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Impacts of planting spacing and nitrogen level on growth, yield and quality of baby corn and green fodder from the same crop

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ABSTRACT

An experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh to investigate the effect of planting spacing and nitrogen levels on yield and quality of baby corn and green fodder. The experiment comprised three plant spacing *viz.* 45 cm × 30 cm, 45 cm × 20 cm, 45 cm × 10 cm and five nitrogen levels *viz.* 0, 80, 120, 160 and 200 kg N ha^{-1}. The experiment was laid out in a randomized complete block (RCB) design with three replications. The highest number of leaves plant^{-1}, total dry matter plant^{-1} at 30 DAS, chlorophyll content at 65 DAS were observed by at 45 cm × 20 cm spacing fertilized with 200 kg N ha^{-1}. The highest number of cobs plant^{-1} and cob length without husk were recorded in 45 cm × 30 cm which was at par with 45 cm × 20 cm. The highest cob length with husk, cob diameter with husk, cob diameter without husk, cob yield with husk, cob yield without husk, fodder yield and protein content of cob were found at 45 cm × 20 cm spacing while the lowest values were recorded at 45 cm × 10 cm spacing. The highest number of cobs plant^{-1}, cob length with husk, cob length without husk, cob diameter with husk, cob yield with husk, cob yield without husk, fodder yield and protein content of cob were observed by at 45 cm × 20 cm spacing fertilized with 200 kg N ha^{-1}. Therefore, it may be concluded that planting of baby corn at 45 cm × 20 cm spacing along with application of 200 kg N ha^{-1} could be considered for obtaining higher cob yield, cob protein content (%) and green fodder from the same plant.

Introduction

Maize is one of the most important cereal crops in the world and is used as food, feed, and fodder and in industrial applications. Baby corn is the ear of maize *(Zea mays* L.) plant harvested young, especially when the silks have either not emerged or just emerged and no fertilization has taken place, depending on the cultivar grown. It is referred to as the "Queen of Cereals", which has a wide adaptability and is grown almost throughout the world. In the real sense, the tender dehusked young ear of the female inflorescence of maize plant harvested 3-4 days after silking and before fertilization is sweet and crispy in taste called baby corn. It is a profitable crop that allows a diversification of production, aggregation of value and increased income (Dutta *et al.*, 2015). This venture proved enormously successful in countries like Thailand, Taiwan, Srilanka and Myanmar. The countries like Guatemala, Zambia, Zimbabwe and South Africa have also started its cultivation. Now, Thailand and China are the world leaders in baby corn production. It is widely accepted and habituated as a cereal vegetable in USA, Europe and in some Asian countries. In Bangladesh, maize is mainly grown as fodder and feed crop in many areas, but it is not commercially grown as baby corn yet. The crop has multipurpose uses. It is used as vegetables, fodder feed, fuel etc. It is mainly used as vegetable in different chinese hotel and restaurants in our country. It is consumed through preparation of several recipies *viz.* soup, salad, pakora, pickles, candy, murabba, jam, laddoo, burfy etc. (Das *et al.*, 2008). Baby corn has a great potential both for internal consumption as well as for export. It is being used by the Chinese as vegetables and this practice has spread to other Asian countries. It is becoming popular very rapidly as vegetables, salad, pasta, soup, pakora, chutney, cutlets chat, dry vegetables, koftacurry, masala, manchurian, chilly, raita, pickle, candy, jam, murabba, burfi, halwa, kheer, laddo and other favorite dishes for different chinese hotels and restaurants in Bangladesh. Baby corn shows great adaptability to wide range of agro-climatic regions (Roy *et al*., 2015) and can be grown in Bangladesh year round (Salahuddin and Ivy, 2003). It is suited for peril-urban Agriculture. It has short growth duration of about 70-80 days, thus the farmer can grow baby corn three or four times a year. Generally, farmers have to wait for a longer time if they grow maize as a grain crop.

Cite this article

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On the other hand, it is a short duration crop; farmers can earn money in the shortest possible time by cultivating baby corn. Crop yield depends on many factors such as light, water and nutrients etc. The availability of these inputs for the plants may be influenced by planting space. To achieve higher productivity and resource-use efficiencies optimum plant stand is the key factor. Thus the optimum nitrogen rate and appropriate plant spacing has to be ensured with a view to maximizing baby corn yield. With the above view, the study was carried out to find out the effect of spacing, nitrogen level and their interaction on yield and quality of baby corn and green fodder.

Materials and Methods

The present piece of research was carried out at the Agronomy Field Laboratory, Department of Agronomy, Bangladesh Agricultural University, during the period from October 2016 to January 2017 to study the effect of planting spacing and nitrogen on yield and quality of baby corn. The experimental site belongs to the Old Brahmaputra Floodplain Agro-ecological Zone (AEZ-9) having non-calcareous dark gray floodplain soils with silty-loam texture (UNDP and FAO, 1988). The plot was designed with RCB having three plant spacings *viz*. 45 cm × 30 cm, 45 cm × 20 cm, 45 cm × 10 cm and five nitrogen levels *viz*. 0, 80, 120, 160 and 200 kg N ha^{-1}. Thus the number of total plots was 45. The size of each unit plot was 2.7 m × 3.0 m. The distance between plot to plot and block to block was 0.50 m, 0.75 m, respectively. The land was first opened with power tiller on 10 October 2016 and laid out in the field on 28 October 2016. Seeds were sown on 2 November 2016 as per experimental spacing by opening 3-4 cm deep furrows and seedlings emerged out within 6-8 days after sowing (DAS). Gap filling was done at 25 DAS maintaining desired number of plant(s) $hill^{-1}$. Nitrogen was applied as the form of urea. One third urea was applied as basal during final land preparation and the rest part was top dressed in two equal splits at 25 and 45 DAS, respectively. Weeding was done two times, first at 25 DAS, second at 40 DAS. Irrigation was done twice after topdressing of urea at 25 and 45 DAS. Row-wise detasseling was carried soon after tassel emergence in order to maintain quality of baby corn. The green cobs were removed on alternate days within 2-3 days of silk emergence from each plot by leaving border and penultimate rows. Baby corn was harvested on 25 January 2017 (82 DAS). Data on the following plant characters, yield and yield components were collected from the sample plants of each plot. At harvest, the heights of five randomly selected plants were measured from the base of the plant to the tip of the flag leaf. Plant height was recorded in cm and mean value of five plants for each plot was calculated. Number of fresh leaves $plant^{-1}$ were recorded from five sample plants from each plot and counted. One plant was randomly selected in the sampling row from each plot. These samples were washed and dried in an electric oven for 72 hours maintaining a constant temperature of 70^0 C. After drying, weight of each sample was recorded. Total dry matter accumulation $plant^{-1}$ was measured at 30, 50 and 65 DAS. Determination of Soil-Plant-Analysis Development (SPAD) value has been used as an indirect indicator of crop N status. Chlorophyll meter values (SPAD) were taken using a portable SPAD meter (Model SPAD-502, Minolta crop, Ramsey, NJ) starting from 30 DAS with 20-day interval from the marked plants and taken thrice as 30, 50, and 65 DAS. The number of young cobs harvested from the five randomly selected plants in each plot was recorded separately and then average number of baby corn cobs $plant^{-1}$was worked out. The length of five randomly selected young cobs of each plot was measured with and without husk from top to bottom of the cob with meter scale and the mean length cob^{-1} with and without husk was determined in centimeters (cm). The cumulative weight of young cobs with husk and without husk harvested from each plot in all pickings was recorded in kilograms and then converted on hectare basis in t ha^{-1}. The baby corn plants were then cut immediately from ground level with the help of sickles and then weighed to determine the green fodder yield in t ha^{-1}. Protein percent of leaf and cob are measured by chemical analysis. Total N content was determined from the various varieties of maize (hybrid and composite) of each treatment by modified Micro-Kjeldahl method. The method consists of three steps; digestion, distillation, titration. The collected data were compiled and tabulated in proper form and were subjected to statistical analysis. Data were analyzed using the analysis of variance (ANOVA) technique with the help of computer package program MSTAT-C and mean differences were adjudged by Duncan's Multiple Range Test (Gomez and Gomez, 1984).

Results and Discussion

Growth parameters

Interaction between spacing and levels of nitrogen exerted significant effect on the growth parameters like plant height, number of leaves $plant^{-1}$, dry matter production and chlorophyll content (SPAD value) of baby corn (Table 1). The tallest plant at 30 DAS (57.21 cm) and at 50 DAS (112.2 cm) were found at $S_3 \times N_0$ (45 cm × 10 cm spacing with 0 kg N ha^{-1}) and $S_3 \times N_1$(45 cm × 10 cm spacing with 80 kg N ha^{-1}), respectively, whereas, the interaction effect was non-significant at 65 DAS. The lowest plant height at 30DAS (48.33 cm) and 50 DAS (96.31 cm) was found in the treatment $S_1 \times N_2$ (45 cm × 30 cm spacing with 120 kg N ha^{-1}) (Table 1). The highest number of leaves $plant^{-1}$ at different DAS were found at different interaction treatments. However, the highest number of leaves $plant^{-1}$ (9.43) at 30 DAS was found in $S_2 \times N_4$ (45 cm × 20 cm spacing with 200 kg N ha^{-1}) which later on appeared as one of the highest at 50 DAS (11.30) and 65 DAS (13.20) for the same. On the other hand, the lowest number of leaves $plant^{-1}$ at 30 DAS (8.5) was found at $S_1 \times N_2$ (45 cm × 30 cm spacing with 120 kg N ha^{-1})

which was at par with $S_3 \times N_4$ (45 cm × 10 cm spacing with 200 kg N ha^{-1}). The interaction treatment $S_1 \times N_1$ (45 cm × 30 cm spacing with 80 kg N ha^{-1}) and $S_3 \times N_0$ (45 cm × 10 cm spacing with 0 kg N ha^{-1}) gave the lowest number of leaves plant^{-1} at 50 DAS (9.93) and at 50 DAS (11.10), respectively (Table 1). Dry matter production increased sharply over time in all the interaction treatments. The highest total dry matter at 30 DAS (3.63g) was found in $S_2 \times N_4$ (45 cm × 20 cm spacing with 200 kg N ha^{-1}) but the treatment $S_1 \times N_4$ (45 cm × 30 cm spacing with 200 kg N ha^{-1}) gave the highest values at 50 DAS (55.32g) and 65 DAS (107.2 g) for the same. Differential chlorophyll content (SPAD value) for the same interaction treatment was found at different DASs. At 30 DAS, the highest chlorophyll content (SPAD value) (47.43) was found in $S_1 \times N_1$ (45 cm × 30 cm spacing with 80 kg N ha^{-1}) which was statistically identical with that of $S_1 \times N_4$ (45 cm × 30 cm spacing with 200 kg N ha^{-1}). The highest chlorophyll content (SPAD value) at 50 DAT (58.43) and 65 DAT (67.47) was found in $S_1 \times N_4$ (45 cm × 30 cm spacing with 200 kg N ha^{-1}) and $S_2 \times N_4$ (45 cm × 20 cm spacing with 200 kg N ha^{-1}), respectively. The lowest chlorophyll content (SPAD value) at 30 DAT (38.67), 50 DAT (31.97) and 65 DAT (26.03) were found at $S_3 \times N_4$ (45 cm × 10 cm spacing with 200 kg N ha^{-1}), $S_2 \times N_0$ (45 cm × 20 cm spacing with 0 kg N ha^{-1}) and $S_3 \times N_0$ (45 cm × 10 cm spacing with 0 kg N ha^{-1}), respectively (Table 1). Rathika *et al.* (2009) also found significant increase in growth parameters of baby corn viz., plant height and dry matter percentage with increase in the level of nitrogen application. Similarly, Singh *et al.* (2010) reported considerable improvement in growth factors of baby corn with the increased level of N, P and K. On the other hand, Kunjir *et al.* (2007) also observed that the spacing of 45 cm × 20 cm produced significantly higher plant height of maize (sweet corn), which coincides with the results of this study. Zarapkar (2006) reported that the plant height of baby corn was significantly higher under the closer spacing than wider spacing. Similarly, Gozubenli *et al.* (2003) experimented out that higher plant densities produced taller plants and greater ear length with lower stem diameter. Verma *et al.* (2012) also reported that variable plant height was found due to differences in crop geometry in maize.

Yield components, yield and quality

The effect of plant spacing on number of cobs plant^{-1}, cob length (cm), cob diameter (cm) with and without husk, cob yield (t ha^{-1}) with husk and without husk, fodder yield (t ha^{-1}) and protein content (%) was significant (Table 2). The highest values for number of cobs plant^{-1} (1.87), cob length with husk (24.11 cm) and without husk (9.34 cm), cob diameter with husk (2.71 cm) and without husk (1.35 cm), cob yield with husk (19.45 t ha^{-1}) and without husk (2.41 t ha^{-1}), fodder yield (59.99 t ha^{-1}) and protein content of cob (22.27 %) were observed in 45 cm × 20 cm spacing (Table 2). The lowest values for number of cobs plant^{-1} (1.82), cob length with husk (21.88 cm) and without husk (8.32 cm), cob diameter with husk (2.42 cm), cob diameter with husk (2.42 cm) and without husk (1.21 cm), and protein content of cob (20.25 %) were found in 45 cm × 10 cm spacing. The lowest cob yield with husk (16.61 t ha^{-1}) and without husk (1.69 t ha^{-1}) and the lowest fodder yield (39.46 t ha^{-1}) were found in 45 cm × 30 cm spacing (Table 2). Sangoi *et al.* (2001) also found that the closer spacing produces less number of cobs plant^{-1} than the larger spacing. Mathukia *et al.* (2014) concluded that the larger spacing produces more cob yield than the closer spacing. Nand (2015) evaluated the effect of spacing and fertility levels on protein content and yield of hybrid and composite maize (*Zea mays*) and found the higher protein level in wider spacing.

Table 1. Effect of interaction between spacing and levels of nitrogen on plant height, number of leaves plant^{-1}, dry matter production and chlorophyll content (SPAD value) of baby corn

Interaction (spacing × levels of N)	Plant height (cm)			Number of leaves plant^{-1}			Dry matter production plant^{-1} (g)			Chlorophyll content (SPAD value)		
	Days after sowing (DAS)			Days after sowing (DAS)			Days after sowing (DAS)			Days after sowing (DAS)		
	30	50	65	30	50	65	30	50	65	30	50	65
$S_1 \times N_0$	53.42cd	98.42f	127.55	9.16a-c	10.63cde	11.89ef	3.40bc	43.73d	84.05 e	39.87c	37.43g	37.37e
$S_1 \times N_1$	54.44a-d	104.4 b-e	147.76	8.53d	9.93f	12.21cde	3.55ab	21.26i	38.95 j	47.43a	45.73de	51.20c
$S_1 \times N_2$	48.33e	96.31f	146.97	8.50d	10.73bcde	12.97abcd	2.25g	49.59b	96.92 b	38.70c	49.20c	48.20cd
$S_1 \times N_3$	55.55 a-d	104.8b-e	149.56	8.83cd	10.76bcde	13.07abc	2.85de	44.37 d	85.88 de	39.53c	55.00b	63.30 b
$S_1 \times N_4$	56.78ab	106.5a-c	159.67	8.86 b-d	11.32abc	13.40ab	3.42abc	55.32a	107.2a	46.40a	58.43 a	61.30 b
$S_2 \times N_0$	55.67a-d	99.43ef	126.11	9.23a-c	10.53 def	12.09de	2.94d	36.24 e	69.52f	41.03bc	31.97h	31.47f
$S_2 \times N_1$	55.44a-d	105.4b-e	149.99	9.30 a-c	11.40 ab	13.63a	2.25g	46.30 c	90.34cd	42.82 b	41.10f	45.73d
$S_2 \times N_2$	52.67d	102.1c-f	154.11	8.86 b-d	11.42ab	12.89abcd	2.54f	24.23 h	45.95i	38.77c	47.63cd	48.43cd
$S_2 \times N_3$	53.89b-d	106.3b-d	157.09	8.96a-d	10.42def	13.21ab	2.72f	28.75 f	54.78g	40.80bc	52.63b	50.70c
$S_2 \times N_4$	54.33a-d	105.5b-d	154.45	9.43a	11.30 abc	13.20ab	3.63a	26.24 g	48.85hi	41.17bc	48.20cd	67.47a
$S_3 \times N_0$	57.21a	100.2d-f	126.76	8.96a-d	10.11ef	11.10f	3.60ab	20.87i	38.14 j	38.70c	35.30g	26.03g
$S_3 \times N_1$	56.78ab	112.2a	161.30	9.40ab	10.76 bcde	13.00abcd	3.28 c	24.30 h	45.31i	39.33c	38.00g	40.07e
$S_3 \times N_2$	56.11a-c	110.3ab	160.33	8.83cd	10.86 abcd	12.97abcd	3.52ab	27.59fg	51.65gh	41.07bc	46.83cde	46.30d
$S_3 \times N_3$	52.89d	102.2c-f	163.32	9.00abcd	11.53a	13.43ab	2.89de	19.96i	37.01j	40.17bc	55.10b	63.33b
$S_3 \times N_4$	53.00d	107.5a-c	163.88	8.50d	10.43def	12.53bcde	2.69ef	48.54 b	94.37bc	38.67 c	44.37e	51.03c
Level of sig.	**	**	NS	**	**	*	**	**	**	**	**	**
CV (%)	2.91	3.04	3.54	3.19	3.41	3.92	3.68	3.26	4.66	3.71	3.75	3.38

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 5% level of probability, ** =Significant at 1% level of probability, NS= Not significant;

S_1 = 45 cm × 30 cm, S_2 = 45 cm × 20 cm, S_3 = 45 cm × 10 cm,

N_0 = 0 kg N ha^{-1}, N_1 = 80 kg N ha^{-1}, N_2 = 120 kg N ha^{-1}, N_3 = 160 kg N ha^{-1}, N_4 = 200 kg N ha^{-1}

The result showed that number of cobs plant^{-1}, cob length (cm), cob diameter (cm), cob yield (t ha^{-1}), fodder yield (t ha^{-1}) and protein content (%) were significantly influenced by nitrogen (Table 2). The highest values for number of cobs plant^{-1} (2.05), cob length with husk (25.46 cm) and without husk (9.90 cm), cob yield with husk (19.81 t ha^{-1}), cob yield without husk (2.56 t ha^{-1}), fodder yield (57.68 t ha^{-1}) and protein content of cob (21.69 %) were observed by the application of 200 kg N ha^{-1} (Table 2). The lowest values for number of cobs plant^{-1} (1.39), cob length with husk (20.19 cm), cob length without husk (7.52cm), cob diameter with husk (2.46 cm), cob diameter without husk (1.15 cm), cob yield with husk (16.55 t ha^{-1}), cob yield without husk (1.63 t ha^{-1}), fodder yield (38.40 t ha^{-1}) and protein content of cob (20.41%) were found at the application of 0 kg N ha^{-1} (Table 2). Sakarami and Rafiee (2009) found that number of cobs plant^{-1} increased with increasing nitrogen levels. Almaz *et al.* (2017) and Lone *et al.* (2013) reported that cob length was significantly influenced by fertilizer levels. Bhushan and Khare (2018) observed that cob breadth differed significantly among different fertilizer levels. Hussain (2014) reported that higher dose of fertilizer application resulted the increased fodder yield. Neupane *et al.* (2011) found significantly higher protein, carbohydrate and sugar content in baby corn with the application of 75% N through urea + 25% N through FYM.

Table 2. Effect of spacing of planting and levels of nitrogen on the yield components, yield and quality of baby corn and green fodder

Treatments	No. of cob plant^{-1}	Cob length (cm)		Cob diameter (cm)		Cob yield (t ha^{-1})		Fodder yield (t ha^{-1})	Protein (%)	
		With husk	Without husk	With husk	Without husk	With husk	Without husk		Leaf	Cob
Spacing of Planting										
45 cm× 30 cm	1.92a	23.98a	9.39a	2.69a	1.30b	16.61c	1.69c	39.46c	9.24 b	21.87a
45 cm× 20 cm	1.87ab	24.11a	9.34a	2.71a	1.35a	19.45a	2.41a	59.99a	7.30 c	22.27a
45 cm× 10 cm	1.82b	21.88b	8.32 b	2.42b	1.21c	18.75b	2.22b	47.90b	10.19a	20.25b
Levels of nitrogen (kg N ha^{-1})										
0	1.39c	20.19c	7.53d	2.46 b	1.15c	16.55 e	1.63e	38.40 e	6.033d	20.41 c
80	1.89b	23.42 b	8.93 c	2.47 b	1.23 b	17.46d	1.85d	45.11d	10.53 a	21.31bc
120	1.99a	24.04 b	9.54b	2.79a	1.39a	18.18c	2.11 c	50.17c	10.27ab	21.43b
160	2.02a	23.51b	9.21c	2.79a	1.39a	19.35b	2.37b	54.23b	7.724 c	22.49a
200	2.05a	25.46a	9.90 a	2.53b	1.26b	19.81a	2.56a	57.68a	10.01b	21.69ab
Level of significance	**	**	**	**	**	**	**	**	**	**
CV (%)	4.11	4.62	3.56	6.44	3.39	1.49	3.42	3.70	3.12	4.48

Figures in a column under each factor of treatment having 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

Table 3. Effect of interaction between spacing of planting and nitrogen on the yield components, yield and quality of baby corn and green fodder

Interaction (spacing of planting × nitrogen levels)	No. of cob plant^{-1}	Cob length (cm)		Cob diameter (cm)		Cob yield (t ha^{-1})		Fodder yield (t ha^{-1})	Protein (%)	
		With husk	Without husk	With husk	Without husk	With husk	Without husk		Leaf	Cob
$S_1 \times N_0$	1.60e	21.37ef	8.37 g	2.70abcd	1.13d	15.10 h	1.33 i	33.67 j	6.930 f	20.79cde
$S_1 \times N_1$	1.94bcd	23.74bcd	8.91efg	2.32f	1.16d	15.75 g	1.48 h	35.89ij	13.86 a	23.49ab
$S_1 \times N_2$	2.00bc	24.94b	9.90bc	2.66 bcde	1.33bc	16.36 f	1.75 g	39.80gh	8.470 e	21.18cd
$S_1 \times N_3$	2.00bc	25.25b	10.10bc	3.00a	1.50a	17.85 e	1.87 f	42.60fg	5.010 i	25.03a
$S_1 \times N_4$	2.03 bc	24.61bc	9.70 cd	2.79abc	1.39b	18.00 e	2.00 e	45.36 f	11.94c	18.87fg
$S_2 \times N_0$	1.33f	20.33fg	7.30h	2.36ef	1.18 d	17.89e	1.89ef	43.58 f	6.160gh	21.95bc
$S_2 \times N_1$	1.85d	24.42bc	9.30de	2.69abcd	1.34bc	18.76d	2.15d	56.75 c	5.780 h	18.10g
$S_2 \times N_2$	2.00bc	25.64ab	10.40 ab	2.96ab	1.48a	19.22d	2.33 c	61.75 b	9.240 d	23.10b
$S_2 \times N_3$	2.00bc	22.85cde	8.81 efg	2.76abc	1.38bc	20.36 b	2.69 b	67.89 a	6.480fg	23.19b
$S_2 \times N_4$	2.17a	27.31a	10.90 a	2.78abc	1.39b	21.00 a	3.00 a	70.00 a	8.860 de	25.03a
$S_3 \times N_0$	1.23f	18.87g	6.90 h	2.32f	1.16d	16.67f	1.67 g	37.95 hi	5.010 i	18.48fg
$S_3 \times N_1$	1.89cd	22.09def	8.60 fg	2.42def	1.20d	17.86 e	1.91ef	42.69fg	11.94 c	22.33bc
$S_3 \times N_2$	1.96bcd	21.54ef	8.31g	2.75 abc	1.37bc	18.96 d	2.25 cd	48.96 e	13.09 b	20.02def
$S_3 \times N_3$	2.07ab	22.43de	8.72efg	2.61cdef	1.30 c	19.84 c	2.57 b	52.19 d	11.68 c	19.25efg
$S_3 \times N_4$	1.96bcd	24.46bc	9.10ef	2.02g	1.00 e	20.44 b	2.67 b	57.69 c	9.240 d	21.18cd
Level of sig.	**	**	**	**	**	*	**	**	**	**
CV (%)	4.11	4.62	3.56	6.44	3.39	1.49	3.42	3.70	3.12	4.48

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 5% level of probability, ** =Significant at 1% level of probability
S_1 = 45 cm × 30 cm, S_2 = 45 cm × 20 cm, S_3 = 45 cm × 10 cm
N_0 = 0 kg N ha^{-1}, N_1 = 80 kg N ha^{-1}, N_2 = 120 kg N ha^{-1}, N_3 = 160 kg N ha^{-1}, N_4 = 200 kg N ha^{-1}

The yield and yield contributing characters were significantly influenced by the interaction between spacing and levels of nitrogen (Table 3). The highest number of cobs plant^{-1} (2.17), cob length with husk (27.31 cm), cob length without husk (10.90 cm), cob yield with husk (21.00 t ha^{-1}), cob yield without husk (3.00 t ha^{-1}), fodder yield (70.00 t ha^{-1}) and protein content of cob (25.03 %) were observed in $S_2 \times N_4$ (45 cm × 20 cm spacing with 200 kg N ha^{-1}) (Table 3). The better performance of the yield components cumulatively resulted in the highest yield and fodder yield performance of baby corn. The result coincides with the findings of Kunjir *et al*. (2007), who conducted a field experiment on sweet corn and observed that close spacing of 45 cm × 20 cm resulted in significantly higher cob yield, stover yield and total biomass yield than the remaining wider spacing (60 cm × 20 cm and 75 cm × 20 cm). Singh *et al*. (2013) reported that maize fertilized with 160 kg N/ha registered significantly higher yield attributes viz. cob length, cob girth, grain rows cob^{-1}, grains row^{-1}, grains cob^{-1}, 1000-grain weight, ten cobs weight, grain weight/ten cobs, shelling percentage, grain yield (6240 kg ha^{-1}) and stover yield over 40 kg kg ha^{-1}, but it was at par with 120 N kg/ha. Similarly increase in yield attributes with nitrogen application has been reported by Kumar *et al*. (2014). Variable baby corn yield, total green fodder yield as well as dry fodder yield was found at different planting geometry reported by Dar *et al.* (2014). Kunjir *et al*. (2007) conducted a field experiment on sweet corn and observed that close spacing of 45 cm × 20 cm resulted in significantly higher cob yield, stover yield and total biomass yield than the remaining wider spacing.

Conclusion

The highest cob length with husk, cob diameter with husk, cob diameter without husk, cob yield with husk, cob yield without husk, fodder yield and protein content of cob were found at 45 cm × 20 cm spacing while the lowest values were recorded at 45 cm × 10 cm spacing. The highest number of leaves plant^{-1}, total dry matter (TDM) at 30 DAS, chlorophyll content at 65 DAS, number of cobs plant^{-1}, cob length with husk, cob length without husk, cob diameter with husk, cob yield with husk, cob yield without husk, fodder yield and protein content of cob were observed by at 45 cm × 20 cm spacing fertilized with 200 kg N ha^{-1}. It may be concluded that baby corn can be cultivated at 45 cm × 20 cm spacing fertilized with 200 kg N ha^{-1} to obtain higher cob yield, quality of cob and green fodder from the same plant.

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