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RESEARCH ARTICLE

EFFECT OF VARIETIES AND DIFFERENT SOURCES OF NITROGEN FERTILIZER ON YIELD AND YIELD CONTRIBUTING CHARACTERS OF BABY CORN

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ABSTRACT

Maize as well as baby corn is an exhaustive crop in terms of nutrient and water uptake from soil hence soil health become deteriorate easily and as different amounts and forms of nutrient supply in baby corn affect the productivity of baby corn so combination of organic and inorganic sources of nutrient is beneficial for soil heath and to maximize the productivity of baby corn thus an experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during November 2017 to February 2018 to investigate the effect of varieties and sources of nitrogen fertilizer on yield and yield contributing characters of baby corn. The experiment was laid out in randomized complete block design (RCBD) with three replications. The experiment consisted of two varieties *viz.,* BARI Sweet corn-1(V_1), Baby star (V_2) and five sources of nitrogen fertilizer *viz.,*100% recommended N from urea(N_1),75% N from urea + 25% N from cowdung (N_2), 50% N from urea + 50% N from cowdung (N_3), 75% N from urea + 25% N from poultry manure(N_4),50% N from urea + 50% N from poultry manure(N_5).Yield and yield contributing characters of baby corn were significantly influenced by variety, sources of nitrogen fertilizer and their interactions. The highest number of cob plant^{-1} (1.67), cob length (13.50 cm), cob girth(3.84 cm), cob yield with husk (14.66 t ha^{-1}), cob yield without husk (3.52 t ha^{-1}), and fresh fodder yield (42.50 t ha^{-1}) were recorded when Baby star was fertilized with N_2 (75% N from urea + 25% N from cowdung) treatment. Therefore, it may be concluded that Baby star is the promising baby corn variety when coupled with (75% N from urea + 25% N from cowdung) for maximizing baby corn production and improving soil health.

KEYWORDS

baby corn, organic fertilizer, nitrogen source, mymensingh.

1. INTRODUCTION

Maize (*Zea mays*) is considered as the most important grain crops in developing countries like Bangladesh and in Bangladesh it is ranked as second grain crops for its capability of higher productivity (Kobir et al., 2019). After wheat and rice it is ranked as third cereal crops in the world for its acceptability and productivity (Kobir et al., 2020). In the last year about 4.7 million metric ton maize was produced from 0.507 million ha of land in Bangladesh. Moreover, the average yield of maize in Bangladesh is 9.27 ton per hectare (AIS, 2020).

Baby corn is a converted new commercial economic product of maize and people little known to it. It is because there is lack of availability of high yielding variety and improved production technology, besides there is a gap in knowledge about use and economic benefits of this promising crop. Fresh young maize cob which is harvested within 2-3 days of silk emergence prior to fertilization is generally known as Baby corn. Maize is an important potential crop of Bangladesh and it is grown almost year-round, in addition to increase of the economic return of maize production, its production as Baby corn can be the best tool provided that the availability of modern agro-production technique (Neupane et al., 2011). In terms of area and production it comprises about 8 and 25 percent in the world, respectively (Subedi et al., 2018). Countries like Sri Lanka, Myanmar, Thailand and Taiwan was proved successful in cultivating Baby corn (Dangwal et al., 2010). But cultivation of this crop in Bangladesh is very negligible. For intensive sustainable commercial farming in Bangladesh production of Baby corn has not yet started for lacks of suitable production techniques. There is lack of information in cultivation technology, moreover adequate management practices like water management; quantity, time and form of fertilizer application had not been discovered yet.

Yield and quality of Baby corn is enormously affected by application of different levels and forms of nutrition (Kunushi et al., 1986). Food insecurity which is the result of insufficient production so far in term of demand of that crop and this may be overcome by production of more food within the same area. To increase productivity of Baby corn nutrient like nitrogen is essential tool. Nitrogen is actively involved in each living cells of plants body and it is act as an important element of chlorophyll and protoplast. A group researcher noticed that there is a remarkable increase in response in case of applying nitrogen in Baby corn (Pandey et al., 2002). In addition, Maize, being an exhaustive crop, much attention is required in its nutrient management (Naveen and Saikia, 2020). Amount of applied organic manure like cowdung, vermi-compost and inorganic fertilizer like Urea, TSP, MoP greatly affect the growth performance and yield of Baby corn (Singh et al., 2010; Mahmood et al., 2017). More over organic sources

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of nutrient can improve the soil physical and chemical properties. Integration of organic (FYM) and chemical fertilizers is a cost-effective tool of maintaining soil quality along with increasing productivity of frequently practiced cropping system (Neupane et al., 2011).

As judicious fertilizer application comprising of organic and inorganic source of nutrient can improve the productivity of Baby corn so during cultivation of Baby corn all issues of cultivation procedure especially judicious and balanced fertilization like combination of organic and chemical fertilizer should have taken into consideration. In order to put forward toward the commercial Baby corn farming improvement in farming techniques with suitable cultivars is needed. Hence this research was undertaken as Baby corn cultivation allows farmers to convert from subsistence farming to commercial farming in Bangladesh.

2. Materials and Methods

2.1 Experimental Site

The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh-2202 in the year of 2017-2018. The experimental site was associated with a medium high land with silt-loam soil texture and the soil was neutral or slightly acidic in reaction. The physico-chemical properties of the soil have been presented in (Table 1).

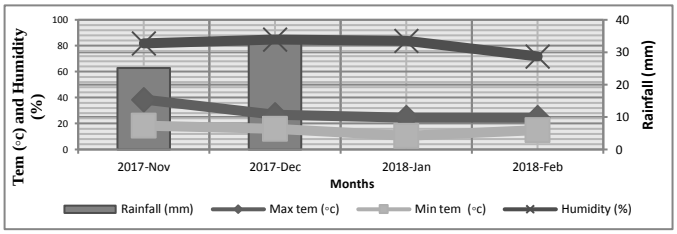
Table 1: Physical and chemical properties of soil

Physical characteristics of the soil	Chemical characteristics of the soil
1. Sand (%) (0.2-0.02 min) : 32	1. pH : 6.50
2. Silt (%) (0.02-0.002 min) : 60	2. Organic matter (%) : 1.19
3. Clay (%) (<0.002 min) : 08	3. Total nitrogen (%) : 0.10
4. Soil textural class : silt loam	4. Available sulphur (ppm) : 14.2
5. Particle density (g/cc) : 2.60	5.Available phosphorus (ppm) : 16.72
6. Bulk density (g/cc) : 1.35	6. Exchangeable potassium (meq %) : 0.12
7. Porosity (%) : 46.67	

Source: Department of Soil Science, Bangladesh Agricultural University, Mymensingh.

2.2 Climate

The experimental area was located under the sub-tropical climate which is specialized by moderately low rainfall with moderately low temperature during *rabi* season (October- March) and high temperature with heavy rainfall during the *kharif* season (April-September). Weather information at the experimental site during the period of study regarding max temperature, min temperature, rainfall and relative humidity has been presented in (Figure 1).



Source: Department of Irrigation and Water Management, Bangladesh Agricultural University, Mymensingh

Figure 1: Weather data during cropping season (Nov-2017 to Feb-2018)

2.3 Planting material

For conducting the experiment two cultivars of baby corn crops were selected namely BARI Sweet corn-1 and Baby star. BARI Sweet corn-1 was collected from Bangladesh agricultural research Institute and Baby star was collected from local seed marketer.

2.4 Experimental Treatment, design and layout

The experiment was conducted considering the following factor treatments:

Factor A: Sources of nitrogen fertilizer	Factor B: Variety
N_1= 100% recommended Nfrom Urea	V_1= BARI Sweet corn-1
N_2=75% recommended N from Urea+ 25%Nfromcowdung (CD)	V_2= Baby star
N_3=50% recommended Nfrom Urea+ 50%NfromCD	
N_4=75% recommended N from Urea+ 25% N from poultry manure (PM)	
N_5=50% recommended nitrogen from Urea+ 50% N from PM	

Here, recommended fertilizer dose (ha^{-1}) = Urea: 300 kg, TSP: 150 kg, MoP: 100 kg (Azad et al., 2019). The experiment was laid out in randomized complete block design (RCBD) with three replications. The treatments comprised two varieties and five sources of nitrogen fertilizers which have mentioned above. Each block was divided into ten-unit plots of size 5 m^2 (2.5 m x 2 m). Thus, the total numbers of unit plots were 30 (2× 5× 3). The distance maintained between two-unit plots was 0.5 m and between blocks was 1.0 m.

2.5 Crop husbandry

The land was prepared thoroughly by tilling once with a power tiller and subsequently ploughing three times with country plough followed by laddering. Well decomposed cowdung and poultry manure were applied to plots as per treatment and incorporated and mixed thoroughly with the soil before sowing and full doses of TSP and MoP were applied as per recommended dose as basal before sowing in the plots. One third of the urea was applied as a basal dose just before sowing and remaining 2/3 of urea was applied in two equal splits each 15 days after sowing (DAS) and 35 DAS. Seeds of selected corn cultivars were used for sowing with recommended seed rate of 20 kg/ha. Time to time different intercultural operations like thinning and gap filling, irrigation, weeding, plant protection measures, detasseling was followed when needed. The green cobs were harvested just after two- or three-days past of silk emergence. Baby star was harvested on 15 February (90 DAS), BARI Sweet corn-1 was harvested on 20 February (94 DAS).

2.6 Collection of experimental data and statistical analysis

Five plants from each plot were selected randomly and number of cobs plant^{-1}, cob length (cm), cob girth (cm), cob yield with husk (t ha^{-1}), cob yield without husk (t ha^{-1}), fresh fodder yield (t ha^{-1}) were collected from these sample plants. Data were then tabulated to make analysis of variance and the mean difference was calculated by Duncan's Multiple Range Test (DMRT) according to Gomez and Gomez (1984) with the help of (M-STATC) a software program.

3. Results

3.1 Number of cobs plant^{-1}

Number of cob plant^{-1} was significantly affected by the variety. The maximum number of cob plant^{-1} was observed in Baby star (1.27) and the minimum number of cob plant^{-1} observed in BARI sweet corn-1 (1.20) (Table 2). Number of cob plant^{-1} of baby corn was significantly influenced by different sources of nitrogen fertilizer. The highest number of cob plant^{-1} (1.502) was found in N_2 (75% N from urea + 25% N from cowdung) followed by (1.335) N_4 (75% N from urea + 25% N from poultry manure) and the lowest number of cob plant^{-1} (1.002) was recorded in N_1(100% recommended N from urea) (Table 3). The maximum number of cob plant^{-1} (1.67) was observed in Baby star with N_2 (75% N from urea + 25% N from cowdung) and the lowest value (1.00) was obtained when BARI sweet corn-1 fertilized with N_1(100% recommended N from urea) (Table 4).

Table 2: Effect of variety on yield and yield contributing characters of baby corn

Variety	Cob plant^{-1}	Cob length (cm)	Cob girth (cm)	Yield with husk (t ha^{-1})
V_1	1.20b	10.63 b	2.88 b	9.95b
V_2	1.27 a	11.87 a	3.05 a	12.05a
Level of sig.	*	**	**	**

In a column, figures with same letter (s) or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT). * =Significant at 5% level of probability, ** =Significant at 1% level of probability, V_1 = BARI sweet corn-1, V_2 = Baby star

Table 3: Effect of nitrogen sources on yield and yield contributing characters of baby corn

Nitrogen sources	Cob plant^{-1}	Cob length (cm)	Cob girth (cm)	Yield with husk (t ha^{-1})
N_1	1.002 c	9.750 d	2.690 c	9.580 c
N_2	1.502 a	12.50 a	3.510 a	12.55a
N_3	1.330 b	11.75b	2.915 b	10.95 b
N_4	1.335 b	11.66 b	2.880 b	11.04 b
N_5	1.002 c	10.58 c	2.810 bc	10.90b
Level of sig.	**	**	**	**

In a column, figures with the same letter (s) or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT).** =Significant at 1% level of probability, N_1= (100% urea – N), N_2= (75% urea – N + 25% CD – N), N3= (50% urea – N + 50% CD – N), N_4= (75% urea – N + 25% PM – N), N_5= (50% urea – N + 50% PM – N).

3.2 Cob length

A significant variation was observed due to variety at the cob length of the baby corn. The maximum cob length was observed in Baby star (11.87 cm) and minimum in BARI sweet corn-1 (10.63 cm) (Table 2). Sources of nitrogen fertilizer had significant influence on cob length of baby corn. The highest number of cob length (12.50 cm) was observed in N_2 (75% N from urea + 25% N from cowdung) and the lowest number of cob length (9.75 cm) was recorded in N_1(100% recommended N from urea) (Table 3). The longest cob (13.50 cm) was obtained in Baby star fertilized with N_2 (75% N from urea + 25% N from cowdung) (Table 4).

3.3 Cob girth

The highest cob girth was found in Baby star (3.05 cm) and the lowest cob girth was found in BARI sweet corn-1 (2.88 cm)(Table 02).The highest cob breadth (3.51 cm) was found in N_2 (75% N from urea + 25% N from cowdung) and the lowest cob girth (2.69 cm) was recorded in N_1(100% recommended N from urea) (Table 3). The maximum cob girth (3.84 cm) was observed in Baby star fertilized with N_2 (75% N from urea + 25% N from cowdung) and the lowest (2.63 cm) was recorded in BARI sweet corn-1fertilized with N_1(100% recommended N from urea) (Table 4).

Table 4: Interaction effects of varieties and nitrogen sources on yield and yield contributing characters of baby corn

Interaction (Variety x N sources)	Cob plant^{-1}	Cob length (cm)	Cob girth (cm)	Yield with husk (t ha^{-1})
V_1xN_1	1.000 c	9.330 f	2.630 d	7.67 f
V_1xN_2	1.334 b	11.50 c	3.180 b	10.44 de
V_1xN_3	1.330 b	11.00 cd	2.900 cd	11.13 bcd
V_1xN_4	1.333 b	11.00 cd	2.860 cd	10.59 de
V_1xN_5	1.000 c	10.33 de	2.800 cd	9.94 e
V_2xN_1	1.003 c	10.17 e	2.750 cd	11.49 bc
V_2xN_2	1.670 a	13.50 a	3.840 a	14.66 a
V_2xN_3	1.330 b	12.50 b	2.930 c	10.77 cd
V_2xN_4	1.337 b	12.33 b	2.900 cd	11.49 bc
V_2xN_5	1.003 c	10.83 cd	2.820 cd	11.87 b
Level of sig.	**	*	**	**

In a column, figures with the same letter (s) or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT). ** =Significant at 1% level of probability, NS = Not significant, V_1 = BARI sweet corn-1,V_2 = Baby star, N_1= (100% urea – N), N_2= (75% urea – N + 25% CD – N), N3= (50% urea – N + 50% CD – N), N_4= (75% urea – N + 25% PM – N), N_5= (50% urea – N + 50% PM – N).

3.4 Cob yield with husk

The highest cob yield with husk (12.05 t ha^{-1}) was found in Baby star. The lowest cob yield with husk (9.95 t ha^{-1}) was observed in BARI sweet corn-1 (Table 2).The highest cob yield with husk (12.55 t ha^{-1}) was observed in N_2 (75% N from urea + 25% N from cowdung) and the lowest cob yield with husk (9.58 t ha^{-1}) was recorded in N_1(100% recommended N from urea) (Table 3). The highest (14.66 t ha^{-1}) was observed in Baby star fertilized with N_2 (75% N from urea + 25% N from cowdung) and the minimum cob yield with husk (7.67 t ha^{-1}) was obtained in BARI sweet corn-1with N_1(100% recommended N from urea) (Table 4).

3.5 Cob yield without husk

The maximum cob yield without husk was observed in Baby star (2.91 t ha^{-1}) and minimum in BARI sweet corn-1 (2.44 t ha^{-1}) (Figure 2). The highest cob yield without husk (3.18 t ha^{-1}) was observed in N_2 (75% N from urea + 25% N from cowdung) and the lowest cob yield without husk (2.34 t ha^{-1}) was recorded in N_1(100% recommended N from urea) (Figure 3). The highest (3.52 t ha^{-1}) was observed in Baby star fertilized with N_2 (75% N from urea + 25% N from cowdung) and the minimum cob weight with husk (1.89 t ha^{-1}) was obtained in BARI sweet corn-1 with N_1(100% recommended N from urea) (Figure 4).

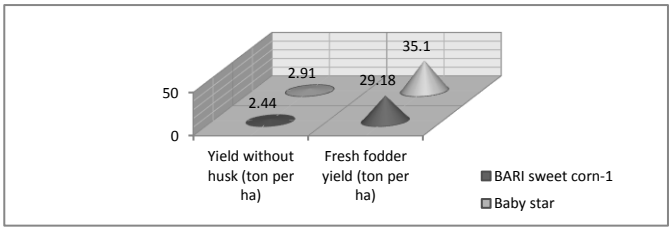


Figure 2: Effect of varieties on yield without husk (t ha^{-1}) and fresh fodder yield (t ha^{-1})

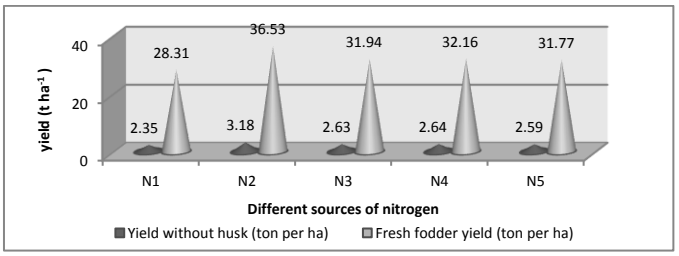


Figure 3: Effect of different sources of nitrogen fertilizers on yield without husk (t ha^{-1}) and fresh fodder yield (t ha^{-1})

N_1= (100% urea – N), N_2= (75% urea – N + 25% CD – N), N3= (50% urea – N + 50% CD – N), N_4= (75% urea – N + 25% PM – N), N_5= (50% urea – N + 50% PM – N).

3.6 Fresh fodder yield

The maximum fodder yield was observed in Baby star (35.10 t ha^{-1}) and minimum in BARI sweet corn-1 (29.18 t ha^{-1}) (Figure 2). The highest fodder yield (36.53 t ha^{-1}) was observed in N_2 (75% N from urea + 25% N from cowdung) and the lowest fodder yield (28.31 t ha^{-1}) was recorded in N_1(100% recommended N from urea) (Figure 3). Due to interaction effect the highest (42.58 t ha^{-1}) was observed in Baby star fertilized with N_2 (75% N from urea + 25% N from cowdung) while the minimum fodder yield (23.15 t ha^{-1}) was obtained in BARI sweet corn-1 with N_1(100% recommended N from urea) (Figure 4).

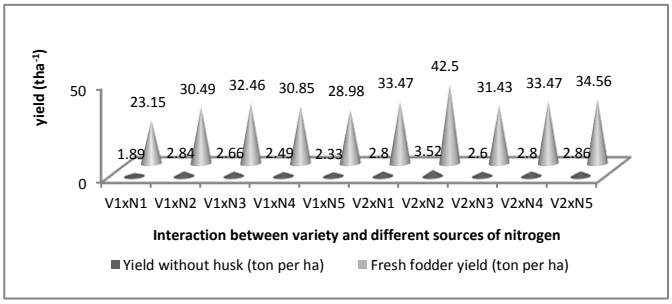


Figure 4: Interaction effect (varieties X different sources of nitrogen) on total dry matter production

(V_1 = BARI sweet corn-1, V_2 = Baby star, N_1= (100% urea – N), N_2= (75% urea – N + 25% CD – N), N3= (50% urea – N + 50% CD – N), N_4= (75% urea – N + 25% PM – N), N_5= (50% urea – N + 50% PM – N).

3.7 Correlation-co-efficient and regression equation

Cobs plant^{-1} (r = 0.67) (Figure 5) showed positive correlation with cob yield without husk (t ha^{-1}).

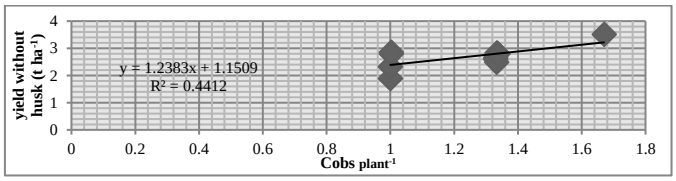


Figure 5: Correlation -co- efficient and regression equation for cobs plant^{-1} Vs yield without husk (t ha^{-1})

Cob yield with husk (t ha^{-1}) (r = 0.97), cob length (r = 0.78), fresh fodder yield (r = 0.97) showed very strong positive correlation with cob yield without husk (t ha^{-1}) (Table 5)

Table 5: Correlation -co- efficient and regression equation for yield contributing characters with yield of baby corn

	Correlation-co-coefficient		
Parameters (t ha^{-1})	R^2 value	R value	Regression equation
Yield with husk Vs yield without husk	0.931	0.97	y = 0.263x - 0.281
Fresh fodder yield Vs yield without husk	0.931	0.97	y = 0.083x + 0.003
Cob length Vs yield without husk	0.606	0.78	y = 0.263x - 0.281

Cob girth (r = 0.678) (Figure 6) showed positive correlation with cob yield without husk (t ha^{-1}).

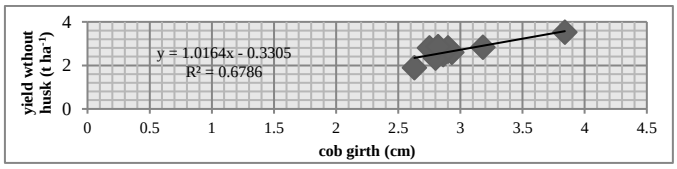


Figure 6: Correlation -co- efficient and regression equation for cob girth Vs yield without husk (t ha^{-1})

4. Discussions

The number of cob plant^{-1} in Baby star variety was about 6% greater than the BARI sweet corn-1. Cob length of Baby star was around 12% higher than BARI sweet corn-1. Cob breadth of Baby star was 6% greater than BARI sweet corn-1. Cob yield without husk of Baby star was around 19% greater than BARI sweet corn-1. Fodder yield of Baby star was around 20% greater than BARI sweet corn-1. From the above-mentioned points, it is clear that there exist strong differences between two varieties like BARI Sweet corn-1 and Baby star for all the yield contributing characters. A studied five genotypes of baby corn and found one variety performed better physical characteristics like ear girth, ear length, ear weight than other four varieties (Sharma et al., 2009). This finding was declared that different varieties perform differently due to genetic variation among the cultivars. Present research findings also corroborate with that previous study. Similar result was also found by (Surender and Jitendra, 2010; Sahoo, 2011; Kumar et al., 2015). The number of cob plant^{-1} in N_2 (75% N from urea + 25% N from cowdung) was about 50% greater than N_1 (100% recommended N from urea). Cob length of in N_2 (75% N from urea + 25% N from cowdung) was around 28% higher than N_1 (100% recommended N from urea).

Fodder yield of N_2 (75% N from urea + 25% N from cowdung) was around 28% greater than N_1 (100% recommended N from urea). Cob yield with husk in N_2 (75% N from urea + 25% N from cowdung) was 31% higher than N_1(100% recommended N from urea). Cob yield without husk of N_2 (75% N from urea + 25% N from cowdung) was around 35% greater than N_1(100% recommended N from urea). When variety Baby star was fertilized with N_2 (75% N from urea + 25% N from cowdung) treatment then all the parameters showed better result in contrast with the recommended mineral fertilization treatment. Maybe it is attained as combined application of organic and inorganic fertilization can increase the micro-organism and enzyme activity and can make available the nutrient in the soil (He and Li, 2004; Saha et al., 2008; Sharma and Banik, 2014). A group researcher revealed that integrated fertilizer application in Baby corn can maximize number of cob, corn yield, fresh fodder yield, corn length, corn girth and green cob weight (Singh et al., 2016). In other study, they found that (¾ NPK + ½ organic fertilizer) resulted in the highest N, P and K uptake and the heaviest weight of sweet corn (Sofyan and Sara, 2018). Our present study also showed more or less similar results. Our result is also at par with (Lone et al., 2013). A study showed that application of recommended N through inorganic sources maximize the yield contributing characters which is statistically similar when N fertilizer application combined with 75% from chemical sources and 25% from FYM or poultry manure or from sheep manure and our present experiment revealed that yield contributing characters of Baby corn showed better result with the application of N fertilizer as 75% from inorganic sources and 25% from cowdung (Kumar et al., 2009).

5. Conclusion

According to the results obtained from the experiment, Baby star performed well considering all the yield and yield contributing characters. Among the different nitrogen fertilizer sources, 75% N from urea + 25% N from cowdung gave better performance. Baby star fertilized with 75% N from urea + 25% N from cowdung gave better performance inrespect of yield and yield contributing characters. Finally, it can be concluded thatBaby star coupled with 75% N from urea + 25% N from cowdung appeared as the promising practice in baby corn cultivation in terms of better yield.

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