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Quality and Yield Performance of Baby Corn (*Zea mays* L.) as Influenced by Nitrogen Sources and Row Spacing

M. P. NEUPANE[1], R. K. SINGH[1], RAKESH KUMAR[2] AND ANUPMA KUMARI[3*]

[1]*Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University Varanasi 221005, India*
[2]*Division of Agronomy, ICAR-RC for NEH Region, Jharnapani, Nagaland, India*
[3]*KVK, Hajipur, Bihar, India*
**Correspondence*

Abstract

Field experiment was carried out on sandy loam soil during pre- *kharif* seasons of 2008 and 2009 to evaluate the quality and yield performance of baby corn (*Zea mays* L.) as influenced by N sources and spacing. The experiment was laid out in randomized block design (4 × 2 factorial) replicated thrice with four nitrogen sources viz. N_1(100% N through urea), N_2 (75% N through urea + 25% N through FYM), N_3 (50% N through urea + 50% N through FYM) and N_4 (25% N through urea + 75% N through FYM) and 2 row spacing *viz.* S_1 (40 cm × 15 cm) and S_2 (30 cm × 15 cm). Significantly higher chlorophyll contents in leaves, protein, carbohydrate and sugar content in baby corn cobs were recorded in nitrogen source N_2 (75% N through urea + 25% N through FYM) followed by N_1 (100% N through urea) and the minimum was with N_4 (25% N through urea + 75% N through FYM) accompanied with spacing of 40 cm × 15 cm (S_1). However, results revealed that 75% N through urea + 25% N through FYM (N_2) and spacing of 40 cm × 15 cm (S_1) were found to be best source of nitrogen and spacing, respectively and their combination N_2S_1 (75% N through urea + 25% N through FYM + 40 cm × 15 cm spacing) emerged superior over all other treatment combinations is relation to yield attributes finally yield of baby corn for commercial cultivation of baby corn under agro-climatic conditions of Varanasi.

Key words : Baby corn, Nitrogen, Spacing, Carbohydrate content, Sugar content.

Maize (*Zea mays* L.) is the third most important cereal crop next to rice and wheat and has the highest production potential among the cereals. For diversification and value addition of maize and the growth of the food processing industry, many new vegetables have been evolved. One among them is baby corn. It is a small young corn ear harvested at the stage of silk emergence. Baby corn production, being a recent development has proved as an enormously successful venture in countries like India. Attention is now being paid explore its potential in India, for earning foreign exchange besides higher economic returns to the farmers. Thus, it is essential to standardize the agro techniques for baby corn growing in order to popularize its cultivation among farming community. Baby corn (*Zea mays* L.) is immature dehusked, unfertilized maize ear, harvested 1 to 2 days after silking at 2—3 cm long silk stage are consumed as vegetable due to its sweet flavor. High nutritional value, eco-friendly and crispy nature of baby corn has made it special choice for various traditional and continental dishes apart from the canning in the elite society. After the harvest of babies, economics potential is further enhanced since it supplies green, soft, succulent, nutritious, palatable fodder with higher digestibility. Recently cultivation has started and gaining popularity in peri-urban areas due to its export potential besides huge employment generation. Being a short duration crop (50—60 days) it can be sown and harvested 3 to 4 times in an year. In rice- wheat system, cultivation of summer mungbean *(Vigna radiata)* is a recommended practice which has been reported not remunerative when planted beyond 10 April. Besides being the privilege of bonus mungbean is grown on limited area, otherwise such lands remain unused between the turnover periods of wheat and paddy. Natural resources and irrigation system also found unutilized but paid for their services charges. The pre-season period (15 April—15 July) if put under the cultivation of short duration vegetables like baby corn it will not cause any problem to the rice-wheat. Baby corn is nutrient exhaustive crop and due to high plant

density and extremely short duration, requires heavy application of nitrogen along with phosphorus and potassium. The integrated nutrient supply including organic (FYM) and inorganic fertilizers improved the productivity of major cropping systems along with maintaining better soil quality on cost effective basis. Crop geometry is one of the important factors which have to be maintained at optimum level to harvest maximum solar radiation and utilize the soil resources effectively. Hence, to cope-up with the situation, present investigation was taken to evaluate the yield performance of baby corn as influenced by N sources and spacing.

Methods

Field experiment was conducted the pre-*kharif* seasons of 2008 and 2009 after the harvest of wheat at Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. The farm is situated at $25^0$18 N′ latitude, $83^0$03′ E longitude and at an altitude of 78.1 m above mean sea level. The sandy-loam soil of the experimental field was low in organic carbon (0.32%) and available N (182 kg/ha), medium in available P (17.86 kg/ha) and K (260.45 kg/ha) with pH 7.4. The experiment was laid out in randomized block design (4 × 2 factorial) replicated thrice with 4 nitrogen sources viz. N_1 (100% N through urea), N_2 (75% N through urea + 25% N through FYM), N_3 (50% N through urea + 50% N through FYM) and N_4 (25% N through urea + 75% N through FYM) and 2 row spacing viz. S_1 (40 cm × 15 cm) and S_2 (30 cm × 15 cm). Baby corn "Malviya Makka-2" were sown adopting the seed rate of 40 kg/ha levelled soil by opening 5 cm deep furrow at 40 cm × 20 cm spacing. Baby corn was sown on 12 May and 14 May during 2008 and 2009, respectively. The minimum and maximum temperature ranged from 26.9 to 29.9 and 33.6 to 45.9 C during second year, respectively. The crop received 348 mm rainfall during 24 May to 273 mm rainfall during 25 June to 2 August 2009. FYM (0.45-0.2-0.5% N-P-K) was used as an organic source of nitrogen and applied as per treatment. Urea, diammonium phosphate and muriate of potash were taken as fertilizer sources for N, P and K, respectively. Farmyard manure and fertilizer were calculated and applied based on treatment. Full dose of FYM, P, K and half-dose of N were applied as basal. Remaining N was top dressed at knee high stage. Crop received five irrigations during both the year. All the agronomic practices were followed throughout the cropping period. The immature cobs (baby corn) were harvested at 2 to 3 days after silk emergence. These baby cobs were counted weighted and thereafter husked and silk was removed and baby corn yield was recorded. Crop was harvested on 2 and 3 August 2008 and 2009, respectively. Forage yield was calculated by subtracting cob yield from bundle weight. The data collected was analyzed using Fisher's analysis of variance technique and least significant differences (LSD) test at 5% probability level to compare the treatment means.

All the recommended agronomic practices were carried out uniformly to raise the crop. Immediately after emergence of the silk, the cobs were harvested along with sheath from each net plot. Total sugar, starch and protein contents of fresh corn were estimated by following standard methods. Corns harvested from the sampling plants were analyzed for total N by micro Kjeldahl method and from that crude protein (%)content was obtained. Vitamin C and A contents were estimated from the corns of sampling plants by volumetric method. The cobs from the net area of each plot were harvested separately and weighed for obtaining young cob yield (kg/ha). All the agronomic practices were carried out uniformly to raise the crop. Detasseling was done as and when emergence of tassel i.e., normally at 52—55 DAS. Topping beyond 9, 10 and 11 internode was done at 47, 50 and 52—55 DAS, respectively. Immediately after emergence of the silk, cobs was harvested along with sheath periodically and a maximum of five to six harvests with an interval of two days were performed and the cumulative yield obtained. Length, diameter and weight of the cob from the representative plants were measured. Cob sheath peeled off and the length, diameter and weight of corn inside the sheath were measured. Total number of cobs harvested from the sampling plants was converted to the total population/ha 1 and expressed in cobs in lakhs/ha. Period from start of first harvest to the last harvest was recorded and expressed in days (harvesting period). Young baby corn cobs should be carefully picked by hand pulling. After harvest of cobs, the baby corn stalks were harvested, weighed and expressed as green fodder yield (t/ha).

Table 1. Quality and yield of baby corn as affected by sources of nitrogen (N) and spacing (S) (pooled data of 2 years).

Treatments	Chlorophyll content in leaves (%)	Protein content (%)	Carbohydrate content (%)	Sugar content (ppm)	Cob weight without husk (%)	Cob yield (q/ha)	Forage yield (q/ha)
Sources of Nitrogen (N)							
N_1	42.54	19.70	74.87	150.26	6.90	24.48	118.32
N_2	44.27	20.18	76.54	155.29	7.31	26.45	125.61
N_3	40.91	18.58	72.41	144.71	6.70	23.38	114.83
N_4	39.81	18.17	71.36	139.34	6.25	20.98	103.03
CD (P = 0.05)	0.88	0.30	0.59	2.29	0.15	0.58	1.83
Spacing (S)							
S_1	44.35	20.12	76.33	144.38	7.27	27.30	144.38
S_2	39.42	18.19	71.26	86.51	6.31	20.33	86.51
CD (P = 0.05)	0.62	0.21	0.42	1.29	0.11	0.41	1.29

Results and Discussion

Effect on Quality Parameters

Among the combined sources of organic and inorganic nitrogen, 75% N through urea + 25% N through FYM, wider row spacing of 40 cm × 15 cm and their combination registered higher chlorophyll content in leaves of baby corn plants (Table 1). However, chlorophyll content in plants treated with 100% N through urea, 50% N through urea + 50% N through FYM and 25% N through urea + 75% N through FYM coupled with narrow spacing of 30 cm × 15 cm were statistically at par. Chlorophyll content in treatment combinations of 75% N through urea + 25% N through FYM + narrow spacing of 30 cm × 15 cm and vice-versa, i.e. 25% N through urea + 75% N through FYM + wider spacing of 40 cm × 15 cm were also statistically at par. Combination of 75% N through urea + 25% N through FYM, wider row spacing of 40 cm × 15 cm their combination registered higher protein content in cobs of baby corn. However, protein content in cobs from plants treated with 100% N through urea, 75% N through urea + 25% N through FYM and 25% N through urea + 75% N through FYM along with narrow spacing of 30 cm × 15 cm were statistically at par. Protein content in treatment combinations of 75% N through urea + 25% N through FYM + narrow spacing of 30 cm × 15 cm and vice versa, i.e. 25% N through urea + 75% N through FYM + wider spacing of 40 cm × 15 cm were also statistically at par. The results reported by Saha and Mondal (1) are in close conformity with these findings. 75% through urea + 25% N through FYM, wider row spacing of 40 cm × 15 cm and their combination recorded higher carbohydrate content in cobs of baby corn. However, carbohydrate content in cobs from plants treated with 75% N through urea + 25% N through FYM and narrow spacing, 50% N through urea + 50% N through FYM along with wide spacing of 40 cm × 15 and 25% N through urea + 75% N through FYM + wider spacing of 40 cm × 15 cm were statistically at par. Combination of 75% N through urea + 25% N through FYM, wider row spacing of 40 cm × 15 cm and their combination registered higher sugar content in cobs of baby corn. However, sugar content in cobs from plants treated with 100% N through urea, 50% N through urea + 50% N through FYM along with wider spacing of 40 cm × 15 cm were statistically at par. Sugar content in treatment combinations of 75% N through urea + 25% N through FYM was higher than 100% N through urea or other combinations of urea and FYM. It was also observed that with the increase in percentage of N through urea, i.e. 75% to 50% and 25% sugar content maintained a decreasing trend. The results reported by Ramachandrappa et al. (2) are similar to these findings. It was observed that out of the eight interacting combinations of organic and inorganic sources of nitrogen tried in this experiment, N_2 (75% N through urea + 25% N through FYM), S_1 (40 cm × 15 cm spacing and their combination N_2S_1 (75% N through urea + 25% N through FYM + 40 cm × 15 cm spacing) maintained its superiority over all other treat-

Table 2. Interaction effect on quality parameter as influenced by sources of nitrogen (N) and spacing (S) (pooled data of 2 years).

Treatments	Chlorophyll content in leaves (%)	Protein content (%)	Carbohydrate content (%)	Sugar content (ppm)
N_1S_1	44.13	20.32	77.67	159.44
N_1S_2	40.95	19.09	72.07	141.08
N_2S_1	46.23	21.02	78.88	164.30
N_2S_2	42.32	19.34	74.21	146.28
N_3S_1	43.92	19.76	74.48	156.32
N_3S_2	37.89	17.40	70.33	133.10
N_4S_1	43.12	19.39	74.29	151.48
N_4S_2	36.50	16.95	68.43	127.21
CD (P = 0.05)	1.25	0.42	0.83	3.24

ment combinations with regard to quality of baby corn. Cobs of best quality with higher protein, carbohydrate and sugar content were obtained with treatments combination N_2S_1 (75% N through urea + 25% N through FYM + 40 cm × 15 cm spacing).

Effects on Yield

Table 1 shows that outstanding influence of sole inorganic sources of nitrogen application (100% through urea) and integrated approach of nitrogen application (75% through urea + 25% through FYM) caused spectacular improvement in all growth characters of the crop, consequently plants of the crop attained profound growth and become capable to produce full expression of the yield attributes and yield of baby corn. Significantly higher cobs/plant, higher cob length, cob girth, cob weight with husk and cob weight without husk and finally the cob yield and forage yield was found to be higher when the crop was supplied with 75% N through urea + 25% N through FYM accompanied by wider row spacing of 40 cm × 15 cm. These results were also in conformity with the results of the investigation carried out by Kumar and Ghosh (3), 75% N through urea + 25% N through FYM, 40 cm × 15 cm spacing and their interaction were more effective in producing better yield attributes and finally yield (Table 2) over rest of the treatment combinations. This might be due to plants with wider spacing exposed to more better plat stand due to more availability of light, nutrient and moisture adequately ultimately produced longer cobs with higher girth and weight resulting better crop yield. Among the combined sources of organic and inorganic nitrogen, higher quantity of nitrogen through urea (75% N through urea + 25% N through FYM) was more effective in producing higher cob yield. Wider spacing of 40 cm × 15 cm also resulted in higher cob yield. The interacting combination of 75% N through urea + 25% N through FYM + 40 cm × 15 cm spacing registered maximum cob yield out of the nine interacting combinations tried in this experiment. These findings are similar to the results reported by Thavaprakash and Velayudham (4), 75% N through urea + 25% N through FYM was more effective in producing maximum forage yield. 40 cm × 15 cm row spacing and combination of 75% N through urea + 25% N through FYM also registered maximum forage yield. Out of the eight interacting combinations of organic and inorganic sources of nitrogen tried in this experiment, N_2 (75% N through urea + 25% N through FYM), S_1 (40 cm × 15 cm spacing and their combination N_2S_1(75% N through urea + 25% N through FYM + 40 cm × 15 cm spacing) emerged as superior over all other treatment combinations for yield and yield attributing components of baby corn under the agro-climatic condition of Varanasi.

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