 and 3.28 cm at 45, 70 and 90 DAT, respectively) was found from the treatment combination of P_2N_2 which was significantly different from other treatment combinations at all growth stages of squash followed by P_1N_2. The lowest stem base diameter (1.21, 1.56 and 1.77 cm at 45, 70 and 90 DAT, respectively) was found from the treatment combination of P_0N_0 which was significantly different from other treatment combinations at all growth stages of squash.

Table 6. Stem base diameter of squash as influenced by male flower pruning and nitrogen at different growth stages

Treatment	Stem base diameter (cm)		
	45 DAT	70 DAT	90 DAT
P_0N_0	1.21 g	1.56 g	1.77 g
P_0N_1	1.51 de	2.06 e	2.45 e
P_0N_2	1.71 b	2.46 bc	2.95 bc
P_1N_0	1.36 f	1.77 f	2.03 f
P_1N_1	1.58 cd	2.22 d	2.64 d
P_1N_2	1.75 b	2.54 b	3.06 b
P_2N_0	1.47 e	1.95 e	2.29 e
P_2N_1	1.66 bc	2.36 cd	2.83 cd
P_2N_2	1.88 a	2.71 a	3.28 a
$LSD_{0.05}$	0.095	0.155	0.189
CV (%)	6.43	8.01	8.75

(In a column means having similar letter(s) is/ are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability; here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT, P_2= Male flower pruning at 35 DAT and N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1}, N_2= 90 kg N ha^{-1})

4.2 Yield contributing parameters

4.2.1 Days to 1st flowering

Effect of male flower pruning

Non-significant variation was observed on days to 1st flowering influenced by different male flower pruning levels (Table 7 and Appendix XVI). However, the highest days to 1st flowering (21.33) was found from the treatment P_2 (male flower pruning at 35 DAT) whereas the lowest days to 1st flowering (20.22) was found from the control treatment P_0 (no pruning).

Effect of nitrogen (N)

Significant influence was noted on days to 1st flowering affected by different levels of nitrogen (Table 7 and Appendix XVI). The highest days to 1st flowering (22.33) was found from the treatment N_2 (90 kg N ha^{-1}) followed by N_1 (45 kg N ha^{-1}) whereas the lowest days to 1st flowering (19.33) was found from the control treatment N_0 (no nitrogen). The result obtained from the present study was similar with the findings of Mohammad (2004) in squash who found delayed flowering with higher nitrogen doses.

Combined effect of male flower pruning and nitrogen

Days to 1st flowering was significantly influenced by the combined effect of male flower pruning and nitrogen levels (Table 7 and Appendix XVI). Results revealed that the highest days to 1st flowering (22.67) was found from the treatment combination of P_2N_2 which was statistically similar with the treatment combination of P_0N_2 and P_1N_2. The lowest days to 1st flowering (18.33) was found from the treatment combination of P_0N_0 which was significantly different from other treatment combinations.

4.2.2 Number of female flowers

Effect of male flower pruning

Considerable variation was observed on number of female flowers influenced by different male flower pruning treatment (Table 7 and Appendix XVI). Results revealed that the highest number of female flowers (5.37) was found from the treatment P_2 (male flower pruning at 35 DAT) followed by P_1 (male flower pruning at 25 DAT) whereas the lowest number of female flowers (4.73) was found from the control treatment P_0 (no pruning).

Effect of nitrogen (N)

Significant influence was remarked on number of female flowers affected by different nitrogen levels (Table 7 and Appendix XVI). The highest number of female flowers (6.19) was found from the treatment N_2 (90 kg N ha^{-1}) followed by N_1 (45 kg N ha^{-1}) whereas the lowest number of female flowers (4.02) was found from the control treatment N_0 (no nitrogen). The result obtained from the present study was similar with the findings of Ngetich *et al*. (2013) and Refai and Hassan (2019) in case of squash.

Combined effect of male flower pruning and nitrogen

Number of female flowers of squash affected by combined effect of male flower pruning and nitrogen levels was significant (Table 7 and Appendix XVI). The highest number of female flowers (6.52) was found from the treatment combination of P_2N_2 which was statistically similar with the treatment combination of P_0N_2 and P_1N_2. The lowest number of female flowers (3.83) was found from the treatment combination of P_0N_0 which was significantly different from other treatment combinations.

4.2.3 Fruit length (cm)

Effect of male flower pruning

Fruit length was significant with the treatment of different male flower pruning (Table 7 and Appendix XVI). The highest fruit length (26.77 cm) was found from the treatment P_2 (male flower pruning at 35 DAT) which was significantly different from other treatments followed by P_1 (male flower pruning at 25 DAT) whereas the lowest fruit length (23.41 cm) was found from the control treatment P_0 (no pruning).

Effect of nitrogen (N)

The recorded data on fruit length was affected significantly due to the application of different nitrogen levels (Table 7 and Appendix XVI). It was observed that the highest fruit length (29.58 cm) was found from the treatment N_2 (90 kg N ha^{-1}) which was significantly different from other treatments followed by N_1 (45 kg N ha^{-1}) whereas the lowest fruit length (20.53 cm) was found from the control treatment N_0 (no nitrogen). Similar result was also observed by Mohamed *et al*. (2010) and Ngetich *et al*. (2013).

Combined effect of male flower pruning and nitrogen

Fruit length varied significantly due to combined effect of male flower pruning and nitrogen levels (Table 7 and Appendix XVI). Results indicated that the highest fruit length (31.40 cm) was found from the treatment combination of P_2N_2 which was significantly different from other treatment combinations followed by P_1N_2. The lowest fruit length (18.82 cm) was found from the treatment combination of P_0N_0 which was statistically same with the treatment combination of P_1N_0.

4.2.4 Fruit diameter (cm)

Effect of male flower pruning

Fruit diameter of squash was influenced significantly due to the treatment of different male flower pruning (Table 7 and Appendix XVI). The highest fruit diameter (8.02 cm) was found from the treatment P_2 (male flower pruning at 35 DAT) followed by P_1 (male flower pruning at 25 DAT) whereas the lowest fruit diameter (7.15 cm) was found from the control treatment P_0 (no pruning).

Effect of nitrogen (N)

Fruit diameter of squash was affected significantly due to the application of different nitrogen levels (Table 7 and Appendix XVI). It was observed that the treatment N_2 (90 kg N ha^{-1}) gave the highest fruit diameter (8.86 cm) was which was significantly different from other treatment followed by N_1 (45 kg N ha^{-1}) whereas the lowest fruit diameter (6.29 cm) was found from the control treatment N_0 (no nitrogen). The result obtained from the present study was similar with the findings of Mohamed *et al*. (2010) and Ngetich *et al*. (2013).

Combined effect of male flower pruning and nitrogen

Fruit diameter varied significantly due to combined effect of male flower pruning and nitrogen levels (Table 7 and Appendix XVI). The highest fruit diameter (9.22 cm) was found from the treatment combination of P_2N_2 which was statistically similar with the treatment combination of P_0N_2 and P_1N_2. The lowest fruit diameter (5.85 cm) was found from the treatment combination of P_0N_0 which was statistically similar with the treatment combination of P_1N_0.

4.2.5 Percent (%) fruit dry weight

Effect of male flower pruning

Variation on percent (%) fruit dry weight was not significant influenced by different male flower pruning treatments (Table 7 and Appendix XVI). However, the highest % fruit dry weight (6.21%) was found from the treatment P_2 (male flower pruning at 35 DAT) whereas the lowest % fruit dry weight (5.86%) was found from the control treatment P_0 (no pruning).

Effect of nitrogen (N)

Percent (%) fruit dry weight of squash obtained from different nitrogen levels showed significant variation (Table 7 and Appendix XVI). N_2 (90 kg N ha^{-1}) treatment gave the highest % fruit dry weight (6.57%) which was statistically same with N_1 (45 kg N ha^{-1}) whereas the lowest % fruit dry weight (5.44%) was found from the control treatment N_0 (no nitrogen). Similar result was also observed by Mohamed *et al*. (2010) and Naderi *et al*. (2017).

Combined effect of male flower pruning and nitrogen

Percent (%) fruit dry weight of squash affected significantly by the combined effect of male flower pruning and nitrogen levels (Table 7 and Appendix XVI). The highest % fruit dry weight (6.72%) was found from the treatment combination of P_2N_2 which was statistically similar with the treatment combination of P_1N_2. The lowest % fruit dry weight (5.22%) was found from the treatment combination of P_0N_0 which was statistically same with the treatment combination of P_1N_0.

Table 7. Yield contributing parameters of squash as influenced by male flower pruning and nitrogen

Treatment	Yield contributing parameters				
	Days to 1st flowering	Number of female flowers	Fruit length (cm)	Fruit diameter (cm)	% fruit dry weight
Effect of male flower pruning					
P_0	20.22	4.73 c	23.41 c	7.15 c	5.86
P_1	20.78	5.04 b	24.89 b	7.55 b	6.01
P_2	21.33	5.37 a	26.77 a	8.02 a	6.21
$LSD_{0.05}$	NS	0.112	0.6719	0.105	NS
CV (%)	6.12	7.70	6.47	7.66	6.97
Effect of nitrogen					
N_0	19.33 c	4.02 c	20.53 c	6.29 c	5.44 b
N_1	20.67 b	4.92 b	24.96 b	7.56 b	6.07 a
N_2	22.33 a	6.19 a	29.58 a	8.86 a	6.57 a
$LSD_{0.05}$	0.8815	0.644	1.565	0.942	0.540
CV (%)	6.12	7.70	6.47	7.66	6.97
Combined effect of male flower pruning and nitrogen					
P_0N_0	18.33 d	3.83 g	18.82 f	5.85 f	5.22 f
P_0N_1	20.33 c	4.54 e	23.60 de	7.13 d	5.93 d
P_0N_2	22.00 ab	5.82 b	27.82 bc	8.47 ab	6.44 bc
P_1N_0	19.67 c	3.97 fg	20.39 f	6.25 ef	5.42 f
P_1N_1	20.33 c	4.91 d	24.77 d	7.48 cd	6.04 d
P_1N_2	22.33 a	6.24 a	29.53 b	8.90 a	6.57 ab
P_2N_0	20.00 c	4.26 ef	22.38 e	6.77 de	5.68 e
P_2N_1	21.33 b	5.32 c	26.53 c	8.06 bc	6.25 c
P_2N_2	22.67 a	6.52 a	31.40 a	9.22 a	6.72 a
$LSD_{0.05}$	0.7624	0.337	1.752	0.782	0.205
CV (%)	6.12	7.70	6.47	7.66	6.97

(In a column means having similar letter(s) is/ are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability; here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT, P_2= Male flower pruning at 35 DAT and N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1}, N_2= 90 kg N ha^{-1})

4.3 Yield parameters

4.3.1 Number of fruits plant^{-1}

Effect of male flower pruning

Number of fruits plant^{-1} was not significant with the treatment of different male flower pruning (Table 8 and Appendix XVII). However, the highest number of fruits plant^{-1} (3.93) was found from the treatment P_2 (male flower pruning at 35 DAT) whereas the lowest number of fruits plant^{-1} (3.69) was found from the control treatment P_0 (no pruning).

Effect of nitrogen (N)

The recorded data on number of fruits plant^{-1} was affected significantly due to the application of different nitrogen levels (Table 8 and Appendix XVII). The highest number of fruits plant^{-1} (4.12) was found from the treatment N_2 (90 kg N ha^{-1}) followed by N_1 (45 kg N ha^{-1}) whereas the lowest number of fruits plant^{-1} (3.46) was found from the control treatment N_0 (no nitrogen). The result obtained from the present study was similar with the findings of Mohamed *et al*. (2010) in summer squash.

Combined effect of male flower pruning and nitrogen

Number of fruits plant^{-1} varied significantly due to combined effect of male flower pruning and nitrogen levels (Table 8 and Appendix XVII). The highest number of fruits plant^{-1} (4.26) was found from the treatment combination of P_2N_2 which was significantly different from other treatment combinations followed by P_1N_2. The lowest number of fruits plant^{-1} (3.32) was found from the treatment combination of P_0N_0 which was statistically similar with the treatment combination of P_1N_0.

4.3.2 Single fruit weight (g)

Effect of male flower pruning

Considerable variation was observed on single fruit weight influenced by different male flower pruning treatment (Table 8 and Appendix XVII). Results revealed that P_2 (male flower pruning at 35 DAT) gave the highest single fruit weight (576.70 g) followed by P_1 (male flower pruning at 25 DAT) whereas the lowest single fruit weight (526.00 g) was found from the control treatment P_0 (no pruning).

Effect of nitrogen (N)

Significant influence was remarked on single fruit weight affected by different nitrogen levels (Table 8 and Appendix XVII). It was observed that the N_2 (90 kg N ha^{-1}) treatment gave the highest single fruit weight (620.70 g) followed by N_1 (45 kg N ha^{-1}) whereas the lowest single fruit weight (474.90 g) was found from the control treatment N_0 (no nitrogen). The result obtained from the present study was consistent with the findings of Mohamed *et al*. (2010) in summer squash. Wahocho and Maitlo (2017) also found similar result.

Combined effect of male flower pruning and nitrogen

Single fruit weight of squash affected by combined effect of male flower pruning and nitrogen levels was significant (Table 8 and Appendix XVII). Results indicated that the treatment combination of P_2N_2 showed the highest single fruit weight (648.20 g) which was significantly different from other treatment combinations followed by P_1N_2 whereas P_0N_0 gave lowest single fruit weight (451.60 g) which was significantly different from other treatment combinations.

4.3.3 Fruit weight plant^{-1} (kg)

Effect of male flower pruning

Fruit weight plant^{-1} was significant with the treatment of different male flower pruning (Table 8 and Appendix XVII). The highest fruit weight plant^{-1} (2.28 kg) was found from the treatment P_2 (male flower pruning at 35 DAT) which was significantly different from other treatments followed by P_1 (male flower pruning at 25 DAT) whereas the lowest fruit weight plant^{-1} (1.96 kg) was found from the control treatment P_0 (no pruning).

Effect of nitrogen (N)

The recorded data on fruit weight plant^{-1} was affected significantly due to the application of different nitrogen levels (Table 8 and Appendix XVII). The treatment N_2 (90 kg N ha^{-1}) gave highest fruit weight plant^{-1} (2.56 kg) which was significantly different from other treatments followed by N_1 (45 kg N ha^{-1}) whereas the lowest fruit weight plant^{-1} (1.64 kg) was found from the control treatment N_0 (no nitrogen). The result obtained from the present study was similar with the findings of Naderi *et al*. (2017) and Mohamed *et al*. (2010). Wahocho and Maitlo (2017) also found similar result with the present study.

Combined effect of male flower pruning and nitrogen

Fruit weight plant^{-1} varied significantly due to combined effect of male flower pruning and nitrogen levels (Table 8 and Appendix XVII). The highest fruit weight plant^{-1} (2.76 kg) was found from the treatment combination of P_2N_2 which was significantly different from other treatment combinations followed by P_1N_2. The lowest fruit weight plant^{-1} (1.50 kg) was found from the treatment combination of P_0N_0 which was statistically identical with the treatment combination of P_1N_0.

4.3.4 Fruit yield (t ha^{-1})

Effect of male flower pruning

Considerable variation was observed on fruit yield of squash influenced by different male flower pruning treatment (Table 8 and Appendix XVII). Results revealed that the treatment P_2 (male flower pruning at 35 DAT) gave highest fruit yield (25.36 t ha^{-1}) which was significantly different from other treatments followed by P_1 (male flower pruning at 25 DAT) whereas the control treatment P_0 (no pruning) gave lowest fruit yield (21.79 t ha^{-1}).

Effect of nitrogen (N)

Significant influence was remarked on fruit yield of squash affected by different nitrogen levels (Table 8 and Appendix XVII). It was found that the treatment N_2 (90 kg N ha^{-1}) gave highest fruit yield (28.49 t ha^{-1}) followed by N_1 (45 kg N ha^{-1}) whereas the control treatment N_0 (no nitrogen) gave lowest fruit yield (18.26 t ha^{-1}). The result obtained from the present study was similar with the findings of Naderi *et al*. (2017) and Mohamed *et al*. (2010). Wahocho and Maitlo (2017), Sabreen *et al*. (2015) and Ngetich *et al*. (2013) also found similar result with the present study.

Combined effect of male flower pruning and nitrogen

Fruit yield of squash affected by combined effect of male flower pruning and nitrogen levels was significant (Table 8 and Appendix XVII). Results revealed that the treatment combination of P_2N_2 gave highest fruit yield (30.70 t ha^{-1}) which was significantly different from other treatment combinations followed by P_1N_2. The lowest fruit yield (16.68 t ha^{-1}) was found from the treatment combination of P_0N_0 which was statistically same with the treatment combination of P_1N_0 and P_2N_0.

Table 8. Yield parameters of squash as influenced by male flower pruning and nitrogen

Treatment	Yield parameters			
	Number of fruits plant^{-1}	Single fruit weight (g)	Fruit weight plant^{-1} (kg)	Fruit yield (t ha^{-1})
Effect of male flower pruning				
P_0	3.69	526.00 c	1.96 c	21.79 c
P_1	3.80	546.50 b	2.09 b	23.27 b
P_2	3.93	576.70 a	2.28 a	25.36 a
$LSD_{0.05}$	NS	7.109	0.109	0.6328
CV (%)	8.53	10.14	10.07	10.22
Effect of nitrogen				
N_0	3.46 c	474.90 c	1.64 c	18.26 c
N_1	3.84 b	553.60 b	2.13 b	23.66 b
N_2	4.12 a	620.70 a	2.56 a	28.49 a
$LSD_{0.05}$	0.2681	6.718	0.274	1.309
CV (%)	8.53	10.14	10.07	10.22
Combined effect of male flower pruning and nitrogen				
P_0N_0	3.32 g	451.60 i	1.50 g	16.68 f
P_0N_1	3.75 e	529.10 f	1.98 e	22.05 e
P_0N_2	4.01 bc	597.20 c	2.40 bc	26.65 c
P_1N_0	3.46 fg	470.30 h	1.62 g	18.06 f
P_1N_1	3.85 de	552.50 e	2.13 de	23.62 e
P_1N_2	4.10 b	616.70 b	2.53 b	28.11 b
P_2N_0	3.59 f	502.80 g	1.80 f	20.05 f
P_2N_1	3.93 cd	579.10 d	2.28 cd	25.32 d
P_2N_2	4.26 a	648.20 a	2.76 a	30.70 a
$LSD_{0.05}$	0.145	12.91	0.189	1.480
CV (%)	8.53	10.14	10.07	10.22

(In a column means having similar letter(s) is/ are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability; here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT, P_2= Male flower pruning at 35 DAT and N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1}, N_2= 90 kg N ha^{-1})

4.4 Economic analysis

All the material and non-material input cost like land preparation, squash seed cost, manure and fertilizer cost, irrigation cost, labor cost, interest on fixed capital of land (leased land by bank loan basis) and miscellaneous cost were considered for calculating the total cost of production from planting seeds to harvesting of squash were recorded for unit plot and converted into cost per hectare (Table 9 and Appendix XVIII). Price of squash was considered at market rate @ Tk. 10 kg^{-1}. The economic analysis was presented under the following headlines:

4.4.1 Gross income

The combination of different male flower pruning and nitrogen levels showed different gross return (Table 9). Gross income was calculated on the basis of market price of squash fruit. The highest gross return (Tk 307000) was obtained from P_2N_2 (male flower pruning at 35 DAT with 90 kg N ha^{-1}) treatment combination followed by P_1N_2 and lowest gross return (Tk 166800) obtained from the treatment combination of P_0N_0 (no pruning with 0 kg N ha^{-1}).

4.4.2 Net return

Treatment combinations of different male flower pruning and nitrogen levels showed net returns variation (Table 9). The highest net return (Tk 192186) was obtained from the treatment combination of P_2N_2 (male flower pruning at 35 DAT with 90 kg N ha^{-1}) followed by P_1N_2 and the lowest net return (Tk 52200) obtained from the treatment combination of P_0N_0 (no pruning with 0 kg N ha^{-1}).

4.4.3 Benefit cost ratio (BCR)

Among different treatment combinations of male flower pruning and nitrogen levels, variation on BCR was observed among the treatment combinations (Table 9). The Benefit cost ratio (BCR) was the highest (2.67) from the treatment combination of P_2N_2 (male flower pruning at 35 DAT with 90 kg N ha^{-1}) followed by P_1N_2 and the lowest BCR (1.46) was obtained from P_0N_0 (no pruning with 0 kg N ha^{-1}) treatment combination. From economic point of view, it was noticeable from the above results, the treatment combination of P_2N_2 (male flower pruning at 35 DAT with 90 kg N ha^{-1}) was more profitable than rest of the treatment combinations.

Table 9. Economic analysis of squash production as influenced by male flower pruning and nitrogen

Treatment	Economic analysis				
	Yield (t ha^{-1})	Total cost of production (Tk. ha^{-1})	Gross return (Tk. ha^{-1})	Net return (Tk. ha^{-1})	BCR
P_0N_0	16.68	114600	166800	52200	1.46
P_0N_1	22.05	114707	220500	105793	1.92
P_0N_2	26.65	114814	266500	151686	2.32
P_1N_0	18.06	114600	180600	66000	1.58
P_1N_1	23.62	114707	236200	121493	2.06
P_1N_2	28.11	114814	281100	166286	2.45
P_2N_0	20.05	114600	200500	85900	1.75
P_2N_1	25.32	114707	253200	138493	2.21
P_2N_2	30.70	114814	307000	192186	2.67

Selling cost = 10 Tk/kg

(Here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT, P_2= Male flower pruning at 35 DAT and N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1}, N_2= 90 kg N ha^{-1})

CHAPTER V

SUMMARY AND CONCLUSION

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Summary

The study was carried out at the Horticulture Farm of Sher-e-Bangla Agricultural University, Sher-e-Bangla Nagar, Dhaka-1207 to find out the effect of male flower pruning and different doses of nitrogen on growth and yield of squash (*Cucurbita pepo* L.) during the period from December 2019 to March 2020. The seed of BARI squash-1 was used as planting materials. The experiment consisted of two factors: Factor A: three male flower pruning as P_0= Control (no pruning), P_1= Male flower pruning at 25 DAT and P_2= Male flower pruning at 35 DAT and Factor B: three levels of nitrogen application as N_0= Control (no nitrogen), N_1= 45 kg N ha^{-1} and N_2= 90 kg N ha^{-1}. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. Data on different growth, yield contributing parameters and yield parameters were recorded and statistically analyzed using MSTAT-C computer package program.

Different male flower pruning treatments and nitrogen doses and also their combinations showed significant influence of different growth, yield contributing parameters and yield of squash.

Most of the growth parameters showed non-significant results among the treatments except leaf length and leaf breadth influenced by male flower pruning treatments. However, the treatment, P_2 (male flower pruning at 35 DAT) at 25, 45, 70 and 90 DAT, respectively gave the highest plant height (31.50, 39.22, 52.44 and 56.90 cm), the highest stem length (20.55, 32.13, 43.2 and 47.24 cm), the highest number of leaves $plant^{-1}$ (9.96, 14.76, 17.78 and 19.19), the highest leaf length (32.22, 43.89, 48.08 and 50.37 cm) and the highest leaf breadth (18.00, 27.06, 30.69 and 33.01 cm). The highest stem base diameter at 45, 70 and 90 DAT (1.67, 2.34 and 2.80 cm, respectively) was also found from the treatment P_2. Again, at 25, 45, 70 and 90 DAT respectively, the control treatment P_0 (no pruning) gave the lowest plant height (29.11, 37.61, 47.72 and 51.07 cm, respectively), the lowest stem length (18.50, 29.34, 39.00 and 42.54 cm), the lowest number of leaves $plant^{-1}$ (8.84, 12.81, 15.83 and 17.40), the lowest leaf length (31.22, 40.72, 43.61 and 45.62 cm) and the lowest leaf breadth (16.67, 24.59, 27.87 and 29.80 cm). The lowest stem base diameter (1.48. 2.03 and 2.39 cm at 45, 70 DAT and at harvest, respectively) was also found from the control treatment P_0. Similarly, the different male flower pruning treatments showed significant variation on yield and yield contributing parameters and P_2 gave the highest days to 1st flowering (21.33), the highest number of female flowers (5.37), the highest fruit length (26.77 cm), the highest fruit diameter (8.02 cm), the highest % fruit dry weight (6.21%), the highest number of fruits plant^{-1} (3.93), the highest single fruit weight (576.70 g), the highest fruit weight plant^{-1} (2.28 kg) and the highest fruit yield (25.36 t ha^{-1}) whereas the lowest days to 1st flowering (20.22), the lowest number of female flowers (4.73), the lowest fruit length (23.41 cm), the lowest fruit diameter (7.15 cm), the lowest % fruit dry weight (5.86%), the lowest number of fruits plant^{-1} (3.69), the lowest single fruit weight (526.00 g), the lowest fruit weight plant^{-1} (1.96 kg) and the lowest fruit yield (21.79 t ha^{-1}) were recorded from control treatment P_0.

Regarding application of nitrogen treatments, all the parameters were influenced significantly. At 25, 45, 70 and 90 DAT respectively, the highest plant height (33.56, 39.83, 57.00 and 63.67 cm), the highest stem length (22.08, 35.61, 48.57 and 53.05 cm), the highest number of leaves plant^{-1} (11.32, 16.68, 19.72 and 20.92), the highest leaf length (36.00, 49.56, 52.57 and 55.47 cm) and the highest leaf breadth (19.22, 29.00, 33.21 and 35.90 cm) were found from the treatment N_2 (90 kg N ha^{-1}). The highest stem base diameter (1.78, 2.57 and 3.10 cm at 45, 70 DAT and at harvest, respectively) was also found from the treatment N_2 (90 kg N ha^{-1}). But at 25, 45, 70 and 90 DAT, respectively, the control treatment N_0 (no nitrogen) gave the lowest plant height (27.11, 36.33, 45.22 and 46.96 cm), the lowest stem length (16.81, 26.64, 34.60 and 37.62 cm), the lowest number of leaves plant^{-1} (7.34, 10.72, 13.77 and 15.52), the lowest leaf length (28.44, 36.00, 38.57 and 39.93 cm) and the lowest leaf breadth (15.61, 23.11, 25.42 and 27.00 cm). The lowest stem base diameter (1.35, 1.76 and 2.03 cm at 45, 70 DAT and at harvest, respectively) was also recorded from control treatment N_0. Likewise, the highest days to 1st flowering (22.33), the highest number of female flowers (6.19), the highest fruit length (29.58 cm), the highest fruit diameter (8.86 cm), the highest % fruit dry weight (6.57%), the highest number of fruits plant^{-1} (4.12), the highest single fruit weight (620.70 g), the highest fruit weight plant^{-1} (2.56 kg) and the highest fruit yield (28.49 t ha^{-1}) were recorded from the treatment N_2 whereas control treatment N_0 showed the lowest days to 1st flowering (19.33), the lowest number of female flowers (4.02), the lowest fruit length (20.53 cm), the lowest fruit diameter (7.15 cm), the lowest % fruit dry weight (5.44%), the lowest number of fruits plant^{-1} (3.46), the lowest single fruit weight (474.90 g), the lowest fruit weight plant^{-1} (1.64 kg) and the lowest fruit yield (18.26 t ha^{-1}).

Treatment combination of male flower pruning and nitrogen application showed significant variation on different parameters. At 25, 45, 70 and 90 DAT, respectively the highest plant height (35.33, 40.50, 59.50 and 66.52 cm), the highest stem length (22.75, 36.67, 50.25 and 54.85 cm), the highest number of leaves plant^{-1} (11.80, 17.41, 20.45 and 21.58), the highest leaf length (40.17, 50.50, 53.87 and 56.97 cm) and the highest leaf breadth (20.00, 30.17, 34.73 and 37.60 cm) were found from the treatment combination of P_2N_2 whereas the lowest plant height (26.67, 38.33, 42.17 and 43.77 cm), the lowest stem length (15.67, 25.34, 33.25 and 35.98 cm), the lowest number of leaves plant^{-1} (6.31, 9.37, 12.41 and 14.24), the lowest leaf length (25.83, 35.67, 37.17 and 38.47 cm) and the lowest leaf breadth (15.17, 21.83, 23.80 and 25.13 cm) were found from the treatment combination of P_0N_0. At 45, 70 and 90 DAT, respectively the highest stem base diameter (1.88, 2.71 and 3.28 cm) was found from the treatment combination of P_2N_2 whereas the lowest stem base diameter (1.21, 1.56 and 1.77 cm) was found from the treatment combination of P_0N_0. Accordingly, the highest days to 1st flowering (22.67), the highest number of female flowers (6.52), the highest fruit length (31.40 cm), the highest fruit diameter (9.22 cm), the highest % fruit dry weight (6.72%), the highest number of fruits plant^{-1} (4.26), the highest single fruit weight (648.20 g), the highest fruit weight plant^{-1} (2.76 kg) and the highest fruit yield (30.70 t ha^{-1}) was found from the treatment combination of P_2N_2 whereas, the lowest days to 1st flowering (18.33), the lowest number of female flowers (3.83), the lowest fruit length (18.42 cm), the lowest fruit diameter (5.85 cm), the lowest % fruit dry weight (5.22%), the lowest number of fruits plant^{-1} (3.32), the lowest single fruit weight (451.60 g), the lowest fruit weight plant^{-1} (1.50 kg) and the lowest fruit yield (16.68 t ha^{-1}) was found from the treatment combination of P_0N_0.

For the consideration of economic return, the highest gross return (Tk 307000), highest net return (Tk 192186) and the highest BCR (2.67) was from the treatment combination of P_2N_2 whereas the lowest gross return (Tk 166800), the lowest net return (Tk 52200) and the lowest BCR (1.46) was obtained from P_0N_0.

Conclusion

From the above results, it can be concluded that among the different treatment combination of male flower pruning and nitrogen treatments, P_2N_2 (male flower pruning at 35 DAT with 90 kg N ha^{-1}) have significant positive effect on growth and yield of squash and resulted in the highest fruit yield ha^{-1} (30.70 t ha^{-1}) compared to all other treatment combinations.

Recommendation

Application of male flower pruning and nitrogen treatments ensured a higher yield in squash. At present squash is a newly introduced and promising crop in the global perspective. Its consumption demand is increasing day by day. It stands on an excellent as vegetable crops for its nutritional values. The experiment was conducted in AEZ no. 28 for one season. Further such type of experiment may be conducted in different Agro-Ecological Zones of Bangladesh for more confirmation.

REFERENCES

REFERENCES

Abd-El-Fattah, M.A. and Sorial, M.E. (1988). Efficiency of bio-fertilization on responses of the productivity and chemical composition of lettuce plants grown under different nitrogen levels. *Menofiya J. Agric. Res*. **23**(5): 1185-1207.

Acquaah, G. (2009). Horticulture: principles and practices. **In**: Vernon R. Anthony (ed.). Pearson Education, Inc. Upper Saddle River, New Jersey 07458, USA.

Alam, M., Islam, N., Ahmad, S., Hossen, M., and Islam, M. (2016). Effect of different staking methods and stem pruning on yield and quality of summer tomato. *Bangladesh J. Agril. Res.* **41**(3): 419-432. https://doi.org/10.3329/bjar.v41i3.29714

Al-Said, M.A. and Kamal, A.M. (2008). Effect of folair spray with folic acid and some amino acids on flowering yield and quality of sweet pepper. *J. Agric. Sci. Mansoura Univ*. **33**(10): 7403-7412.

Alscher, R.G., Donahne, J.L. and Cromer, C.L. (1997). Reactive oxygen species and antioxidants: Relationships in green cells. *Physiol. Plam*. **100**: 224-233.

Brady, N.C. and Ray, R.W. (2016). The nature and properties of soils. **In:** Rita S. Buckman (15^{th} ed.). Macmillan Publishing Com. New York, USA. https://lccn.loc.gov/2016008568

Caili, F., Huan, S. and Quanhong, L. (2006). A review on pharmacological activities and utilization technologies of pumpkin. *Plant Foods Hum. Nutr*. **61**(2): 70-77.

Edris, K.M., Islam, A.T.M.T., Chowdhury, M.S. and Haque, A.K.M.M. (1979). Detailed Soil Survey of Bangladesh, Dept. Soil Survey, Govt. People's Republic of Bangladesh. p.118.

Ekwu, L.G., Nwokwu, G.N. and Utobo, E.B. (2012). Effect of mulching materials and pruning on growth and yield of Cucumber (*Cucumis sativus* L). *Intl. J. Agric. Ruraldev*. **15**(2): 1014-1021.

FAO (1988). Production Year Book. Food and Agricultural Organizations of the United Nations Rome, Italy. **42**: 190-193.

Gholipouri, A. and Nazarnejad, H. (2007). The effect of stem pruning and nitrogen levels of on some physico-chemical characteristics of pumpkin seed (*Cucurbita pepo* L.). *Pakistan J. Bio. Sci*. **10**(20): 3726-3729. https://dx.doi.org/10.3923/pjbs.2007.3726.3729

Gomez, K.A. and Gomez, A.A. (1984). Comparison between treatment means. **In:** Statistical Procedures for Agricultural Research. K.A. Gomez and A.A. Gomez, (eds.). 2nd Edn. John Wiley and Sons, NY, USA. pp. 187-240.

Grazia, J., Tittonell, P.A. and Chiesa, A. (2001). Effects of sowing date, radiation and nitrogen nutrition on growth pattern and yield of lettuce (*Lactuca sativa* L.) crop. *Investigation Agraria. Produc. Protec. Vegetales* (Espana). **16**(3): 355-365.

Harrington, J. (2020). Removal of blooms from squash plants. SFGate; Home Guides, Garden, Grow Vegetables. pp. 1-2.

Jasso-Chaverria, C., Hochmuth, G.J., Hochmuth, R.C. and Sargent, S.A. (2005). Fruit yield, size, and colour responses of two Greenhouse cucumber types to nitrogen fertilization in perlite soilless culture. *Hort. Technol. J*. **15**: 565-571.

Jha, R.K. and Neupane, R.B. (2018). Effect of different spacing and mulching on growth and yield of okra (*Abelmoschus esculentus* L.) in Chitwan. *Nepal. J. Agric. Sci. Natur. Resour*. **1**(1): 168-178.

Johannes, F.J.M., Schmidt, L., Urbanus, N.M. and Kahlen, K. (2016). Effects of shoot pruning and inflorescence thinning on plant growth, yield and fruit quality of greenhouse tomatoes in a tropical climate. *J. Agric. Rural Dev. Trop. Subtrop*. **117**(1): 45-56.

Jones, J.B. (2003). Agronomic handbook: management of crops, soils, and their fertility. New York, USA: CRC Press.

Kathiravan, K., Vengedesan, G., Singer, S., Steinitz, B., Paris, H.S. and Gaba, V. (2006). Adventitious regeneration in vitro occurs across a wide spectrum of squash (*Cucurbita pepo*) genotypes. *Plant Cell Tissue Organ Cult*. **85**: 285-295.

Kostalova, Z., Hromadkova, Z. and Ebringerova, A. (2009). Chemical evaluation of seeded fruit biomass of oil pumpkin (*Cucurbita pepo* L.). *Chem. Paper*. **63**(4): 406-413.

Lutfa, A.F., Happy, A., Yasmin, F. and Hera, H.R. (2018). Production and marketing of cucumber in some selected areas of Mymensingh district. *Agril. Res. Tech*. **15**(5): 555-569.

Mardhiana, Pradana, A.P., Adiwena, M., Kartina, Santoso, D., Wijaya, R. and Maliki, A. (2017). Effects of pruning on growth and yield of cucumber (*Cucumis sativus*) Mercy variety in the acid soil of North Kalimantan, Indonesia. *Cell. Biol. Dev*. **1**(1): 13-17.

Matsumoto, S., Yamagata, M. and Koga, N. (2001). Identification of organic forms of nitrogen in soils and possible direct uptake by plants. Fourteenth International Plant Nutrition Colloquium, Hannover, Germany. pp. 208-209.

Mir, A.A., Sadat, M.A. Amin, M.R. and Islam, M.N. (2019). Pruning: a mechanical stress inducing method to improve growth and yield of Bangladeshi local cucumber variety “Baromashi”. *Int. J. Bus. Soc. Sci. Res*. **7**(4): 31-35.

Mohamed, H.A., Mahmoud, A.R., Ezzo, M.I. and Hafez, M.M. (2010). Physiological response of growth, yield and its quality of squash **(***Cucurbita pepo* L.) to foliar application of some nutrients. *Res. J. Agric. Biol. Sci*. **6**(4): 568-576.

Mohamed, S.B., Rania, M., Nassar, A. and Ahmed, F.A. (2012). Response of sesame plant (*Sesamum orientale* L.) to treatments with mineral and Bio-fertilizers. *Res. J. Agric. Biol. Sci.* **8**(2): 127-137.

Mohammad, M.J. (2004). Squash yield, nutrient content and soil fertility parameters in response to methods of fertilizer application and rates of nitrogen fertigation. *Nutr. Cycl. Agroecosys*. **68**: 99-108.

Musa, A., Ezenwa, M.I.S., Oladiran, J.A., Akanya, H. and Ogbadoyi. (2010). Effect of soil nitrogen levels on some micronutrients, antinutrients and toxic substances in *Corchorus olitorius* grown in Minna, Nigeria. *Afr. J. Agric. Res.* **5**(22): 3075-3081.

Naderi, M.R., Bannayan, M., Goldani, M. and Alizadeh, A. (2017). Effect of nitrogen application on growth and yield of pumpkin. *J. Plant Nutr*. **40**(6): 890-907.

Ngetich, O.K., Niyokuri, A.N., Rono, J.J., Fashaho, A. and Ogweno, J.O. (2013). Effect of different rates of nitrogen fertilizer on the growth and yield of zucchini (*Cucurbita pepo* cv. Diamant L.) hybrid f_1 in Rwanda high altitude zone. *Int. J. Agril. Crop Sci*. **5**(1): 54-62.

Oga, I.O. and Umekwe, P.N. (2016). Effects of pruning and plant spacing on the growth and yield of watermelon (*Citrullus lanatus* L.) in Unwana-Afikpo. *Intl. J. Sci. Res*. **5**(4): 110-115.

Okafor, C.G. (2007). Effect of staking and pruning on the vegetable growth and yield of cucumber. Unpublished undergraduate projects. Ebonyi State University, Abakaliki, p. 95.

Purseglove, J.W. (1968) Tropical Crops: Dicotyledons. **In:** Longmans Scientific and Technical. 1st edition . John Wiley and Sons Inc., New York, USA. p. 76.

Refai, E.F.S. and Hassan, A.M.A. (2019). Management of irrigation and nitrogen fertilization for squash grown at different plantation seasons under Assiut Governorate Conditions. *Middle-East J. Agri*. **8**(1): 356-370.

Rehman, Z., Hussain, S.A., Abdur, R. and Muhammad, S. (2001). Effect of nitrogen levels and sowing dates on yield of lettuce. *Sarhad J. Agric*. **17**(3): 359-362.

Sabreen, K. Ibraheim, A. and Mohsen, A.A.M. (2015). Effect of chitosan and nitrogen rates on growth and productivity of summer squash plants. *Middle East J. Agric*. **4**(4): 673-681.

Salomez, J. and Hofman, G. (2009). Nitrogen nutrition effects on nitrate accumulation of soil-grown greenhouse butterhead lettuce. *Commun. Soil Sci. Plant Anal.* **40**(1-6): 620-632.

Sanjuan, N., Clemente, G. and Ubeda, L. (2003). Environmental effect of fertilizers. **In:** Dris, R., Niskanen, R. and Jain, M.S. (eds.). Crop Management and Post-harvest Handling of Horticultural Products: Crop Fertilization, Nutrition and Growth. Enfield, USA: Science Publishers, Inc. pp. 1-53.

Santos, G.M., Braz, L.T., Grilli, G.V.G., Costa, C.C. and Nascimeto, W.M. (2003). Effect of protecting broccoli plants with non- woven polypropylene. *Acta Hort*. **60**(7): 175-178.

Shaheen, A., Naeem, M.A., Jilani, G. and Shafiq, M. (2010). Integrated soil management in eroded land augments the crop yield and water use efficiency. *Plant. Produc. Sci*. **60**(3): 274-282.

Swiader, J.M., Sipp S.K. and Brown, R.E. (1994). Pumpkin growth, flowering and fruiting response to nitrogen and potassium sprinkler fertigation in sandy soil. *J. Amer Soc. Hort. Sci*. **119**(3): 414-419.

Tamer, C.E., Incedayi, B., Yonel, S.P., Yonak, S. and Copur, O.U. (2010). Evaluation of several quality criteria of low-calorie pumpkin dessert. *Not. Bot. Horti. Agrobo.* **38**(1): 76-80.

Thakur, O., Kumar, V. and Singh, J. (2018). A review on advances in pruning to vegetables crops. *Int. J. Curr. Microbiol. App. Sci*. **7**(2): 3556-3565.

Tisdale, S.L. and Nelson, W.L. (1990). Soil fertilizer and effect of magnesium on the yield and chemical of crops. Michigan Agricultural Experimental Statistics. *Bull Press, Mechigan, American*. pp. 29-31.

Tlustos, P., Pavlikova, D., Balik, J. and Vanek, V. (2002). The uptake of nitrogen released from slow release N fertilizers by radish, lettuce and carrot. *Acta. Hort.* **571**: 127-133.

Tripti, S.I. (2017). Effect of leaf pruning and vermicompost on growth and yield of squash (*Cucurbita pepo*). M.S. thesis, Department of Horticulture, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh.

UNDP (1988). Land Resource Apprisal of Bangladesh for Agricultural Development Report 2: Agro-ecological Regions of Bangladesh, FAO, Rome, Italy. p. 577.

Vandre, W. (1990). Greenhouse cucumber production. University of Alaska. Fair Banks Cooperative Extension Service.

Wahocho, N.A. and Maitlo, A.A. (2017). Effect of varying levels of nitrogen on the growth and yield of muskmelon *(Cucumis melo* L.). *J. Basic Appl. Sci.* 13**:** 448-453.

Wolf, B. (1999). The fertile triangle: The interrelationship of air, water and nutrients in maximizing soil productivity. New York, USA: Food Products Press. New York, USA.

Zaman, M.S., Hashem, M.A., Jahiruddin, M. and Rahim, M.A. (2011). Effect of nitrogen for yield maximization of garlic in old brahmaputra flood plain soil. *Bangladesh J. Agril. Res.* **36**(2): 357-367.

Zarei, D., Shabani, G., Chaichi, M.R. and Akbarabadi, A. (2016). Effects of head pruning and different nutritional systems (chemical, biological and integrated) on seed yield and oil content in medicinal pumpkin (Cucurbita pepo L.). *J. Agril. Sci.* **61**(1): 103-112.

APPENDICES

APPENDICES

Appendix I. Agro-Ecological Zone of Bangladesh showing the experimental location

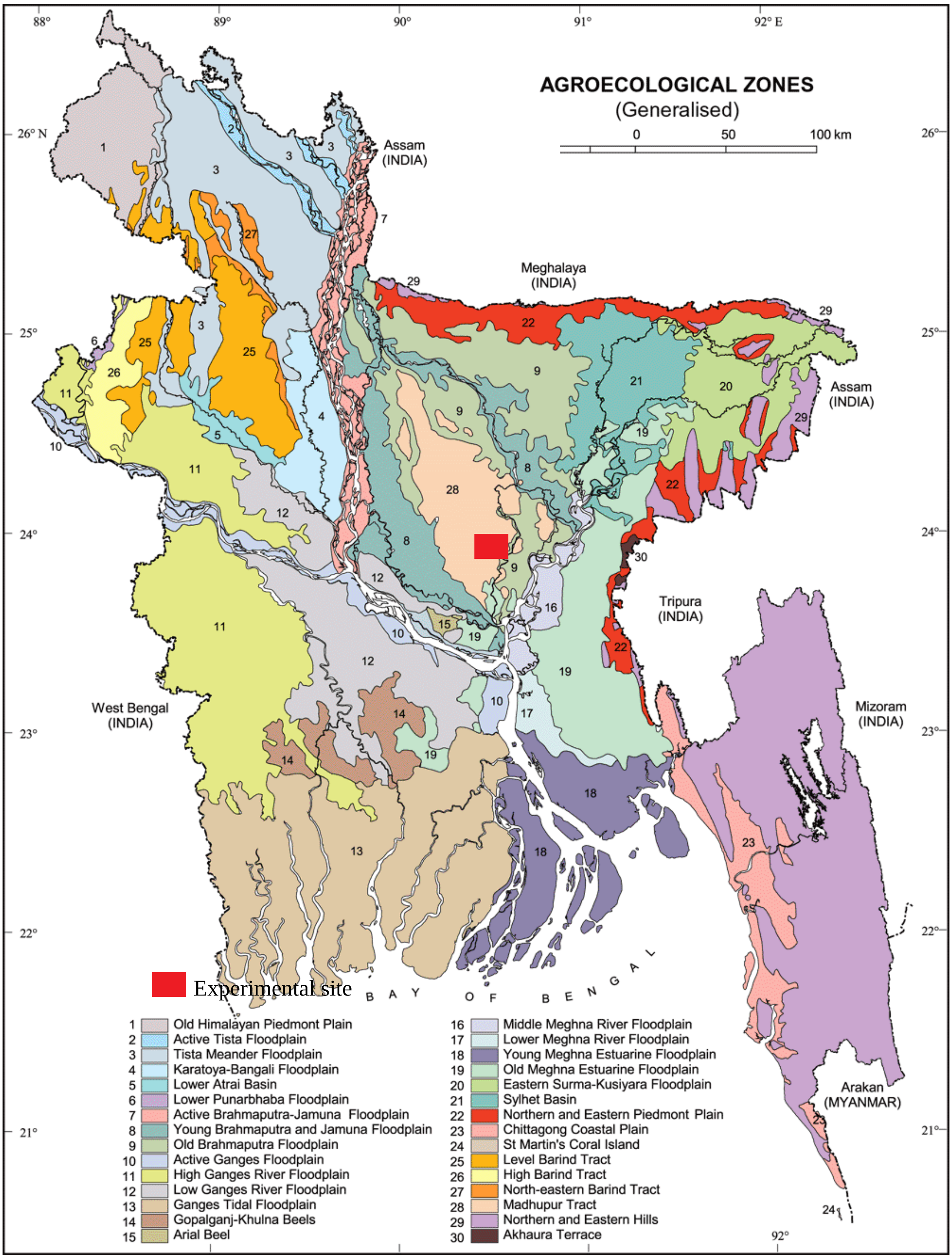

Figure 14. Map of experimental site

Appendix II. Monthly records of air temperature, relative humidity and rainfall during the period from December 2019 to March 2020

Month	Air temperature (°C)			Relative humidity (%)	Rainfall (mm)
	Max.	*Min.*	*Mean*		
December, 19	25.50	6.70	16.10	54.80	0.0
January, 20	23.80	11.70	17.75	46.20	0.0
February, 20	22.75	14.26	18.51	37.90	0.0
March, 20	35.20	21.00	28.10	52.44	20.4

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

Appendix III. Characteristics of experimental soil analyzed at Soil Resource Development Institute (SRDI), Farmgate, Dhaka

A. Morphological characteristics of the experimental field

Morphological features	**Characteristics**
Location	Horticulture Farm, 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	Not Applicable

Source: Soil Resource Development Institute (SRDI)

B. Physical and chemical properties of the initial soil

Characteristics	Value
Partical size analysis	
% Sand	27
% Silt	43
% Clay	30
Textural class	Silty Clay Loam
pH	5.6
Organic carbon (%)	0.45
Organic matter (%)	0.78
Total N (%)	0.03
Available P (ppm)	20
Exchangeable K (me/100 g soil)	0.1
Available S (ppm)	45

Source: Soil Resource Development Institute (SRDI)

Appendix IV. Mean square of plant height of squash as influenced by male flower pruning and nitrogen at different growth stages

Sources of variation	Degrees of freedom	Mean square of plant height (cm) at			
		25 DAT	45 DAT	70 DAT	90 DAT
Replication	2	2.565	1.731	2.926	3.533
Factor A	2	NS	NS	NS	NS
Factor B	2	93.48*	29.78*	321.01*	656.02*
AB	4	1.454**	1.981**	4.120**	3.220*
Error	16	1.127	3.377	3.134	4.221

^{NS} indicates non-significant
*indicates significant at 5% level of probability
**indicates significant at 1% level of probability

Appendix V. Plant height of squash as influenced by male flower pruning and nitrogen at different growth stages

Treatment	Plant height (cm)			
	25 DAT	45 DAT	70 DAT	90 DAT
Effect of male flower pruning				
P_0	29.11	37.61	47.72	51.07
P_1	30.28	38.28	51.44	54.92
P_2	31.50	39.22	52.44	56.90
$LSD_{0.05}$	NS	NS	NS	NS
CV (%)	8.17	10.60	7.70	8.89
Effect of nitrogen				
N_0	27.11 c	36.33 b	45.22 c	46.96 c
N_1	30.22 b	38.94 a	49.39 b	52.26 b
N_2	33.56 a	39.83 a	57.00 a	63.67 a
$LSD_{0.05}$	1.051	1.142	1.016	1.483
CV (%)	8.17	10.60	7.70	8.89

(In a column means having similar letter(s) is/ are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability; here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT, P_2= Male flower pruning at 35 DAT and N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1}, N_2= 90 kg N ha^{-1})

Appendix VI. Mean square of stem length of squash as influenced by male flower pruning and nitrogen at different growth stages

Sources of variation	Degrees of freedom	Mean square of stem length (cm) at			
		25 DAT	45 DAT	70 DAT	90 DAT
Replication	2	1.493	2.985	0.302	3.055
Factor A	2	NS	17.666**	40.258*	49.873*
Factor B	2	62.70	184.02*	443.64*	539.35*
AB	4	0.765	0.940**	2.185**	2.208**
Error	16	2.180	3.152	4.402	4.431

^{NS} indicates non-significant
*indicates significant at 5% level of probability
**indicates significant at 1% level of probability

Appendix VII. Stem length of squash as influenced by male flower pruning and nitrogen at different growth stages

Treatment	Stem length (cm)			
	25 DAT	45 DAT	70 DAT	90 DAT
Effect of male flower pruning				
P_0	18.50	29.34 b	39.00 c	42.54 c
P_1	19.54	30.87 a	41.32 b	45.11 b
P_2	20.55	32.13 a	43.23 a	47.24 a
$LSD_{0.05}$	NS	1.466	1.549	2.006
CV (%)	10.47	8.69	9.64	8.17
Effect of nitrogen				
N_0	16.81 c	26.64 c	34.60 c	37.62 c
N_1	19.71 b	30.10 b	40.38 b	44.22 b
N_2	22.08 a	35.61 a	48.57 a	53.05 a
$LSD_{0.05}$	1.086	1.774	2.097	2.104
CV (%)	10.47	8.69	9.64	8.17

(In a column means having similar letter(s) is/ are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability; here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT, P_2= Male flower pruning at 35 DAT and N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1}, N_2= 90 kg N ha^{-1})

Appendix VIII. Mean square of number of leaves plant^{-1} of squash as influenced by male flower pruning and nitrogen at different growth stages

Sources of variation	Degrees of freedom	Mean square of number of leaves plant^{-1} at			
		25 DAT	45 DAT	70 DAT	90 DAT
Replication	2	0.125	0.223	0.341	0.422
Factor A	2	NS	NS	NS	NS
Factor B	2	35.66*	80.14*	79.99*	65.86*
AB	4	0.487**	0.299**	0.328**	0.317**
Error	16	0.207	0.499	0.494	0.487

^{NS} indicates non-significant
*indicates significant at 5% level of probability
**indicates significant at 1% level of probability

Appendix IX. Number of leaves plant^{-1} of squash as influenced by male flower pruning and nitrogen at different growth stages

Treatment	Number of leaves plant^{-1}			
	25 DAT	45 DAT	70 DAT	90 DAT
Effect of male flower pruning				
P_0	8.48	12.81	15.83	17.40
P_1	9.52	13.86	16.86	18.36
P_2	9.96	14.76	17.78	19.19
$LSD_{0.05}$	NS	NS	NS	NS
CV (%)	7.89	9.11	8.18	8.81
Effect of nitrogen				
N_0	7.34 c	10.72 c	13.77 c	15.52 c
N_1	9.31 b	14.02 b	16.98 b	18.50 b
N_2	11.32 a	16.68 a	19.72 a	20.92 a
$LSD_{0.05}$	0.4590	0.5483	1.184	0.8403
CV (%)	7.89	9.11	8.18	8.81

(In a column means having similar letter(s) is/ are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability; here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT, P_2= Male flower pruning at 35 DAT and N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1}, N_2= 90 kg N ha^{-1})

Appendix X. Mean square of leaf length of squash as influenced by male flower pruning and nitrogen at different growth stages

Sources of variation	Degrees of freedom	Mean square of leaf length (cm) at			
		25 DAT	45 DAT	70 DAT	90 DAT
Replication	2	1.250	1.583	2.855	0.751
Factor A	2	NS	NS	45.393	51.518
Factor B	2	128.52*	416.44*	441.15*	543.64*
AB	4	10.444*	8.111*	6.862*	7.414**
Error	16	3.406	4.531	4.854	3.862

^{NS} indicates non-significant
*indicates significant at 5% level of probability
**indicates significant at 1% level of probability

Appendix XI. Leaf length of squash as influenced by male flower pruning and nitrogen at different growth stages

Treatment	Leaf length (cm)			
	25 DAT	**45 DAT**	**70 DAT**	**90 DAT**
Effect of male flower pruning				
P_0	31.22	40.72	43.61 b	45.62 b
P_1	32.06	42.72	45.43 b	47.45 b
P_2	32.22	43.89	48.08 a	50.37 a
$LSD_{0.05}$	NS	NS	2.190	2.407
CV (%)	7.23	9.02	7.02	10.94
Effect of nitrogen				
N_0	28.44 c	36.00 c	38.57 c	39.93 c
N_1	32.06 b	41.78 b	45.98 b	48.04 b
N_2	36.00 a	49.56 a	52.57 a	55.47 a
$LSD_{0.05}$	1.844	1.870	2.190	1.749
CV (%)	7.23	9.02	7.02	10.94

(In a column means having similar letter(s) is/ are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability; here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT, P_2= Male flower pruning at 35 DAT and N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1}, N_2= 90 kg N ha^{-1})

Appendix XII. Mean square of leaf breadth of squash as influenced by male flower pruning and nitrogen at different growth stages

Sources of variation	Degrees of freedom	Mean square of leaf breadth (cm) at			
		25 DAT	**45 DAT**	**70 DAT**	**90 DAT**
Replication	2	0.481	2.009	2.010	1.121
Factor A	2	NS	NS	18.055	23.356
Factor B	2	29.73*	78.62*	136.823*	178.61*
AB	4	0.065**	0.231**	0.294**	4.381*
Error	16	1.023	2.249	3.240	3.334

^{NS} indicates non-significant
*indicates significant at 5% level of probability
**indicates significant at 1% level of probability

Appendix XIII. Leaf breadth of squash as influenced by male flower pruning and nitrogen at different growth stages

Treatment	Leaf breadth (cm)			
	25 DAT	**45 DAT**	**70 DAT**	**90 DAT**
Effect of male flower pruning				
P_0	16.67	24.89	27.87 c	29.80 c
P_1	17.22	25.78	29.07 b	31.18 b
P_2	18.00	27.06	30.69 a	33.01 a
$LSD_{0.05}$	NS	NS	0.752	1.044
CV (%)	7.96	10.39	9.21	8.64
Effect of nitrogen				
N_0	15.61 c	23.11 c	25.42 c	27.00 c
N_1	17.06 b	25.61 b	28.99 b	31.09 b
N_2	19.22 a	29.00 a	33.21 a	35.90 a
$LSD_{0.05}$	1.011	1.451	1.789	1.797
CV (%)	7.96	10.39	9.21	8.64

(In a column means having similar letter(s) is/ are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability; here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT, P_2= Male flower pruning at 35 DAT and N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1}, N_2= 90 kg N ha^{-1})

Appendix XIV. Mean square of stem base diameter of squash as influenced by male flower pruning and nitrogen at different growth stages

Sources of variation	Degrees of freedom	Mean square of stem base diameter (cm) at		
		45 DAT	**70 DAT**	**90 DAT**
Replication	2	0.002	0.080	0.058
Factor A	2	NS	NS	NS
Factor B	2	0.430**	1.483**	2.599*
AB	4	0.004**	0.005**	0.008**
Error	16	0.003	0.008	0.012

^{NS} indicates non-significant
*indicates significant at 5% level of probability
**indicates significant at 1% level of probability

Appendix XV. Stem base diameter of squash as influenced by male flower pruning and nitrogen at different growth stages

Treatment	Stem base diameter (cm)		
	45 DAT	70 DAT	90 DAT
Effect of male flower pruning			
P_0	1.48	2.03	2.39
P_1	1.56	2.18	2.58
P_2	1.67	2.34	2.80
$LSD_{0.05}$	NS	NS	NS
CV (%)	6.43	8.01	8.75
Effect of nitrogen			
N_0	1.35 b	1.76 b	2.03 b
N_1	1.58 a	2.21 a	2.64 a
N_2	1.78 a	2.57 a	3.10 a
$LSD_{0.05}$	0.219	0.451	0.556
CV (%)	6.43	8.01	8.75

(In a column means having similar letter(s) is/ are statistically identical and those having dissimilar letter(s) differ significantly as per 0.05 level of probability; here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT, P_2= Male flower pruning at 35 DAT and N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1}, N_2= 90 kg N ha^{-1})

Appendix XVI. Yield contributing parameters of squash as influenced by male flower pruning and nitrogen

Sources of variation	Degrees of freedom	Mean square of yield contributing parameters				
		Days to 1st flowering	Number of female flowers	Fruit length (cm)	Fruit diameter (cm)	% fruit dry weight
Replication	2	0.778	0.011	1.373	0.005	0.008
Factor A	2	NS	0.915**	25.452*	1.699**	NS
Factor B	2	20.333*	10.684*	184.35*	14.88*	2.920*
AB	4	0.444**	0.031**	0.115**	0.015**	0.007**
Error	16	0.194	0.083	2.624	0.041	0.014

^{NS} indicates non-significant
*indicates significant at 5% level of probability
**indicates significant at 1% level of probability

Appendix XVII. Yield parameters of squash as influenced by male flower pruning and nitrogen

Sources of variation	Degrees of freedom	Mean square of yield parameters			
		Number of fruits plant^{-1}	Single fruit weight (g)	Fruit weight plant^{-1} (kg)	Fruit yield (t ha^{-1})
Replication	2	0.004	19.551	0.004	1.432
Factor A	2	NS	586.29*	0.305**	13.493*
Factor B	2	1.012**	4794.19*	2.500**	160.71*
AB	4	0.002**	8.384*	0.002**	0.628**
Error	16	0.009	55.619	0.021	1.431

^{NS} indicates non-significant
*indicates significant at 5% level of probability
**indicates significant at 1% level of probability

Appendix XVIII. Cost of production of squash per hectare

A. Input cost (Tk. ha^{-1})

Treatments	Cultivation with Labor	Seed cost	Pesticides	Irrigation	Seedbed preparation and seed sowing cost	Seedling transplanting cost	Manure and fertilizer					Subtotal (A)
							Compost	Urea	TSP	MoP	Gypsum	
P_0N_0	15000	3000	4000	8000	3000	16000	10000	0.00	4250	2400	1200	66850
P_0N_1	15000	3000	4000	8000	3000	16000	10000	97.83	4250	2400	1200	66947.83
P_0N_2	15000	3000	4000	8000	3000	16000	10000	195.65	4250	2400	1200	67045.65
P_1N_0	15000	3000	4000	8000	3000	16000	10000	0.00	4250	2400	1200	66850
P_1N_1	15000	3000	4000	8000	3000	16000	10000	97.83	4250	2400	1200	66947.83
P_1N_2	15000	3000	4000	8000	3000	16000	10000	195.65	4250	2400	1200	67045.65
P_2N_0	15000	3000	4000	8000	3000	16000	10000	0.00	4250	2400	1200	66850
P_2N_1	15000	3000	4000	8000	3000	16000	10000	97.83	4250	2400	1200	66947.83
P_2N_2	15000	3000	4000	8000	3000	16000	10000	195.65	4250	2400	1200	67045.65

(Here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT, P_2= Male flower pruning at 35 DAT and N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1}, N_2= 90 kg N ha^{-1})

B. Overhead cost (Tk. ha^{-1}), Cost of production (Tk. ha^{-1}), Gross return (Tk. ha^{-1}), Net return (Tk. ha^{-1}) and BCR

Treatments	Overhead cost (Tk. ha^{-1})				Subtotal (A)	Total cost of production (A+B)	Yield ha^{-1} (ton)	Gross return (Tk. ha^{-1})	Net return (Tk. ha^{-1})	BCR
	Cost of leased land for 6 months (8% of value of land Tk. 10,00,000/-	Miscellaneous cost (Tk. 5% of the input cost)	Interest on running capital for 6 month (8% of cost year^{-1})	Subtotal (B)						
P_0N_0	40000	3342.50	4408	47750.2	66850.00	114600	16.68	166800	52200	1.46
P_0N_1	40000	3347.39	4412	47759.2	66947.83	114707	22.05	220500	105793	1.92
P_0N_2	40000	3352.28	4416	47768.2	67045.65	114814	26.65	266500	151686	2.32
P_1N_0	40000	3342.50	4408	47750.2	66850.00	114600	18.06	180600	66000	1.58
P_1N_1	40000	3347.39	4412	47759.2	66947.83	114707	23.62	236200	121493	2.06
P_1N_2	40000	3352.28	4416	47768.2	67045.65	114814	28.11	281100	166286	2.45
P_2N_0	40000	3342.50	4408	47750.2	66850.00	114600	20.05	200500	85900	1.75
P_2N_1	40000	3347.39	4412	47759.2	66947.83	114707	25.32	253200	138493	2.21
P_2N_2	40000	3352.28	4416	47768.2	67045.65	114814	30.70	307000	192186	2.67

Selling cost = 10 Tk/kg

(Here, P_0= Control (No pruning), P_1= Male flower pruning at 25 DAT, P_2= Male flower pruning at 35 DAT and N_0= Control (No nitrogen), N_1= 45 kg N ha^{-1}, N_2= 90 kg N ha^{-1})

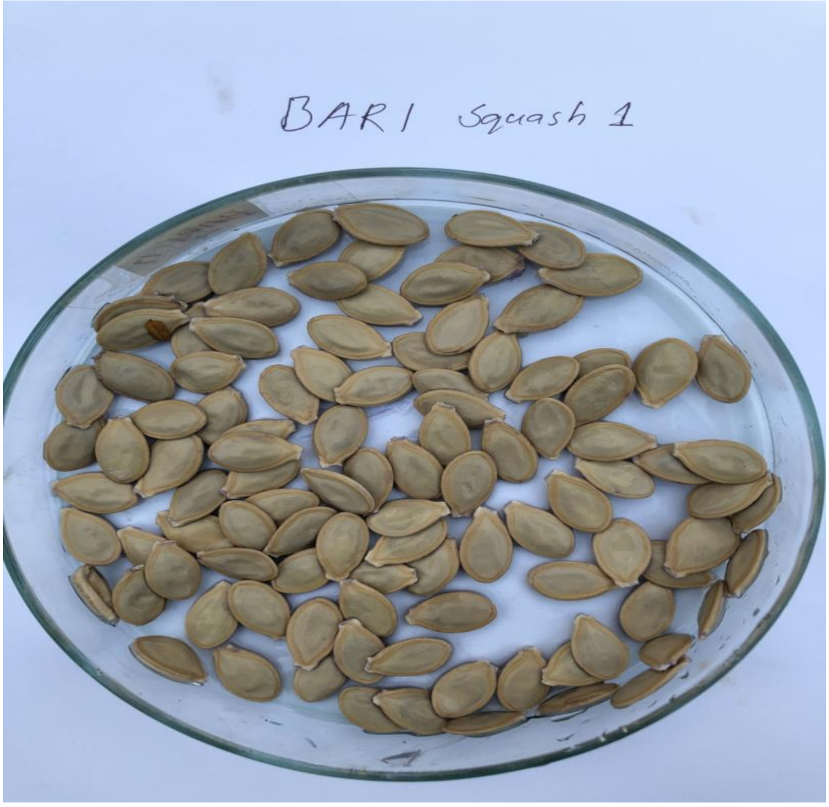

Plate 1. Seeds of BARI Squash-1

Plate 2. Prepared land (plot)

Plate 3. Field view of growing squash

Plate 4. Overall field view of BARI Squash-1 at vegetative stage

Plate 5. Sample of BARI Squash-1 at flowering stage

Plate 6. Sample squash plant at fruiting stage