Ann. Agric. Res. New Series Vol. 44 (3) : 275-279 (2023)

Idealization of planting density and nitrogen levels for density tolerant baby corn

Shanti Devi Bamboriya[1*] and Pradeep Kumar[2]

ICAR-Indian Institute of Maize Research, Ludhiana, Punjab- 141 004
Corresponding Author's Email: sbamboriya93@gmail.com

Received: February 2023; Revised Accepted May 2023

Abstract

Baby corn (*Zea mays* L.) is a short duration crop that generate large amount of profit in comparatively lesser time span. The high density tolerant cultivars have different optimum plant population as well as nitrogen requirement. Therefore, a field study was planned to find out best density and nitrogen level for density tolerant baby corn. The experiment was laid out in split plot design with three replications. The treatments comprised of four density levels (111111; 148000; 222222 and 296296) and three doses of nitrogen (150, 180 and 210 kg N/ha). High density planting (296296 plants/ha) produced taller plants with more cobs per ha that resulted into higher green fodder yield (40.0 t/ha) and cob yield (3.1 t/ha), respectively. Additional application of nitrogen beyond 150 kg/ha increased plant height, cob number per plant, cob weight and corn/cob ratio. Moreover cob and fodder yields were also increased with increase in nitrogen levels. Planting of 296 296 plants per ha with the application of 210 kg N/ha was observed the best treatment combination as compared to rest other combinations in terms of cob yield.

Key words: Baby corn, plant population, nitrogen, spacing yield

Maize (*Zea mays* L.) is a C4 plant with wider adaptability to diverse agro-ecologies. It stands at first position with respect to total annual harvest (1.13 billion tonne) (FAOSTAT, 2020). It is India's third-largest basic food crop in terms of output and acreage, after rice and wheat. Maize is grown on 9.86 million hectares area in India, contributing 31.5 million tonnes produce (DES, 2021), and employing roughly 15 million farmers (Dhillon *et al*., 2020). Baby corn is a special form of corn that is quite rich in nutrients and mainly used as vegetable and salad or for making various sweet and salted dishes. It is highly remunerative commercial crop that is mainly grown near cities due to its high demand in hotels and restaurants. With changing dietary habits and nutrition consciousness, baby corn demand is picking up in market. Moreover, it is a short duration crop (60-90 days) therefore, it is suitable for intercropping and relay cropping (Singh, 2020).

Planting density is one of the most important factor that influence crop yield particularly in non tillering cereals like maize. Generally 80% extra plant population is recommended for baby corn (111111/ha) than normal maize (65000/ha) (Jaidka *et al.,* 2020). But, recently many high density tolerant, male sterile, input responsive and stay green genotypes were released for baby corn. Hence, a new study is needed to find out the best planting density for such cultivars. Increased plant population also needs higher doses of nutrients particularly for nitrogen (N). Despite being a short duration crop baby corn has higher nutrient requirement as the crop yields more than one cob per plant and also have higher density than normal corn (Singh *et al.,* 2019). Moreover, high nutrient supply is very much needed to enhance prolification in baby corn. Keeping these facts in view, a field experiment was planned to explore the possibility of high density and increased N doses on baby corn production.

Materials and Methods

A field experiment was conducted at the research farm of ICAR-Indian Institute of maize Research, Ludhiana, Punjab. The experimental site was loamy sand in texture and low in soil fertility having 200 kg/ha available N, 10.2 kg/ha available P and 150 kg/ha available K. The experiment was carried out in the *Kharif* 2019 (July 26 to September 25). The mean minimum and maximum temperature during the cropping season was 23.2°C and 33.5°C, respectively. During the cropping season 503 mm of rainfall was received. The crop was planted on July 26, 2019 using G 5417-an male sterile baby corn variety. Split plot design was used in this experiment with three replications. In main plot four planting densities were used *viz.,* 111 111 (45*15 cm spacing and single plant per hill) (D_1); 148 148 (45*15 cm spacing and single plant per hill (D_2); 296 296 (45*15 cm spacing and two plants per hill) (D_3); 222, 222 (60*15 cm spacing and two plants per hill) (D_4). Whereas in sub plot, three N levels 150 kg N/ha; 180 kg N/ha and 210 kg N/ha were applied. The sources of fertilizers were urea, single super phosphate and muriate of potash for N, P and K, respectively. One third dose of N and full dose of P and K were applied as basal before sowing. The remaining N was applied at knee high and tasseling stages in equal splits. Data on growth parameters, yield attributes and yield were taken using standard protocols. Statistical data analysis was done by applying "Analysis of Variance" using R software. The significance of different sources of variations was tested by F test at probability level 0.05.

Results and Discussion

Plant height

Plant height was significantly affected by planting density (Table 1). With increasing density an increase in plant height was observed. Among the various planting densities, D_3 resulted into tallest plants (196 cm) followed by D_4 (192 cm), D_1 (191 cm), and D_2 (189 cm). Such increase in plant height may be due to competition among the plants to obtain sunlight that induced tallness in plants (Pant and Sah, 2020).

Plant height was significantly affected by various N levels. It increased with the increasing N levels. The maximum plant height was observed at 210 kg N/ha (194 cm) followed by 180 kg N/ha (192 cm) and 150 kg N/ha (190 cm). This might be due to the enhanced cell division and elongation under nitrogen fertilization which supported vegetative growth, and plant elongation (Karki *et al.,* 2020).

Yield attributing character

Planting density exerted significant effect on cobs per ha, cobs per plant, corn/cob ratio, cob length and diameter and cob weight (Table 1). The highest cobs per ha was obtained at higher densi-

Table 1. Growth and yield parameters as affected by planting density and N levels

Treatment	Plant height (cm)	Cobs per ha (× 000)	Cobs per plant	Corn/cob ratio	Cob length (cm)	Cob diameter (cm)	Cob weight with cover (g)	Cob weight without cover (g)
Planting density								
D_1	191.0	240.9	1.58	0.19	7.51	2.50	50.1	8.0
D_2	189.2	202.5	1.81	0.18	7.66	2.56	51.0	8.4
D_3	196.0	364.2	1.25	0.20	6.51	2.17	43.4	7.6
D_4	192.3	267.9	1.37	0.22	7.19	2.40	47.9	7.8
SEm ±	0.9	3.1	0.04	0.00	0.14	0.03	0.3	0.1
CD (*P*=0.05)	3.3	11.0	0.70	0.01	0.49	0.10	1.1	0.2
N levels (kg/ha)						0.0	0.0	
150	189.5	235.0	1.36	0.18	6.40	2.13	42.7	7.3
180	192.4	270.3	1.51	0.20	7.07	2.36	47.2	8.0
210	194.5	301.3	1.64	0.20	8.17	2.74	54.5	8.6
SEm±	4.5	9.8	0.02	0.00	0.27	0.05	0.6	0.3
CD (*P*=0.05)	NS	29.7	0.08	0.01	0.80	0.15	1.8	0.8

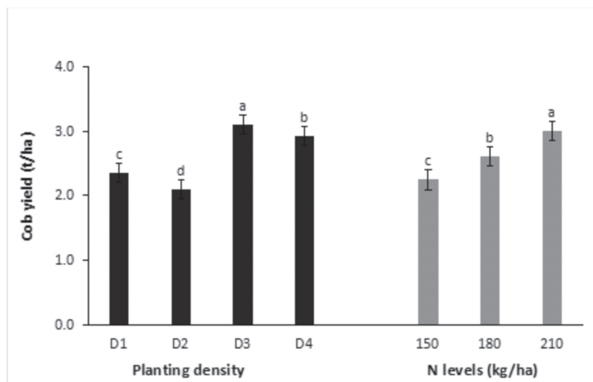
ties (D_3 followed by D_4). Comparatively more cob count per ha at higher density may be attributed due to more total number of plants (Tasisa and Teshome, 2019). An inverse relation was found between number of cobs per ha and number of cobs per plant. The highest number of cobs per plant was obtained at lower plant population (D_2 followed D_1). A considerable decline in per plant cob count was found at the higher plant density. This might be due to enhanced barrenness due to increased competition at higher plant population (Ma *et al*., 2020).

The corn/cob ratio ranges between 0.18-0.22 and the maximum corn recovery was obtained in D_4 (0.22) followed by D_3 (0.20). Average weight of a cob without cover was highest (8.4 g) at lowest plant density (D_2) and lowest (7.6 g) at highest density (D_3). Gosh *et al.* (2017) also reported the highest corn/cob ratio and lowest average cob weight was received from highest planting density. The maximum values of cob length and cob diameter were seen under lower planting density treatments i.e. D_2 and D_1. The greater inter-plant competition for light, water and nutrients with excessive planting density might have reduced the yield parameters of baby corn in the study (Zhang *et al*., 2022).

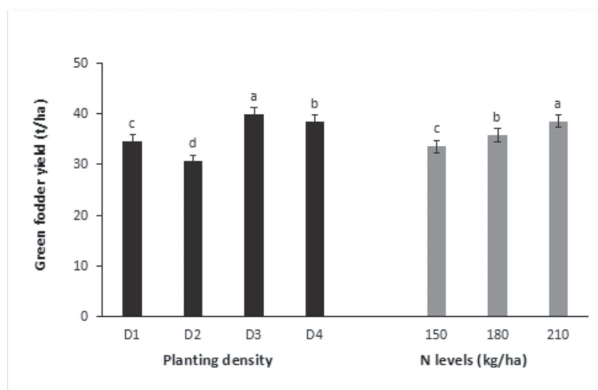
All the yield contributing characters like number of cobs per ha, number of cobs per plant, corn/cob ratio, cob length, cob diameter, cobs weight with and without cover were found to be significantly affected by N levels. Number of cobs per ha increased with N levels and maximum cobs were produced at 210 kg N/ha followed by 180 kg N/ha and 150 kg N/ha. It is evident from Table 1 that per 30 kg increase in N level enhances the cob number by 30000-40000. The highest number of cobs per plant were harvested when N was applied @ 210 kg N/ha (1.64) and lowest from 150 kg N/ha (1.36). Similar corn: cob ratio (0.22) was obtained at 210 kg N/ha and 180 kg N/ha which was statistically superior than 150 kg N/ha (0.18). The highest cob length and cob diameter, cob weight with cover (54.5 g) and without cover (8.6 g) were obtained under 210 kg N/ha. Plants that receive insufficient amounts of nitrogen may produce less dry matter as a result ear length and diameter tends to decrease. Patel *et al.* (2020) also reported similar kind of effect of nitrogen application on baby corn yield parameters.

Cob and green fodder yield

Significant effect of density levels was seen on cob yield (Fig.1). Among various density treatments, D_3 produced highest uncovered cobs yield (3.1 t/ha) closely followed by D_4 (2.9 t/ha). Compared to D_2 and D_1, D_3 had 47% and 32% higher cob yield, respectively. More number of cobs per ha and higher corn: cob ratio might be a reason behind handsome baby corn harvest from higher planting densities. Although at lower planting densities, cob length and girth and average cob weight was comparatively more, but it could not compensate the yield loss by lower cobs per ha. Therefore, lesser cob yield was obtained at lower plant population. Contrary to these findings, reported non-significant effect of planting densities on baby corn yield. Such difference in findings may be due to varietal difference or use of lower



(a)



(b)

Fig. 1. Effect of planting density and N levels on cob yield (a) and fodder yield (b) of baby corn. Error bar indicates standard error of mean.

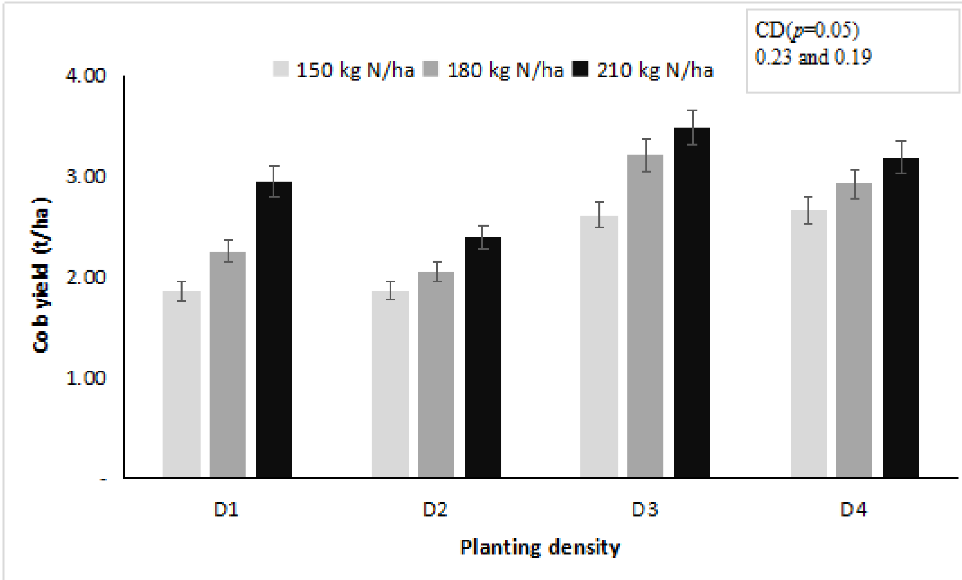


Fig. 2. Interaction effect of planting density and N levels on cob yield of baby corn. Error bar indicates standard error of mean.

N doses. The fodder yield was also significantly differed among various density levels (Fig. 2). At lower population level (D_2), significantly lesser green fodder yield was obtained (30.7 t/ha). Oppositely, D_3 yielded highest fodder quantity (40.0 t/ha) followed by D_4 (38.5 t/ha) and D_1 (34.7 t/ha). Exceeded plant population and increased plant height at higher density treatments may be the possible reasons for such improved fodder yield. was also reported higher biomass under more plant population.

Cob and fodder yields differed significantly among the N levels. The highest N level (210 kg N/ha) yielded maximum quantity of baby corn (3.0 t/ha) followed by 180 kg N/ha (2.6 t/ha) and 150 kg N/ha (2.2 t/ha). It is evident from Fig. 1a that per 30 kg increase in N level enhanced the cob yield by 0.4 t. The increased cob yield with N application might be due to the improved yield attributing parameters under high N levels. The green fodder yield increased with increase in N doses and the highest yield was recorded at the highest N level (38.5 t/ha). The high (240 kg N/ha) and medium (180 kg N/ha) N levels respectively recorded 14.8% and 6.7% higher baby corn yield over 150 kg N/ha. Increased cob and fodder yields with N application were also reported by (Patel *et al.*, 2020). Interaction effect was found significant for cob yield. Among the various treatment combinations, maximum cob yield was found under D_3 with 210 kg N/ha whereas least value was obtained at D_2 with 150 kg N/ha (Fig. 2).

Conclusion

Based on the results of the experiment it may be concluded that input responsive and density tolerant baby corn cultivar like G 5417 can be planted following 45*15 cm spacing @ two plants per hill (296, 296 plants per ha) with 210 kg N/ha to get maximum cob yield and green fodder for livestock.

References

Department of Economics and Statistics (DES). 2021. Agricultural statistics at a glance, 2021.

Dhillon, B.S., Sandhu, S.K. and Chawla, J.S. 2020. Maize for sustainable agriculture in changing climate. In *National Seminar on ''Maize for Crop Diversification under Changing Climatic Scenario''*, pp-4.

FAOSTAT. 2020. Retrived from: https://www.fao.org/

faostat/en/#data/QCL

Ghosh, M., Maity, S.K., Gupta, S.K. and Chowdhury, A.R. 2017. Performance of baby corn under different plant densities and fertility levels in Lateritic soils of Eastern India. *International Journal of Pure Applied Bioscience*. **5**(3) : 696-702.

Jaidka, M., Bathla, S. and Kaur, R. 2020. Improved Technologies for Higher Maize Production. IntechOpen. doi: 10.5772/intechopen.88997

Karki, M., Panth, B.P., Subedi, P., Aarty G.C. and Regmi, R. 2020. Effect of different doses of nitrogen on production of spring maize (*Zea Mays*) in Gulmi, Nepal. *Sustainability in Food and Agriculture*. **1**(1) : 1-5.

Ma, D., Li, S., Zhai, L., Yu, X., Xie, R. and Gao, J. 2020. Response of maize barrenness to density and nitrogen increases in Chinese cultivars released from the 1950s to 2010s. *Field Crops Research.* **250**: 107766. https://doi.org/10.1016/j.fcr.2020.107766.

Pant, C. and Sah, S.K. 2020. Managing plant population and competition in field crops. *Acta Scientifica Malaysia.* **4**(2) : 33-36.

Patel, K.H., Parmar, P.K., Patel, M.B., Varma, H.S., Singh, S.K., Mehta, P.V., Patel, N.J. and Patel, V.J. 2021. Production of baby corn hybrid as influenced by nitrogen and phosphorus in rabi season. *The Pharma Innovation Journal.* **10**(12) : 712-715.

Singh, S.P., Neupane, M.P., Sai-Sravan, U., Kumar, S., Yadav, T. and Choudhary, S.K. 2019. Nitrogen management in baby corn: A review. *Current Journal of Applied Science and Technology.* **34**(5) : 1-11.

Singh. 2020. Production practices for doubling farmers income through speciality corn cultivation-an efficient diversification to achieve the goal. *In Souvenir and Book of Abstracts of National Seminar On Maize for Crop Diversification under Changing Climatic Scenario,* pp-70.

Tasisa T. and Teshome, K. 2019. Effects of varieties and intra row spacing on yield of maize (*Zea mays* L.) under supplementary irrigation at Guliso, Western Ethiopia. *International Journal of Environmental Science and Natural Resources*. **19**(5): 556024.

Zhang, H., Zhang, C., Sun, P., Jiang, X., Xu, G. and Yang, J. 2022. Optimizing planting density and nitrogen application to enhance profit and nitrogen use of summer maize in Huanghuaihai region of China. *Scientific Repports.* **12**(1) : 2704. doi: 10.1038/s41598-022-06059-0.