Indian Journal of Agricultural Sciences **95** (4): 474–478, April 2025/Short Communication
https://doi.org/10.56093/ijas.v95i4.158209

Growth, productivity and quality of male sterile baby corn (*Zea mays*) hybrid under varying nitrogen levels and timings of detasseling

KADAGONDA NITHINKUMAR[1,*], S P SINGH[1], VED PRAKASH[1], SHREYAS BAGRECHA[1], NILUTPAL SAIKIA[1], ANCHAL DASS[2], AYEKPAM DOLINA DEVI[2] and DEVIKA A R[2]

Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh 221 005, India

Received: 15 October 2024; Accepted: 21 January 2025

Keywords: Baby corn nutrition, Detasseling schedule, Nitrogen levels, SPAD value

Baby corn (*Zea mays* L.) is becoming a prevalent crop in India and worldwide due to its unique characteristics, including its production potential, short duration, fit for diversification of crops, opportunities for increased value-addition, and employment generation (Bhat and Patil 2014, Kaur *et al*. 2022). Baby corn is an unfertilized, dehusked maize ear, harvested within 1–2 days after silking at a 2–3 cm long silk stage before fertilization (Nithinkumar *et al*. 2024b). Baby corn is a fast-maturing crop that is gaining popularity in semi-urban locations due to its nutritional benefits and versatility in various dishes (Hooda and Kawtra 2013). Its green fodder benefits livestock (Wadhwa *et al*. 2018) and supports rural employment (Bhat and Patil 2014). Baby corn cultivation differs from maize, requiring a higher plant population, increased nitrogen application, detasseling and early harvesting (Nithinkumar *et al*. 2024a).

Baby corn crop demands a higher amount of nitrogen to meet the requirement of higher plant population demand and increase production and quality (Kumar and Bohra 2014). The winter season baby corn crop takes a long duration due to its low temperatures; thus requires a higher amount of nitrogen (Singh *et al.* 2019). Nitrogen plays an important role in increasing the quality parameters such as carbohydrates, starch and sugars (Yue *et al*. 2022). Carbohydrates, starch and sugars are key indicators of baby corn's nutritional and culinary value, as they determine sweetness, texture and consumer preference (Chaudhary *et al*. 2013). The nitrogen scheduling coincides with various critical growth stages (basal, knee-high stage and before tasseling) are key factors in improving the yield and quality (Neupane *et al*. 2017). Yue *et al*. (2022) reported that the application of 200 kg N/ha with one-third application at sowing and two-third application at the six-leaf stage is suitable N supply improved starch metabolizing enzymes and grain yield in maize. Asaduzzaman *et al*. (2014) revealed that the application of 160 kg N/ha significantly increases the plant height and dry matter accumulation similar to the 200 kg N/ha, and the leaf area index recorded the highest value at 200 kg N/ha in baby corn. Similarly, detasseling time is an important production technology in baby corn to improve the nutritional quality and yield (Moreira *et al.* 2010). The removal of the tassel from the plant (detasseling) is necessary in baby corn, because it reduces nutrient competition between the silk and tassel and the flag leaf efficiently utilizes solar radiation during the reproductive phase (Cheng and Pareddy 1994). The detasseling helps to divert all nutrients and dry matter from the tassel to silk; hence improving the baby corn production and quality (Nithinkumar *et al*. 2024b). Sammauria *et al*. (2019) reported that tassel removal just after emergence showed higher yield attributes and grain yield and stover yield, however results were at par with 3 days after emergence (DAE) and 7 DAE in maize. Moreira *et al*. (2010) revealed that detasseling in baby corn increased the number of ears/ha, and marketable unhusked ears/ha and marketable husked ears/ha compared to the undetasseled baby corn plants. Hence, based on the above fact, it is hypothesized that combined production technology of nitrogen levels and detasseling time may improve the primary objective of the growth, yield and quality of male-sterile baby corn under irrigated conditions of the Varanasi region.

The experiment was carried out during the 2021–22 winter (*rabi*) season at the Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (25º18’ N, 83º31’E and an altitude of 75.7 m), Uttar Pradesh. The experimental site was sandy clay loam soil and 7.56 *p*H (neutral), 0.4 dS/m electrical conductivity, 0.33% organic carbon (low), 198.1 kg/ha available nitrogen (low) and 19.56 kg/ha phosphorous (medium) and 147.3 kg/ha potassium (medium). The present study was laid out in factorial randomized complete block design (Factorial-RCBD) consisting of four nitrogen levels

[1]Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh; [2]ICAR- Indian Agricultural Research Institute, New Delhi. *Corresponding author email: nithinkumarkadagonda@gmail.com

such as 50 kg N/ha, 100 kg N/ha, 150 kg N/ha and 200 kg N/ha and three detasseling times such as no detasseling (control), immediate after tassel emergence and 7-days after tassel emergence. The 12 treatment combinations and three replications have a plot size of 4.8 m × 3.3 m. The baby corn crop was sown during the winter season on 27th November 2021 using the G-5414 (male sterile hybrid). The recommended seed rate was 25 kg/ha and the spacing was 40 cm × 20 cm. The nitrogen was applied as three splits (50% basal, 25% at the knee-high stage and 25% at the tassel emergence stage) as per the treatments. The recommended dose of phosphorous, potassium, sulfur and zinc (75, 60, 40 and 10 kg/ha, respectively) were applied as basal to all the treatments. The detasseling was done as per the treatments (108–115 DAS). The baby corn was harvested in four pickings and fodder was harvested at 135 DAS.

The growth characteristics such as plant height, no. of leaves and SPAD value of leaves were recorded at 30-day intervals, and at harvest. Five random plants were selected and tagged to record the growth observations throughout the experiment. Five representative plants per plot were selected from the plot leaving 50 cm border rows for measuring leaf area 40, 60 and 90 DAS using LI-3100C leaf area meter (Li-COR, Lincoln, NE, USA) as cm^2/plant, and the LAI (leaf area index) was calculated. The SPAD (Soil plant analysis development) values were taken by using the SPAD meter for diagnosis of the chlorophyll content of leaves. The SPAD readings were taken from tagged five plants in each plot at the topmost fully expanded leaves by a non-destructive method and averaged.

$$\text{Leaf area index} = \frac{\text{Leaf area per plant (cm}^2\text{)}}{\text{Ground area occupied (cm}^2\text{)}}$$

The four pickings of husked baby cobs were harvested at regular intervals at 2–3 cm silk emergence stage from each net plot (8.74 m^2) separately and husked and dehusked baby corn yields were recorded and converted into kg/ha (Supplementary Table 1 and 2). Quality parameters like carbohydrates (Hedge and Hofreiter 1962), starch (Knutson and Grove 1994) and sugar (Dubois *et al*. 1956) were determined by the Anthrone method.

The analysis of variance method (ANOVA) was used for data analysis of a factorial randomized completely block design (Gomez and Gomez 1984). The standard F test was used to confirm the significant difference (P=<0.05) among different treatment means. Critical difference value was computed for the parameters that revealed significant differences due to the treatment mean. The treatment mean was compared at a 5% level of significance.

Growth attributes such as plant height, number of leaves/plant, leaf area index and SPAD value of leaves were non-significant variations due to detasseling time at 30, 60, 90 DAS and harvest (Fig. 1). The growth characters like plant height and no. of leaves were significant variations with nitrogen level treatments (except 30 DAS). It is evident from Fig. 1 that nitrogen increases from 50–200 kg N/ha recorded significantly higher plant height and no. of leaves at 60, 90 DAS, and at harvest. This might be due to cell elongation, nucleus formation as well as green foliage, more photosynthetic activity due to higher nitrogen availability, and also encouraged shoot growth and more solar radiation interception because of less interspecific competition between the rows (Dar *et al*. 2014). Moreover, the LAI and SPAD values recorded significant variation with 200 kg N/ha over the other treatments, however, there was no statistical difference with 150 kg N/ha. The higher availability of

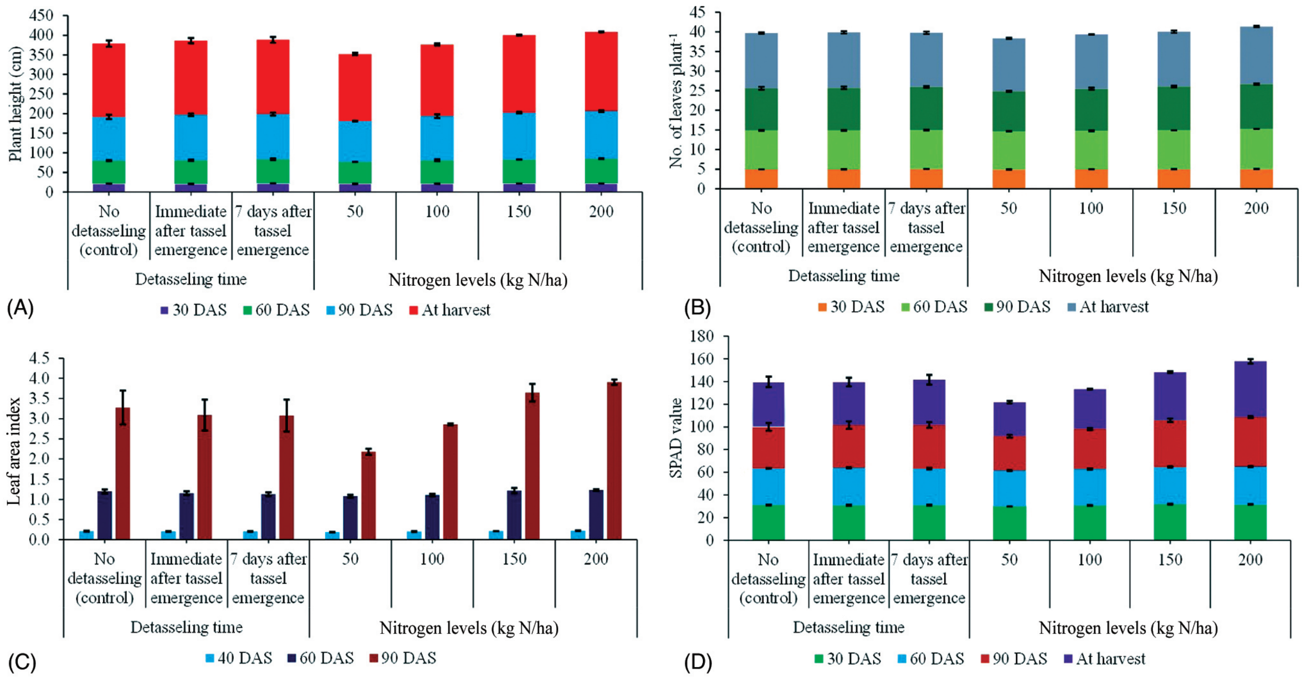

Fig. 1 Effect of nitrogen levels and detasseling timing on growth characteristics of male-sterile baby corn (A) Plant height (cm); (B) No. of leaves/plant; (C) Leaf area index; (D) SPAD value.

nitrogen might increase the photosynthesis and chlorophyll content in the leaves (Sobhana *et al*. 2012).

The picking-wise husked and dehusked baby corn yields were increased with the application of different levels of nitrogen and detasseling time (Fig. 2 and 3). Detasseling immediately after tassel emergence resulted in significantly higher husked and dehusked baby corn yields across all four pickings compared to no detasseling. However, detasseling 7 days after tassel emergence produced yields statistically at par with immediate detasseling. The four picking of husked and dehusked baby corn yields were increased from 10.6–38.5% and 15.7–44.2%, respectively with the detasseling immediately after tassel emergence over the no detasseling. Among the four pickings of husked and dehusked baby corn, the higher picking order was $2^{nd}>1^{st}>3^{rd}>4^{th}$ pickings (Supplementary Table 1 and 2). These results are in line with Moreira *et al*. (2010), detasseling operation in baby corn significantly increased the number and weight of husked and dehusked baby corn. However, picking yields were higher with higher amounts of nitrogen levels from 50–200 kg N/ha. The picking yields were significantly higher with the application of 200 kg N/ha compared to 50 kg N/ha and 100 kg N/ha. However, the yields at 200 kg N/ha were statistically at par with those observed at 150 kg N/ha. The four picking of husked and dehusked baby corn yields were increased from 46.9–156.2% and 44.16–152.48%, respectively with the application of 200 kg N/ha over the 50 kg N/ha. The interaction between nitrogen and detasseling has not resulted in any significant difference among the treatments (Supplementary Table 3 and 4). The increase in baby corn yield from 150–200 kg N/ha followed the law of diminishing returns, where the additional nitrogen resulted in smaller incremental gains in yield, indicating a saturation point in the crop's nutrient utilization efficiency (Yue *et al*. 2022). These results are in accordance with the findings of Nithinkumar *et al*. (2024a), the application of 200 kg N/ha significantly increased husked and dehusked baby corn yields.

The quality parameters of baby corn, viz. carbohydrates, starch and sugar were registered significantly higher in detasseling immediately after tassel emergence over no detasseling, however, it is at par with 7 days after tassel emergence (Table 1). The 200 kg N/ha recorded higher carbohydrates, starch and sugar (%) in baby corn over the 50 and 100 kg N/ha, but it was found statistically at par with 150 kg N/ha. The improvement in quality parameters might be due to the high concentration of nitrogen (%) in baby corn and also congenial biochemical reactions at high N content. Higher nitrogen levels contribute to the accumulation of sucrose and starch in baby corn by enhancing the activity of key enzymes involved in sucrose synthesis, such as sucrose phosphate synthase (SPS) and sucrose synthase (SuSy) (Yue *et al*. 2022). Nitrogen also plays a pivotal role in maize starch biosynthesis by regulating the activity of ADP-glucose pyrophosphorylase (AGPase) and soluble starch synthase (SSS). The increased activity of these enzymes promoted higher starch accumulation, results improved quality (Liu *et al*. 2021). Early detasseling influenced the assimilate partitioning by reallocating photosynthates from the tassel to the developing cob, promoting more efficient nutrient allocation to ears, which enhanced the accumulation of starch, sugars, and carbohydrates (Nicoletti *et al*. 2023).

The interaction between nitrogen levels and detasseling time on quality parameters showed non-significant variation due to various treatments. While both factors improved quality traits independently, the lack of a significant interaction may be due to nitrogen availability not directly altering the physiological response triggered by detasseling, and vice versa. This study identifies environmental factors and scalability as key limitations, requiring further research to adapt treatments to diverse climates and soil conditions. Long-term field trials are essential to assess sustainability

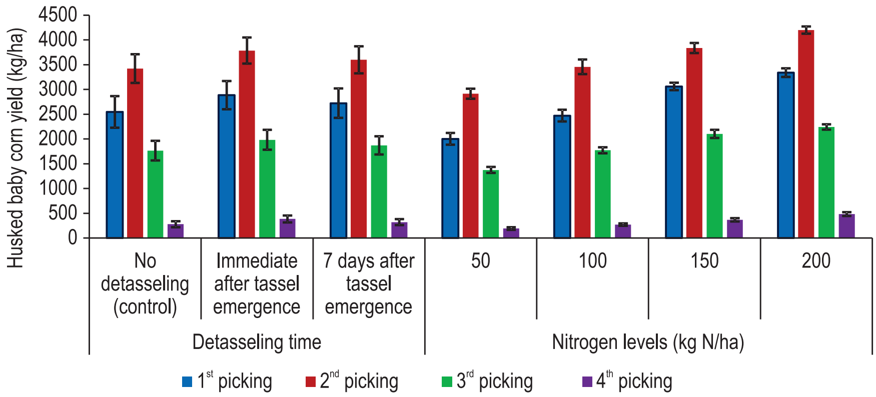

Fig. 2 Effect of nitrogen levels and detasseling time on picking-wise husked baby corn yields of male sterile baby corn.

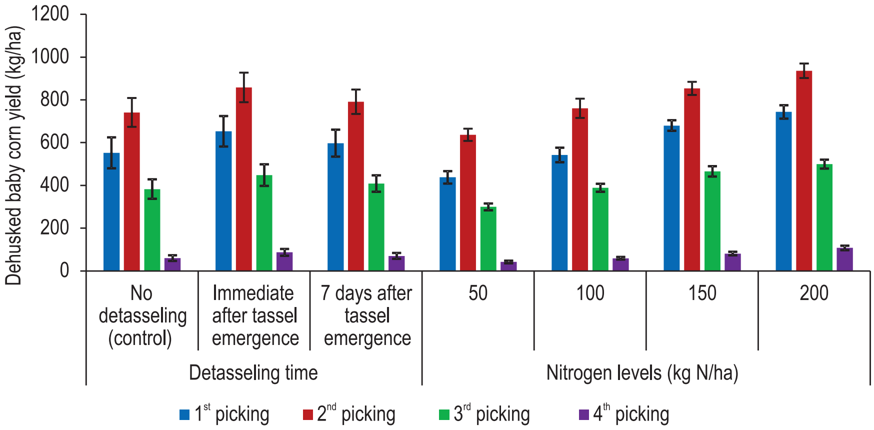

Fig. 3 Effect of nitrogen levels and detasseling time on picking-wise dehusked baby corn yield of male sterile baby corn.

Table 1 Effect of nitrogen levels and detasseling time on quality parameters of male sterile baby corn (on dry weight basis)

Treatment	Total carbohydrates (%)	Starch (%)	Total soluble sugars (%)
Detasseling time			
D_1, No detasseling (control)	67.66	56.51	1.46
D_2, At tassel emergence	69.78	64.68	1.62
D_3, 7 days after tassel emergence	69.30	62.38	1.53
SEM ±	0.58	1.86	0.04
CD (P=0.05)	1.69	5.45	0.12
Nitrogen levels (kg/ha)			
N_1, 50	63.54	54.95	1.36
N_2, 100	66.68	61.46	1.46
N_3, 150	71.87	63.17	1.63
N_4, 200	73.57	65.18	1.70
SEM ±	0.67	2.15	0.05
CD (P=0.05)	1.96	6.30	0.14

and refine practices for different agroecological zones. Farmers are advised to adopt cost-effective nitrogen levels and detasseling timings for sustainable baby corn production.

It could be concluded that the application of 200 kg N/ha and detasseling immediately after tassel emergence significantly improved the growth characters such as plant height, no. of leaves/plant, LAI and SPAD, husked and dehusked yields of baby corn and carbohydrate, starch and sugars in winter season baby corn in Varanasi region of Uttar Pradesh. Further research is required to optimize agronomic technologies in different climates and locations, aiming to enhance sustainable baby corn production.

SUMMARY

The present study was conducted at Institute of Agricultural Sciences, Banaras Hindu University, Varanasi during the winter (*rabi*) season of 2021–2022 to determine effect of different levels of nitrogen and detasseling time on picking-wise productivity and quality of baby corn. The results revealed that detasseling immediately after tassel emergence significantly higher four pickings of husked and dehusked baby corn yield (10.6–38.5% and 15.7–44.2%, respectively increased), and carbohydrates, starch and sugars over the no detasseling, but at par with detasseling at 7 days after tassel emergence. Similarly, the 200 kg N/ha increased the plant height, no. of leaves/plant, LAI, SPAD, four pickings of husked and dehusked baby corn yield (46.9–156.2% and 44.16–152.48%), respectively increased), and carbohydrates, starch and sugars over the 50 and 100 kg N/ha, however, at par with 150 kg N/ha. Overall, this experimental study recommended that detasseling immediately after tassel emergence combined with 200 kg N/ha increased the growth characteristics, yield and quality parameters of male-sterile baby corn in the Varanasi region of Uttar Pradesh.

REFERENCES

Asaduzzaman M, Biswas M, Islam M N, Rahman M M, Begum R and Sarkar M A R. 2014. Variety and N-fertilizer rate influence the growth, yield and yield parameters of baby corn (*Zea mays* L.). *Journal of Agricultural Science* **6**(3): 118–31.

Bhat J S and Patil B S. 2014. The story of baby corn. *Indian Farming* **63**(12): 20–23.

Chaudhary D P, Kumar S and Yadav O P. 2013. Nutritive value of maize: Improvements, applications and constraints. *Maize: Nutrition Dynamics and Novel Uses*, pp. 3–17. Springer, New Delhi, India. DOI 10.1007/978-81-322-1623-0

Cheng P C and Pareddy D R. 1994. Morphology and development of the tassel and ear in maize. *Maize Handbook*, pp. 37–47, Springer, New York, USA.

Dar E A, Harika A S, Datta A and Jat H S. 2014. Growth, yield, and economic returns from the dual-purpose baby corn (*Zea mays* L.) under different planting geometry and nitrogen levels. *Indian Journal of Agronomy* **59**(3): 468–70.

Dubois M, Gilles K A, Hamilton J K, Rebers P A and Smith F. 1956. Colorimetric method for determination of sugars and related substances. *Analytical Chemistry* **28**: 350–56.

Gomez K A and Gomez A A. 1984. *Statistical Procedure for Agricultural Research*, 2nd edn, pp. 241–71. John Wiley and Sons, New York.

Hedge J E and Hofrieter B T. 1962. *Chemistry of Carbohydrate*, pp. 17. Academic Press, New York

Hooda S and Kawatra A. 2013. Nutritional evaluation of baby corn (*Zea mays*). *Nutrition and Food Science* **43**(1): 68–73.

Knutson C A and Grove M T. 1994. Rapid method for estimation of amylase in maize starch. *American Association of Cereal Chemists* **71**(5).

Kumar R and Bohra J S. 2014. Effect of NPKS and Zn application on growth, yield, economics and quality of baby corn. *Archives of Agronomy and Soil Science* **60**(9): 1193–1206.

Liu X M, Gu W R, Li C F, Li J and Wei S. 2021. Effects of nitrogen fertilizer and chemical regulation on spring maize lodging characteristics, grain filling, and yield formation under high planting density in Heilongjiang Province, China. *Journal of Integrative Agriculture* **20**(2): 511–26. doi: 10.1016/S2095-3119(20)63403-7

Moreira J N, Silva P S L, Silva K, Dombroski J L and Castro R S. 2010. Effect of detasseling on baby corn, green ear and grain yield of two maize hybrids. *Horticultura Brasileira* **28**: 406–11.

Neupane M P, Singh S P and Sravan U S. 2017. Response of baby corn genotypes to soil and foliar nitrogen application schedule. *Archives of Agronomy and Soil Science* **63**(13): 1912–26.

Nicoletti M A, Ortiz T A and Takahashi L S A. 2023. Yield and physiological quality of corn seeds after application of detasseling techniques in two cropping seasons. *Australian Journal of Crop Science* **17**(1): 69–73.

Nithinkumar K, Singh S P, Prakash V, Saikia N, Bagrecha S, Sachin K S, Dass A and Singh A. 2024a. Nitrogen and detasseling influences growth, yield and economics of male sterile baby corn (*Zea mays*). *Indian Journal of Agronomy* **69**(2): 211–15.

Nithinkumar K, Singh S P, Prakash V, Bagrecha S, Saikia N, Sachin K S, Dass A and Singh A. 2024b. Nutrient uptake, protein, and soil fertility status of winter baby corn (*Zea mays* L.) as influenced by nitrogen management and detasseling time. *Journal of Soil and Water Conservation* **23**(2): 203–08.

Sammauria R, Balyan J K and Bairwa P C. 2019. Time, intensity of detasseling rainfed maize (*Zea mays* L.) for improving productivity, economics and rainwater-use efficiency. *The Indian Journal of Agricultural Sciences* **89**(12): 2053–58. doi.org/10.56093/ijas.v89i12.96273

Singh S P, Neupane M P, Sravan U S, 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.

Sobhana V, Kumar A, Idnani L K and Singh I. 2012. Plant population and nutrient requirement for baby corn hybrids (*Zea mays* L.). *Indian Journal of Agronomy* **57**(3): 294–96.

Wadhwa M, Kumar B and Bakshi M P S. 2018. Nutritional evaluation of ensiled baby corn fodder as livestock feed. *Animal Nutrition and Feed Technology* **18**(2): 267–72.

Yue K, Li L, Xie J, Liu Y, Xie J, Anwar S and Fudjoe S K. 2022. Nitrogen supply affects yield and grain filling of maize by regulating starch metabolizing enzyme activities and endogenous hormone contents. *Frontiers in Plant Science* **12**: 798119. doi: 10.3389/fpls.2021.798119