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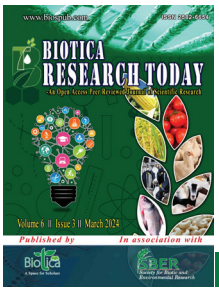

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Article ID: RT1557 **Review Article**

Effect of Variety and Nitrogen Levels on Summer Baby Corn (*Zea mays* L.): A Review

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Abstract

Maize holds the position of the third most significant crop within the cereal category which gives highly nutritional value food and fodder. Baby corn is immature maize which is harvested at 3-4 cm long silk, which is a highly nutritive and delicious vegetable that may be eaten as a natural food source. It offers minerals, vitamins, carbs, protein, fat and sugar in a form that is palatable, nutritious, hygienic and digestible. Baby corn, being a relatively recent introduction to our country, thus needs to have production technology developed, including identification of suitable cultivars and nitrogen dose to realise the higher baby corn yield and financial benefits, before it can be widely adopted by farmers. In Indian soils, nitrogen (N) insufficiency is a widespread problem and correct management is crucial from an environmental and economic standpoint. A combination of optimal nitrogen levels and superior varieties significantly enhances the growth and yield attributes of baby corn. Numerous studies have consistently shown that increasing nitrogen dosage positively impacts baby corn growth, yield parameters and quality characteristics. However economic optimum nitrogen dose may vary on soil and climatic conditions with seasonality. It has been also indicated that the single cross hybrid variety influences growth and yield attributes more than local variety and a location wise interaction between hybrid variety and proper nitrogen level is good strategy which helps to increase yield and more profitable to farmers.

Keywords: Baby corn, Cultivar, Nitrogen, Yield

Introduction

Maize, known as the "Queen of Cereal," is a versatile crop cultivated successfully across temperate, subtropical and tropical climates worldwide. Ranking third in both area and production behind wheat and rice, maize is a significant staple food crop. Globally, it covers an area of 13.88 million hectares, yielding approximately 60.26 million tonnes, averaging 4.34 million tonnes hectare^{-1} (Bindhani, 2004). Its adaptability and high productivity make it a crucial crop for future agricultural sustainability. Based on the endosperm of the kernels, maize is divided into many groups or varieties, of which baby corn is cultivated for vegetables.

Baby corn is the young ear of fully grown maize harvested within two to three days of silk emergence. Baby corn has a special place in Indian agriculture because it is used for food, feed and fodder in addition to many other industrial applications. Thailand started producing baby maize in 1976 using an open-pollinated variety (Kumar, 2016). Baby corn is versatile and can be enjoyed raw or incorporated into various dishes, including salads, chutneys, vegetable dishes, pickles and Chinese cuisine. Its mild flavor and crunchy texture make it a popular choice for adding a unique touch to many recipes. It has a huge potential for both domestic and international consumption.

Baby corn is grown using maize genotypes and in-depth research has not been done to find and/or create variations that are suited for baby corn. In India, only a limited number of single cross hybrids have been identified as optimal for cultivating baby corn. These hybrids are particularly favored for their suitability in baby corn production. All of these hybrids were initially created for grain use but are now taken

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into consideration for baby corn use due to their desirable characteristic traits. Exclusive and particular single cross baby corn hybrids are not now accessible through the public domain (Neupane, 2014). In plants, nitrogen is used for many kinds of purposes. It is a necessary component that includes amino acids, which are the fundamental components of proteins, as well as a portion of DNA and RNA. Compounds found in plants, such as amines, nucleotides and amides contain nitrogen (Neupane, 2014). Nitrogen is vital for metabolic processes as it's found in protein enzymes and chlorophyll, essential for functions like photosynthesis and respiration. This element is crucial for maintaining biochemical balance and supporting growth in organisms. Being a labor-intensive crop, baby corn needs large amounts of nitrogen when it is being used effectively. To improve nitrogen use efficiency, timing nitrogen delivery according to crop requirements is crucial.

One of the main problems the world is currently experiencing is the need to enhance food production. In agriculture, the solution isn't expanding cultivated areas; it's maximizing productivity on existing land. This involves optimizing fertilizer doses, particularly nitrogen and selecting the right cultivar for each plot. It's about getting more from the land we have, rather than seeking more land.

Effect of Cultivars on Baby Corn Growth

In the growth phase of baby corn, the choice of cultivar is critical for timely tassel and silk 2s-emergence. The cultivar directly influences the development and synchronization of these key components, impacting pollination and yield. Therefore, selecting the right cultivar is essential for successful baby corn cultivation and optimal results. A good cultivar helps take more nutrient uptake by plant which helps to improve growth parameters such as plant height, LAI, stem girth, *etc*.

In a recent study by Medhi and Dutta (2019), the growth of three baby corn varieties was compared. CMVL Baby corn-2 emerged as a standout, boasting the tallest plant height at 148.61 cm, tying with G-5414. Interestingly, both outstripped VL Baby corn-1 significantly. Moreover, in dry matter production, G-5414 took the lead, matching CMVL Baby corn-2 in its impressive yield.

Kabir *et al.* (2021) studied between 2 cultivars and five different sources of nitrogen. In result they observed that Baby Star cultivar shows maximum plant height (148.27 cm) at 90 DAS and in case BARI Sweet corn-1 cultivar gave lowest plant height (144.33 cm). The number of leaves and chlorophyll content also observed similar results.

Archana and Lalitha Bai (2017) did experiment on various three cultivars (G 5414, NSC 1009 B and CO 6) which produced the highest plant height in CO 6 (212.74 cm) cultivar.

Alie (2010) reported between 2 different varieties (C6 and VL-78) that variety C6 (201.14 cm) was significantly tallest plant height then VL-78 (180.92 cm) variety and other growth parameter also similar result recorded (dry matter production and leaf area index).

Neupane (2014) studied on three different cultivars: Azad Uttam, HQPM-1 and HM-4. According to the results of the experiment, the plant height of Azad Uttam was significantly higher (209.7 cm) compared to the other two cultivars, HQPM-1 and HM-4. This indicates that Azad Uttam exhibited superior growth in terms of plant height compared to the other cultivars at the specified time point in the experiment. In case number of green leaves and dry matter accumulation also shows Azad Uttam cultivar significantly superior then other cultivars (HQPM-1 and HM-4).

Effect of Cultivars on Baby Corn Yield

Maize comes in a wide range of varieties. Every variation has distinct genotypic and phenotypic characteristics. As a result, they react differently to various environmental factors and agronomic techniques. The days to maturity, cob weight, cob length ha^{-1}, *etc*. are all highly influenced by variety. The type that is suitable for a given area greatly enhances the economic output significantly.

Kabir *et al*. (2020) analyzed between 2 cultivars (BARI Sweet corn-1 and Baby Star) along with different source N-fertilizer, which Baby Star (2910 kg ha^{-1}) cultivar significantly gives more yield then BARI Sweet corn-1.

Singh *et al*. (2015) conducted a research on 2 varieties (HM 4 and VL Baby corn-1) with different spacing and sowing time basis. The results revealed that cultivar HM 4 given maximum corn yield (17.15 q ha^{-1}), no. cobs $plant^{-1}$ (34.61) and fodder yield (375.52 q ha^{-1}) then VL Baby corn cultivar.

da Silva *et al*. (2014) did research in South Brazil among the 10 corn hybrids in 48 environments at 12 locations. They reported that the 30F36 hybrid showed good yield in the superior environment and the 30F53 hybrid for cultivation under different environments. The 32R48 and 30R50 hybrids are suitable for a moderate environment.

Archana and Lalitha Bai (2017) a study was conducted comparing three cultivars: NSC 1009 B, CO 6 and G 5414, across four different crop geometries. The research findings revealed that there were no significant differences observed among the cultivars concerning baby corn yield and fodder yield. However, NSC 1009 B stood out for its shorter duration for tasseling and silking, while G 5414 exhibited superiority in terms of cob production, with an average of 3 cobs $plant^{-1}$. These results underscore the importance of selecting appropriate cultivars and crop geometries to optimize different aspects of crop yield and growth characteristics in baby corn cultivation.

Medhi and Dutta (2019) evaluated three cultivars under various levels of fertilizer. They reported that in G-5414 cultivar with fertilizer 105 N, 70 P_2O_5 and 70 K_2O kg ha^{-1} treatment produce maximum corn yield, fodder yield and no of cobs $plant^{-1}$.

Fahrurrozi *et al*. (2016) carried out experiment on 3 varieties (Talenta, Jambore and Asian Honey) along with local organic fertilizer, in experiment they observe that Asian Honey cultivar produce significantly higher husked cob and without husked cob yield.

Subaedah *et al*. (2021) researched among 3 cultivars (Master

Sweet, Talenta and Bonanza) along with 3 harvesting times (75, 70 and 65 days after planting). The result are recorded that Bonanza cultivar (22.33 t ha^{-1}) was maximum cob yield in two row system at 65 days then other cultivars.

Effect of Nitrogen Levels on Baby Corn Growth

Application of fertilizer and other cultural management practices have an impact on baby corn's growth. Baby corn is highly nitrogen sensitive crop, it needs large amounts of nitrogen to be utilized well and produce more. Nitrogen is linked to the functioning of all living cells and is necessary for improving crop yield because it is an essential part of protoplasm and photosynthesis. Baby corn responded more strongly to applied nitrogen than usual.

Roy *et al*. (2019) in a recent agricultural study, different nitrogen (N) and zinc (Zn) concentrations were tested on baby corn growth. Results showed that the tallest plants, reaching 96.07 cm, were in the treatment with 120 kg ha^{-1} of N and 1.5% Zn. Following closely behind, the treatment with 120 kg ha^{-1} of N and 0.5% Zn exhibited a plant height of 94.10 cm. These findings highlight the significant impact of N-Zn interactions on baby corn growth, offering potential for enhancing crop productivity.

Asaduzzaman *et al.* (2014) in a recent study, researchers tested different nitrogen levels (on plant growth. They found that at 200 kg ha^{-1}, plants reached a height of 179.1 cm, with a higher leaf area index compared to other treatments. Interestingly, the 160 kg ha^{-1} nitrogen treatment showed similar growth to 200 kg ha^{-1}, indicating its potential effectiveness. These findings offer valuable insights for optimizing agricultural nitrogen application.

Hekmat *et al.* (2019) did research effect of NPK, Biofertilizer and Zn on baby corn which at 90% RDF + 5 kg ha^{-1} Zn + Azospirillum gave higher plant height more no of leaves then other treatments.

Mohammadi *et al*. (2019) in a recent study focused on enhancing baby corn growth through biofertilizers, researchers delved into the effects of varying nitrogen and phosphorus levels. The investigation unveiled a promising combination: applying 100 kg ha^{-1} of nitrogen and 75 kg ha^{-1} of phosphorus alongside azospirillum yielded remarkable results. This particular treatment stood out, showcasing superior outcomes in terms of plant height, dry matter production and leaf count compared to alternative approaches. Such findings underscore the potential of tailored biofertilizer formulations in optimizing crop growth and productivity, offering a sustainable avenue for agricultural advancement.

Kumar (2016) observed that between 4 nitrogen levels (60, 75, 90 and 105 kg ha^{-1}) which the plant height (187.4 cm) at 105 kg ha^{-1} nitrogen management was noticeably greater than the another treatment and 60 kg ha^{-1} nitrogen found less in plant height which was 177.3 cm at harvest time.

Effect of Nitrogen Levels on Baby Corn Yield

A good nutrient management strategy is essential to achieving a higher baby maize production. Its productivity depends heavily on nutrition control because it is a strong feeder of nutrients. Plant nutrients are primarily obtained through chemical fertilizers. In plants, nitrogen is very important. It has an impact on the weight cob, cob size and ultimately the yield of baby corn.

Belay *et al.* (2023) in a recent agricultural study, researchers investigated the effects of different nitrogen levels and intra-row spacing on corn growth. They found that using 200 kg ha^{-1} of nitrogen delayed tasseling and silking, prolonging the time to first harvest. However, this nitrogen level, combined with 15 cm intra-row spacing, resulted in significantly higher yields of baby corn (8.3 t ha^{-1}) and fodder (21.5 t ha^{-1}) compared to other treatments. These findings emphasize the importance of careful nitrogen management and spacing for maximizing corn yields.

Patel *et al*. (2021) in a study on baby corn growth, researchers tested different nitrogen and phosphorus levels. They found that 80 kg N ha^{-1} produced the highest yield (6205 kg ha^{-1} with husk, 1102 kg ha^{-1} without husk), comparable to 60 kg N ha^{-1}. Additionally, 20 kg ha^{-1} P_2O_5 resulted in the best yield (5766 kg ha^{-1} with husk, 1029 kg ha^{-1} without husk). These findings highlight the importance of nitrogen and phosphorus levels in optimizing baby corn production.

Thakur *et al.* (2020) worked on nitrogen levels (75,100, 125 kg ha^{-1}) and spacing of crop, which in 125 kg ha^{-1} nitrogen treatment given maximum yield of baby corn (27.81 q ha^{-1}) and harvest index (30.8).

Araujo *et al*. (2017) applied various doses of nitrogen (120, 80, 40 and 0 kg ha^{-1} N) top dressing at 6 leaf stage on baby corn plant. They reported that baby corn's vegetative properties were unaffected by nitrogen topdressing doses but 120 kg ha^{-1} N gave highest productivity (7815.06 kg ha^{-1} with husk and 3244.06 kg ha^{-1} without husk).

Bhaladhare *et al.* (2018) in a study examining different nitrogen (N) and phosphorus (P) levels in baby corn fields, researchers found that the combination of 200 kg ha^{-1} N and 100 kg ha^{-1} P_2O_5 resulted in the highest yields: 60.33 q ha^{-1} corn yield and 34.41 t ha^{-1} fodder yield. This highlights the importance of proper nutrient management for optimal crop productivity in baby corn cultivation.

Gosavi and Bhagat (2009) A recent study explored the effects of different nitrogen doses and spacing on corn yield. Results showed that the treatment with 150 kg N ha^{-1} and 45 cm × 20 cm spacing produced the highest yield of 22.53 q ha^{-1}. Increasing nitrogen up to 150 kg ha^{-1} led to improved cob length, baby corn weight and cobs $plant^{-1}$. Interestingly, sugar content was comparable between 150 kg ha^{-1} and 200 kg ha^{-1} treatments, surpassing other nitrogen levels. These findings underscore the importance of nitrogen management in optimizing corn yield and quality.

Srikanth *et al*. (2023) in a recent agricultural study, researchers experimented with different nitrogen and boron levels for maize cultivation. They found that using 60 kg ha^{-1} of nitrogen and 7 kg ha^{-1} of boron significantly increased cob number (2.17), husk yield (3110.46 kg ha^{-1}) and without husk yield (1498.59 kg ha^{-1}). These findings highlight the importance of nitrogen and boron levels in maximizing maize crop yield.

Effect of Interaction Cultivars and Nitrogen on Baby Corn

Genotypes differ in their genetic makeup and capability for production. A medium-sized, early-maturing, prolific cultivar with consistent flowering is needed for baby corn. A desired genotype is the most important factor in growing baby maize successfully. An inadequate genotype may result in a significant decrease in yield, ranging from 30% to 35% (Singh *et al.*, 2019). Genetic ability varies throughout genotypes and they typically show different physiological responses to administered nitrogen. Effective nitrogen utilization depends on responsive genotypes, application timing, technique and nitrogen sources.

Asaduzzaman *et al*. (2014) reported interaction effects of various cultivar and nitrogen doses (0, 80, 120, 160 and 200 kg ha^{-1} N) on baby corn. Results showed that the Shuvra cultivar with 200 kg ha^{-1} N produced the tallest plants, while BARI sweet corn-1 without nitrogen had the shortest (Figure 1). Hybrid baby corn-271 took the longest to tassel at 200 kg ha^{-1} N, while BARI sweet corn-1 took the shortest time at 160 kg ha^{-1} N. Hybrid baby corn-271 yielded the most corn at 200 kg ha^{-1} N, while Shuvra produced the least without nitrogen. Shuvra also had the highest fodder yield at 200 kg ha^{-1} N, while BARI sweet corn-1 had the lowest without nitrogen. These findings highlight the importance of cultivar and nitrogen level selection for optimizing baby corn production.

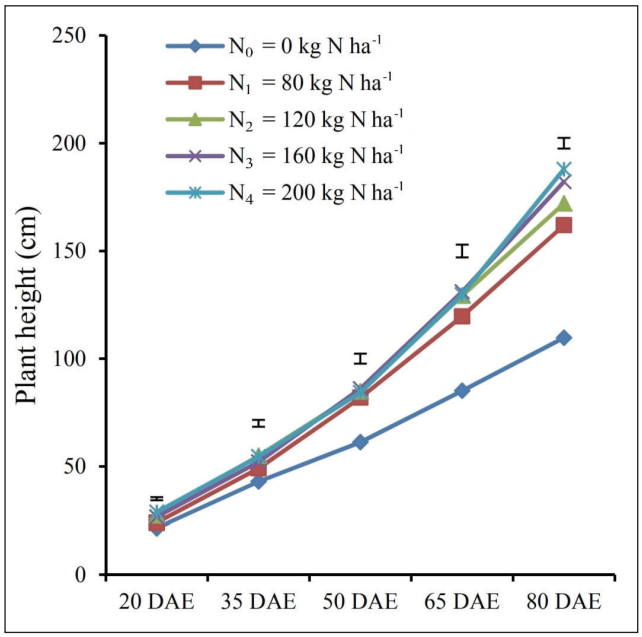

Figure 1: Baby corn plant height influenced through nitrogen fertiliser (Asaduzzaman *et al*., 2014)

Hokmalipour *et al.* (2010) compared the combined effect among different verities (Konsur, Korduna and Kenez 410) with different nitrogen doses (180, 120, 60 and 0 kg ha^{-1} N) on baby corn. They located that Korduna cultivar produced the highest yield (7679 kg ha^{-1}) at 180 kg ha^{-1} nitrogen. Interestingly, Korduna also showed the highest nitrogen use efficiency at 60 kg ha^{-1} nitrogen. These results emphasize the importance of selecting the right variety and optimizing nitrogen levels for maximizing baby corn yields while conserving resources.

Conclusion

Maize is a very exhaustive crop which positively responds to fertilizer application and as such a balanced supply of nutrients influences the crop's yield. Thus, Baby corn is more productive, higher-quality and more profitable when optimum nitrogen dose is paired with superior cultivar under suitable agro climatic conditions. Nitrogen management and cultivar selection are key factors influencing baby corn growth, yield and quality. Increasing nitrogen doses has been consistently shown to enhance these aspects. Effective management of nitrogen and choosing suitable cultivars are essential for optimizing productivity and ensuring high-quality produce. However economic optimum nitrogen dose may vary on soil and climatic conditions with seasonality. It has been also indicated that the single cross hybrid variety influences growth and yield attributes more than local variety and a location wise interaction between hybrid variety and proper nitrogen level is good strategy which helps to increase yield and more profitable to farmers.

Future Strategy

Developing special baby corn varieties with desired traits requires systematic evaluation of current cultivars across different agro-ecological zones. This ensures suitability for producing baby maize, considering factors like morphological features and quality. Such assessments enable researchers to identify the best cultivars for each region, facilitating the creation of tailored high-quality baby corn varieties.

Optimizing nitrogen application in baby corn involves a unique strategy: applying nitrogen to the soil at critical growth stages and supplementing with urea foliar spray at harvest. This method maximizes nutrient uptake tailored to the plant's needs, representing a shift towards precision farming for enhanced yields and sustainability across various agro-climatic conditions.

To boost baby corn yield across diverse climates, it's crucial to determine the ideal nitrogen levels and select superior cultivars. By optimizing nitrogen use, soil health is maintained while minimizing environmental impact. Simultaneously, choosing cultivars suited to specific conditions ensures resilience. Through research, identifying precise nitrogen needs and superior cultivars enables farmers to optimize yield sustainably, fostering a resilient agricultural system.

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