GROWTH AND YIELD OF BABY CORN AS INFLUENCED BY NITROGEN FERTILIZER MANAGEMENT

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*This is to certify that thesis entitled, "GROWTH AND YIELD OF BABY CORN AS INFLUENCED BY NITROGEN FERTILIZERMANAGEMENT" submitted to the Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka, in partial fulfilment of the requirements for the degree of MASTER OF SCIENCE (MS) in AGRONOMY, embodies the result of a piece of bona-fide research work carried out by Nusrat Jahan Sarna,RegistrationNo..**13-05538**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.

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DEDICATED TO

MY

BELOVED PARENTS

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ABSTRACT

A field experiment was carried out at the Agronomy Field of Sher-e-Bangla Agricultural University, Dhaka, during the period from October-2019 to February 2020 in Rabi season, to find out the performance of baby corn as influenced by management of nitrogen fertilizer. The experiment consisted of two factors, and followed split plot design. Factor A (main plot): Different nitrogen dose *viz.* N_0 = 0 kg ha^{-1}, N_1 = 40 kg ha^{-1}, N_2 = 80 kg ha^{-1}, N_3 = 120 kg $ha^{-1}$and Factor B (sub plot): Nitrogen application method *viz.* M_1 = Basal, M_2 = Side dressing at 30 DAS and M_3 = 50% basal +50% side dressing at 30 DAS. Among different nitrogen dose, N_3 (120 kg ha^{-1}) treatment perform well and recorded the highest (86.22) days to silking, number of cobs $plant^{-1}$ (3.78), number of cobs ha^{-1} (100.42 thousands), cob length (14.46 cm), cob circumference (11.69 cm), cob weight $plant^{-1}$ (31.99 g), dehusked cob weight $plant^{-1}$ (15.86 g),number of rows cob^{-1} (10.03), cob yield (13.27 t ha^{-1}), biological yield (27.91 t ha^{-1}) and harvest index (47.44 %). In case of different application method of nitrogen, the highest number of cobs $plant^{-1}$(3.85), number of cobs ha^{-1} (97.23 thousands), cob length (15.42 cm), cob circumference (11.55 cm), cob weight $plant^{-1}$ (31.43 g), dehusked cob weight $plant^{-1}$ (14.89 g), number of rows cob^{-1} (9.41), cob yield (12.48 t ha^{-1}) biological yield (26.77 t ha^{-1}) and harvest index (46.39 %) was recorded in M_3 (50% basal + 50% side dressing at 30 DAS) treatment. In case of combined effect, the highest (87.33) days to silking, number of cobs $plant^{-1}$ (4.08), number of cobs ha^{-1} (106.32 thousands), cob length (17.52 cm), cob circumference (12.75 cm), cob weight $plant^{-1}$ (38.47 g), dehusked cob weight $plant^{-1}$ (18.35 g), number of rows cob^{-1} (10.57), cob yield ^{1} (15.24 t ha^{-1}), stover yield (15.81 t ha^{-1}), biological yield (31.05 t ha^{-1}) and harvest index (49.03 %) was recorded in N_3M_3 treatment combination. Thus for cultivation of baby corn, application of 120 kg nitrogen ha^{-1} as 50% basal and rest of 50% as side dressing at 30 DAS increased the baby corn yield.

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ABBREVIATIONS

AEZ	Agro-Ecological Zone
BARI	Bangladesh Agricultural Research Institute
BAU	Bangladesh Agricultural University
BBS	Bangladesh Bureau of Statistics
CV%	Percentage of coefficient of variance
cv.	Cultivar
DAE	Department of Agricultural Extension
DAS	Days after sowing
^{0}C	Degree Celsius
et al	And others
FAO	Food and Agriculture Organization
FYM	Farm Yard Manure
G	gram(s)
ha^{-1}	Per hectare
HI	Harvest Index
HYV	High Yielding Variety
IFDC	International Fertilizer Development Center
LSD	Least Significant Difference
Max	Maximum
Mg	Milligram
Min	Minimum
MoP	Muriate of Potash
N	Nitrogen
No.	Number
NS	Not significant
%	Percent
SAU	Sher-e-Bangla Agricultural University
SRDI	Soil Resources and Development Institute
TSP	Triple Super Phosphate
UPOV	Union for the Protection of Plant Varieties
Wt.	Weight

CHAPTER I

INTRODUCTION

Among the different grain crops Maize (*Zea mays L.*) is acted as an important crop in most of the developing countries and it is ranked as 2nd grain crop in terms of crop production in Bangladesh after rice (Kobir *et al.,* 2019). For it's various use and efficiency it is 3rd in rank in the world after wheat and rice (Kobir*et al*., 2020). The average yield of maize is 9.27 ton ha^{-1} in Bangladesh and in the fiscal year (2018-2019) about 4.7 million MT maize has been produced in Bangladesh from 0.507 million hectares of land (AIS, 2020). Being a C_4 plant maize can withstand in adverse climatic condition and can convert large amount of prevails nutrient into food for consumption of human (Lara and Andreo, 2011; Archana and Bai, 2017). At the time of silk emergence when entire maize cob is harvested in raw green form prior to fertilization is known as baby corn (Galiant, 1985). Baby corn is mostly used as vegetables and it contains about 86 mg phosphorus in 100 g of it's corn where other vegetable commodities contain 17 mg- 57 mg phosphorus in their 100 g part (Demjanova *et al.,* 2009). Baby corn contains potassium: 2-3%, calcium: 0.3-0.5%, protein: 15-18%, fiber: 3-5%, ascorbic acid: 75-80 mg per 100 g, sugar: 0.016-0.020% (Das *et al*., 2008; Thavaprakrasaash *et al*., 2005). For being eco-friendly, high nutritive value and delicious food item baby corn is becoming popular day by day to the elite as well as middle income people in our society. Baby corn has short growth duration offers an intensive rotation cultivation system which is an excellent solution for promoting economic and poverty alleviation in countries with high populations like Bangladesh, Vietnam, Thailand and the Philippines. The other advantage of growing baby corn is its remaining biomass after harvesting. These green products can be used as feed for animal and aquaculture raising (Bindhani *et al*., 2007). Ears are ideal for baby corn if they are bite size, 5-10 cm long and 0.85-1.70 cm diameter at the base (Bar-zur and Saadi, 1990). Expected yield is approximately 8500 pounds of unhusked baby corn ears $acre^{-1}$, or 1140 pounds of husked baby corn ears $acre^{-1}$. The baby corn has many uses. It is being used by Chinese as vegetables and this practice has spread to other Asian countries. Recently it is becoming popular very rapidly as vegetables, salad, pasta, soup, pakora, chutney, cutlets chat, dry vegetable, kofta curry, masala, manchurian, chilly, raita, pickle, candy, jam, murabba, burfi, halwa, kheer, laddo and other favorite dishes for different Chinese hotels and restaurants in Bangladesh. Recently with the establishment of new dairy and beef fattening farms in our country, the demand of maize plants as a fodder are increasing day by day. Moreover stover, dry leaves and cob covering can be used as good fuel (Ahmed, 1994). Foreign exchange can be earned by exporting baby corn and its products (Das *et al.,* 2008).

In Bangladesh, it is not commercially grown yet in different locations. At present, baby corn is growing some areas of Chittagong hill tracts. The soil and climate of our country is suitable for baby corn production. It can be grown all the year round (Salahuddin and Ivy, 2003). It has short growth duration of about 70-80 days, thus the farmer can grow baby corn three or four times a year and thus farmers can earn money in the shortest possible time by cultivating baby corn even it can be fitted for any cropping pattern. Although the production and marketing started since 1992-93 in our country with the co-operation of IFDC but its uses, area and marketing facility have not yet been increased considerably. Eventually to meet the demand of baby corn it is imported from foreign countries like Thailand, Taiwan etc. and costing about Tk. 10 (ten) crores per year (BARI, 2004). The yield of baby corn of our country is 0.99-1.1 t ha^{-1} (BARI, 2008). But its potentiality is 5 t ha^{-1} (BARI, 2004). Nevertheless it is not cultivated all over the country due to the lack of production technology knowledge and cultural management practices especially fertilizer rate and fertilizer application method. For improving crop yields and farm profit fertilizer is considered as the principal inputs. In case of agricultural sector of Bangladesh this is also true, because the country has hardly any possibility of expanding its cultivable land area. For this, the production of food of this country can be accelerated through improving irrigation facilities alongside better practice of fertilizer as well as high yielding variety (HYV) (Shah *et al*., 2008). Fertilizer application greatly affected the yield and quality of baby corn (Lone *et al.,* 2013). Fertilizers supply essential nutrient of plants and among them nitrogen is the most important element for growth and yield of baby corn (Henrique *et al*., 2016). Nitrogen fertilizer application is generally the most effective way to increase plant nitrogen accumulation and grain yield, and to improve the grain protein content and other quality indicators (Ma *et al.,* 2019).However, farmers often misinterpret the relationship between grain yield and nitrogen fertilization, and thus overestimate the yield benefits. This results in excessive nitrogen fertilizer application in agricultural production (Wu and Ma, 2015; Gao *et al*., 2020). In fact, excessive nitrogen application does not significantly improve the grain yield once the levels have exceeded the ability of plants to uptake nitrate (Wang *et al.,* 2020). Therefore, it was necessary to give optimum dose of nitrogen for improving quality of maize (Li *et al.,* 2010).

Efficient use of nitrogen by maize, permits use of appropriate source in an adequate amount, at proper timing and suitable application rates (Rizwan *et al*., 2003). The utilization efficiency of added nitrogen fertilizer is very low, as applied nitrogen is subjected to various kinds of losses like leaching, volatilization and denitrification. The efficiency of applied N fertilizer not only depends on right quantity but also on right time, method of N application, crops and different genotypes of the same crops.

Timing of N application is also deliberated as the best managing strategy and is very crucial for maize production (Walsh, 2006). However, split application of N can nourish the crop better through optimum N uptake and thus protects the environment from the adverse effect of these chemical inputs. Application method of nitrogen in maize has a great importance and considered the best and appropriate for production of maize. Hassan *et al.* (2010) reported that application of nitrogen in three splits at planting, V_4 and V_6 stages significantly increased number of leaves plant^{-1}, plant height, leaf area index, leaf area duration, crop growth rate and total dry matter. Mariga *et al*. (2000) reported that biomass yield in maize considerably increased when nitrogen was applied up to tassel initiation stage. Scharf *et al*. (2002) observed significant increase in maize yield when nitrogen was applied in splits. In order to get highest and appropriate vegetative growth and yield, increasing the nitrogen use efficiency by crop could be achieved through best management practices of nitrogen (Rehmati, 2009).

The research work was carried out with the following objectives:

i. To observe the effect of nitrogen doses on baby corn production.
ii. To study the influence of N-application method on growth and yield of baby corn and
iii. To determine the combined effect of N doses and application method on growth and yield of baby corn.

CHAPTER II

REVIEW OF LITERATURE

An attempt was made in this section to collect and study relevant information available regarding to growth and yield of baby corn as influenced by the management of nitrogen fertilizer, to gather knowledge helpful in conducting the present piece of work.

2.1 Effect of different nitrogen dose

Plant height

Ullah *et al.* (2015) stated that plant height was increased significantly with increased levels of nitrogen @ 200, 240, and 280 kg N ha^{-1} in fodder maize on silt loam soils of Peshawar, Pakistan.

Asaduzzaman *et al.* (2014) reported that highest plant height and dry matter accumulation was recorded at 160 kg N ha^{-1} which was statistically similar to 200 kg N ha^{-1}. LAI and dry matter accumulation increased sharply with the increase of N-rates.

Mannan *et al.* (2010) concluded that plant height and number of tillers were significantly increased with the increase in nitrogen level at different growth stages *viz*., 30, 45 and 60 DAT. They found proportionate increase in dry matter with increase in nitrogen levels from 0 to 100 kg ha^{-1} at different growth stages.

Behera and Panda (2009) concluded that the cell size and its elongation and division that determine growth parameters like plant height was increases with increasing nitrogen fertilization.Eltelib *et al.*(2006) also reported significant increase in plant height, stem diameter, LAI and number of leaves per plant of baby corn due to nitrogen application. Shah *et al.* (2003) also reported that application of 175 kg N ha^{-1} and 120 kg $P_2O_5ha^{-1}$ significantly increased leaf area and plant height of baby corn as compared to control.

Leaf area index

Asaduzzaman *et al.*(2014) reported that at all growth stages, the highest LAI of baby corn was obtained with 200 kg N ha^{-1}.Azarpour*et al.* (2014) conducted experiment with four rice cultivars and four nitrogen fertilizer levels (0, 30, 60, and 90 Kg N ha^{-1}) and reported that leaf area index (LAI) significantly increase with 90 kg N ha^{-1}application compared to others treatment. Krishnamurthy *et al.* (1974) reported increase in leaf area (LA) of maize with increase in level of nitrogen application.

Above ground dry matter weight

Jeet *et al*. (2017) noticed the highest dry matter accumulation with application of 150 kg N ha^{-1}(232.4 and 240.0 g $plant^{-1}$ during 2009-10 and 2010-11, respectively) over 100 and 50 kg N ha^{-1} in Quality protein maize on sandy loam soils of Varanasi, Uttar Pradesh.

Dadarwal *et al.* (2009) reported that application of 100, 125 and 150 per cent of recommended dose of NPK (120: 40: 30 kg ha^{-1}) resulted in significant improvement in dry matter accumulation rate in baby corn with increasing level of NPK.

Thavaprakaash and Velayudham (2009) reported significant increase in growth parameters of baby corn *viz*., plant height, LAI and dry matter percentage with increase in the level of nitrogen application. Eltelib *et al* (2006) reported that application of 80 and 40 kg N ha^{-1} resulted in significant increase in the dry matter yield of forage maize over the control by 69.3% and 55.7%, respectively. Reddy (2000) reported that dry matter accumulation was increasing through increasing vegetative growth resulting from higher photosynthetic activities is well known to be influenced by nitrogen.

Days required to tasseling

Singh *et al.* (2014) observed that successive increase in nitrogen levels from 0 to 160 kg N ha^{-1} resulted in less number of days taken to 50% tasseling over control treatment in maize. Asif *et al.* (2013) reported that minimum days to 50 per cent tasseling was recorded with application of nitrogen @ 300 kg ha^{-1} against highest days to 50 per cent tasseling and silking, where no nitrogen was applied in maize on sandy clay loam soils of Faisalabad, Pakistan. Amin (2011) revealed that nitrogen application accelerated the time to reach 50% tasseling compared to control in fodder maize on sandy clay loam soils of Sudan.

Days required to silking

Imran *et al*. (2015) carried out an experiment to observed the effect of nitrogen levels and plant population on yield and yield components of maize and reported that, highest number of days to silking (75.92) was recorded for 210 kg N ha^{-1} while control treatment took minimum numbers of days to silking (71.50).Asaduzzaman *et al.* (2014) conducted an experiment to observed the effect of variety and N fertilizer rate on growth, yield and yield parameters of baby corn (*Zea mays* L.) and found that, days to 1st silking of baby corn was not significantly influenced by different levels of nitrogen. Numerically, the highest days required to 1st silking (78.80) was obtained when the plot treated with 200 kg N ha^{-1} on the other hand the minimum days required to 1st silking (78.30) was obtained rest of the nitrogen treatments.

Number of cobs $plant^{-1}$

Sahoo and Mahapatra (2004) reported that increase in the level of NPK increased the number of cobs per plant, weight of whole green cob and yield of green cob significantly. Thavaprakaash *et al.* (2005) reported that with the application of recommended dose of NPK + vermicompost @ 5 tonnes/ha recorded the highest number of cobs per plant (2.60) than recommended NPK alone (2.39).

Number of cob $hectare^{-1}$

Rakib *et al.* (2011) reported that number of baby corn per hectare and total husked cob yield increased significantly with increase in the level of NPK up to 120:60:60 kg ha^{-1}.

Cob length

Asim *et al.* (2012) reported that highest ear height (67.15 cm) was observed with application of 150 kg N ha^{-1} as compared to 120 and 90 kg N ha^{-1}.

Mohsin *et al.* (2012) conducted a study on nitrogen application through different combinations of urea and farm yard manure in spring maize and reported that the application of 50% N from urea + 50% from FYM produced longer cobs (18.57 cm).

Thavaprakaash *et al.* (2005) reported that with the application of recommended dose of NPK + vermicompost @ 5 tonnes/ha recorded the higher cob length (23.18 cm) than recommended NPK alone (22.04 cm).

Derbay *et al*. (2004) reported that the probable reason for longer cob length at a higher level of N could be due to optimum utilization of solar light, higher assimilated production and its conversion to starches resulted in higher ear length.

Singh *et al.* (2000) reported that increasing levels of N from 150 to 200 kg/ha resulted in significant increase in length and girth of baby corn. Raja (2001) reported that increment in N levels from 0 to 120 kg N ha^{-1} significantly increased cob length, cob girth, ear number and kernel weight of sweet corn.

Panchanathan *et al.* (1987) reported that application of N at120 kg ha^{-1} a recorded highest cob length which was found at par with application of nitrogen at 180 kg ha^{-1} but was significantly better over 60 kg $Nha^{-1}$and no nitrogen.

Cob circumference

Majid *et al*. (2017) reported that a higher cob circumference was obtained from higher dose of Nitrogen application due to sufficient availability of Nitrogen which is responsible for cell division and cell elongation. Saleem *et al*. (2017) observed the significant increment in cob circumference with increasing level of Nitrogen.Grazia *et al.* (2003) observed that application of 200 kg Nha^{-1}recorded significantly higher cob circumference of baby corn than control.

Number of rows cob^{-1}

Kandil (2013) indicated that highest number of kernels $row^{-1}$of cob was produced by the application of either 429 or 357 kg N ha^{-1}.Dawadi and Shah (2012) suggested a decrease in the number of rows cob^{-1} under lower N application might be attributed to poor development of sinks and reduced translocation of photosynthates.

Cob weight

Verma *et al.* (2012) studied performance of different nitrogen doses (50, 100 and 150 kg N ha^{-1}) and their results indicated that highest weight of cobs $plant^{-1}$ (77.18) was recorded with application of 150 kg N ha^{-1}over 100 and 50 kg N ha^{-1}.Sahoo and

Mahapatra (2004) reported that an increase in nitrogen level resulted in significant increase in weight of green cob, yield of fresh grain and ear and net profit of sweet corn cultivation. The fresh weight of ear over the years was maximum (201gcob^{-1}) with application of 180 kg N ha^{-1} which was at par with 120 kg N ha^{-1}.

Dehusked cob weight

Dadarwal *et al.*(2009) reported that increasing the rates of NPK application from 120: 40: 30 to 180: 60: 45 kg NPK ha^{-1} significantly increased dehusked cob weight of baby corn. Parodhan *et al.* (2007) reported that highest husked, dehusked and standard weight of baby corn was obtained with 175 kg N ha^{-1} and it was at par with 125 kg N ha^{-1}.

Cob yield

Mahesh *et al.* (2016) concluded that application of240 kg Nha^{-1}recorded the highest grain yield (8349 kg ha^{-1}) and stover yield (10525 kg ha^{-1}) compared to 120 and 180 kg N ha^{-1} on sandy loam soils of Agricultural Research Institute, Rajendranagar, Telangana.

Sahoo (2011) reported that with increase in levels of nitrogen progressively increased the baby corn and fodder yield. Maximum yield of fodder 16.09 t ha^{-1}during 2006 and 16.93 t ha^{-1}during 2007 and baby corn yield 1.08 t ha^{-1}during 2006 and 1.19t ha^{-1}during 2007 was obtained with nitrogen level of 180 kg ha^{-1}, which was statistically at par with 120 kg N ha^{-1}.

Gosavi and Bhagat (2009) revealed that application of 200 kg N ha^{-1} recorded significantly higher baby corn yield with husk, green fodder yield and total biomass production than rest of the nitrogen levels. It was followed by 150 kg N ha^{-1}, 100 kg N/ha, 50 kg N ha^{-1}and control in the order of sequence. The beneficial effects of the higher levels of nitrogen to baby corn in terms of dry matter accumulation ultimately reflected in increasing the yield attributing characters, the higher availability of source under the higher nitrogen levels created more sink than the nitrogen lower level.

Rathika *et al.* (2009) showed significant increase in growth parameters and yield of baby corn with application of nitrogen and plant growth regulators.

Kar *et al.* (2006) reported that nitrogen application significantly increased the number of prime cobs, length and girth of green cobs and green forage yield. The highest green cob yield was obtained at 80 kg N ha^{-1}, which was 220, 160, 48 and 21 per cent higher than that of control, 20, 40 and 60 kg N ha^{-1}, respectively. Maximum green forage yield was also recorded at the highest nitrogen level (80 kg ha^{-1}), which was significantly higher than that of other levels.

Harikrishna *et al.* (2005) reported that application of 200 per cent RDN in four splits resulted in significantly higher yield and yield attributes of baby corn over 100 per cent RDN in four splits and was at par with the treatment receiving 150 per cent RDN in four splits.

Singh *et al.* (2003) noticed that combined application of 120 kg N ha^{-1} and 70 kg K_2O ha-^{1} recorded significantly higher growth and yield of baby corn over control.

Bangarwa *et al.* (1989) reported that application of 60–180 kg N ha^{-1} to maize grown with 40,000, 65,000 and 90,000 plants per hectare gave average grain yield of 36.0–52.2, 41.7–64.9 and 42.3–72.7 q ha^{-1} respectively compared with corresponding yield of 21.6, 23.4 and 26.5 q ha^{-1} with no nitrogen. Yield increased significantly with increasing nitrogen rates.

Straw yield

Das *et al.* (2009) experimented with four levels of nitrogen (0, 60, 120 and 180 kg ha^{-1}) and three levels of potassium (0, 40 and 80 kg ha^{-1}) and reported maximum grain and straw yield with 80 kg N ha^{-1}.Karki *et al.* (2005) reported that grain and stover yield of maize increased significantly with increase in the level of nitrogen application.

Biological yield

Abera *et al*. (2013) carried out a study to observed the preferences and constraints of maize farmers in the development and adoption of improved varieties in the mid-altitude, sub-humid agro-ecology of western Ethiopia and found a significantly increase in biomass yield at higher Nitrogen dose.

Harvest index

Adhikari *et al.* (2021) conducted a study to determine the effects of different rates of nitrogen and varieties on growth and yield of hybrid maize in Lamahi Municipality, Dang, Nepal from June to October, 2019 and reported that different level of Nitrogen showed significant differences in harvest index. Nitrogen doses 220 kg ha^{-1}, 200 kg ha^{-1} and 180 kg ha^{-1} had shown statistically similar i.e., 43.80, 43.97, 43.08 Harvest Index respectively but Nitrogen dose 160 kg ha^{-1} had least harvesting index i.e., 39.85.Sharifi and Namvar (2016) found the maximum harvest index (42.1%) with the application of 225 kg N ha^{-1}. Wajid *et al*. (2007) also found the increase in harvest index with increasing fertilizer dose up to 250 kg N ha^{-1}.

2.2 Effect of nitrogen application method

Plant height

Niaz *et al.* (2014) conducted a experiment to observed variable nitrogen rates and timing effect on yield, nitrogen uptake and economic feasibility of maize production and reported that maximum plant height (167.69 cm) and leaf area index (2.98%) were obtained with S_3 (50% N broadcast-incorporated at seed bed preparation + 50% N top dressed at V_9 + C_2) which was at par with S_4 (25% N broadcast-incorporated at seed bed preparation + 75% N top dressed at V_9 + C_2), S_5 (100% N top dressed at V_9 + C_2), S_2 (25% N broadcast-incorporated at seed bed preparation + 75% N top dressed at V_9 + C_2) and S_1 (100% N broadcast-incorporated at seed bed preparation + C_2).

Singh *et al*. (2013) reported that highest plant height (197.0 cm) was noted under T_1 treatment (30% as basal 10% at 4 leaf stage, 30% at 8 1eaf stage and 30% at tasseling stage) which was significantly superior to other treatments.

Wasaya *et al.* (2012) reported that nitrogen applied in three split (S_5-1/3 at sowing + 1/3 at V_5 + 1/3 at tasseling) gave maximum plant height as compare to S_1-Whole at sowing, S_2- ½ at sowing + ½ at V_5 (5-leaf stage), S_3-½ at sowing + ½ at tasseling, S4-½ at V_5 + ½ at tasseling.

Amanullah *et al.* (2009) conducted an experiment on split application of nitrogen including T_1 two split (50%at sowing and 50% at 14 DAE), T_2 three splits (50% at sowing and 50% at 25 DAE and 25%DAE), T_3 three split (33.3% each at sowing , 14, DAE and 28 DAE), T_4 four split (25% eachat sowing , 14 DAE, 28 DAE and 42 DAE), T_5 five split (20% each at sowing, 14 DAE, 28DAE, 42 DAE and 56 DAE) T_5 six split (8.3, 16.6, 25, 33.3 and 16.6 at sowing 14, 28, 42,and 56 DAE) and concluded that maximum plant height was observed with five to six splits. Mollah *et al.* (2007) reported that plant height were highest when N splitted as 50% as basal and 50% at 8 leaves stage compared to others.

Leaf area index

Harikrishna *et al.* (2005) reported that application of 200 per cent RDN in four equal splits registered significantly higher leaf area index as compared to two equal splits followed by 150 per cent and 100 per cent RDN. However, the results observed in 200 per cent RDN was significant over results noticed in 100 per cent RDN. Muthukumar *et al*. (2005) while working in sandy clay loam soil at Tamil Nadu Agricultural University, Coimbatore during late *rabi* season (February-March) 2003, reported that application of nitrogen in three splits (1/2 as basal + 1/4 at 25 DAS + 1/4 at 45 DAS) produced highest leaf area index (3.74) whereas application of nitrogen in two splits (1/2 as basal + 1/2 at 45 DAS) resulted in minimum leaf area index (3.11).

Above ground dry matter weight

Amanullah *et al.* (2009) reported that application of N at later vegetative stages of maize extended growth phase and produced relatively more assimilates by maize crop in response to the longer growth period, as a result dry matter weight of the plant was significantly increased. Saleem *et al*. (2009) concluded that maize took more days for maturity with accumulating higher dry matter/plant at Faisalabad (Pakistan) when 1/3 N was applied at sowing + 1/3 N at 25 DAS and 1/3 N at 55 DAS as compared to other timings of N application at different growth stages of crop.

Days required to tasseling

Hammad *et al.* (2013) conducted an experiment on different times of nitrogen application *viz.,* T_1 (1/3rd N at seed bed preparation, 1/3rd N at V_6 and 1/3rd N at VT stage), T_2 (1/3rd at V_2 stage, 1/3rd at V_{16} and 1/3rd N at R_1 stage) and T_3 (1/3rd at seed bed preparation, 1/3rd N at V_{12} and 1/33rd N at R_2 stage) at Pakistan and concluded that time of nitrogen application did not significantly affect the number of days to emergence in both the years. T_3 took more days to tasseling, silking and maturity compared to other treatments.

Days required to silking

Akbar *et al.* (2002) found that maize crop took 102 days to maturity when the crop was subjected to changes in the nitrogen application timing and increase in nitrogen fertilizer rate, and this might have enhanced the rate of photosynthesis which resulted in the leaf longevity and delayed silking and maturity stage of maize.

Number of cobs hectare^{-1}

Mollah *et al*. (2007) observed that the highest number of cobs/ha was found when N splitted as 1/3 as basal + 1/3 at 8 leaves stage + 1/3 at tasseling stage.

Cob length

Singh (2010) observed that application of nitrogen in five splits (10 % as basal, 30 % at 4 leaf emergence, 30 % at 8 leaf emergence, 20 % at tassel emergence and 10 % at early grain filling stages respectively) gave highest cob length.

Amanullah *et al.* (2009) conducted an experiment on split application of nitrogen including T_1 two split (50% at sowing and 50% at 14 DAE), T_2 three splits (50% at sowing and 50% at 25 DAE and 25% 42DAE), T_3 three split (33.3% each at sowing, 14 and 28 DAE), T_4 four split (25% each at sowing, 14, 28 and 42 DAE), T_5 five split (20% each at sowing, 14, DAE 28 DAE. 42 DAE and 56 DAE) and T_6 six split (8.3, 16.6, 25, 33.3 and 16.6 12 at sowing 14, 28, 42, and 56 DAE) who concluded that maximum ear height was observed with five to six splits. Harikrishna *et al.* (2005) reported that application of 200 per cent RDN in four equal splits recorded higher length of cob over two equal splits in both *kharif* and *rabi* seasons.

Cob circumference

Muthukumar *et al*. (2005) while working in sandy clay loam soil at Tamil Nadu Agricultural University, Coimbatore during late *rabi* season (February-March) 2003, reported that application of nitrogen in three splits (1/2 as basal + 1/4 at 25 DAS + 1/4 at 45 DAS) resulted in higher diameter of cob (cm) as compared to nitrogen applied in two splits (1/2 as basal + 1/2 at 45 DAS).

Number of rows cob^{-1}

Dawadi and Sah (2012) while working in sandy loam soil at Chitwan (Nepal) recorded higher number of kernel rows/ear (15.19) when 200 kg N/ha was applied as 50 % at planting, 25% at knee high stage and 25% at tasseling stage.

Cob weight

Ogunboye *et al*. (2020) carried out an experiment to study the effects of Split Application of Urea Fertilizer on Soil Chemical Properties, Maize Performance and Profitability in Southwest Nigeria and found that application of N fertilizer increased the growth of maize at both sites (except the number of leaves and leaf area for site II) compared with the control. The values of maize growth parameters increased in the order: control < 120 kg N ha^{-1} applied once < 90+30 < 60+30+30. Yield parameters such as weight of cob/plant increased significantly with the application of N fertilizer compared with the control. The yield parameters increased in the order: control < 120 kg N ha^{-1} applied once < 90+30 < 60+30+30. Kumar *et al*. (2014) while working in sandy loam soil reported that N application in three equal splits as basal, knee height stage and pre tasseling stage registered the highest cob weight comparable to other treatments. Choudhary *et al.* (2013) reported that application of 175 kg N/ha in four equal splits as 25% at sowing+25% at 4-6 leaf stage+25% at knee high stage+25% at 50% tasseling stages showed marked improvement in yield attributes and yields as compared to three splits of nitrogen application as (1/3 each) at sowing, knee high and 50% at tasseling stages.

Cob yield

Pandey and Chaudhary(2014) conducted a field experiment at Phulbari (Chitwan, Nepal) during 2012 reported that application of nitrogen in four equal splits (as basal, at 30 days after sowing, at 45 days after sowing and at 60 days after sowing) had maximum grain yield (7.68 t /ha) than two equal splits (50 % each at basal and at 45 DAS)

Singh *et al.* (2013) observed that split application of nitrogen as 10% (basal), 20% (four leaf stage), 30% (eight leaf stage) and 10% (grain filling stage) resulted into significantly higher values of all the yield attributes and yield as compared to rest of the treatments. Hammad *et al.* (2013) observed that maximum grain yield (8.27 t ha^{-1}) and was recorded with the application of nitrogen in three split at V_2, V_{16} and R_1.

Niaz *et al.* (2014) reported that maximum grain yield (6.17 t ha^{-1}) was recorded with S_4 (25% N broadcast-incorporated at seed bed preparation + 75% N top dressed at V_9 + C_2), it was at par with S_3 (50% N broadcast-incorporated at seed bed preparation +50% N top dressed at V_9 + C_2) and stover yield was maximum in S_4 (25% N broadcast- incorporated at seed bed preparation + 75% N top dressed at V_9 + C_2) which was at par with S_3 (50% N broadcast-incorporated at seed bed preparation + 50% N top dressed at V_9 + C_2), S5 (100% N top dressed at V_9 + C_2), S_2 (25% N broadcast-incorporated at seed bed preparation + 75% N top dressed at V_9 + C_2) and S_1 (100% N broadcast-incorporated at seed bed preparation + C_2). Mariga *et al.* (2000) reported that grain yield in maize increases when N is applied at tassel initiation stage.

Stover yield

Ogoke *et al*. (2003) reported that application of nitrogen in two equal splits (at planting and tasselling stage) gave higher stover yield as compared to when nitrogen was applied first at three weeks after planting and second at tasselling stage in a humid tropical environment of Nigeria.

Biological yield

Wasaya *et al.* (2012) reported that nitrogen application in three splits (S_5-1/3 at sowing + 1/3 at V_5 + 1/3 at tasseling) produced highest biomass yield and shelling percentage as compare to S_1-Whole at sowing, S_2- ½ at sowing + ½ at V_5 (5 leaf stage), S_3-½ at sowing + ½ at tasseling and S_4- ½ at V_5 + ½ at tasseling. Scharf *et al.* (2002) observed significant increase in maize yield when nitrogen was applied in splits. Mariga *et al*. (2000) reported that biomass yield in maize considerably increased when nitrogen was applied up to tassel initiation stage.

Harvest index

Nemati *et al*. (2012) tested three nitrogen application timing including (1/3 in planting + 1/3 in 8-10 leaf stages + 1/3 in tassel initiation), (½ planting + ½ in tassel initiation) and (½ in planting + ¼ in 8-10 leaf stages + ¼ in tassel initiation) as T_1, T_2 and T_3, respectively. Results indicated that the highest harvest index was recorded with nitrogen application timing as T_1. Rizwan *et al.* (2003) reported that harvest index (41.44%) was observed when nitrogen was applied in three equal splits (at sowing, at first irrigation and at knee height stage).

CHAPTER III

MATERIALS AND METHODS

The experiment was conducted at Sher-e-Bangla Agricultural University, Dhaka to study the growth and yield of baby corn as influenced by nitrogen application method. Materials used and methodologies followed in the present investigation have been described in this chapter.

3.1 Experimental period

The experiment was conducted during the period from October-2019 to February 2020 in Rabi season.

3.2 Description of the experimental site

3.2.1 Geographical location

The experiment was conducted in the Agronomy field of Sher-e-Bangla Agricultural University (SAU). The experimental site is geographically situated at 23°77′ N latitude and 90°33′ E longitude at an altitude of 8.6 meter above sea level (Anon., 2004).

3.2.2 Agro-Ecological Zone

The experimental field belongs to the Agro-ecological zone (AEZ) of "The Modhupur Tract", AEZ-28 (Anon., 1988a). This was a region of complex relief and soils developed over the Modhupur clay, where floodplain sediments buried the dissected edges of the Modhupur Tract leaving small hillocks of red soils as 'islands' surrounded by floodplain (Anon., 1988b). For better understanding about the experimental site has been shown in the Map of AEZ of Bangladesh in Appendix-I.

3.2.3 Soil

The soil texture was silty clay with pH 6.1. The morphological, physical and chemical characteristics of the experimental soil have been presented in Appendix- II.

3.2.4 Climate and weather

The climate of the experimental site was subtropical, characterized by the winter season 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). Meteorological data related to the temperature, relative humidity and rainfall during the experiment period was collected from Bangladesh Meteorological Department (Climate division), Sher-e-Bangla Nagar, Dhaka and has been presented in Appendix-III.

3.3 Test crop

Baby star" variety of baby corn was used as test crop for this experiment. It is an open Pollinated crop. The plant produces good yields of tiny ears of baby corn. These tiny ears of corn are very tender and entirely edible. Plant height around 175-180 cm. Silk appear at 80-90 days after sowing. Excellent for stir-fries and pickling. Best if harvested within 5-10 days of the appearance of silk.

3.4 Seed collection

"Baby star" variety of baby corn seed,was collected from Kushtia seed store located at plot no.-7,block-A,section-11,Harun al-Rashid molla road,Mirpur,Dhaka-1216.

3.5 Experimental treatment

There were two factors in the experiment namely nitrogen fertilizer dose and nitrogen application method as mentioned below:

Factor A: Nitrogen dose (4, main plot)

N_0 = 0 kg ha^{-1}

N_1 = 40 kg ha^{-1}

N_2 = 80 kg ha^{-1}

N_3 = 120 kg ha^{-1} and

Factor B: Nitrogen application method (3, sub plot)

M_1= Basal

M_2 = Side dressing at 30 DAS and

M_3 = 50% basal + 50% side dressing at 30 DAS

3.6 Detail of experimental procedure

3.6.1 Experimental design

The experiment was laid out in Split-plot design with 2 factor and three replications. There are 12 treatment combinations and 36 unit plots. The unit plot size was 10 m^2 (4 m × 2.5 m). The blocks and unit plots were separated by 1.0 m and 0.50 m spacing, respectively. The layout of the experimental field was shown in Appendix- IV.

3.6.2 Land preparation

The experimental land was opened with a power tiller on Date 25th October, 2019. Ploughing and cross ploughing were done with power tiller followed by laddering. Land preparation was completed on date 30th October, 2019.Immediately after final land preparation, the field layout was made on November, 2, 2019 according to experimental specification. Individual plots were cleaned and finally prepared the plot for seed showing.

3.6.3 Fertilizer application

During final land preparation, the land was fertilized with 150-100-15--10 kg ha^{-1} of TSP, MOP, Gypsum and $ZnSO_4$, respectively as basal dose. Nitrogen fertilizer was applied as per treatment requirements.

3.6.4 Seed sowing

The "Baby star" corn seeds were sown in lines maintaining 60 cm × 25 cm planting geometry having 2 seeds $hole^{-1}$under direct sowing in the well-prepared plot on November 4, 2019.

3.6.5 Thinning and gap filling

The unhealthy seedling were removed after 2 weeks of sowing. In case, where seeds are not germinated, presoaked seeds were dipped @ 2 seeds per hole following immediate irrigation.

3.6.6 Weeding

Baby corn field was infested with some weeds. So weeding was done for removing of weed from the field. Weeding was done after 15 DAS and 40 days after seed sowing.

3.6.7 Earthen up

Earthen up is an important intercultural operation which helps better establishment and anchorage of crown root of baby corn. It was done after 25 and 45 days after seed sowing.

3.6.8 Irrigation

Irrigation was given in the respective plots to ensure proper moisture attain in the root zone of baby corn. First irrigation was given at 15 days after sowing (DAS) and the second irrigation was given at 40 days after sowing (DAS). Third irrigation was given at 60 days after sowing (DAS).

3.6.9 Pests management

The experimental field was infested by shoot fly, pink borer and stem borer. Spraying of carbaryl @ 700 grams per hectare in 700 liter of water control these pests. Mole attack was preventing by application of bleaching powder.Virtiko 40WG was used @ 75 g per hectare to control fall army worm.

3.7 General observations of the experimental field

Regular observations were made to see the growth stages of the crop. In general, the field looked nice with normal green plants, which were vigorous and luxuriant.

3.8 Harvesting and post-harvest operations

Baby corn crop was ready for harvesting when baby corn silk comes out 2 to 3 cm from the top of ears, usually in 3 to 5 days after their emergence. Small cobs need to be plucked without damaging the plant. After first harvesting (7 to 10 days), second and third cobs will be ready to be plucked. An average size of cob was 8 to 10 cm long with golden yellow colour. At 27 January, 2020, the cobs of five randomly selected plants of each plot were separately harvested for recording yield attributes and other data. The five cobs were harvested for recording cob yield and other data.

3.9 Data collection

The data were recorded on the following parameters

A) Growth parameters

i. Seedling emergence
ii. Plant height
iii. Leaf area index
iv. Above ground dry matter weight plant^{-1}

B. Yield and other contributing parameters:

v. Days to 1st tasseling
vi. Days to 1st silking
vii. Number of cobs plant^{-1}
viii. Number of cobs ha^{-1}
ix. Cob length
x. Cob circumference
xi. Cob weight plant^{-1}
xii. Dehusked cob weight plant^{-1}
xiii. Number of rows cob^{-1}
xiv. Duration of baby corn harvesting
xv. Cob yield
xvi. Straw yield
xvii. Biological yield
xviii. Harvest index

3.10 Procedure of recording data

i) Germination percentage

Germination percentage is an estimate of the viability of a population of seeds. The equation to calculate germination percentage is:

$$\text{Germination percentage} = \frac{\text{seeds germinated}}{\text{total seeds set for test}} \times 100$$

ii) Plant height

The height of the randomly selected five plant were measured from the ground level to the tip of the plant at 25, 45, 65 and 85DAS.Mean plant height of baby corn was calculated and expressed in cm.

iii) Leaf area index

Leaf area index were estimated manually by counting the total number of leaves per plant and measuring the length and average width of leaf and multiplying by a factor of 0.70 (Kluen and Wolf, 1986). It was done at 25, 45, 65 and 85 DAS.

$$\text{Leaf area index} = \frac{\text{Surface area of leaf sample (cm}^2) \times \text{Correction factor}}{\text{Ground area from where the leaves were collected}}$$

iv)Above ground dry matter weight plant^{-1}

Five plants were collected randomly from each plot at 25, 65 DAS and at harvest respectively. The sample plants were oven dried for 72 hours at 70°C and then dry matter content plant^{-1} was determined. Mean dry matter plant^{-1} of baby corn plant was calculated and expressed in gram (g) for recording data.

v) Days to 1sttasseling

Days to 1st flowering (male flower) was recorded as the number of days from planting date to 1st pollen shedding in five selected plants in each plot and average value was recorded.

vi) Days to 1st silking

The number of days recorded from the date of planting to the 1st emergence of silks in five selected plants in each plot and average value was recorded.

vii) Number of cobs plant^{-1}

Number of cobs plant^{-1}was counted from the 5 selected plant sample and then the average number of cobs plant^{-1}was calculated.

viii) Number of cobs ha^{-1}

Cob number of 1 m^{-2}area in each plot were counted and finally converted into ha and data were recorded in thousand-unit basis.

ix)Cob length

Five cobs were collected randomly from the sampled plants and the mean length of baby corn was recorded using measuring tape in centimeter scale.

x)Cob circumference

Five cob were collected randomly from the sampled plants and the mean circumference at middle position of baby corn was recorded using measuring tape in centimeter scale.

xi) Cob weight plant^{-1}

Cob weight with husk of five randomly selected cobs from the five selected plants in each plot was taken and the average weight was recorded in gram (g).

xii) Dehusked cob weight plant^{-1}

Dehusked cob weight of five randomly selected cobs from the five selected plant in each plot was taken and the average weight was recorded in gram (g).

xiii) Number of rows cob^{-1}

Number of rows of five randomly selected cobs from the five selected plants plot^{-1} were counted and finally averaged.

xiv) Duration of baby corn harvesting

The duration of baby corn harvesting from the date of 1st harvesting till last one from selected plants in each plot and average value was recorded.

xv) Cob yield

The mean fresh cob yield was taken from 1m^2 sample area and then converted to t ha^{-1} in dehusked cob weight basis..

xvi) Stover yield

Weight cleaned and well dried stover were collected from each plot were taken and converted into hectare and were expressed in t ha^{-1}.

xvii) Biological yield

The summation of cob yield (Dehusked) and above ground stover yield was the biological yield. Biological yield =Cob yield + Stover yield.

xviii) Harvest index

Harvest index was calculated using the following formula.

Harvest index (HI %) = $\frac{\text{Cob yield}}{\text{Biological yield}} \times 100$

Here, Biological yield = Cob yield + stover yield

3.11 Data analysis technique

The collected data were compiled and analyzed statistically using the analysis of variance (ANOVA) technique with the help of a computer package program name Statistix 10 software and the mean differences were adjusted by Least Significant Difference (LSD) test at 5% level of probability (Gomez and Gomez, 1984).

CHAPTER IV

RESULTS AND DISCUSSION

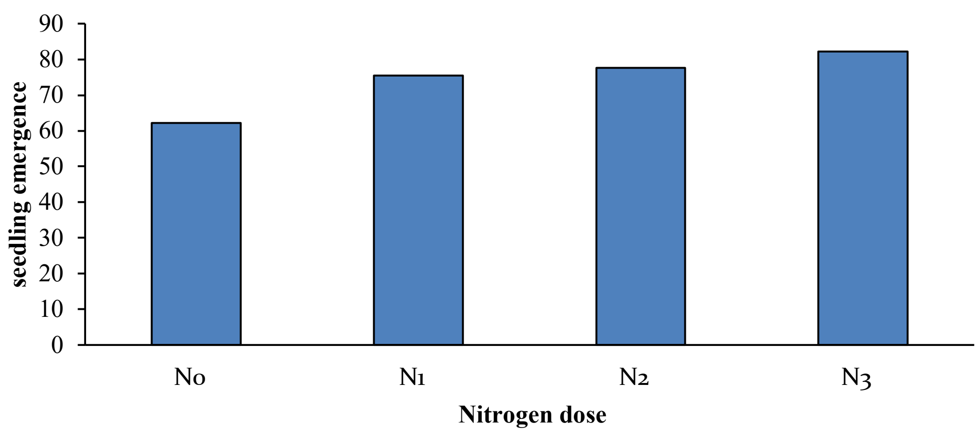
Results obtained from the present study have been presented and discussed in this chapter with a view to study the growth and yield of baby corn as influenced by nitrogen application method. The data are given in different tables and figures. The results have been discussed, and possible interpretations are given under the following headings.

4.1 Plant growth parameters

4.1.1 Seedling emergence

Effect of nitrogen dose

Germination percentage is an estimate of the viability of a population of seeds. From the experiment, result revealed that, seedling emergence of baby corn showed significant variation due to application of nitrogen doses at 5 days after sowing (Fig. 1 and Appendix V).The highest seedling emergence (82.22 %) at 5 DAS recorded in N_3 treatment whereas the lowest seedling emergence (62.22 %) at 5 DAS was recorded in N_0treatment.Nitrogen is an essential nutrient and many plants in terrestrial ecosystems are adapted to conditions of low N availability; in addition to serving as a basic nutrient, N also promotes seed germination through function as a signaling molecule.

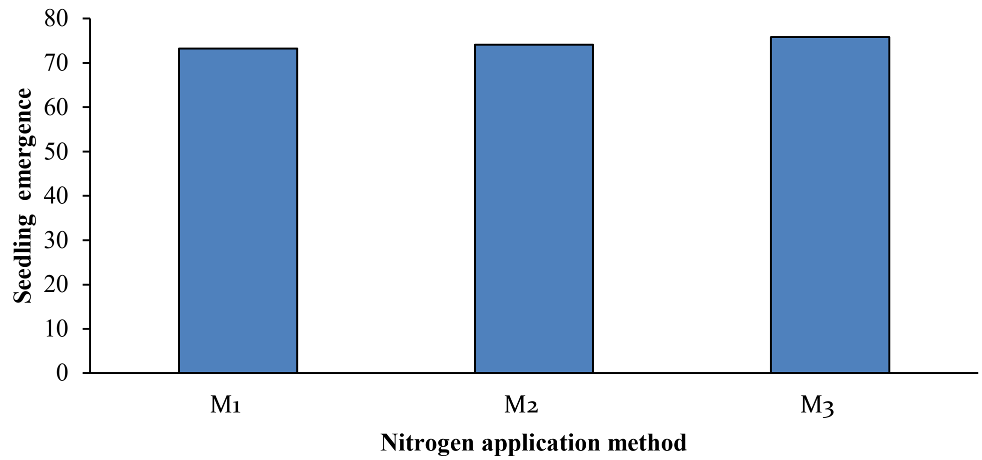


Here, N_0 = 0 kg nitrogen ha^{-1}, N_1 = 40 kg nitrogen ha^{-1}, N_2 = 80 kg nitrogen ha^{-1} and N_3 = 120 kg nitrogen ha^{-1}.

Fig. 1. Effect of nitrogen dose on seedling emergence of baby corn at five DAS($LSD_{(0.05)}$= 3.58).

Effect of nitrogen application method

Different nitrogen application method showed non significant effect on seedling emergence of baby corn at 5 days after sowing (Fig. 2 and Appendix V). Experiment result showed that highest seedling emergence (75.83%) at 5 DAS was recorded in M_3 treatment whereas the lowest seedling emergence (73.25 %) at 5 DAS was recorded in M_1 treatment.



Here, M_1 = Basal, M_2 = Side dressing at 30 DAS and M_3 = 50 % basal + 50 % side dressing at 30 DAS

Fig. 2. Effect of nitrogen application method on seedling emergence of baby corn at five DAS($LSD_{(0.05)}$=NS).

Combined effect of nitrogen dose and nitrogen application method

Combined effect of nitrogen dose and nitrogen application method showed significant variation in respect of seedling emergence of baby corn at 5 days after sowing (Table 1 and Appendix V). Experiment result showed that the highest seedling emergence of baby corn (96.67 %) was recorded in N_3M_1 treatment combination whereas the lowest seedling emergence of baby corn (36.67 %) was recorded in N_0M_1 treatment combination.

Table 1. Combined effect of nitrogen dose and nitrogen application method on seedling emergence of baby corn at five DAS

Treatment combinations	Germination percentage
N_0M_1	36.67 g
N_0M_2	73.33 de
N_0M_3	76.67 cd
N_1M_1	76.67 cd
N_1M_2	70.00 ef
N_1M_3	80.00 bc
N_2M_1	83.00 bc
N_2M_2	83.33 b
N_2M_3	66.67 f
N_3M_1	96.67 a
N_3M_2	70.00 ef
N_3M_3	80.00 bc
$LSD_{(0.05)}$	6.39
CV(%)	5.05

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

Notes *viz*:

N_0= 0 kg nitrogen ha^{-1}

N_1= 40 kg nitrogen ha^{-1}

N_2= 80 kg nitrogen ha^{-1}

N_3 = 120 kg nitrogen ha^{-1}

M_1= Basal

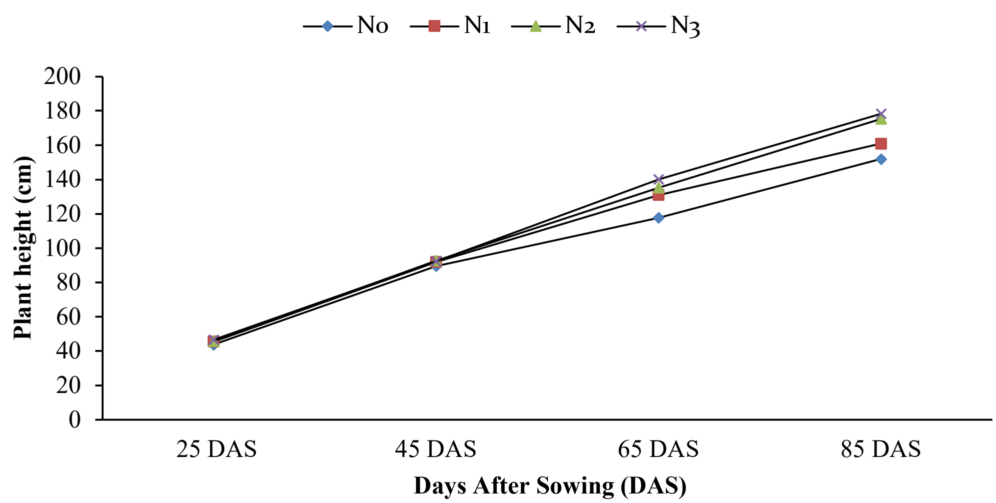
M_2 = Side dressing at 30 DAS

M_3 = 50% basal + 50% side dressing at 30 DAS

4.1.2 Plant height

Effect of nitrogen dose

Plant height is an important morphological character that acts as a potential indicator of availability of growth resources in its approach. From the experiment, result revealed that, plant height of baby corn showed significant variation due to application of different nitrogen doses (Fig. 3 and Appendix V). The highest plant height (46.69 cm) at 25 DAS was recorded in N_3 treatment. At 45 DAS, the highest plant height (92.65 cm) was recorded in N_2 treatment which was statistically similar with N_3 (92.17 cm) and with N_1 (91.87 cm) treatment. At 65 and 85 DAS the highest plant height (140.18cm and 178.33 cm) was recorded in N_3 treatment. Whereas the lowest plant height (43.72cm, 89.43cm, 117.73cm and 151.92 cm) at 25, 45, 65 and 85 DAS was recorded in N_0 treatment. The increase in plant height in response to increasing application of N fertilizers is probably due to enhanced availability of nitrogen which enhanced more leaf area resulting in higher photo assimilates and thereby resulted in more dry matter accumulation. The result obtained from the present study was similar with the findings of Ullah *et al.* (2015) and they stated that plant height was increased significantly with increased levels of nitrogen. Behera and Panda (2009) also reported that the cell size and its elongation and division that determine growth parameters like plant height was increases with increasing nitrogen fertilization. Eltelib *et al.*(2006) also reported significant increase in plant height, stem diameter, LAI and number of leaves plant^{-1} of baby corn due to nitrogen application.



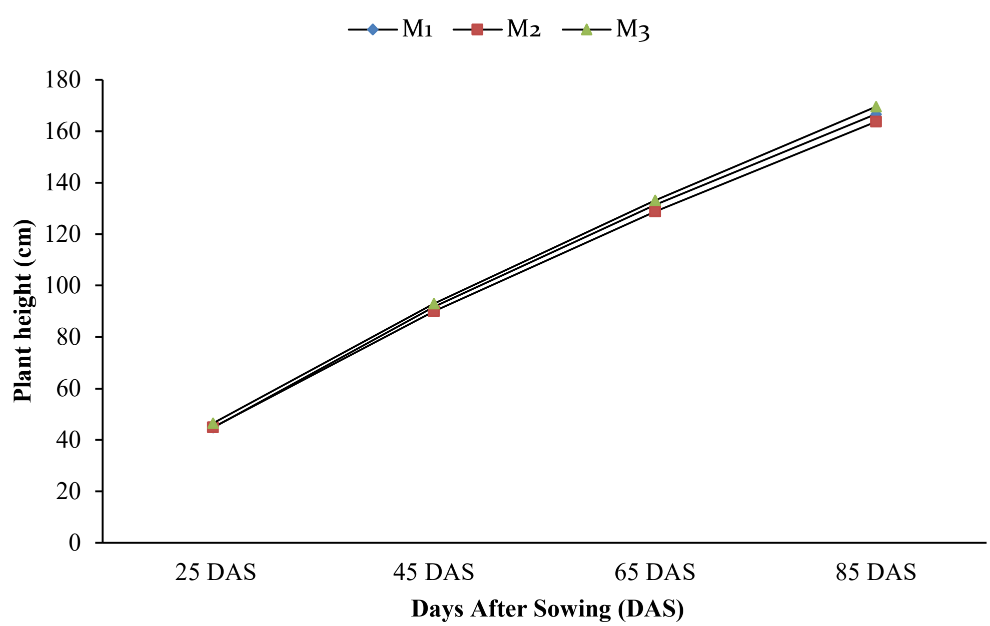
Here, N_0= 0 kg nitrogen ha^{-1}, N_1= 40 kg nitrogen ha^{-1}, N_2= 80 kg nitrogen ha^{-1} and N_3 = 120 kg nitrogen ha^{-1}.

Fig. 3. Effect of nitrogen dose on plant height of baby corn at different DAS (LSD$_{(0.05)}$=0.65, 2.30, 0.33 and 1.33 at 25, 45, 65 and 85 DAS respectively).

Effect of nitrogen application method

Different nitrogen application method significantly effect on plant height of baby corn only at 25, 45 and 85 days after sowing (Fig. 4 and Appendix V) Experiment result showed that the highest plant height (46.51cm, 92.96cm, 133.02cm and 169.49 cm) at

25, 45, 65 and 85 DAS was recorded in M_3 treatment which was statistically similar with M_1 treatment recorded plant height (91.67cm and 166.62 cm) at 45 and 85 DAS. Whereas the lowest plant height (44.77 cm) at 25 DAS was recorded in M_1 treatment which was statistically similar with M_2(44.88 cm) treatment. At 45, 65 and 85 DAS the lowest plant height (89.97cm, 128.70cm and 163.70 cm) was recorded in M_2 treatment. High amount of nitrogen at basal might not be fully utilized by the plants due to late germination and initial very slow growth rate in winter season. Whereas optimal and regular supply of nitrogen at different growth stages of crop through splitting application resulted in better utilization of nitrogen by the plants which improved the growth and yield attributes. Similar result with the present study also found by Singh *et al*. (2013) and reported that highest plant height (197.0 cm) was noted under T_1 treatment (30% as basal 10% at 4 leaf stage, 30% at 8 1eaf stage and 30% at tasseling stage) which was significantly superior to other treatments. Mollah *et al.* (2007) also reported that plant height were highest when N splitted as 50% as basal and 50% at 8 leaves stage compared to others.



Here, M_1 = Basal, M_2 = Side dressing at 30 DAS and M_3 = 50 % basal + 50 % side dressing at 30 DAS

Fig. 4. Effect of nitrogen application method on plant height of baby corn at different DAS ($LSD_{(0.05)}$=1.37, 1.76, Ns and 4.44 at 25, 45, 65 and 85 DAS respectively).

Combined effect of nitrogen dose and nitrogen application method

Combined effect of different nitrogen dose and nitrogen application method showed significant variation in respect of plant height of baby corn (Table 2 and Appendix V). Experiment result showed that the highest plant height of baby corn (48.43 cm) was recorded in N_3M_3 treatment combination which was statistically similar with N_2M_3 (48.15 cm) and N_3M_2 (46.63 cm) treatment combination at 25 DAS. At 45 DAS the highest plant height of baby corn (96.06 cm) was recorded in N_2M_3 treatment combination which was statistically similar with N_3M_1 (93.93 cm); N_3M_3 (93.61 cm) and N_1M_3 (92.66 cm) treatment combination. At 65 DAS the highest plant height of baby corn (144.00 cm) was recorded in N_3M_1 treatment combination which was statistically similar with N_3M_3 (141.60 cm); N_3M_2 (138.27 cm) and N_2M_2 (137.47 cm) treatment combination. At 85DAS the highest plant height of baby corn (180.07 cm) was recorded in N_3M_3 treatment combination which was statistically similar with N_3M_1 (177.80 cm); N_2M_3 (177.73 cm); N_3M_2 (177.13 cm) and N_2M_2 (176.33 cm) treatment combination. Whereas the lowest plant height (41.82 cm and 88.83 cm) was recorded in N_0M_2 treatment combination at 25 and 45 DAS which was statistically similar with N_2M_1 (43.87 cm) at 25 DAS and N_3M_2 (88.97 cm); N_0M_3 (89.51 cm); N_0M_1 (89.94 cm); N_2M_1 (90.98 cm); N_1M_2 (91.15 cm) and N_1M_1 (91.81 cm) at 45 DAS. At 65 and 85 DAS the lowest plant height (116.07 cm and 149.33 cm) was recorded in N_0M_1 treatment combination which was statistically similar with N_0M_2 (118.53 cm) and N_0M_3 (118.60 cm) treatment combination at 65 DAS and with N_1M_2 (150.40 cm); N_0M_2 (150.93 cm) and N_0M_3 (155.50 cm) treatment combination at 85 DAS.

Table 2. Combined effect of nitrogen dose and nitrogen application method on plant height of baby corn at different DAS

Treatment combinations	Plant height (cm) at			
	25 DAS	45 DAS	65 DAS	85 DAS
N_0M_1	45.19 cd	89.94 c-e	116.07 g	149.33 d
N_0M_2	41.82 e	88.83 e	118.53 fg	150.93 d
N_0M_3	44.16 d	89.51 de	118.60 fg	155.50 d
N_1M_1	44.97 cd	91.81 b-e	135.33 b-d	167.47 c
N_1M_2	45.98 b-d	91.15 b-e	123.87 ef	150.40 d
N_1M_3	45.30 cd	92.66 a-d	133.60 cd	164.67 c
N_2M_1	43.87 de	90.98 b-e	129.93 de	171.87 bc
N_2M_2	45.07 cd	90.91 b-e	137.47 a-c	176.33 ab
N_2M_3	48.15 ab	96.06 a	138.27 a-c	177.73 ab
N_3M_1	45.03 cd	93.93 ab	144.00 a	177.80 ab
N_3M_2	46.63 a-c	88.97 e	134.93 b-d	177.13 ab
N_3M_3	48.43 a	93.61 a-c	141.60 ab	180.07 a
$LSD_{(0.05)}$	2.32	3.68	7.09	7.37
CV(%)	3.48	2.23	3.82	3.08

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

Notes *viz*:

N_0= 0 kg nitrogen ha^{-1}

N_1= 40 kg nitrogen ha^{-1}

N_2= 80 kg nitrogen ha^{-1}

N_3 = 120 kg nitrogen ha^{-1}

M_1= Basal

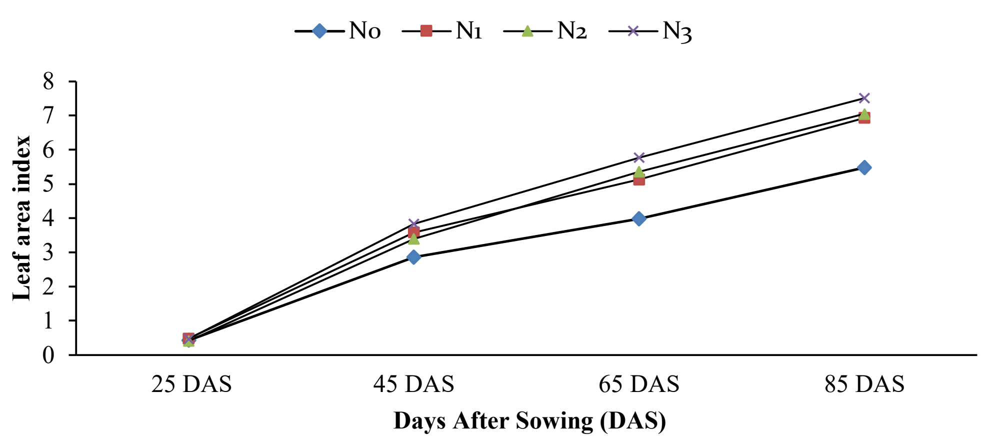
M_2 = Side dressing at 30 DAS

M_3 = 50% basal + 50% side dressing at 30 DAS

4.1.2 Leaf area index

Effect of nitrogen dose

The levels of LAI will vary with the canopy architecture, which depends on the cultivars, geography, and different fertilizer management practices such as application of different doses of nitrogen application in the field. Experiment result showed that different nitrogen dose significantly effect on leaf area index of baby corn at different das after sowing (Fig. 5 and Appendix VI). Experiment result showed that, at 25 DAS the highest leaf area index of baby corn (0.48) was recorded in N_1 treatment. At 45, 65 and 85 DAS the highest leaf area index of baby corn (3.84, 5.77 and 7.51) respectively was recorded in N_3 treatment. Whereas the lowest leaf area index of baby corn (0.41) was recorded in N_2 treatment at 25 DAS. At 45, 65 and 85 DAS, the lowest leaf area index of baby corn (2.86, 3.99 and 5.48) war recorded in N_0treatment.Nitrogen is needed to produce leaves, stems and vegetation growth. Nitrogen is part of the chlorophyll molecule, which gives plants their green color and is involved in creating food for the plant through photosynthesis. The main effect of N fertilizer is to increase the rate of leaf expansion, leading to increased interception of daily solar radiation by the canopy. The difference of leaf area index was due to reason that increasing nitrogen dose gradually increasing leaf number and leaf area though utilization of nitrogen which ultimately impact on leaf area index. The result obtained from the present study was similar with the findings of Asaduzzaman *et al.*(2014) who reported that at all growth stages the highest LAI was obtained with 200 kg N ha^{-1}.Azarpour*et al.* (2014) reported that leaf area index (LAI) significantly increase with 90 kg N ha^{-1} application compared to others treatment. Krishnamurthy *et al.* (1974) reported increase in leaf area (LA) with increase in level of nitrogen application.

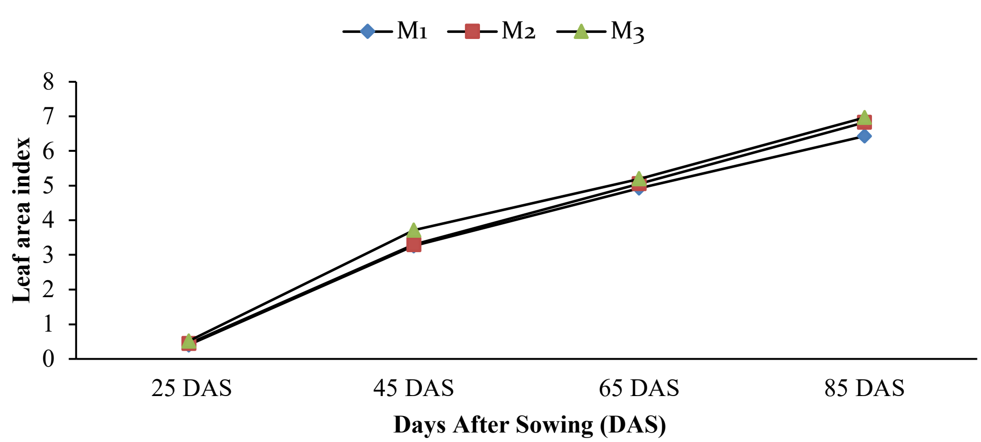


Here, N_0= 0 kg nitrogen ha^{-1}, N_1= 40 kg nitrogen ha^{-1}, N_2= 80 kg nitrogen ha^{-1} and N_3 = 120 kg nitrogen ha^{-1}.

Fig. 5. Effect of nitrogen dose on leaf area index of baby corn at different DAS ($LSD_{(0.05)}$=0.01, 0.15, 0.16 and 0.31 at 25, 45, 65 and 85 DAS respectively) .

Effect of nitrogen application method

Nitrogen application method significantly effect on leaf area index of baby corn at different days after sowing (Fig. 6 and Appendix VI). Experiment result showed that, the highest leaf area index (0.51, 3.71, 5.20 and 6.97) at 25, 45, 65 and 85 DAS respectively was recorded in M_3 treatment, which was statistically similar with M_2 (6.83) treatment at 85 DAS. Whereas the lowest leaf area index (0.40, 3.26, 4.93 and 6.43) at 25, 45, 65 and 85 DAS was recorded in M_1 treatment, which was statistically similar with M_2 (3.30 and 5.06) treatment at 45 and 65 DAS. Regular supply of nitrogen throughout growing period under more number of splits resulted into significant improvement in plant growth and development compared to conventional application. The result of the present study was similar with the findings of Harikrishna *et al.* (2005) who reported that application of 200 per cent RDN in four equal splits registered significantly higher leaf area index as compared to two equal splits followed by 150 per cent and 100 per cent RDN. However, the results observed in 200 per cent RDN was significant over results noticed in 100 per cent RDN. Muthukumar *et al*. (2005) also reported that application of nitrogen in three splits (1/2 as basal + 1/4 at 25 DAS + 1/4 at 45 DAS) produced highest leaf area index (3.74) whereas application of nitrogen in two splits (1/2 as basal + 1/2 at 45 DAS) resulted in lowest leaf area index (3.11).



Here, M_1 = Basal, M_2 = Side dressing at 30 DAS and M_3 = 50 % basal + 50 % side dressing at 30 DAS

Fig. 6. Effect of nitrogen application method on leaf area index of baby corn at different DAS ($LSD_{(0.05)}$=0.01, 0.10 , 0.13 and 0.18 at 25, 45, 65 and 85 DAS respectively).

Combined effect of nitrogen dose and nitrogen application method

Application of different nitrogen dose along with different nitrogen application method significantly effect on leaf area index of baby corn at different days after sowing (Table 3 and Appendix VI). Experiment result showed that, the highest leaf area index (0.54, 4.13, 6.12 and 7.64) at 25, 45, 65 and 85 DAS respectively was recorded in N_3M_3 treatment combination, which was statistically similar with N_1M_3 (0.52) treatment combination at 25 DAS; with N_3M_2 (4.10) and N_1M_1 (3.93) treatment combination at 45 DAS; N_3M_2 (6.02) treatment combination at 65 DAS and N_3M_2(7.54), N_1M_3 (7.43) and N_3M_1 (7.35) treatment combination at 85 DAS. Whereas the lowest leaf area index (0.33, 2.77, 3.63 and 5.05) at 25, 45, 65 and 85 DAS was recorded in N_0M_1 treatment combination which was statistically similar with N_0M_2 (2.85), N_1M_1 (2.96) and N_1M_2 (2.96) treatment combination at 45 DAS.

Table 3. Combined effect of nitrogen dose and nitrogen application method on leaf area index of baby corn at different DAS

Treatment combinations	Leaf area index at			
	25 DAS	45 DAS	65 DAS	85 DAS
N_0M_1	0.33 g	2.77 f	3.63 g	5.05 h
N_0M_2	0.46 cd	2.85 ef	4.17 f	5.74 g
N_0M_3	0.51 b	2.96 ef	4.16 f	5.66 g
N_1M_1	0.48 c	3.93 a-c	5.69 b	6.42 f
N_1M_2	0.45 d	2.96 ef	4.59 e	6.95 de
N_1M_3	0.52 ab	3.85 c	5.10 d	7.43 a-c
N_2M_1	0.37 f	3.04 e	5.21 cd	6.91 e
N_2M_2	0.41 e	3.28 d	5.44 bc	7.10 c-e
N_2M_3	0.45 d	3.89 bc	5.42 bc	7.14 b-e
N_3M_1	0.42 e	3.30 d	5.18 cd	7.35 a-d
N_3M_2	0.45 d	4.10 ab	6.02 a	7.54 ab
N_3M_3	0.54 a	4.13 a	6.12 a	7.64 a
$LSD_{(0.05)}$	0.02	0.23	0.27	0.42
CV(%)	3.21	3.45	3.01	3.09

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

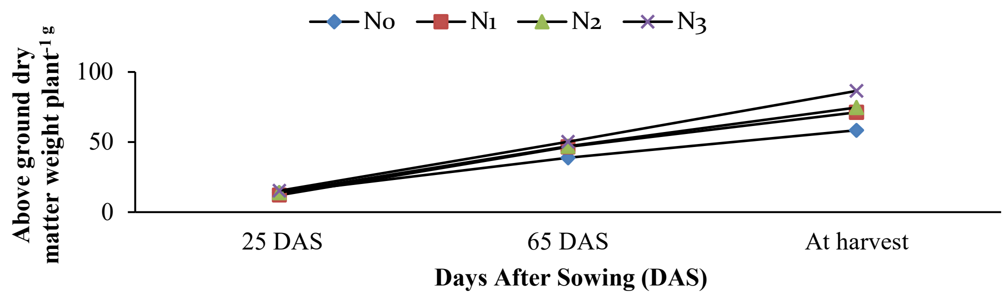
Notes *viz*:

N_0= 0 kg nitrogen ha^{-1} | M_1= Basal
N_1= 40 kg nitrogen ha^{-1} | M_2 = Side dressing at 30 DAS
N_2= 80 kg nitrogen ha^{-1} | M_3 = 50% basal + 50% side dressing at 30 DAS
N_3 = 120 kg nitrogen ha^{-1}

4.1.3 Above ground dry matter weight plant^{-1}

Effect of different nitrogen dose

The above ground dry matter weight plant^{-1} consists of all its constituents excluding water. Different nitrogen doses showed significant effect on above ground dry matter weight plant^{-1} of baby corn at various days after sowing (Fig. 7 and Appendix VII). Experiment result showed that, the highest above ground dry matter weight plant^{-1} (15.34 g, 50.18 g and 86.59 g) at 25, 65 and 85 DAS respectively was recorded in N_3 treatment. Whereas at 25 DAS N_1 treatment recorded the lowest above ground dry matter weight plant^{-1} (12.23 g) of baby corn. At 65 and 85 DAS the lowest above ground dry matter weight plant^{-1} (38.9 and 58.45 g) was recorded in N_0 treatment. The higher dry mass of increasing nitrogen treated plants could be connected with the positive effect of nitrogen in some important physiological processes. Jeet *et al*. (2017) reported that the highest dry matter accumulation with application of 150 kg N ha^{-1} (232.4 and 240.0 g plant^{-1} during 2009-10 and 2010-11, respectively) over 100 and 50 kg N ha^{-1} in quality protein maize on sandy loam soils of Varanasi, Uttar Pradesh.Thavaprakaash and Velayudham (2009) also reported that, significant increase in growth parameters of baby corn *viz*., plant height, LAI and dry matter percentage with increase in the level of nitrogen application. Reddy (2000) reported that dry matter accumulation was increasing through increasing vegetative growth resulting from higher photosynthetic activities is well known to be influenced by nitrogen.

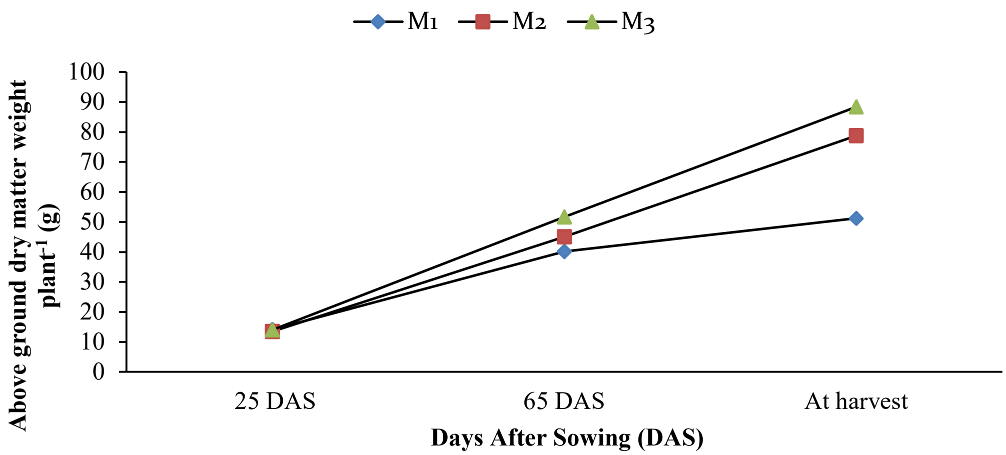


Here, N_0= 0 kg nitrogen ha^{-1}, N_1= 40 kg nitrogen ha^{-1}, N_2 = 80 kg nitrogen ha^{-1} and N_3 = 120 kg nitrogen ha^{-1}.

Fig. 7. Effect of nitrogen dose on above ground dry matter weight plant^{-1} (g) of baby corn at different DAS ($LSD_{(0.05)}$=0.68, 0.69 and 1.34 at 25, 65 and at harvest respectively).

Effect of nitrogen application method

Nitrogen application method significantly effect on above ground dry matter weight plant^{-1}of baby corn at various days after sowing (Fig. 8 and Appendix VII). Experiment result showed that, the highest above ground dry matter weight plant^{-1} (14.15 g) was recorded in M_1 treatment at 25 DAS, which was statistically similar with M_3 (13.99 g) treatment. At 65 and at harvest respectively the highest above ground dry matter weight plant^{-1} (51.72 and 88.37 g) was recorded in M_3 treatment. Whereas at 25 DAS, the lowest above ground dry matter weight plant^{-1} (13.45 g) was recorded in M_2 treatment. At 65 DAS and at harvest respectively the lowest above ground dry matter weight plant^{-1} (40.15 and 51.22 g) was recorded in M_1 treatment. Regular supply of nitrogen throughout growing period under more number of splits resulted into significant improvement in plant growth and development compared to conventional application. Amanullah *et al.* (2009) reported that application of N at later vegetative stages of maize extended growth phase and produced relatively more assimilates by maize crop in response to the longer growth period, as a result dry matter weight of the plant was significantly increased. Saleem *et al*. (2009) also concluded that maize took more days for maturity with accumulating higher dry matterplant^{-1} at Faisalabad (Pakistan) when 1/3 N was applied at sowing + 1/3 N at 25 DAS and 1/3 N at 55 DAS as compared to other timings of N application at different growth stages of crop.



Here, M_1 = Basal, M_2 = Side dressing at 30 DAS and M_3 = 50 % basal + 50 % side dressing at 30 DAS

Fig. 8. Effect of nitrogen application method on above ground dry matter weight plant^{-1} of baby corn at different DAS ($LSD_{(0.05)}$=0.50, 1.60 and 2.79 at 25, 65 and at harvest respectively).

Combined effect of nitrogen dose and nitrogen application method

Application of different nitrogen dose along with different nitrogen application method significantly effect on above ground dry matter weight plant^{-1} of baby corn at various days after sowing (Table 4 and Appendix VII). Experiment result showed that, the highest above ground dry matter weight plant^{-1} of baby corn (17.27 g) was recorded in N_3M_3 treatment combination at 25 DAS. At 65 DAS the highest above ground dry matter weight plant^{-1} of baby corn (57.18 g) was recorded in N_2M_3 treatment combination and at harvest respectively the highest above ground dry matter weight plant^{-1} of baby corn (98.29 g) was recorded in N_3M_3 treatment combination which was statistically similar with N_2M_3 (95.82 g) treatment combination. Whereas the lowest above ground dry matter weight plant^{-1} of baby corn (11.88 g) was recorded in N_1M_3 treatment combination which was statistically similar with N_1M_1 (12.24 g), N_1M_2 (12.57 g) and N_0M_3 (12.87) treatment combination at 24 DAS. At 64 DAS and at harvest respectively the lowest above ground dry matter weight plant^{-1} of baby corn (33.52 and 39.76 g) was recorded in N_0M_1 treatment combination.

Table 4. Combined effect of nitrogen dose and nitrogen application method on above ground dry matter weight (g plant^{-1}) of baby corn at different DAS

Treatment combinations	Above ground dry matter weight(gplant^{-1}) at		
	25 DAS	65 DAS	At harvest
N_0M_1	14.94 b	33.52 h	39.76 h
N_0M_2	13.96 bc	37.59 g	61.93 f
N_0M_3	12.87 de	45.75 e	73.66 e
N_1M_1	12.24 de	42.07 f	48.43 g
N_1M_2	12.57 de	46.17 e	79.86 d
N_1M_3	11.88 e	51.35 bc	85.72 c
N_2M_1	14.85 b	36.62 g	45.75 g
N_2M_2	13.10 cd	47.10 de	82.82 cd
N_2M_3	13.97 bc	57.18 a	95.82 a
N_3M_1	14.57 b	48.39 de	70.94 e
N_3M_2	14.18 b	49.56 cd	90.56 b
N_3M_3	17.27 a	52.58 b	98.29 a
$LSD_{(0.05)}$	1.06	2.70	4.75
CV(%)	4.18	4.05	4.43

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

Notes *viz*:

N_0= 0 kg nitrogen ha^{-1}

N_1= 40 kg nitrogen ha^{-1}

N_2= 80 kg nitrogen ha^{-1}

N_3 = 120 kg nitrogen ha^{-1}

M_1= Basal

M_2 = Side dressing at 30 DAS

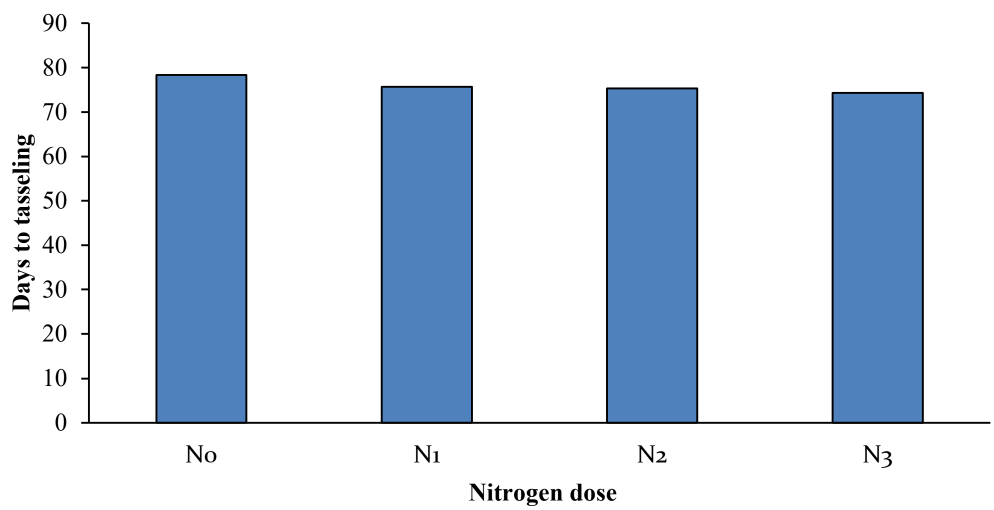
M_3 = 50% basal + 50% side dressing at 30 DAS

4.2 Yield contributing characters

4.2.1 Days to tasseling

Effect of different nitrogen dose

Days to tasseling showed significant variation for different nitrogen dose (Fig. 9 and Appendix VIII). Experiment result showed that, the highest days to tasseling(78.33) was recorded in N_0 treatment whereas the lowest days to tasseling (74.33) recorded in N_3 treatment which was statistically similar with N_2 (75.33 days) treatment. The lowest days required for tasseling initiation in higher nitrogen dose application might be due to the more availability of nitrogen that played a vital role in cell division.Singh *et al.* (2014) observed that successive increase in nitrogen levels from 0 to 160 kg N ha^{-1} resulted in less number of days taken to 50% tasseling over control treatment in maize. Asif *et al.* (2013) reported that lowest days to 50 per cent tasseling was recorded with application of nitrogen @ 300 kg ha^{-1} against highest days to 50 per cent tasseling and silking, where no nitrogen was applied in maize on sandy clay loam soils of Faisalabad, Pakistan.

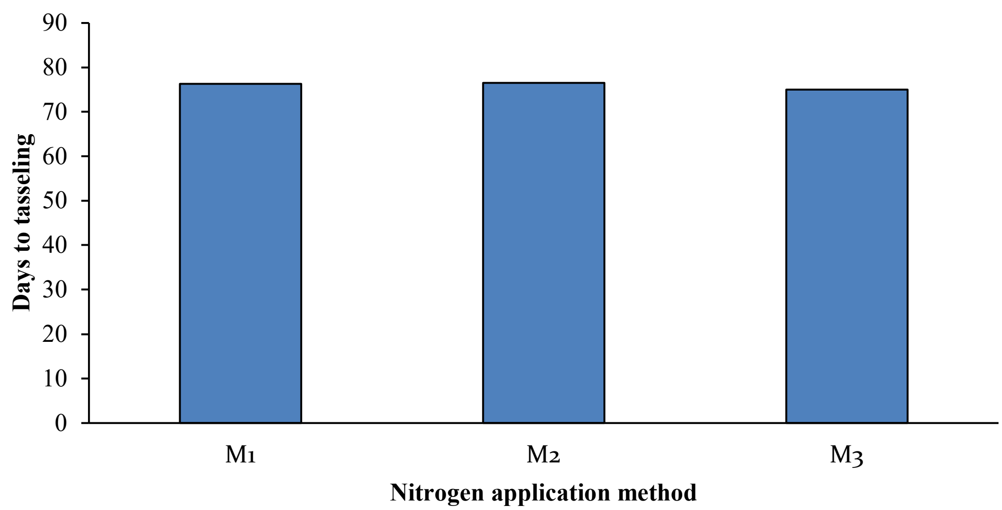


Here, N_0= 0 kg nitrogen ha^{-1}, N_1= 40 kg nitrogen ha^{-1}, N_2= 80 kg nitrogen ha^{-1} and N_3 = 120 kg nitrogen ha^{-1}.

Fig. 9. Effect of nitrogen dose on days to tasseling of baby corn($LSD_{(0.05)}$= 1.27).

Effect of nitrogen application method

Days to tasseling showed significantly difference among different nitrogen application method (Fig. 8and Appendix VIII). Experiment result showed that, the highest (76.50) days to tasseling was recorded in M_2 treatment which was statistically similar with M_1 (76.25) treatment, whereas the lowest (75.00) days to tasseling was recorded in M_3 treatment. The variation of tasseling incitation due to reason that split nitrogen application helps plant to uptake nitrogen sequentially which enhanced plant growth and increasing more leaf area resulting in higher photo assimilates and thereby resulted in more dry matter accumulation thus improve yield contributing characters. The result obtained from the present study was dissimilar with the findings of Hammad *et al.* (2013) who reported that time of nitrogen application did not significantly affect the number of days to emergence in both the years.



Here, M_1 = Basal, M_2 = Side dressing at 30 DAS and M_3 = 50 % basal + 50 % side dressing at 30 DAS

Fig. 10. Effect of nitrogen application method on days to tasseling of baby corn ($LSD_{(0.05)}$=1.12) .

Combined effect of different nitrogen dose and nitrogen application method

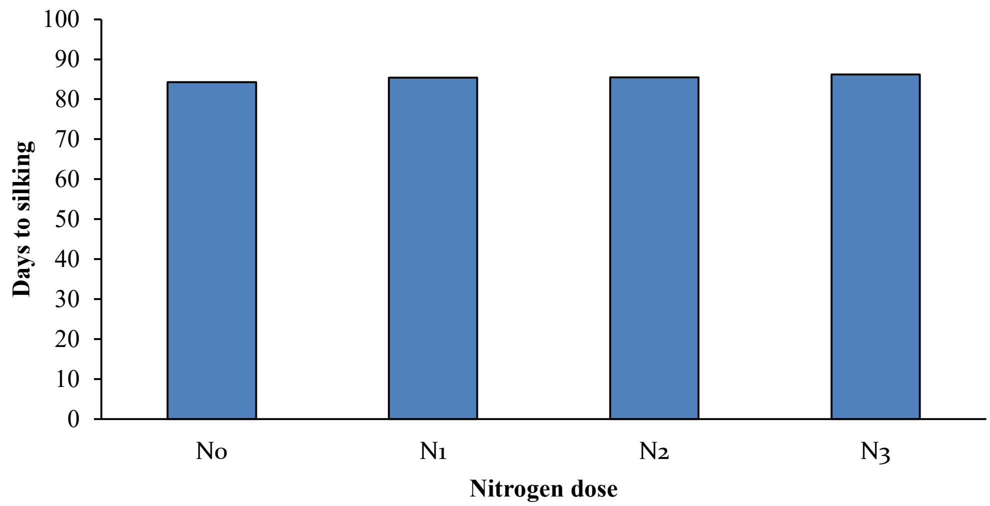
Days to tasseling significantly differed due to application of different nitrogen dose along with different nitrogen application method (Table 5and Appendix VIII). Experiment result revealed that the highest days to tasseling (79.00) was recorded in N_0M_1 treatment combination which was statistically similar with N_0M_1 (78.00days), N_0M_2 (78.00days), N_0M_3 (77.00days) and N_2M_2 (77.00days) treatment combination.

Whereas the lowest days to tasseling (74.00) was recorded in N_3M_3 treatment combination which was statistically similar with N_3M_2 (74.00days), N_2M_3(74.00days), N_2M_1 (75.00days), N_3M_1 (75.00days) and N_1M_1 (76.00days) treatment combination.

4.2.2 Days to silking

Effect of nitrogen dose

Days to silking showed significant variation among different nitrogen dose (Fig. 11 and Appendix VIII). Experiment result showed that, the highest days to silking (86.22) was recorded in N_3treatment whereas the lowest days to silking (84.33) was recorded in N_0 treatment. The result obtained from the present study was similar with the findings of Imran *et al*. (2015) who reported that, highest number of days to silking (75.92) was recorded for 210 kg N ha^{-1} while control treatment took lowest numbers of days to silking (71.50).

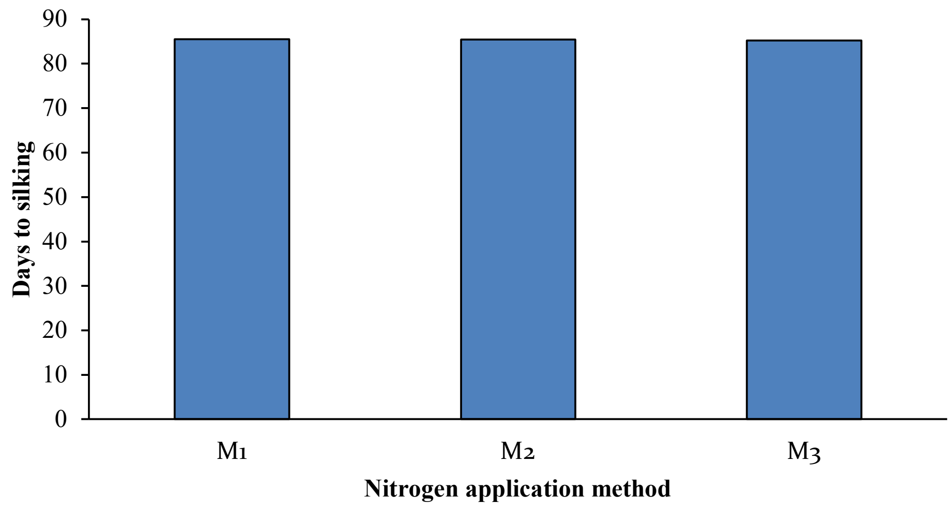


Here, N_0= 0 kg nitrogen ha^{-1}, N_1= 40 kg nitrogen ha^{-1}, N_2= 80 kg nitrogen ha^{-1} and N_3 = 120 kg nitrogen ha^{-1}.

Fig. 11. Effect of nitrogen dose on days to silking of baby corn(LSD$_{(0.05)}$= 0.55).

Effect of nitrogen application method

Days to silking showed non significantly difference among different nitrogen application method (Fig. 12 and Appendix VIII). Experiment result showed that, the highest days to silking (85.50) was recorded in M_1 treatment, whereas the lowest days to silking (85.24) was recorded in M_3 treatment.



Here, M_1 = Basal, M_2 = Side dressing at 30 DAS and M_3 = 50 % basal + 50 % side dressing at 30 DAS

Fig. 12. Effect of nitrogen application method on days to silking of baby corn ($LSD_{(0.05)}$=NS).

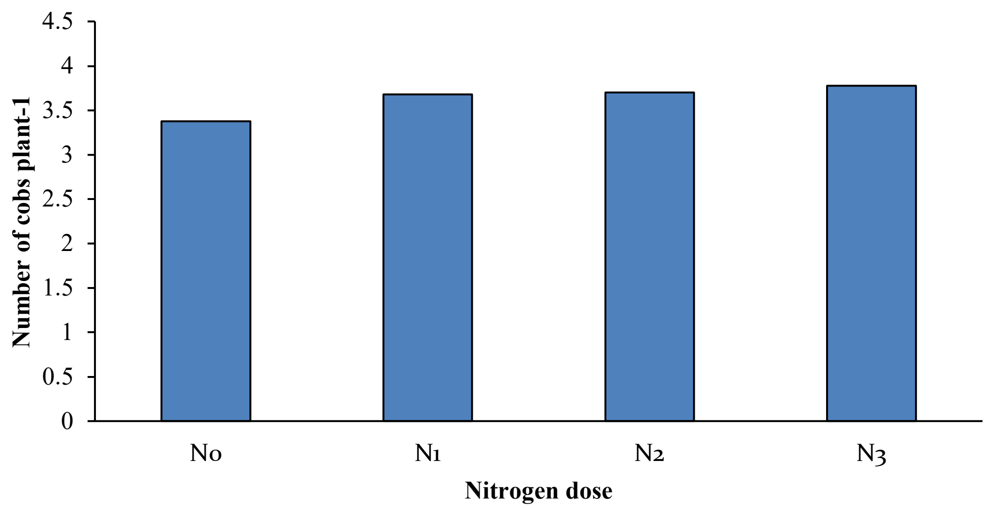
Combined effect of nitrogen dose and nitrogen application method

Days to silking showed significant variation due to application of different nitrogen dose along with different nitrogen application method (Table 5 and Appendix VIII). Experiment result revealed that the highest (87.33) days to silking was recorded in N_3M_3 treatment combination which was statistically similar with N_1M_1 (87.00 days) treatment combination. Whereas the lowest (83.67) days to silking was recorded in N_0M_1 treatment combination which was statistically similar with N_1M_2 (84.00 days) treatment combination.

4.2.3 Number of cobs plant^{-1}

Effect of nitrogen dose

Baby corn showed significant variation on number of cobs plant^{-1} due to the effect of various nitrogen dose (Fig. 13 and Appendix VIII). Experiment result showed that the highest number of cobs plant^{-1} (3.78) was recorded in N_3 treatment which was statistically similar with N_2 (3.70) and N_3 (3.68) treatment. Whereas the lowest number of cobs plant^{-1} (3.38) was recorded in N_0 treatment. Increasing nitrogen dose enhance number of cobs plant^{-1} might be due to source sink interaction, meaning highest proportion of N source was used to produce cob formation. Sahoo and Mahapatra (2004) also found similar results as the present study and reported that increase in the level of NPK increased the number of cobs per plant, weight of whole green cob and yield of green cob significantly. Thavaprakaash *et al.* (2005) also reported that with the application of recommended dose of NPK + vermicompost @ 5 tonnes/ha recorded the highest number of cobs plant^{-1} (2.60) than recommended NPK alone (2.39).

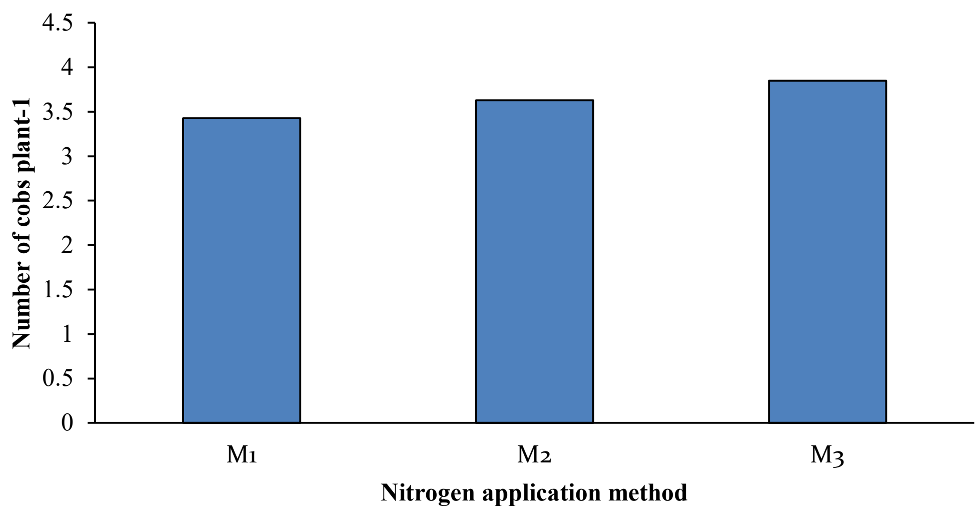


Here, N_0= 0 kg nitrogen ha^{-1}, N_1= 40 kg nitrogen ha^{-1}, N_2= 80 kg nitrogen ha^{-1} and N_3 = 120 kg nitrogen ha^{-1}.

Fig. 13. Effect of nitrogen dose on number of cobs plant^{-1}of baby corn (LSD$_{(0.05)}$= 0.14).

Effect of nitrogen application method

Nitrogen application method significantly effect on number of cobs plant^{-1} (Fig. 14 and Appendix VIII). Experiment result revealed that, the highest number of cobs plant^{-1} (3.85) was recorded in M_3 treatment. Whereas the lowest number of cobs plant^{-1} (3.43) was recorded in M_1 treatment. The differences of number of cobs plant^{-1} might be reason that, split nitrogen application result in proper nitrogen supply in the root zone which was easily uptake by the plant comparable to others treatments. The result obtained from the present study was similar with the findings ofAkbar*et al.* (2002) who found that maize crop took 102 days to maturity when the crop was subjected to changes in the nitrogen application timing and increase in nitrogen fertilizer rate, and this might have enhanced the rate of photosynthesis which resulted in the leaf longevity and delayed silking and maturity stage of maize.



Here, M_1 = Basal, M_2 = Side dressing at 30 DAS and M_3 = 50 % basal + 50 % side dressing at 30 DAS

Fig. 14. Effect of nitrogen application method on number of cobs plant^{-1}of baby corn ($LSD_{(0.05)}$=0.09) .

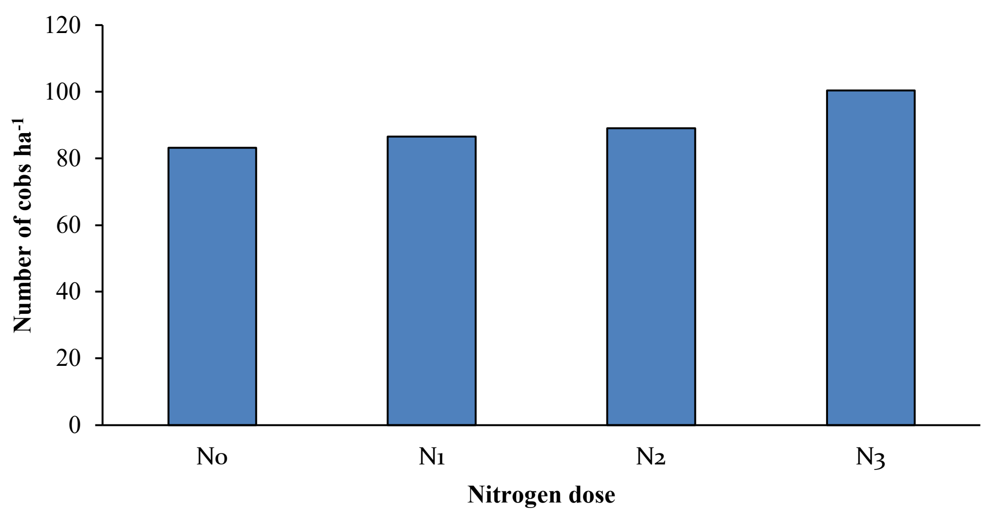
Combined effect of nitrogen dose and nitrogen application method

Application of different nitrogen dose along with different nitrogen application method significantly effect on number of cobs plant^{-1} (Table 5 and Appendix VIII). Experiment result showed that, the highest number of cobs plant^{-1} (4.08) was recorded in N_3M_3 treatment combination which was statistically similar with N_1M_3 (3.97) treatment combination. Whereas the lowest number of cobs plant^{-1} (3.27) was recorded in N_0M_1 treatment combination which was statistically similar with N_0M_2 (3.35) and N_1M_1 (3.40) treatment combination.

4.2.4 Number of cobs ha^{-1}

Effect of nitrogen dose

Baby corn showed significant variation on number of cobs ha^{-1} due to the effect of various nitrogen dose application (Fig. 15 and Appendix VIII). Experiment result showed that the highest number of cobs ha^{-1} (100.42 thousands) was recorded in N_3 treatment. Whereas the lowest number of cobs ha^{-1} (83.17 thousands) was recorded in N_0 treatment which was statistically similar with N_1 (86.53 thousands) treatment. Rakib *et al.* (2011) also found similar result which supported the present finding and reported that number of baby corn per hectare and total husked cob yield increased significantly with increase in the level of NPK up to 120:60:60 kg ha^{-1}.

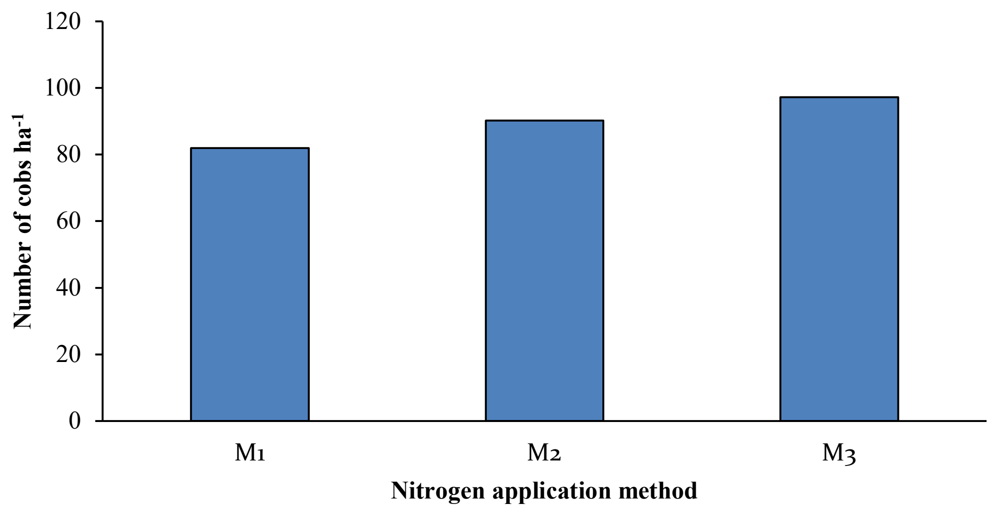


Here, N_0= 0 kg nitrogen ha^{-1}, N_1= 40 kg nitrogen ha^{-1}, N_2= 80 kg nitrogen ha^{-1} and N_3 = 120 kg nitrogen ha^{-1}.

Fig. 15. Effect of nitrogen dose on number of cobs ha^{-1} of baby corn (LSD$_{(0.05)}$ = 3.54).

Effect of nitrogen application method

Nitrogen application method significantly effect on number of cobs ha^{-1} (Fig. 16 and Appendix VIII). Experiment result revealed that, the highest number of cobs ha^{-1}(97.23 thousands) was recorded in M_3 treatment. Whereas the lowest number of cobs ha^{-1} (81.94 thousands) was recorded in M_1 treatment. The result obtained from the present study was similar with the findings of Mollah *et al*. (2007) who observed that the highest number of cobs/ha was found when N splitted as 1/3 as basal + 1/3 at 8 leaves stage + 1/3 at tasseling stage.



Here, M_1 = Basal, M_2 = Side dressing at 30 DAS and M_3 = 50 % basal + 50 % side dressing at 30 DAS

Fig. 16. Effect of nitrogen application method on number of cobs ha^{-1}of baby corn ($LSD_{(0.05)}$=4.11).

Combined effect of nitrogen dose and nitrogen application method

Application of different nitrogen dose along with different nitrogen application method significantly effect on number of cobs ha^{-1} (Table 5 and Appendix VIII). Experiment result showed that, the highest number of cobs ha^{-1} (106.32 thousands) was recorded in N_3M_3 treatment combination which was statistically similar with N_3M_2 (104.58 thousands), N_3M_1 (102.70 thousands) treatment combinations. Whereas the lowest number of cobs ha^{-1} (74.55 thousands) was recorded in N_0M_1 treatment combination which was statistically similar with N_1M_1 (80.19 thousands) and N_2M_2 (81.72 thousands) treatment combination.

Table 5. Combined effect of nitrogen dose and nitrogen application method on days to tasseling, days to silking, number of cobs plant^{-1} and number of cobs ha^{-1}of baby corn

Treatment combinations	Days to tasseling	Days to silking	Number of cobs plant^{-1}	Number of cobs ha^{-1} (`000)
N_0M_1	79.00 a	83.67 e	3.27 h	74.55 f
N_0M_2	78.00 ab	85.33 b-e	3.35 gh	86.60 b-e
N_0M_3	78.00 ab	84.00 de	3.52 e-g	88.35 bc
N_1M_1	76.00 b-d	87.00 ab	3.40 gh	80.19 ef
N_1M_2	77.00 a-c	84.00 de	3.68 c-e	87.85 b-d
N_1M_3	74.00 d	85.33 b-e	3.97 ab	91.54 b
N_2M_1	75.00 cd	86.00 ac	3.59 d-f	82.65 c-e
N_2M_2	77.00 a-c	85.67 a-d	3.71 cd	81.72 d-f
N_2M_3	74.00 d	85.00 c-e	3.81 bc	102.70 a
N_3M_1	75.00 cd	85.33 b-e	3.48 fg	90.36 b
N_3M_2	74.00 d	86.00 ac	3.79 bc	104.58 a
N_3M_3	74.00 d	87.33 a	4.08 a	106.32 a
$LSD_{(0.05)}$	2.23	1.87	0.18	7.57
CV(%)	1.70	1.26	2.92	5.29

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

Notes *viz*:

N_0= 0 kg nitrogen ha^{-1}

N_1= 40 kg nitrogen ha^{-1}

N_2= 80 kg nitrogen ha^{-1}

N_3 = 120 kg nitrogen ha^{-1}

M_1= Basal

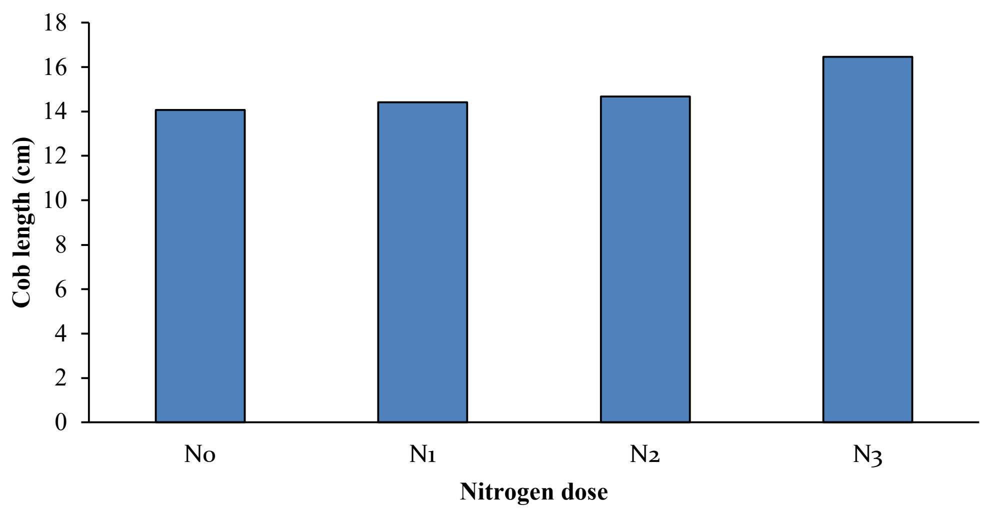
M_2 = Side dressing at 30 DAS

M_3 = 50% basal + 50% side dressing at 30 DAS

4.2.5 Cob length

Effect of nitrogen dose

Different nitrogen dose significantly effect on cob length of baby corn (Fig. 17 and Appendix IX). Experiment result showed that, the highest cob length (16.46 cm) was recorded in N_3 treatment whereas the lowest cob length (14.06 cm) was recorded in N_0 treatment, which was statistically similar with N_1 (14.41 cm) and N_2 (14.68 cm). The role of nitrogen in the stimulation of cell division may have led to increasing cob length during the milking stage of baby corn. Asim *et al.* (2012) reported that highest ear height (67.15 cm) was observed with application of 150 kg N ha^{-1} as compared to 120 and 90 kg N ha^{-1}. Mohsin *et al.* (2012) reported that the application of 50% N from urea + 50% from FYM produced longer cobs (18.57 cm).Derbay *et al*. (2004) reported that the probable reason for longer cob length at a higher level of N could be due to optimum utilization of solar light, higher assimilated production and its conversion to starches resulted in higher ear length.

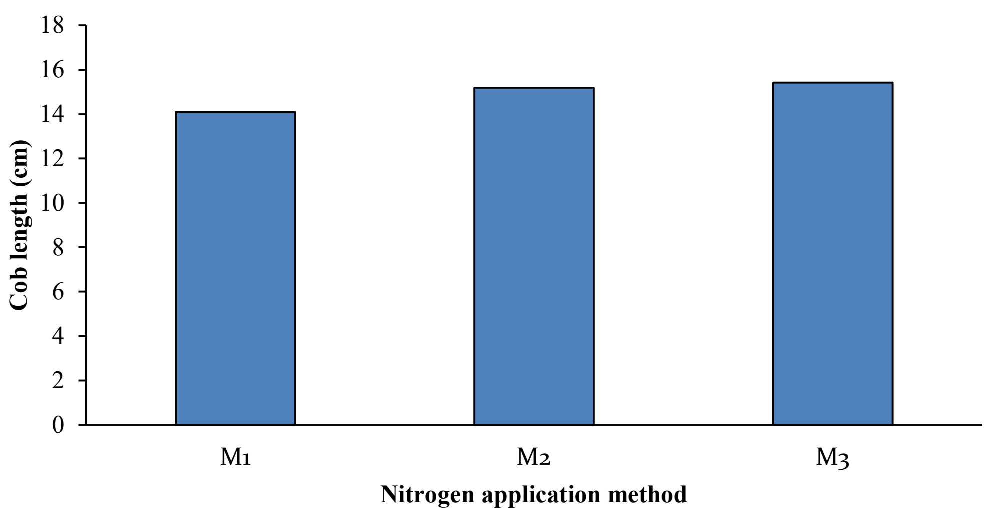


Here, N_0= 0 kg nitrogen ha^{-1}, N_1= 40 kg nitrogen ha^{-1}, N_2= 80 kg nitrogen ha^{-1} and N_3 = 120 kg nitrogen ha^{-1}.

Fig. 17. Effect of nitrogen dose on cob length of baby corn($LSD_{(0.05)}$= 0.76).

Effect of nitrogen application method

Different nitrogen application method, significantly effect on cob length of baby corn (Fig. 18 and Appendix IX). Experiment result showed that, the highest cob length (15.42 cm) was recorded in M_3 treatment which was statistically similar with M_2 (15.19 cm) treatment whereas the lowest cob length (14.09 cm) was recorded in M_1treatment.The variation of cob length due to reason that split nitrogen application helps plant to uptake nitrogen sequentially which enhanced plant growth and increasing more leaf area resulting in higher photo assimilates and thereby resulted in more dry matter accumulation thus improve yield contributing characters.The result obtained from the present study was similar with the findings of Singh (2010) who observed that application of nitrogen in five splits (10 % as basal, 30 % at 4 leaf emergence, 30 % at 8 leaf emergence, 20 % at tassel emergence and 10 % at early grain filling stages respectively) gave highest cob length. Harikrishna *et al.* (2005) also reported that application of 200 per cent RDN in four equal splits recorded higher length of cob over two equal splits in both *kharif* and *rabi* seasons.



Here, M_1 = Basal, M_2 = Side dressing at 30 DAS and M_3 = 50 % basal + 50 % side dressing at 30 DAS

Fig. 18. Effect of nitrogen application method on cob length of baby corn ($LSD_{(0.05)}$=0.66).

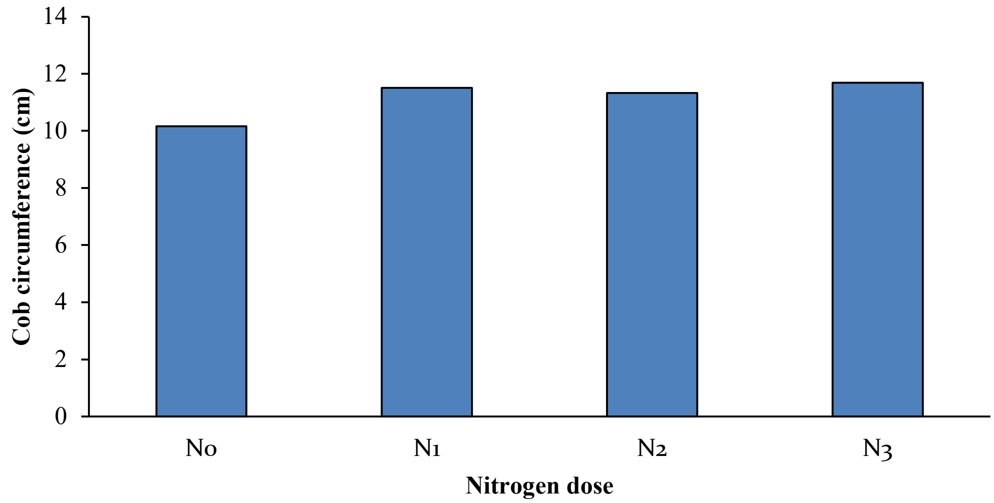
Combined effect of different dose and nitrogen application method

Application of different nitrogen dose along with different nitrogen application method significantly effect on cob length of baby corn (Table 6 and Appendix IX). Experiment result showed that, the highest cob length (17.52 cm) was recorded in N_3M_3 treatment combination whereas the lowest cob length (12.75 cm) was recorded in N_0M_1 treatment combination which was statistically similar with N_2M_1 (13.40 cm) treatment combination.

4.2.6 Cob circumference

Effect of different nitrogen dose

Different nitrogen dose significantly effect on cob circumference of baby corn (Fig. 19 and Appendix IX). Experiment result showed that, the highest cob circumference (11.69 cm) was recorded in N_3 treatment which was statistically similar with N_1 (11.51 cm) and N_2 (11.33 cm) treatment. Whereas the lowest cob circumference (10.16 cm) was recorded in N_0 treatment. Majid *et al*. (2017) also found similar result which supported the present finding and reported that a higher cob circumference was obtained from higher dose of Nitrogen application due to sufficient availability of Nitrogen which was responsible for cell division and cell elongation. Saleem *et al*. (2017) observed the significant increment in cob circumference with increasing level of Nitrogen.Grazia *et al.* (2003) also reported that application of 200 kg N/ha recorded significantly higher cob circumference of baby corn than control.

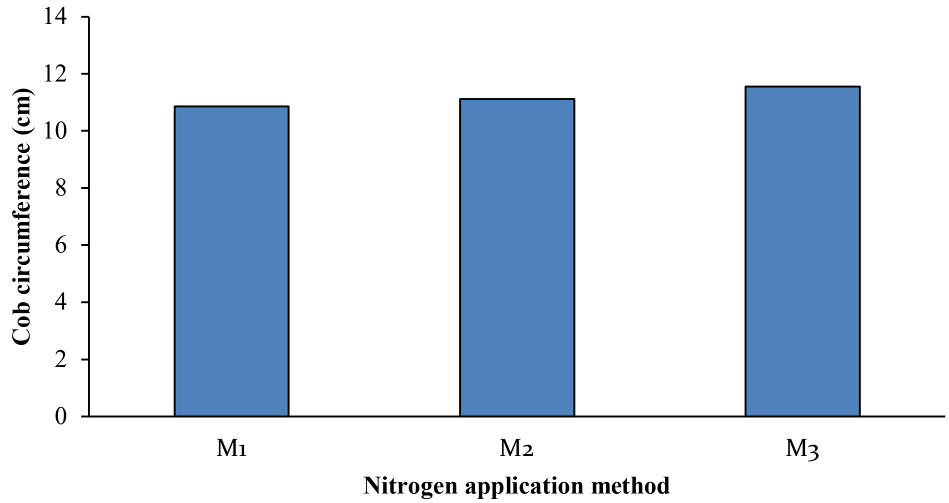


Here, N_0= 0 kg nitrogen ha^{-1}, N_1= 40 kg nitrogen ha^{-1}, N_2= 80 kg nitrogen ha^{-1} and N_3 = 120 kg nitrogen ha^{-1}.

Fig. 19. Effect of nitrogen dose on cob circumference of baby corn($LSD_{(0.05)}$= 0.53).

Effect of nitrogen application method

Different nitrogen application method, significantly effect on cob circumference of baby corn (Fig. 20 and Appendix IX). Experiment result showed that, the highest cob circumference (11.55 cm) was recorded in M_3 treatment whereas the lowest cob circumference (10.86 cm) was recorded in M_1 treatment which was statistically similar with M_2 (11.11cm) treatment. The result obtained from the present study was similar with the findings of Muthukumar *et al*. (2005) who reported that application of nitrogen in three splits (1/2 as basal + 1/4 at 25 DAS + 1/4 at 45 DAS) resulted in higher diameter of cob (cm) as compared to control treatment.



Here, M_1 = Basal, M_2 = Side dressing at 30 DAS and M_3 = 50 % basal + 50 % side dressing at 30 DAS

Fig. 20. Effect of nitrogen application method on cob circumference of baby corn ($LSD_{(0.05)}$=0.41).

Combined effect of nitrogen dose and nitrogen application method

Application of different nitrogen dose along with different nitrogen application method significantly effect on cob circumference of baby corn (Table 6 and Appendix IX). Experiment result showed that, the highest cob circumference (12.75 cm) was recorded in N_3M_3 treatment combination whereas the lowest cob circumference (9.60 cm) was recorded in N_0M_1 treatment combination which was statistically similar with N_0M_2 (10.37 cm) treatment combination.

Table 6. Combined effect of nitrogen dose and nitrogen application method on cob length and cob circumference of baby corn

Treatment combinations	Cob length (cm)	Cob circumference (cm)
N_0M_1	12.75 f	9.60 e
N_0M_2	14.45 de	10.37 de
N_0M_3	14.98 b-d	10.51 cd
N_1M_1	14.30 de	11.39 b
N_1M_2	14.58 c-e	11.57 b
N_1M_3	14.35 de	11.58 b
N_2M_1	13.40 ef	11.42 b
N_2M_2	15.80 bc	11.22 bc
N_2M_3	14.84 b-d	11.36 b
N_3M_1	15.94 b	11.04 b-d
N_3M_2	15.92 b	11.27 bc
N_3M_3	17.52 a	12.75 a
$LSD_{(0.05)}$	1.33	0.84
CV(%)	5.15	4.20

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

Notes *viz*:

N_0= 0 kg nitrogen ha^{-1}

N_1= 40 kg nitrogen ha^{-1}

N_2= 80 kg nitrogen ha^{-1}

N_3 = 120 kg nitrogen ha^{-1}

M_1= Basal

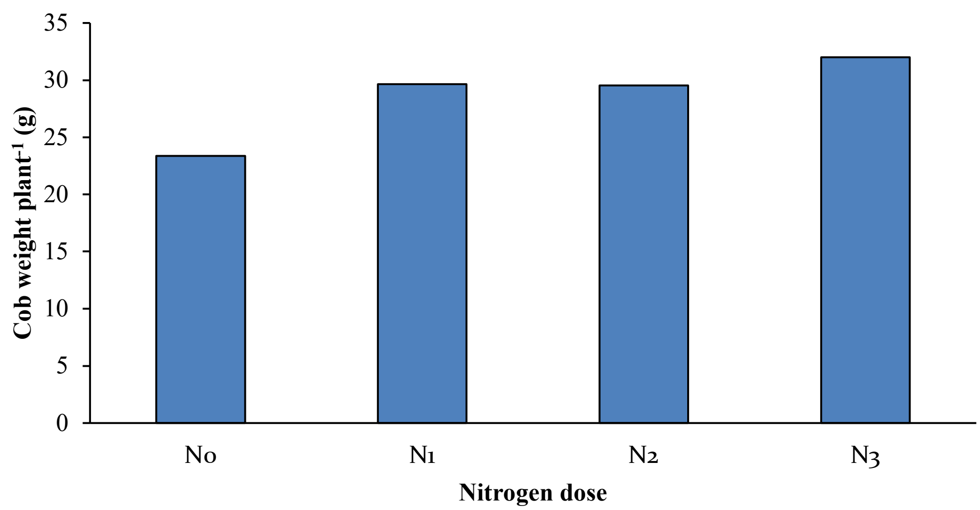
M_2 = Side dressing at 30 DAS

M_3 = 50% basal + 50% side dressing at 30 DAS

4.2.7 Cob weight plant^{-1}

Effect of nitrogen dose

Cob weight plant^{-1} was significantly different due to the application of different nitrogen dose (Fig. 21 and Appendix X). Experiment result showed that, the highest cob weight plant^{-1} (31.99 g) was recorded in N_3 treatment, whereas the lowest cob weight plant^{-1} (23.35 g) was recorded in N_0 treatment. The variation of cob weight plant^{-1} was due to reason that higher nitrogen application available plant to uptake more nitrogen. As the amount of nitrogen absorbed by the crop increases, there is an increase in dry matter accumulation, photosynthesis, and cell division which ultimately influenced cob weight plant^{-1}. The result obtained from the present study was similar with the findings of Verma *et al.* (2012) and reported that highest weight of cobs plant^{-1} (77.18 g) was recorded with application of 150 kg N ha^{-1} over 100 and 50 kg N ha^{-1}. Sahoo and Mahapatra (2004) also reported that an increase in nitrogen level resulted in significant increase in weight of green cob, yield of fresh grain and ear and net profit of sweet corn cultivation. The fresh weight of ear over the years was highest (201 cob^{-1}) with application of 180 kg N ha^{-1} which was at par with 120 kg N ha^{-1}.

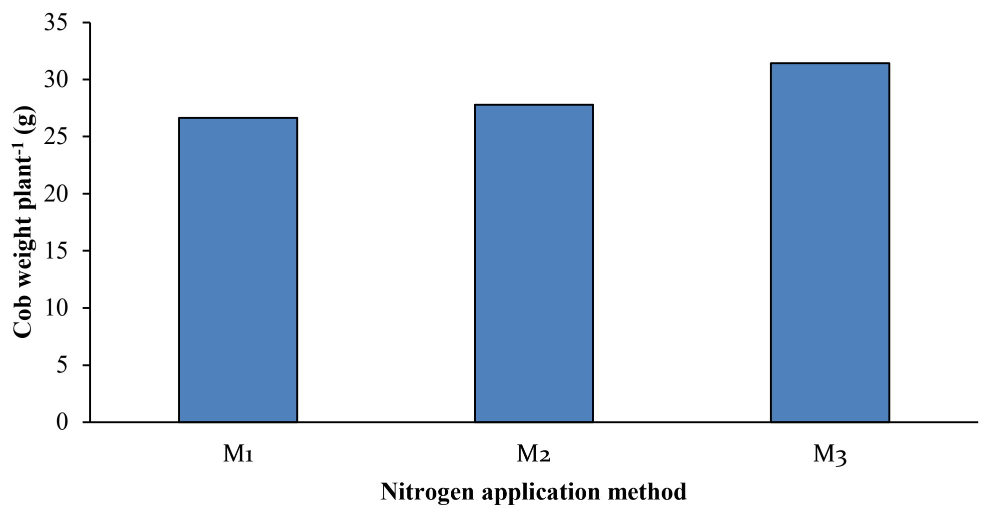


Here, N_0= 0 kg nitrogen ha^{-1}, N_1= 40 kg nitrogen ha^{-1}, N_2= 80 kg nitrogen ha^{-1} and N_3 = 120 kg nitrogen ha^{-1}.

Fig. 21. Effect of nitrogen dose on cob weight plant^{-1} of baby corn ($LSD_{(0.05)}$= 0.57).

Effect of nitrogen application method

Application method of nitrogen significantly effect on cob weight plant^{-1} of baby corn (Fig. 22 and Appendix X). Experiment result showed that, the highest cob weight plant^{-1} (31.43 g) was recorded in M_3 treatment. Whereas the lowest cob weight plant^{-1} (26.63 g) was recorded in M_1 treatment which was statistically similar with M_2 (27.81 g) treatment. High amount of nitrogen at basal application method might not be fully utilized by the plants due to late germination and initial very slow growth rate in winter season. Whereas optimal and regular supply of nitrogen at different growth stages of crop through more number of splitting resulted in better utilization of nitrogen by the plants which improved the growth and yield attributes. The result obtained from the present study was similar with the findings of Ogunboye *et al*. (2020) and found that application of N fertilizer increased the growth of maize at both sites (except the number of leaves and leaf area for site II) compared with the control. The values of maize growth parameters increased in the order: control < 120 kg N ha^{-1} applied once < 90+30 < 60+30+30. Kumar *et al*. (2014) also reported that N application in three equal splits as basal, knee height stage and pre tasseling stage registered the highest cob weight comparable to other treatments.



Here, M_1 = Basal, M_2 = Side dressing at 30 DAS and M_3 = 50 % basal + 50 % side dressing at 30 DAS

Fig. 22. Effect of nitrogen application method on cob weight $plant^{-1}$ of baby corn ($LSD_{(0.05)}$=1.69).

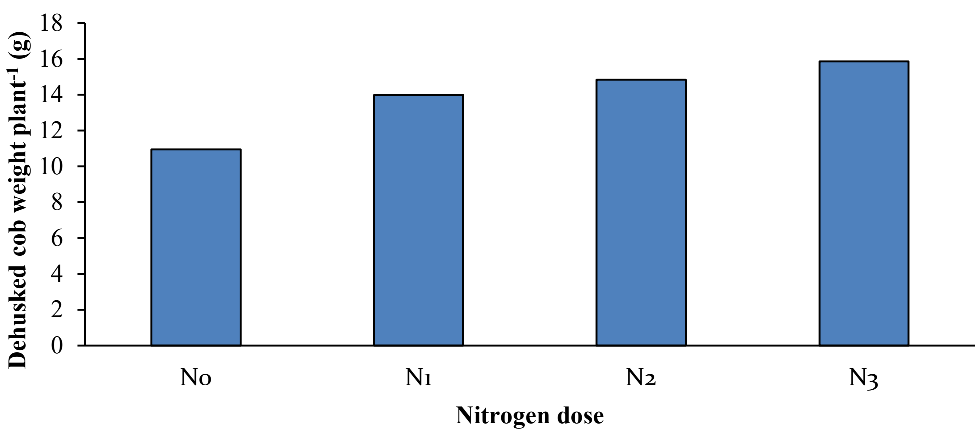
Combined effect of nitrogen dose and nitrogen application method

Combined effect of different nitrogen dose and nitrogen application method significantly effect on cob weight $plant^{-1}$ of baby corn (Table 7 and Appendix X). Experiment result showed that, the highest cob weight $plant^{-1}$ (38.47 g) was recorded in N_3M_3 treatment combination whereas the lowest cob weight $plant^{-1}$(22.47 g) was recorded in N_0M_1 treatment combination which was statistically similar with N_0M_2 (23.47 g) and N_0M_3 (24.11 g) treatment combination.

4.2.8 Dehusked cob weight plant^{-1}

Effect of different nitrogen dose

Dehusked cob weight plant^{-1} was significantly different due to the application of different nitrogen dose (Fig. 23 and Appendix X). Experiment result showed that, the highest dehusked cob weight plant^{-1} (15.86 g) was recorded in N_3 treatment, whereas the lowest dehusked cob weight plant^{-1} (10.95 g) was recorded in N_0treatment.Dadarwal *et al.*(2009) also found similar result which supported the present finding and reported that increasing the rates of NPK application from 120: 40: 30 to 180: 60: 45 kg NPK ha^{-1} significantly increased dehusked cob weight of baby corn. Parodhan *et al.* (2007) reported that highest husked, dehusked and standard weight of baby corn was obtained with 175 kg N ha^{-1} and it was at par with 125 kg N ha^{-1}.

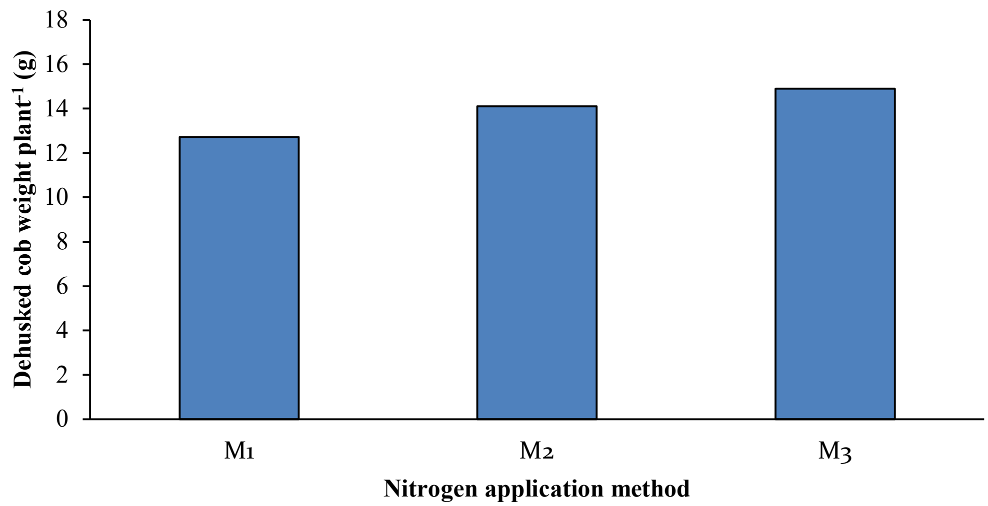


Here, N_0= 0 kg nitrogen ha^{-1}, N_1= 40 kg nitrogen ha^{-1}, N_2= 80 kg nitrogen ha^{-1} and N_3 = 120 kg nitrogen ha^{-1}.

Fig. 23. Effect of nitrogen dose on dehusked cob weight plant^{-1} of baby corn ($LSD_{(0.05)}$= 0.50).

Effect of nitrogen application method

Nitrogen application method significantly effect on dehusked cob weight plant^{-1} of baby corn (Fig. 24and Appendix X). Experiment result showed that, the highest dehusked cob weight plant^{-1} (14.89 g) was recorded in M_3 treatment, whereas the lowest dehusked cob weight plant^{-1} (12.71 g) was recorded in M_1 treatment. Application of differential dose of nitrogen at different growth stage of plants improve the growth and yield of the crops comparable to basal application.



Here, M_1 = Basal, M_2 = Side dressing at 30 DAS and M_3 = 50 % basal + 50 % side dressing at 30 DAS

Fig. 24. Effect of nitrogen application method on dehusked cob weight plant^{-1} of baby corn ($LSD_{(0.05)}$=0.64).

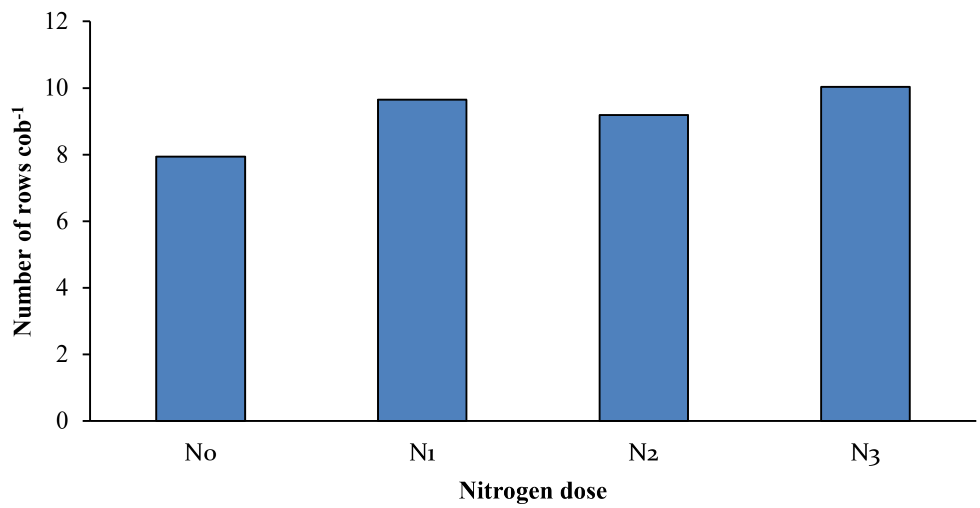
Combined effect of nitrogen dose and nitrogen application method

Combined effect of different nitrogen dose and nitrogen application method significantly effect on dehusked cob weight plant^{-1} of baby corn (Table 7 and Appendix X).Experiment result showed that, the highest dehusked cob weight plant^{-1} (18.35 g) was recorded in N_3M_3 treatment combination whereas the lowest dehusked cob weight plant^{-1}(10.37 g) was recorded in N_0M_1 treatment combination which was statistically similar with N_0M_2 (11.11 g) and N_0M_3 (11.37 g) treatment combination.

4.2.9 Number of rows cob^{-1}

Effect of nitrogen dose

Different nitrogen dose significantly effect on number of rows cob^{-1} of baby corn (Fig. 25 and Appendix X). Experiment result showed that, the highest number of rows cob^{-1} (10.03) was recorded in N_3 treatment. Whereas the lowest number of rows cob^{-1} (7.94) was recorded in N_1 treatment. The plants that didn't receive nitrogen gave the lowest values of number of rows cob^{-1}. It could be concluded that nitrogen fertilization resulted in an increase in the amount of metabolites synthesized by cob in plant. Kandil (2013) also found similar result which supported the present finding and indicated that highest number of kernels row^{-1} of cob was produced by the application of either 429 or 357 kg N ha^{-1}. Dawadi and Sah (2012) also reported that a decrease in the number of row per cob under lower N application might be attributed to poor development of sinks and reduced translocation of photosynthates.

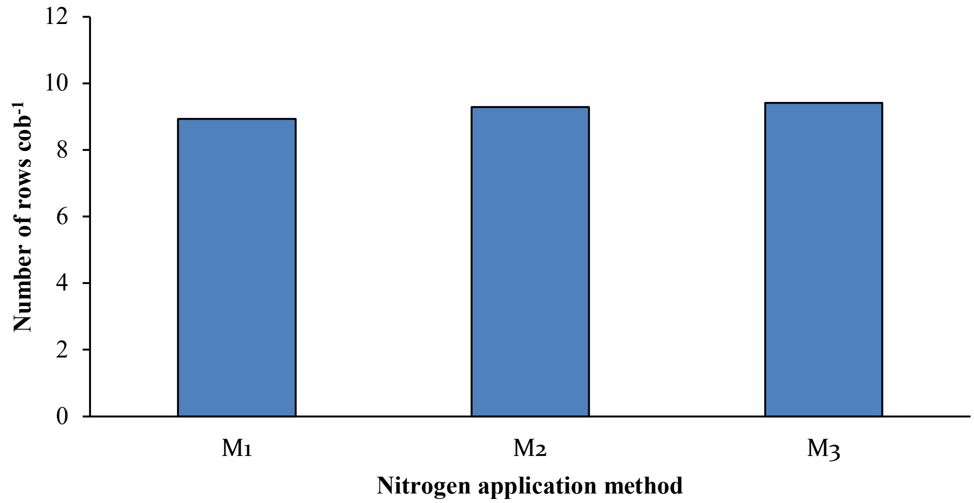


Here, N_0= 0 kg nitrogen ha^{-1}, N_1= 40 kg nitrogen ha^{-1}, N_2= 80 kg nitrogen ha^{-1} and N_3 = 120 kg nitrogen ha^{-1}.

Fig. 25. Effect of nitrogen dose on number of rows cob^{-1} of baby corn($LSD_{(0.05)}$= 0.14).

Effect of nitrogen application method

Application method of nitrogen significantly effect on number of rows cob^{-1} of baby corn (Fig. 26and Appendix X). Experiment result showed that, the highest number of rows cob^{-1} (9.41) was recorded in M_3 treatment which was statistically similar with M_2 (9.29) treatment. Whereas the lowest number of rows cob^{-1} (8.93) was recorded in M_1 treatment. The result obtained from the present study was similar with the findings of Dawadi and Sah (2012) and reported that the higher number of kernel rows ear^{-1}(15.19) when 200 kg N/ha was applied as 50 % at planting, 25% at knee high stage and 25% at tasseling stage.



Here, M_1 = Basal, M_2 = Side dressing at 30 DAS and M_3 = 50 % basal + 50 % side dressing at 30 DAS

Fig. 26. Effect of nitrogen application method on number of rows cob^{-1} of baby corn ($LSD_{(0.05)}$=0.25).

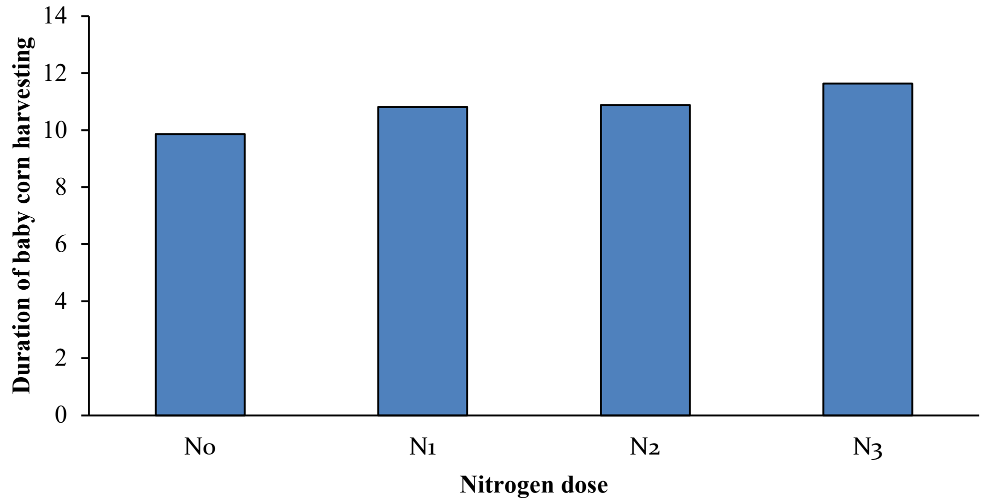
Combined effect of nitrogen dose and nitrogen application method

Combined effect of different nitrogen dose and nitrogen application method significantly effect on number of rows cob^{-1} of baby corn (Table 7and Appendix X). Experiment result showed that, the highest number of rows cob^{-1} (10.57) was recorded in N_3M_3 treatment combination whereas the lowest number of rows cob^{-1}(7.40) was recorded in N_0M_1 treatment combination.

4.2.10 Duration of baby corn harvesting

Effect of nitrogen dose

Duration of baby corn harvesting showed significant variation among different nitrogen dose (Fig. 27 and Appendix X). Experiment result showed that, the highest (11.63) days duration of baby corn harvesting was recorded in N_3 treatment whereas the lowest (9.86) days duration of baby corn harvesting was recorded in N_0treatment.

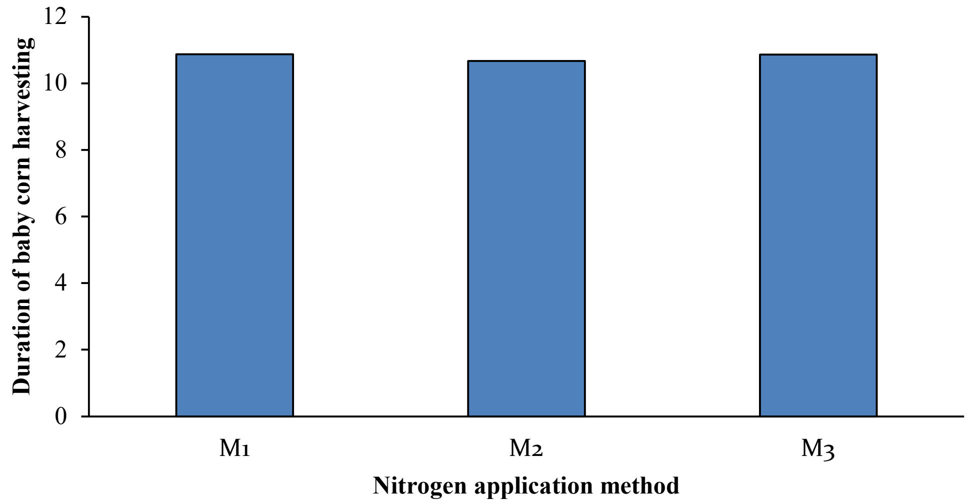


Here, N_0= 0 kg nitrogen ha^{-1}, N_1= 40 kg nitrogen ha^{-1}, N_2= 80 kg nitrogen ha^{-1} and N_3 = 120 kg nitrogen ha^{-1}.

Fig. 27. Effect of nitrogen dose on duration of baby corn harvesting ($LSD_{(0.05)}$= 0.55).

Effect of nitrogen application method

Duration of baby corn harvesting showed non significantly differ among different nitrogen application method (Fig. 28and Appendix X). Experiment result showed that, the highest (10.87) days Duration of baby corn harvesting was recorded in M_1 treatment, whereas the lowest (10.67) days duration of baby corn harvesting was recorded in M_2 treatment.



Here, M_1 = Basal, M_2 = Side dressing at 30 DAS and M_3 = 50 % basal + 50 % side dressing at 30 DAS

Fig. 28. Effect of nitrogen application method on duration of baby corn harvesting ($LSD_{(0.05)}$=NS) .

Combined effect of nitrogen dose and nitrogen application method

Duration of baby corn harvesting showed significantly differ due to application of different nitrogen dose along with different nitrogen application method (Table 7and Appendix X). Experiment result revealed that the highest (12.86) days duration of baby corn harvesting was recorded in N_3M_3 treatment combination which was statistically similar with N_1M_1 (12.39) treatment combination. Whereas the lowest (9.04) days duration of baby corn harvesting was recorded in N_0M_1 treatment combination which was statistically similar with N_1M_2 (9.33) treatment combination.

Table 7. Combined effect of nitrogen dose and nitrogen application method on cob weight plant^{-1}, dehusked cob weight plant^{-1}, number of rows cob^{-1}and duration of baby corn harvesting

Treatment Combinations	Cob weight plant^{-1}(g)	Dehusked cob weight plant^{-1}(g)	Number of rows cob^{-1}	Duration of baby corn harvesting
N_0M_1	22.47 e	10.37 g	7.40 f	9.04 e
N_0M_2	23.47 e	11.11 g	8.37 e	10.94 bc
N_0M_3	24.11 e	11.37 g	8.06 e	9.60 de
N_1M_1	27.35 d	13.32 f	9.52 bc	12.39 a
N_1M_2	30.16 b-d	14.59 c-e	9.71 b	9.33 e
N_1M_3	31.43 bc	14.00 ef	9.73 b	10.72 bc
N_2M_1	27.89 d	13.08 f	9.08 d	11.35 b
N_2M_2	28.92 b-d	15.56 bc	9.24 cd	11.05 bc
N_2M_3	31.72 b	15.87 b	9.27 cd	10.25 cd
N_3M_1	28.79 cd	14.08 d-f	9.71 b	10.68 bc
N_3M_2	28.70 cd	15.16 b-d	9.82 b	11.36 b
N_3M_3	38.47 a	18.35 a	10.57 a	12.86 a
$LSD_{(0.05)}$	2.82	1.15	0.50	0.80
CV(%)	6.84	5.29	3.16	4.30

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

Notes *viz*:

N_0= 0 kg nitrogen ha^{-1}

N_1= 40 kg nitrogen ha^{-1}

N_2= 80 kg nitrogen ha^{-1}

N_3 = 120 kg nitrogen ha^{-1}

M_1= Basal

M_2 = Side dressing at 30 DAS

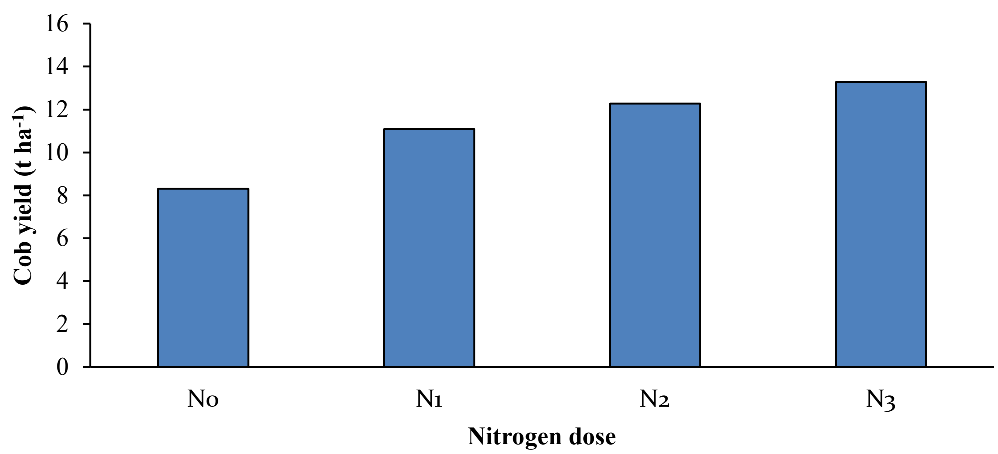
M_3 = 50% basal + 50% side dressing at 30 DAS

4.3 Yield characters

4.3.1 Cob yield

Effect of different nitrogen dose

Cob yield was significantly different due to the application of different nitrogen dose (Fig. 29 and Appendix XI). Experiment result showed that, the highest cob yield (13.27 t ha^{-1}) was recorded in N_3 treatment, whereas the lowest cob yield (8.31 t ha^{-1}) was recorded in N_0 treatment. The increase in cob yield might be due to higher nitrogen application enhancing the dry matter production, cob length, circumference cob weight $plant^{-1}$, and dehusked cob weight $plant^{-1}$. Mahesh *et al.* (2016) also found similar result which supported the present finding and reported that application of 240 kg N ha^{-1} recorded the highest grain yield (8349 kg ha^{-1}) compared to 120 and 180 kg N ha^{-1}.Sahoo (2011) also reported that with increase in levels of nitrogen progressively increased the baby corn and fodder yield. Rathika *et al.* (2009) showed significant increase in growth parameters and yield of baby corn with application of nitrogen and plant growth regulators. Singh *et al.* (2003) noticed that combined application of 120 kg N ha^{-1} and 70 kg K_2O ha^{-1} recorded significantly higher growth and yield of baby corn over control.

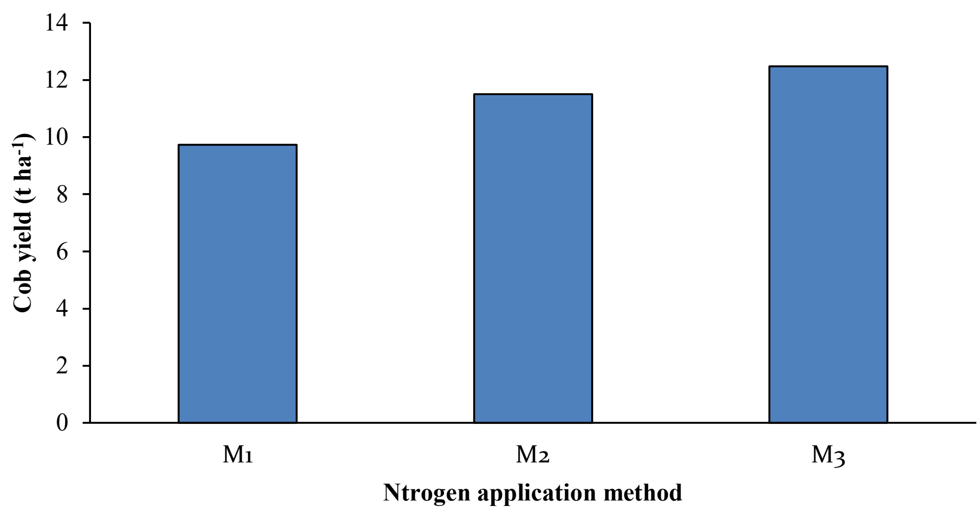


Here, N_0= 0 kg nitrogen ha^{-1}, N_1= 40 kg nitrogen ha^{-1}, N_2= 80 kg nitrogen ha^{-1} and N_3 = 120 kg nitrogen ha^{-1}.

Fig. 29. Effect of nitrogen dose on cob yield of baby corn ($LSD_{(0.05)}$= 0.60).

Effect of nitrogen application method

Nitrogen application method significantly effect on cob yield of baby corn (Fig.30and Appendix XI). Experiment result showed that, the highest cob yield (12.48 t ha^{-1}) was recorded in M_3 treatment, whereas the lowest cob yield (9.73 t ha^{-1}) was recorded in M_1 treatment. The result obtained from the present study was similar with the findings of Pandey and Chaudhary(2014) and reported that application of nitrogen in four equal splits (as basal, at 30 days after sowing, at 45 days after sowing and at 60 days after sowing) had the highest grain yield (7.68 t ha^{-1}) than two equal splits (50 % each at basal and at 45 DAS). Singh *et al.* (2013) also observed that split application of nitrogen as 10% (basal), 20% (four leaf stage), 30% (eight leaf stage) and 10% (grain filling stage) resulted into significantly higher values of all the yield attributes and yield as compared to rest of the treatments.



Here, M_1 = Basal, M_2 = Side dressing at 30 DAS and M_3 = 50 % basal + 50 % side dressing at 30 DAS

Fig. 30. Effect of nitrogen application method on cob yield of baby corn ($LSD_{(0.05)}$=0.46) .

Combined effect of nitrogen dose and nitrogen application method

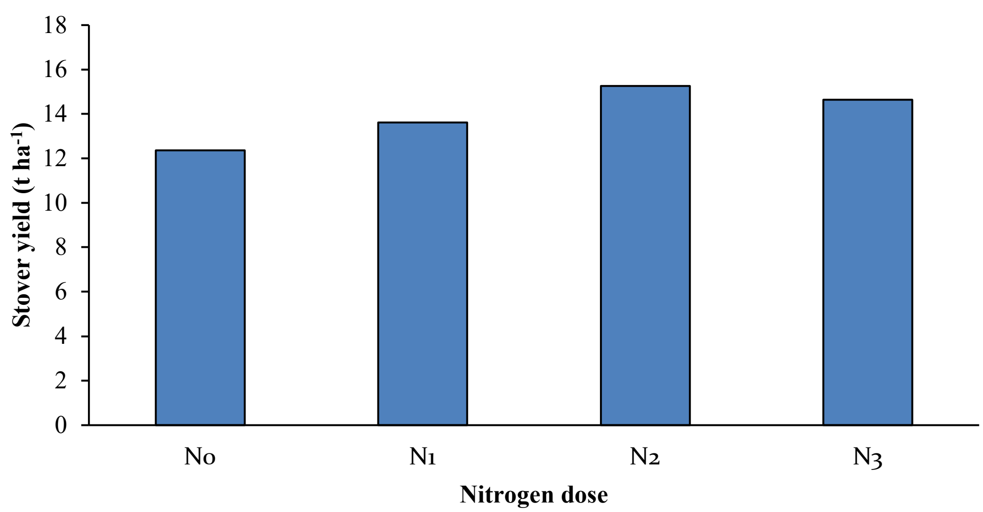
Combined effect of different nitrogen dose and nitrogen application method significantly effect on cob yield of baby corn (Table 8 and Appendix XI). Experiment result showed that, the highest cob yield [1] (15.24 t ha^{-1}) was recorded in

N_3M_3treatment combination whereas the lowest cob yield (6.73 t ha^{-1}) was recorded in N_0M_1 treatment combination.

4.3.2 Stover yield

Effect of nitrogen dose

Application of different nitrogen dose significantly effect on stover yield (t ha^{-1}) of baby corn (Fig. 31and Appendix XI). Experiment result showed that, the highest stover yield (15.25 t ha^{-1}) was recorded in N_2 treatment, whereas the minimum stover yield (12.36 t ha^{-1}) was recorded in N_0 treatment. Das *et al.* (2009) also found similar result which supported the present finding reported that the highest stover yield was found when the soil was treated with 80 kg N ha^{-1}.Karki *et al.* (2005) reported that stover yield of maize increased significantly with increase in the level of nitrogen application.

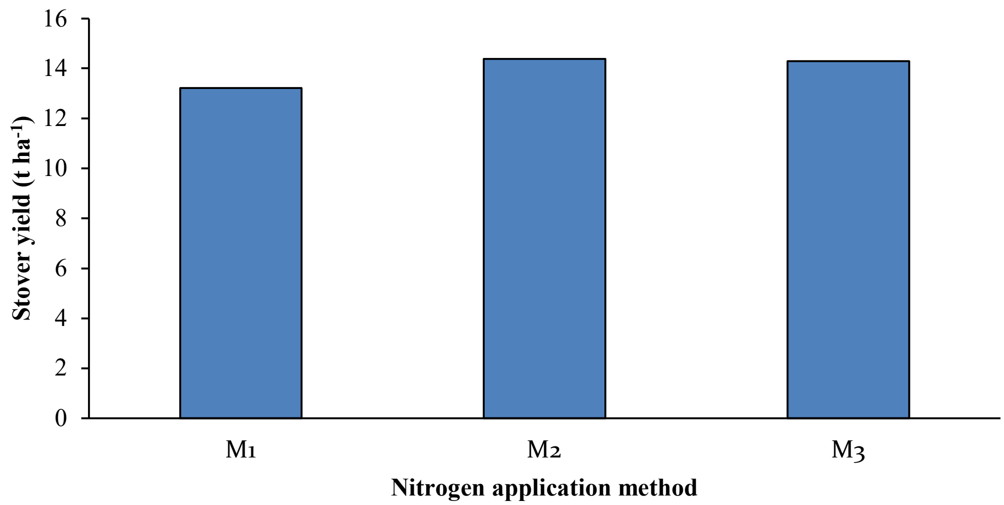


Here, N_0= 0 kg nitrogen ha^{-1}, N_1= 40 kg nitrogen ha^{-1}, N_2= 80 kg nitrogen ha^{-1} and N_3 = 120 kg nitrogen ha^{-1}.

Fig. 31. Effect of nitrogen dose on stover yield of baby corn($LSD_{(0.05)}$= 0.56).

Effect of nitrogen application method

Nitrogen application method significantly effect on stover yield of baby corn (Fig. 32and Appendix XI). Experiment result showed that, the highest stover yield (14.38 t ha^{-1}) was recorded in M_2 treatment, which was statistically similar with M_3 (14.29 t ha^{-1}) treatment, whereas the lowest stover yield (13.22 t ha^{-1}) was recorded in M_1 treatment.



Here, M_1 = Basal, M_2 = Side dressing at 30 DAS and M_3 = 50 % basal + 50 % side dressing at 30 DAS

Fig. 32. Effect of nitrogen application method on stover yield of baby corn ($LSD_{(0.05)}$=0.62) .

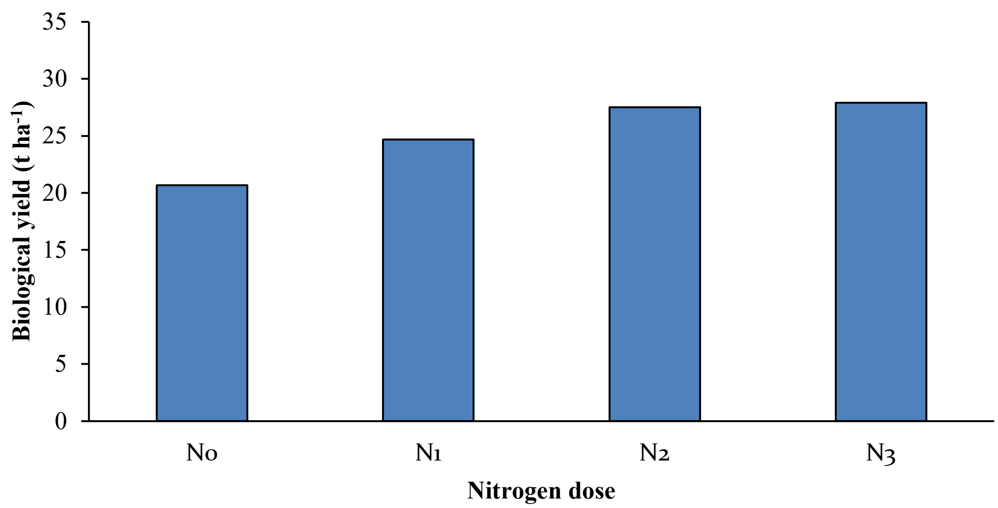
Combined effect of nitrogen dose and nitrogen application method

Application of different nitrogen dose along with different nitrogen application method significantly effect on stover yield of baby corn (Table 8and Appendix XI). Experiment result showed that, the highest stover yield (15.81 t ha^{-1}) was recorded in N_3M_3 treatment combination which was statistically similar with N_2M_3 (15.47 t ha^{-1}), N_2M_2 (15.41tha^{-1}), N_2M_1 (14.87 t ha^{-1}) and N_3M_2 (14.68 t ha^{-1}) treatment combination. Whereas the lowest stover yield (11.18 t ha^{-1}) was recorded in N_0M_1 treatment combination which was statistically similar with N_0M_3 (12.25 t ha^{-1}) treatment combination.

4.3.3 Biological yield

Effect of nitrogen dose

Different nitrogen dose application significantly effect on biological yield of baby corn (Fig. 33and Appendix XI). Experiment result showed that, the highest biological yield (27.91 t ha^{-1}) was recorded in N_3 treatment, which was statistically similar with N_2(27.53 t ha^{-1}) treatment. Whereas the lowest biological yield (20.66 t ha^{-1}) was recorded in N_0 treatment. The result obtained from the present study was similar with the findings of Abera *et al*. (2013) and reported that biomass yield increasing at higher Nitrogen dose application.



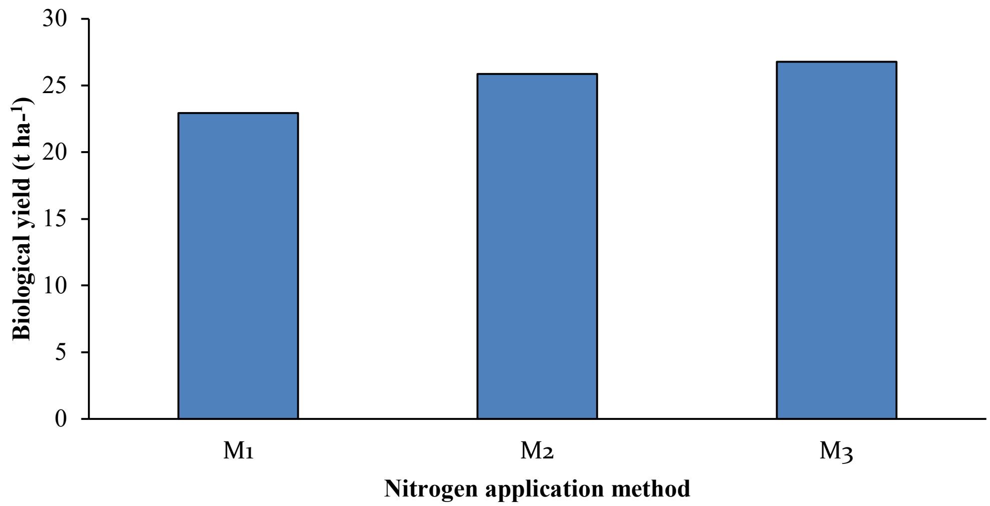
Here, N_0= 0 kg nitrogen ha^{-1}, N_1= 40 kg nitrogen ha^{-1}, N_2= 80 kg nitrogen ha^{-1} and N_3 = 120 kg nitrogen ha^{-1}.

Fig. 33. Effect of nitrogen dose on biological yield of baby corn(LSD$_{(0.05)}$= 1.04).

Effect of nitrogen application method

Nitrogen application method significantly effect on biological yield of baby corn (Fig. 34and Appendix XI). Experiment result showed that, the highest biological yield (26.77 t ha^{-1}) was recorded in M_3 treatment, whereas the lowest biological yield (22.94 t ha^{-1}) was recorded in M_1 treatment. Wasaya *et al.* (2012) also found similar result which supported the present finding and reported that nitrogen application in three splits (S_5-1/3 at sowing + 1/3 at V_5 + 1/3 at tasseling) produced highest biomass yield and shelling percentage as compare to S_1-Whole at sowing, S_2- ½ at sowing + ½ at

V_5(5 leaf stage), S_3-½ at sowing + ½ at tasseling and S_4- ½ at V_5 + ½ at tasseling. Scharf *et al*. (2002) observed significant increase in maize yield when nitrogen was applied in splits. Mariga *et al*. (2000) also reported that biomass yield in maize considerably increased when nitrogen was applied up to tassel initiation stage.



Here, M_1 = Basal, M_2 = Side dressing at 30 DAS and M_3 = 50 % basal + 50 % side dressing at 30 DAS

Fig. 34. Effect of nitrogen application method on biological yield of baby corn ($LSD_{(0.05)}$=0.85).

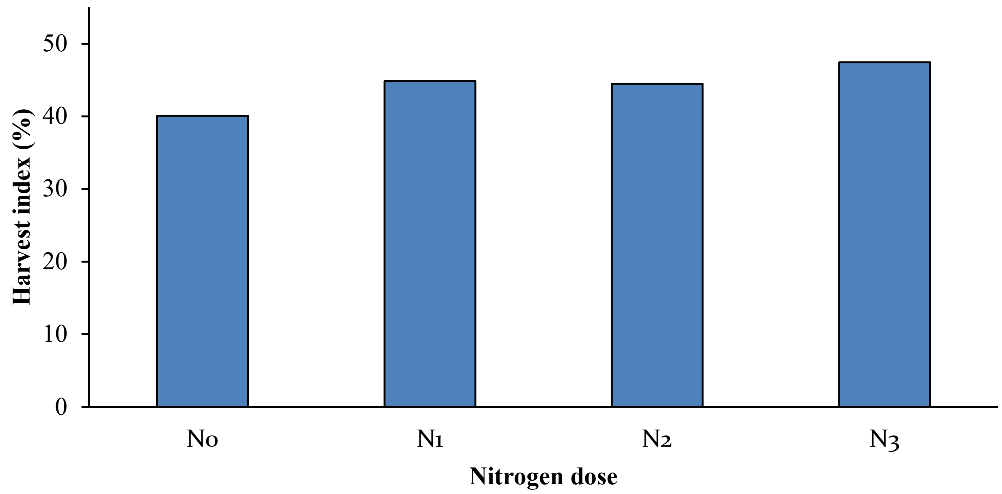
Combined effect of nitrogen dose and nitrogen application method

Application of different nitrogen dose along with different nitrogen application method significantly effect on biological yield of baby corn (Table 8and Appendix XI). Experiment result showed that, the highest biological yield (31.05 t ha^{-1}) was recorded in N_3M_3 treatment combination. Whereas the lowest biological yield (17.91 t ha^{-1}) was recorded in N_0M_1 treatment combination.

4.3.4 Harvest index

Effect of nitrogen dose

Application of different nitrogen dose significantly effect on harvest index (%) of baby corn (Fig. 35and Appendix XI). Experiment result showed that, the highest harvest index (47.44 %) was recorded in N_3 treatment. Whereas the lowestharvest index (40.48 %) was recorded in N_0treatment.Adhikari*et al.* (2021) also found similar result which supported the present finding and reported that different level of Nitrogen showed significant differences in harvest index. Sharifi and Namvar (2016) also found that the highest harvest index (42.1%) with the application of 225 kg N ha^{-1}. Wajid *et al*. (2007) also found the increase in harvest index with increasing fertilizer dose up to 250 kg N ha^{-1}.

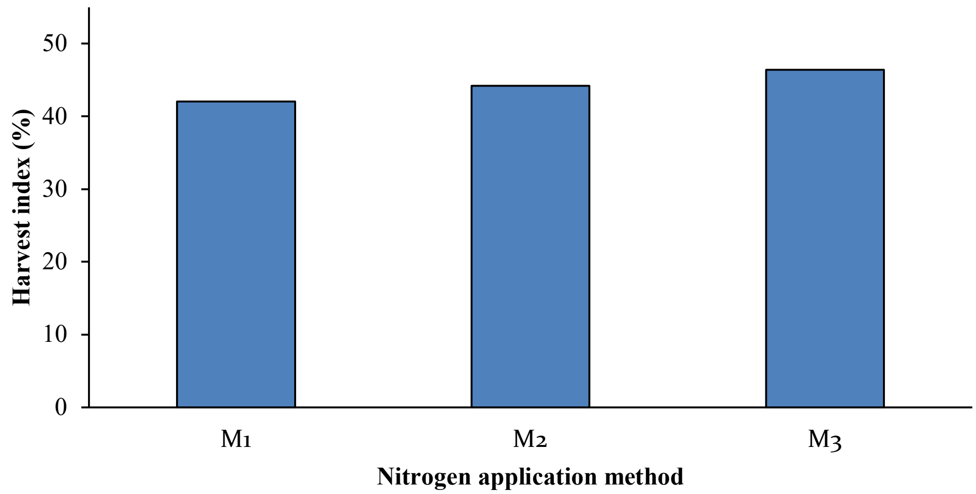


Here, N_0= 0 kg nitrogen ha^{-1}, N_1= 40 kg nitrogen ha^{-1}, N_2= 80 kg nitrogen ha^{-1} and N_3 = 120 kg nitrogen ha^{-1}.

Fig. 35. Effect of nitrogen dose on harvest index of baby corn($LSD_{(0.05)}$= 1.04).

Effect of nitrogen application method

Nitrogen application method significantly effect on harvest index (%) of baby corn (Fig. 36and Appendix XI). Experiment result showed that, the highest harvest index (46.39 %) was recorded in M_3 treatment, whereas the lowest harvest index (42.05 %) was recorded in M_1 treatment. The result obtained from the present study was similar with the findings of Nemati *et al*. (2012) who reported that the highest harvest index was recorded with nitrogen split application as 1/3 in planting + 1/3 in 8-10 leaf stages + 1/3 in tassel initiation. Rizwan *et al.* (2003) reported that harvest index (41.44%) was observed when nitrogen was applied in three equal splits (at sowing, at first irrigation and at knee height stage).



Here, M_1 = Basal, M_2 = Side dressing at 30 DAS and M_3 = 50 % basal + 50 % side dressing at 30 DAS

Fig. 36. Effect of nitrogen application method on harvest index of baby corn ($LSD_{(0.05)}$=1.18).

Combined effect of nitrogen dose and nitrogen application method

Application of different nitrogen dose along with different nitrogen application method significantly effect on harvest index (%) of baby corn (Table 8and Appendix XI). Experiment result showed that, the highest harvest index (49.03 %) was recorded in N_3M_3 treatment combination which was statistically similar with N_3M_2 (46.68 %) treatment combination. Whereas the lowest harvest index (37.64 %) was recorded in N_0M_1 treatment combination which was statistically similar with N_0M_2 (38.79 %) treatment combination.

Table 8. Combined effect of nitrogen dose and nitrogen application method on cob yield, stover, biological yield and harvest index of baby corn

Treatment Combinations	Cob yield (t ha^{-1})	Stover yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
N_0M_1	6.73 h	11.18 f	17.91 e	37.64 e
N_0M_2	8.62 g	13.64 b-d	22.26 d	38.79 e
N_0M_3	9.57 f	12.25 ef	21.82 d	43.80 cd
N_1M_1	9.65 f	13.40 de	23.05 d	41.85 d
N_1M_2	11.81 cd	13.80 b-d	25.61 c	46.11 bc
N_1M_3	11.81 cd	13.62 cd	25.43 c	46.50 b
N_2M_1	10.81 e	14.87 ab	25.68 c	42.09 d
N_2M_2	12.72 bc	15.41 a	28.13 b	45.22 bc
N_2M_3	13.30 b	15.47 a	28.77 b	46.23 b
N_3M_1	11.72 de	13.42 de	25.14 c	46.62 b
N_3M_2	12.85 b	14.68 a-c	27.53 b	46.68 ab
N_3M_3	15.24 a	15.81 a	31.05 a	49.03 a
$LSD_{(0.05)}$	0.92	1.24	1.70	2.36
CV(%)	4.72	5.15	3.91	3.08

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

Notes *viz*:

N_0= 0 kg nitrogen ha^{-1}

N_1= 40 kg nitrogen ha^{-1}

N_2= 80 kg nitrogen ha^{-1}

N_3 = 120 kg nitrogen ha^{-1}

M_1= Basal

M_2 = Side dressing at 30 DAS

M_3 = 50% basal + 50% side dressing at 30 DAS

CHAPTER V

SUMMARY AND CONCLUSION

The present piece of work was carried out at the Agronomy Research Field of Sher-e-Bangla Agricultural University, Dhaka, Bangladesh during the period from October-2019 to February 2020 in Rabi season, to study the growth and yield of baby corn as influenced by nitrogen application method. The experiment consisted of two factors, and followed split-plot design. Factor A: Different Nitrogen dose *viz.*N_0 = 0 kg ha^{-1}, N1 = 40 kg ha^{-1}, N_2 = 80 kg ha^{-1}, N_3 = 120 kg ha^{-1} and Factor B: Nitrogen application method *viz.* M_1 = Basal, M_2 = Side dressing at 30 DAS and M_3 = 50% basal + 50% Side dressing at 30 DAS. Data on different parameters were collected for assessing results for this experiment and showed significant variation in respect of growth, yield and yield contributing characteristics of baby corn due to the effect of different nitrogen dose application, nitrogen application method and their combinations.

In case of different nitrogen dose, the highest seedling emergence (82.22 %) of baby corn at 5 DAS was recorded in N_3 treatment.The highest plant height (46.69 cm) at 25 DAS was recorded in N_3 treatment. At 45 DAS, the highest plant height (92.65 cm) was recorded in N_2 treatment. At 65 and 85 DAS the highest plant height (140.18 cm and 178.33 cm) respectively was recorded in N_3 treatment. At 25 DAS the highest leaf area index of baby corn (0.48) was recorded in N_1 treatment. At 45, 65 and 85 DAS the highest leaf area index of baby corn (3.84, 5.77 and 7.51) was recorded in N_3 treatment. The highest above ground dry matter weight plant^{-1} (15.34g, 50.18g and 86.59 g) at 25, 65 and 85 DAS was recorded in N_3 treatment. The highest (78.33) days to tasseling was recorded in N_0 treatment. The highest (86.22) days to silking, number of cobs plant^{-1} (3.78), number of cobs ha^{-1} (100.42 thousands), cob length (14.46 cm), cob circumference (11.69 cm),cob weight plant^{-1} (31.99 g), dehusked cob weight plant^{-1} (15.86 g), number of rows cob^{-1} (10.03), duration of baby corn harvesting (11.63 days), cob yield (13.27 t ha^{-1}) were recorded in N_3 treatment. The highest stover yield (15.25 t ha^{-1}) was recorded in N_2 treatment. The highest biological yield (27.91 t ha^{-1}) and harvest index (47.44 %) were recorded in N_3 treatment. Whereas the lowest seedling emergence (62.22%) at 5 DAS was recorded inN_0treatment. The lowest plant height (43.72cm, 89.43cm, 117.73 cm and 151.92 cm) at 25, 45, 65 and 85 DAS was recorded in N_0 treatment. The lowest leaf area index of baby corn (0.41) was recorded in N_2treatment at 25 DAS. At 45, 65 and 85 DAS, the lowest leaf area index of baby corn (2.86, 3.99 and 5.48) was recorded in N_0 treatment. At 25 DAS N_1 treatment recorded the lowest above ground dry matter weight plant^{-1} (12.23 g) of baby corn. At 65 and 85 DAS the lowest above ground dry matter weight plant^{-1} (38.9 and 58.45 g) was recorded in N_0 treatment. The lowest (74.33) days to tasseling was recorded in N_3 treatment. The lowest (84.33) days to silking, number of cobs plant^{-1} (3.38), number of cobs ha^{-1} (83.17 thousands), cob length (14.06 cm) , cob circumference (10.16 cm) were recorded in N_0 treatment. The lowest number of rows cob^{-1} (7.94) was recorded in N_1 treatment. The lowest cob weight plant^{-1} (23.35 g), dehusked cob weight plant^{-1} (10.95 g), duration of baby corn harvesting(9.86 days),cob yield (8.31 t ha^{-1}), stover yield (12.36 t ha^{-1}), biological yield (20.66 t ha^{-1}) and harvest index (40.48 %) were recorded in N_0 treatment.

In case of different nitrogen application method result revealed that, the highest germination percentage (75.83 %) of baby corn at 5 DAS was recorded inM_3treatment.Thehighest plant height (46.51 cm, 92.96 cm, 133.02 cm and 169.49 cm) at 25, 45, 65 and 85 DAS, leaf area index of 0.51, 3.71, 5.20 and 6.97 at 25, 45, 65 and 85 DAS were recorded in M_3 treatment. The highest above ground dry matter weight plant^{-1} (14.15 g) was recorded in M_1 treatment at 25 DAS. At 65 and at harvest the highest above ground dry matter weight plant^{-1} (51.72g and 88.37 g) was recorded in M_3 treatment. The highest (76.50) days to tasseling was recorded in M_2 treatment. The highest (85.50) days to silking was recorded in M_1treatment.Thehighest number of cobs plant^{-1} (3.85), number of cobs ha^{-1} (97.23 thousands), cob length (15.42 cm), cob circumference (11.55 cm), number of rows cob^{-1} (9.41) was recorded in M_3treatment. The highest duration of baby corn harvesting (10.87) was recorded in M_1 treatment.The cob weight plant^{-1} (31.43 g), dehusked cob weight plant^{-1} (14.89 g), cob yield (12.48 t ha^{-1})was recorded in M_3 treatment. The highest stover yield (14.38 t ha^{-1}) was recorded in M_2 treatment. The highest biological yield (26.77 t ha^{-1}) and harvest index (46.39 %) was recorded in M_3 treatment. Whereas the lowest germination percentage (73.25%) of baby corn at 5 DAS was recorded in M_1treatment.Thelowest plant height (44.77 cm) at 25 DAS was recorded in M_1 treatment. At 45, 65 and 85 DAS the lowest plant height (89.97, 128.70 and 163.70 cm) was recorded in M_2 treatment. The lowest leaf area index (0.40, 3.26, 4.93 and 6.43) at 25, 45, 65 and 85 DAS was recorded in M_1 treatment. At 25 DAS, the lowest above ground dry matter weight plant^{-1} (13.45 g) was recorded in M_2 treatment. At 65 DAS and at harvest the lowest above ground dry matter weight plant^{-1} (40.15 g and 51.22 g) was recorded in M_1 treatment. The lowest (75.00) days to tasseling was recorded in M_3 treatment. The lowest (85.25) days to silking was recorded in M_3treatment.The lowest duration of baby corn harvesting (10.67 days) was recorded in M_2treatment.Thelowest number of cobs plant^{-1} (3.43), number of cobs ha^{-1} (81.94 thousands), cob length (14.09 cm), cob circumference (10.86 cm), number of rows cob^{-1} (8.93), cob weight plant^{-1} (26.63 g), dehusked cob weight plant^{-1} (12.71 g), cob yield (9.73 t ha^{-1}) stover yield (13.22 t ha^{-1}), biological yield (22.94 t ha^{-1}) and harvest index (42.05 %) were recorded in M_1 treatment.

In case of combination, the highest germination percentage (96.67 %) of baby corn at 5 DAS was recorded in N_3M_3 treatment combination.The highest plant height of baby corn (48.43 cm) was recorded in N_3M_3 treatment combination at 25 DAS. At 45 DAS the highest plant height of baby corn (96.06 cm) was recorded in N_2M_3 treatment combination. At 65 DAS the highest plant height of baby corn (144.00 cm) was recorded in N_3M_1 treatment combination. At 85 DAS the highest plant height of baby corn (180.07 cm) was recorded in N_3M_3 treatment combination. The highest leaf area index (0.54, 4.13, 6.12 and 7.64) at 25, 45, 65 and 85 DAS was recorded in N_3M_3 treatment combination. The highest above ground dry matter weight plant^{-1} of baby corn (17.27 g) was recorded in N_3M_3 treatment combination at 25 DAS. At 65 DAS the highest above ground dry matter weight plant^{-1} of baby corn (57.18 g) was recorded in N_2M_3 treatment combination and at harvest respectively the highest above ground dry matter weight plant^{-1} of baby corn (98.29 g) was recorded in N_3M_3 treatment combination. The highest (79.00) days to tasseling was recorded in N_0M_1 treatment combination. The highest (87.33) days to silking, number of cobs plant^{-1} (4.08), number of cobs ha^{-1} (106.32 thousands),duration of baby corn harvesting (12.86 days), cob length (17.52 cm), cob circumference (12.75 cm), number of rows cob^{-1} (10.57), cob weight plant^{-1} (38.47 g), dehusked cob weight plant^{-1} (18.35 g), cob yield ^{1} (15.24 t ha^{-1}), stover yield ^{1} (15.81 t ha^{-1}), biological yield (31.05 t ha^{-1}) and harvest index (49.03 %) was recorded in N_3M_3 treatment combination. Whereas the lowest germination percentage (36.67%) of baby corn at 5 DAS was recorded in N_0M_1 treatment combination.The lowest plant height (41.82 cm and 88.83 cm) was recorded in N_0M_2 treatment combination at 25 and 45 DAS. At 65 and 85 DAS the lowest plant height (116.07 and 149.33 cm) was recorded in N_0M_1 treatment combination. The lowest leaf area index (0.33, 2.77, 3.63 and 5.05) at 25, 45, 65 and 85 DAS was recorded in N_0M_1 treatment combination.The lowest above ground dry matter weight plant^{-1} of baby corn (11.88 g) was recorded in N_1M_3 treatment combination at 25 DAS. At 65 DAS and at harvest respectively the lowest above ground dry matter weight plant^{-1} of baby corn (33.52 g and 39.76 g) was recorded in N_0M_1 treatment combination. The lowest (74.00) days to tasseling was recorded in N_3M_3 treatment combination. The lowest (83.67) days to silking, number of cobs plant^{-1} (3.27), number of cobs ha^{-1} (74.55 thousands), cob length (12.75 cm), cob circumference (9.60 cm), number of rows cob^{-1}(7.40),duration of baby corn harvesting (9.04 days),cob weight plant^{-1}(22.47 g), dehusked cob weight plant^{-1}(10.37 g), cob yield (6.73 t ha^{-1}), stover yield (11.18 t ha^{-1}), biological yield (17.91 t ha^{-1}) and harvest index (37.64 %) were recorded in N_0M_1 treatment combination.

Conclusion

Based on the above results of the present study, the following conclusions may be drawn

i. The N_3 treatment perform well and recorded the highest days to silking, number of cobs plant^{-1}, number of cobs ha^{-1}, cob length, cob circumference , cob weight plant^{-1},dehusked cob weight plant^{-1}, number of rows cob^{-1}, cob yield , biological yield and harvest index.

ii. The highest number of cobs plant^{-1}, number of cobs ha^{-1}, cob length , cob circumference, cob weight plant^{-1}, dehusked cob weight plant^{-1}, number of rows cob^{-1}, cob yield, biological yield and harvest index was recorded in M_3 treatment and perform well comparable to other treatments.

iii. In case of combined effect, the highest days to silking, number of cobs plant^{-1} ,number of cobs ha^{-1} , cob length , cob circumference , cob weight plant^{-1} , dehusked cob weight plant^{-1} , number of rows cob^{-1} , cob yield , stover yield , biological yield and harvest index was recorded in N_3M_3 treatment combination.

Application of 120 kg nitrogen ha^{-1} as 50% basal dose and rest of 50% as side dressing at 30 DAS increased the baby corn yield.

Recommendation

The following recommendations are proposed here under:

- ❖ Before making final conclusion, further trials with more treatment combinations under different AEZ of Bangladesh is suggested.

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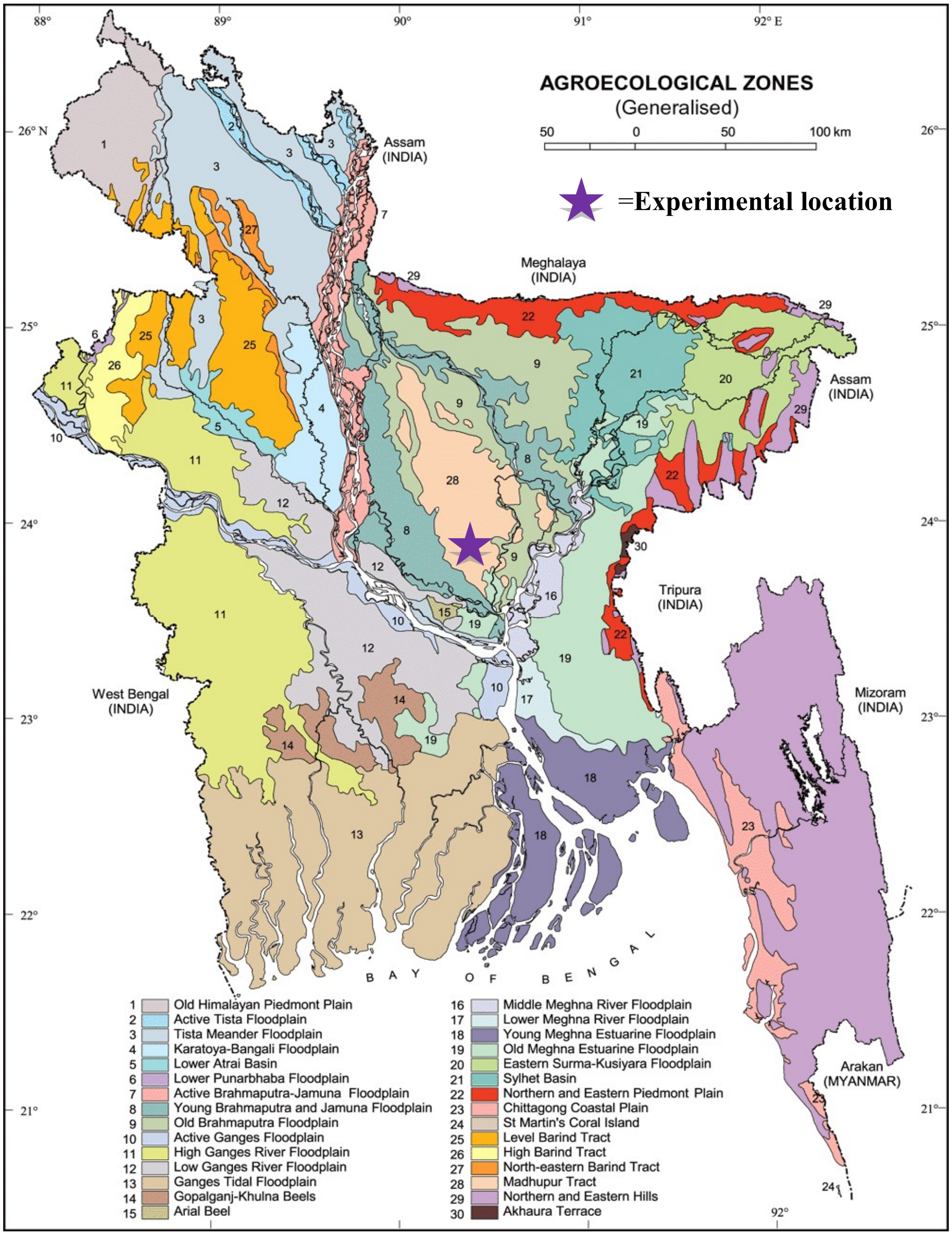
APPENDICES

Appendix I. Map showing the experimental location under study



Appendix II. Soil characteristics of the experimental field

A. Morphological features of the experimental field

Morphological features	Characteristics
AEZ	AEZ-28, Madhapur Tract
General Soil Type	Shallow Red Brown Terrace Soil
Land type	High land
Location	Sher-e-Bangla Agricultural University Agronomy research field, Dhaka
Soil series	Tejgaon
Topography	Fairly leveled

B. The initial physical and chemical characteristics of soil of the experimental site (0 - 15 cm depth)

Physical characteristics

Constituents	Percent
Clay	29 %
Sand	26 %
Silt	45 %
Textural class	Silty clay

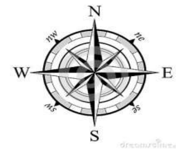
Chemical characteristics

Soil characteristics	Value
Available P (ppm)	20.54
Exchangeable K (mg/100 g soil)	0.10
Organic carbon (%)	0.45
Organic matter (%)	0.78
pH	6.1
Total nitrogen (%)	0.03

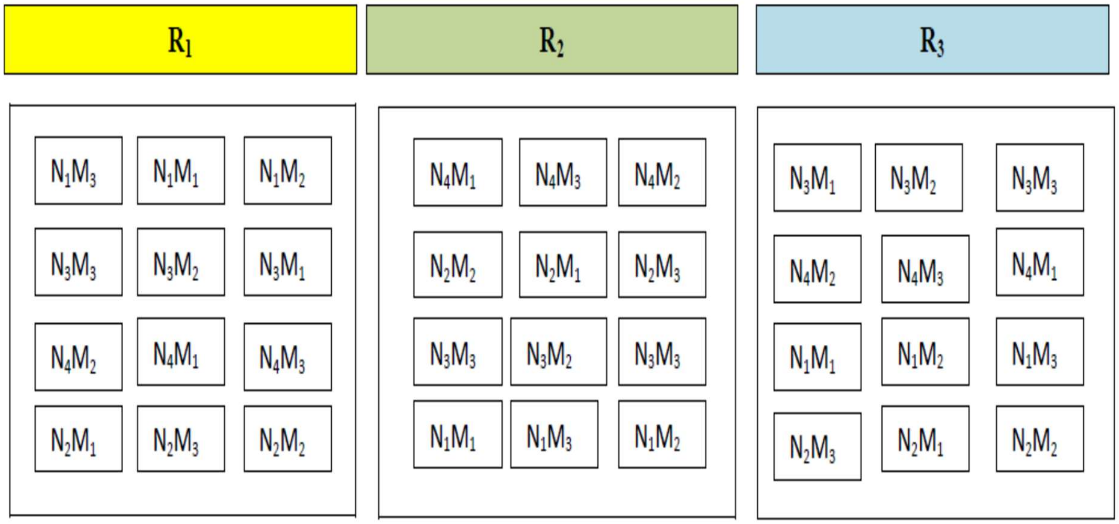
Appendix III. Monthly meteorological information during the period from October, 2019 to February 2020

Year	Month	Air temperature (^0C)		Relative humidity (%)	Total rainfall (mm)
		Maximum	Minimum		
2019	October	31.2	23.9	76	52
	November	29.6	19.8	53	00
	December	28.8	19.1	47	00
2020	January	25.5	13.1	41	00
	February	25.9	14	34	7.7

(Source:Metrological Centre, Agargaon, Dhaka (Climate Division)



Appendix IV. Layout of the experimental field



LEGENDS	
N_0= 0 kg nitrogen ha^{-1}	M_1= Basal
N_1= 40 kg nitrogen ha^{-1}	M_2 = Side dressing at 30 DAS
N_2= 80 kg nitrogen ha^{-1}	M_3 = 50 % basal + 50 % side dressing at 30 DAS
N_3 = 120 kg nitrogen ha^{-1}	

Appendix V. Analysis of variance of the data of germination percentage and plant height of baby corn at different DAS

Sources of variation	Mean square of					
	df	Germination percentage	Plant height at			
			25 DAS	45 DAS	65 DAS	85 DAS
Replication	2	27.44	1.11	4.75	0.08	1.33
Nitrogen dose (N)	3	664.47*	13.73*	18.62*	834.17*	1386.42*
Error (a)	6	9.67	0.32	3.97	0.08	1.33
Method (M)	2	20.58	11.46*	27.07*	56.82^{NS}	100.75*
N×M	6	783.92*	7.19*	8.29*	64.56*	72.22*
Error (b)	16	14.11	2.49	4.17	25.08	26.33
Total	35					

NS: Non-significant

*: Significant at 0.05 level of probability

Appendix VI. Analysis of variance of the data of leaf area index of baby corn at different DAS

Sources of variation	Mean square of leaf area index at				
	df	25 DAS	45 DAS	65 DAS	85 DAS
Replication	2	0.00023	0.03943	0.03250	0.12333
Nitrogen dose (N)	3	0.01016*	1.55603*	5.25528*	6.91656*
Error (a)	6	0.00010	0.01849	0.02008	0.07000
Method (M)	2	0.03348*	0.73953*	0.22441*	0.92890*
N×M	6	0.00421*	0.46616*	0.60841*	0.12483*
Error (b)	16	0.00021	0.01398	0.02319	0.04333
Total	35				

*: Significant at 0.05 level of probability

Appendix VII. Analysis of variance of the data of above ground dry matter weight of baby corn at different DAS

Sources of variation	Mean square of above ground dry matter weight at			
	df	25 DAS	65 DAS	At harvest
Replication	2	0.3033	0.583	5.58
Nitrogen dose (N)	3	14.5919*	203.532*	1207.21*
Error (a)	6	0.3478	0.361	1.36
Method (M)	2	1.6136*	403.987*	4464.42*
N×M	6	4.2508*	36.118*	84.11*
Error (b)	16	0.3367	3.417	10.42
Total	35			

*: Significant at 0.05 level of probability

Appendix VIII. Analysis of variance of the data of days to tasseling, days to silking, number of cobs plant^{-1} and number of cobs ha^{-1}of baby corn

Sources of variation	Mean square value of				
	df	Days to tasseling	Days to silking	Number of cobs plant^{-1}	Number of cobs ha^{-1}
Replication	2	3.0000	12.0278	0.03227	6.083
Nitrogen dose (N)	3	26.2500*	5.5185*	0.28547*	504.347*
Error (a)	6	1.2222	0.8796	0.01405	9.417
Method (M)	2	7.7500*	0.1944^{NS}	0.50660*	702.813*
N×M	6	2.7500*	4.2685*	0.03130*	72.853*
Error (b)	16	1.6667	1.1667	0.01127	22.583
Total	35				

NS: Non-significant

*: Significant at 0.05 level of probability

Appendix IX. Analysis of variance of the data of cob length and cob circumference of baby corn

Sources of variation	Mean square value of		
	df	Cob length	Cob circumference
Replication	2	1.0219	0.25694
Nitrogen dose (N)	3	10.2886*	4.28791*
Error (a)	6	0.4442	0.20806
Method (M)	2	6.0060*	1.45387*
N×M	6	1.6840*	0.63681*
Error (b)	16	0.5886	0.22028
Total	35		

*: Significant at 0.05 level of probability

Appendix X. Analysis of variance of cob weight plant^{-1}, dehusked cob weight plant^{-1}, number of rows cob^{-1}andharvestingduration of baby corn

Sources of variation	Mean square of				
	df	Number of rows cob^{-1}	Cob weight plant^{-1}	Dehusked cob weight plant^{-1}	Harvesting duration of baby corn
Replication	2	0.01583	0.583	0.0833	0.17583
Nitrogen dose (N)	3	7.44841*	122.860*	40.3180*	4.74707*
Error (a)	6	0.01435	0.250	0.1944	0.22917
Method (M)	2	0.74163*	75.253*	14.6827*	0.14839^{NS}
N×M	6	0.24030*	15.414*	3.0465*	4.82001*
Error (b)	16	0.08472	3.833	0.5417	0.21583
Total	35				

NS: Non-significant

*: Significant at 0.05 level of probability

Appendix XI. Analysis of variance of cob yield, stover, biological yield and harvest index of baby corn

Sources of variation	Mean square of				
	df	Cob yield	Stover yield	Biological yield	Harvest index
Replication	2	0.1183	0.0052	0.152	0.4375
Nitrogen dose (N)	3	41.4353*	14.4631*	100.708	84.0089*
Error (a)	6	0.2699	0.2372	0.820	0.1597
Method (M)	2	23.3719*	5.0181*	48.063*	56.5084*
N×M	6	0.7844*	1.4232*	3.247*	5.0941*
Error (b)	16	0.2808	0.5180	0.969	1.8542
Total	35				

*: Significant at 0.05 level of probability

PLATES

Plate 1. Netting of the experimental plot

Plate 2. Reproductive stage of experimental plant a. tasseling b. silking

Plate 3. First harvesting of cob from the experimental field

Plate 4. Sign board with experimental title and treatments

Plate 5. Data collection of baby corn