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RESEARCH ARTICLE

EFFECT OF DIFFERENT NITROGEN DOSES ON PERFORMANCE OF BABY CORN (*ZEA MAYS)* UNDER LOCAL CONDITION IN KUSHMA, PARBAT, NEPAL

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ABSTRACT

The study "Effect of Different Nitrogen Doses on Performance of Baby Corn under Local Conditions in Kushma, Parbat, Nepal" was conducted from February 2023 to July 2023 at Mudikuwa, Phalewas-04, Parbat district. Employing a Single Factorial Randomized Complete Block Design, the experiment included eight nitrogen treatments (0, 75, 115, 150, 190, 225, 260, and 300 kg/ha) with three replications. The field was divided into 24 plots, each measuring 2 meters by 2 meters, with a plant spacing of 40 cm by 20 cm. Standard baby corn cultivation practices were followed under open field conditions.

Data on growth and yield parameters were collected, showing that the highest plant height, leaf number, and leaf length were recorded at 300 kg/ha, while the lowest were observed at 0 kg/ha (control). The longest cobs were found at 260 kg/ha, and the shortest at 0 kg/ha, although cob length differences among treatments were not statistically significant. The largest cob diameter was observed at 190 kg/ha, and the smallest at 0 kg/ha. The maximum number of cobs was recorded at 300 kg/ha, statistically similar to the 150, 190, and 225 kg/ha treatments. The optimum nitrogen dose for maximum cob weight was 150 kg/ha, with no significant yield increase beyond this dose. The highest harvest index was recorded at 190 kg/ha, statistically similar to the 150 kg/ha and higher doses. Overall, baby corn performed well with 150 kg/ha of nitrogen, proving to be economically viable.

KEYWORDS

Baby corn, Nitrogen, Kushma

1. INTRODUCTION

Maize is categorized as both a vegetable and a cereal crop. Baby corn, or unfertilized juvenile ears of maize plucked two or three days following silk emergence, is the term for maize grown for human use. It typically, is eaten complete inclusive of the cob, that's otherwise too hard for human consumption in mature corn. The fact that there are uniqueness corn varieties bred specifically for developing infant corn which can be made to grow extra corn in keeping with stalk, growers can use any range, whether or not sweet corn or discipline corn, to supply baby corn. Although there is little to no flavor difference between types of immature corn, as harvest time approaches, the texture does become firmer. Baby corn ears typically measure 0.7 to 1.7 cm (1/4-3/4 in) in diameter and 4.5 to 10 cm (1+3/4 in) in length. It is a good source of dietary fiber, vitamin C, and other essential vitamins, making it a popular choice among customers for healthy foods. (Alam et al., 2018). Compared to other regularly consumed vegetables, baby corn is a significant source of phosphorus, including an astonishing 86 mg/100g of the edible section. The vital elements in this vegetable include protein (15–18%), fiber (3–5%), potassium (2–3%), calcium (0–0.5%), and ascorbic acid (75–80 mg per 100g). It also has a low sugar content (0.016–0.020%) and no cholesterol. It is a great food for the expanding population because it is a rich source of thiamine, riboflavin, and folic acid. Its popularity has been steadily rising as a result of its nutritional and health benefits.

Asia has the highest global consumption of it. Thailand pioneered its export-oriented farming. Thailand exports more baby corn than any other country in the world, making up 80% of all exports. The following nations also export baby corn: China, Kenya, Zimbabwe, Zambia, and India. India accounted for 1.75% of the world's baby corn production in Asia with a production of 10 million tons. Baby corn has been a huge success in nations like Thailand, Taiwan, Sri Lanka, and Myanmar, accounting for 8 and 25% of the area and cereal production, respectively. (Srinivasan et al., 2014.).

1.1 Objective

- General objective
- To access production potential of GK-3140 variety of baby corn, through various Nitrogen management in spring season in Parbat district of Nepal.
- Specific objectives
- To determine the effect of different nitrogen doses on the growth and yield of baby corn in Parbat district of Nepal.
- To compare the yield and yield attributing characters of baby corn at various doses of Nitrogen and identify the best suitable dose which is cost effective and reliable.
- To provide baseline information to future researchers about baby corn.

By achieving these specific objectives, the research project will contribute to the optimization of fertilization management practices for baby corn cultivation

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1.2 Knowledge gaps/ policy gaps

Although baby corn has been developed as an export vegetable with important nutritional and health benefits and having great commercial potential that can generate foreign currency, only limited scientific research has been reported, resulting in insufficient knowledge and lack of standard technologies that hamper the popularization of baby corn production. There is lack of comprehensive production model of baby corn involving specific domain recommendation, fertilizer management, planting, field management, harvest, and marketing which is imperative for successful baby corn production. There is few research that are conducted solely for baby corn in Nepal. As far as parbat district is concerned no research has been reported which includes baby corn, so baby corn is a newest concept here although there are many municipalities which comes under maize zone. The presence of maize zone in parbat provides opportunity for the feasibility test of baby corn as the climatic requirement and soil requirement of baby corn are most likely similar to that of cereal maize. The main problem that can create difference between the cereal maize and vegetable maize is the fertilizer application. The yield and quality of baby corn are highly dependent on various nutrition levels, particularly nitrogen supply.

Since there is no specified recommendation of nitrogenous fertilizer for baby corn in Nepal. This research will fill the gap by evaluating the performance of baby corn to different nitrogen doses which is anticipated to act as pioneer research for future researchers and pen new gates for further work to different stakeholders.

2. Research Method

Research on baby corn, was conducted in Mudikuwa, Phalebas of Parbat district in design- Randomized Complete Block Design with Eight treatment: 0kg/ha, 75kg/ha, 115kg/ha, 150kg/ha, 190kg/ha, 225kg/ha, 260kg/ha, 300kg/ha each replicated three times under row to row spacing of 40cm and plant to plant spacing of 20cm. The total area of research plot was 165m^2; the GK-3140 Indian Hybrid Maize, a yellow color maize, was used for the research. It was sown on 28 Falgun 2079. Each row contains 10 plants; sample plants were specified and all the respective measurement were taken after that. For fertilizer, muriate of potash(40kg/ha), Urea(variable) and SSP (Single Super Phosphate) (60kg/ha); half of the fertilizer was applied at the time of sowing by basal placement method and remaining was applied at Knee high stage. Detasseling was also performed timely under strict daily observation from the first tassel to avoid pollination. Along with that, Ridges were prepared to minimize interflow of nutrient between the plots; First irrigation was given at knee high stage followed by second at tasseling stage.

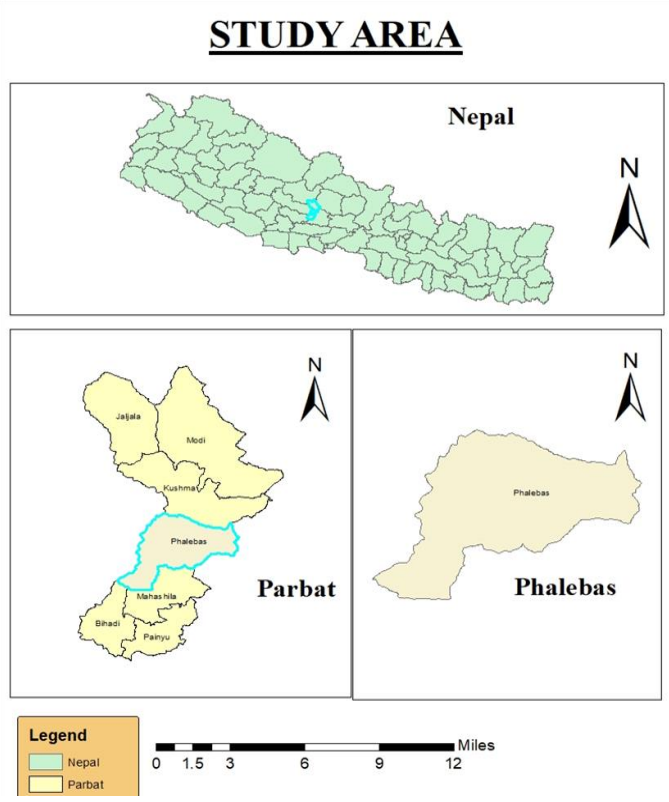

Figure 1: Map of research area

Table 1: Treatment details and signs to indicate them

Treatment no.	Nitrogen dose
T1	260kg/ha
T2	0kg/ha
T3	75kg/ha
T4	115kg/ha
T5	150kg/ha
T6	190kg/ha
T7	225kg/ha
T8	300kg/ha

3. Result and Discussion

3.1 Result

This section mainly deals with field experiment conducted at parbat district during spring season from month of Falgun 2079 to Ashar 2080.Study includes some selected parameters such as phenological, biometric observation, yield attributing character and yield from the experiment. The study also took data of stover yield form field experiment. Moreover, it also interprets and discusses the major factor different nitrogen doses and its response on baby corn plant. The results obtained during the experiment were analyzed and presented in this chapter with the help of the tables and figures wherever necessary. Earlier works which are relevant to the nature of field experiment that either in agreement to and contradict with the findings are also attempted to include to support the results and discussion.

3.2 Growth parameters

3.2.1 plant height, Leaf Number and Leaf Length

Nitrogen doses had noticeable influence on the growth character of the maize plant. There was significant (P<0.001) difference between the plant height among different treatment. The highest plant height was observed at 300kg/ha which is statistically similar to 260kg/ha, 225kg/ha, 150kg/ha, 190kg/ha and similarly lowest plant height was observed at control or 0kg/ha of nitrogen. Similarly, there was a significant increase (P<0.01) in leaf length as the dose of nitrogen increased from 0 kg/ha to 300 kg/ha. However, there was no significant difference observed in leaf number with different nitrogen doses.

Table 2: Plant height, Leaf number and Leaf length of Baby corn at Nitrogen doses at Kushma, Parbat

Treatment (kg N per ha)	Plant height (cm)	Leaf number	Leaf length(cm)
260Kg/ha	189.15^{b}	14.10^{ab}	91.50^{cd}
0Kg/ha(control)	162.00^{g}	12.93^{b}	88.16^{d}
75Kg/ha	168.93^{f}	13.20^{b}	90.83^{cd}
115Kg/ha	171.53^{e}	14.60^{b}	91.81^{bcd}
150Kg/ha	185.60^{d}	14.08^{ab}	93.50^{bc}
190Kg/ha	186.36^{cd}	13.66^{ab}	94.20^{bc}
225Kg/ha	188.03^{bc}	13.60^{ab}	96.16^{ab}
300Kg/ha	191.31^{a}	13.21^{b}	99.28^{a}
LSD (0.05)	1.77	1.38	4.62
SEM (+-) F Probability	1.03 0.01***	0.625 NA	6.97 **
CV%	0.56	5.676	3.834
Grand Mean	180.36	13.68	93.13

Note: Mean followed by common letter(s) within the column are non-significantly different based on DMRT P=0.05, LSD least Significant difference, *** significant at 0.001P, *significant at0.05P, NS: Non significant SEM: Standard error of mean, CV: Coefficient of Variation.

3.3 Yield attributing characters

3.3.1 Cob length and Cob diameter

There was a significant difference observed in cob length (P<0.001) and

cob diameter(P<0.001) in response to varying nitrogen doses. And the highest (10.55cm) cob length was observed at 260kg/ha while the lowest(8.48cm) was observed at 0 kg/ha. The cob diameters were comparatively similar to one another however to be specific the greatest diameter(1.745cm) was at 190kg/ha and lowest was observed at control.

Table 3: Cob length and Cob diameter of Baby corn.

Treatment(kg/ha)	Cob length(cm)	Cob diameter(cm)
260Kg/ha	10.55^{ab}	1.675^{bc}
0Kg/ha(control)	8.48^{e}	1.594^{cd}
75Kg/ha	9.14^{d}	1.87^{bc}
115Kg/ha	9.78^{c}	1.715^{bc}
150Kg/ha	10.17^{bc}	1.648^{cd}
190Kg/ha	10.25^{bc}	1.745^{ab}
225Kg/ha	10.38^{b}	1.592^{d}
300Kg/ha	10.6^{b}	1.62^{d}
LSD (0.05)	0.509	0.0768
SEM (+-)	0.0845	0.001924
F Probability	***	***
CV%	2.85	2.602
Grand Mean	10.190	1.687

Note: Mean followed by common letter(s) within the column are non-significantly different based on DMRT P=0.05, LSD least Significant difference, *** significant at 0.001P, *significant at0.05P, NS: Non significant SEM: Standard error of mean, CV: Coefficient of Variation

3.3.2 Number of Cobs and Cob weight

Significant (P<0.001) difference was observed in term of number of cobs per plant and cob weight under different nitrogen doses. Highest number of cobs was found at 300kg/ha which is statistically similar to 260kg/ha, 125kg/ha, 150kg/ha, 225kg/ha, 190kg/ha whereas lowest was found in control (0kg/ha) which is statistically similar to 75kg/ha. Significant difference was observed in the number of cobs with various nitrogen doses, Highest (2.23) cob number was found at 300kg/ha whilst lowest (1.13) was at 0 kg/ha.

Cob weight was maximum at 225kg/ha which is statistically similar to 150kg/ha,190kg/ha and 300kg/ha. the minimum cob weight was found at control environment i.e., 0kg/ha. The cob weights were significantly higher in doses from 150kg/ha to 300kg/ha than in 0kg/ha and 75 kg/ha treatment.

Table 4: No of Cobs and Cob weight

Treatment	No. of cobs	Cob weight(gm)
260kg/ha	2.13^{b}	33.23^{c}
0kg/ha	1.13^{e}	17.78^{f}
75kg/ha	1.36^{d}	25.25^{e}
125kg/ha	1.66^{c}	28.48^{d}
150kg/ha	2.03^{b}	34.16^{b}
190kg/ha	2.06^{b}	34.45^{a}
225kg/ha	2.13^{b}	35.63^{b}
300kg/ha	2.23^{a}	34.55^{b}
LSD (0.05)	0.134	0.8732
SEM (+-)	0.0058	0.2486
F Probability	0.001***	***
CV	4.27	1.631
Grand Mean	1.79	30.568

3.3.3 Weight of husk and stover yield and harvest index

There was significant(P<0.001) difference observed in husk weight of maize cob. The highest cob husk weight was observed at 300kg/ha and lowest husk weight was observed at 0kg/ha. Similarly, significant difference (P<0.01) was observed in term of stover yield. The highest stover yield per hectare was observed at 300kg/ha while lowest stover yield was observed at 0kg/ha.

Table 5: Weight of husk and Stover yield of baby corn

Treatment	Weight of husk (gm)	Stover yield (kg/ha)
260kg/ha	162.5^{b}	957.12^{bc}
0kg/ha	106.9^{g}	520.66^{e}
75kg/ha	119.6^{f}	770.61^{d}
125kg/ha	134.8^{e}	1013.183^{abc}
150kg/ha	157.3^{c}	1134.35^{ab}
190kg/ha	160.1^{d}	1125.22^{ab}
225kg/ha	162.7^{b}	1050.78^{abc}
300kg/ha	175.3^{a}	1167.00^{a}
LSD	2.965	253.63
SEM (+-)	2.867	20975.61
F Probability	***	**
CV	0.958	15.44
Grand Mean	146.6	937.86

Note: Mean followed by common letter(s) within the column are non-significantly different based on DMRT P=0.05, LSD least Significant difference, *** significant at 0.001P, *significant at0.05P, NS: Non significant SEM: Standard error of mean, CV: Coefficient of Variation

3.3.4 Harvest index and total yield per hectare

Significant (P<0.01) difference was observed in overall harvest index of the baby corn. The highest harvest index (0.0783) was found at 190kg/ha which was statistically similar to that of 150kg/ha, 225kg/ha and 300kgha.Total yield per hectare is highest in 150kgha which 20.7 ton which is statistically similar to 190kg/ha and 300kg/ha.

Table 6: Data for harvest index and total yield per ha (ton)

Treatment	Harvest index	Total yield per ha(ton)
260kg/ha	0.065^{a}	13.283^{c}
0kg/ha	0.0389^{b}	2.719^{d}
75kg/ha	0.04421^{b}	6.213^{d}
125kg/ha	0.0461^{b}	18.865^{b}
150kg/ha	0.0721^{a}	20.37^{a}
190kg/ha	0.0783^{a}	19.007^{ab}
225kg/ha	0.0688^{a}	15.48^{bc}
300kg/ha	0.0653^{a}	20.07^{a}
LSD	0.0184	5.73
SEM (+-)	0.0001108	10.967
F Probability	**	***
CV	17.469	22.44
Grand Mean	0.06037	14.753

Note: Mean followed by common letter(s) within the column are non-significantly different based on DMRT P=0.05, LSD least Significant difference, *** significant at 0.001P, *significant at0.05P, NS: Non significant SEM: Standard error of mean, CV: Coefficient of Variation

4. Discussion

After exhaustive assessment of all parameters and their response with different nitrogen dose application, the outcomes came into light were that the Interaction effects of baby corn plant and N fertilizer was significant for various growth and yield parameters at all growing stages. There were substantial differences in plant height for different N-levels. Usually N-fertilizer enhances the growth of a crop plant synthesizing more protein and chlorophyll. This helps to increase the plant height and other growth parameters. A study reported that plant height of baby corn was found significantly increased up to 200 kg N ha-1 (Thakur and Sharma, 1999). In our case plant height increased significantly up to 300kg/ha and was highest (191.3cm) whilst lowest (162cm) plant height was observed at 0kg/ha. Other scientists also noticed that plant height grew dramatically as N levels increased (Thakur et al., 1997; Sahoo and Panda, 1999; Sunder Singh, 2001).

A study reported that raising the nitrogen levels in baby corn resulted in a notable rise in dry matter output of up to 150 kg ha-1; however, this was equivalent to 180 kg ha-1 throughout both the summer and kharif seasons (Sunder Singh, 2001). Other researchers also suggested the same idea which is a higher dose of Nitrogen administration causes enhanced cell division, cell elongation, nucleus creation, green foliage, and consequently an increase in chlorophyll content (Adhikari et al., 2021). This raises the rate of photosynthesis and causes the stem to extend, increasing plant height and also supported leaf elongation.

The longest (10.55cm) cob length was observed at 260kg/ha which indicated addition of more nitrogen above this dose did not contribute to higher length. However, it was also confirmed that length of baby corn increased significantly with application of higher nitrogen dose up to 150kg/ha.

Maximum number (2.23) of cob was observed at 300kg/ha on contrary lowest cob length and ear per cob was discovered at 0kg/ha. The number of cob at 300kg/ha were statistically similar to number of cob at150kg/ha. which suggested, although the number of cob was high at 300kg/ha it was not economically feasible to input such high dose of N for little margin of increase. Nevertheless, we also concluded the fact that number of cobs increased from 1.13 to 2.23 with increasing nitrogen supply. Roy et al., also gave the same idea about it which is optimal use of solar light, higher assimilation production, and its conversion to starches may account for the longer cob length and higher cob number with a higher level of nitrogen (Roy et al., 2019). A study has explored the same outcome in baby corn where Number of ear plant-1 increased sharply with the increment of N-fertilizer rates and the highest number of ear plant-1 (2.3) was recorded at 200 kg N ha-1 which was significantly different than those outcome from others N-fertilizer rates. The lowest number of ear plant-1 (1.3) was recorded at 0 kg N ha-1 (Asaduzzaman, 2014).

The cob weight without husk was increased significantly up to 150kg/ha and beyond that its increment was inconsiderable till 300kg/ha in hybrid corn GK-3140. The cob weight was maximum (35.63gm) at 225kg/ha which is statistically similar to 150kg/ha whilst lowest(17.78gm) of cob weight was found at 0 kg/ha. The application of 150:75:40 kg NPK ha-1 + 10 t FYM was found to be optimal for obtaining high baby corn and fodder yields with good quality by (Ramchandrappa et al., 2004). As a component of protoplasm and chlorophyll and a factor in every live cell's activity, nitrogen is essential for boosting agricultural yield. An increased response to applied nitrogen was also observed in baby corn by Pandey, Mani, Prakash, Singh, and Gupta (2002). These findings align with our resulted outcome from the research where we found the cob weight without husk was increased significantly up to 150kg/ha and beyond that its increment was inconsiderable till 300kg/ha in hybrid corn GK-3140. Backing up our findings, Asaduzzaman also ascertained the same thing in his research where Baby corn yield without husk increased significantly with 160 kg N ha-1 In hybrid baby corn-271, yield increments over this rate were not statistically significant (Asaduzzaman, 2014). He also suggested fodder yield increased with increased rates of N and finally 200kg N ha-1 produced the highest fodder yield whilst 0kg N ha-1 produced the lowest which incline toward our finding where we increased the N dose up to 300kg/ha and similar outcome was witnessed, fodder yield was highest at 300kg/ha whilst lowest at 0kg/ha.

Number of ear plant-1, length of ear, baby corn yield without husk and with husk varied significantly due to introduction of varied doses of N. Hence, we conclude that Number of cob plant-1 and length of cob were found the main yield parameters attributed to increased baby corn yield without husk.

5. Conclusion

Different observations were recorded on growth parameters, yield parameters, and yield. The collected data were arranged and analyzed systematically using MS excel and R-Studio. The major finding from the experiment is summarized below:

- Growth parameter

Significant difference was found in term of plant height of baby corn. Highest plant height, leaf number and leaf length were observed at 300kg/ha. And similarly lowest of these all was found at 0 kg/ha(control).

- Yield Parameter

The highest cob length was observed at 260kg/ha and lowest cob length as observed at 0kg/ha. There was not large statistical difference in case of cob diameter.

Maximum cob numbers were observed at 300kg/ha which is statistically similar to 150kg/ha,190kg/ha and 225kg/ha. therefore, cob number was similar in case of these treatments. In case of cob weight, the minimum amount of nitrogen that gives maximum cob weight is 150kg/ha. And above this nitrogen dose, there was not significant difference in cob yield.

- Economic parameter

The highest harvest index was found at 190kg/ha which was statistically similar to other dose of nitrogen like 150kg/ha and higher dose like at 300kg/ha. The baby corn which was supplied with 150kg/ha of nitrogen performed well in all overall parameters.

The feasibility of the "GK-3140" of baby corn in Parbat district is quite acceptable by observing the yield parameters with different doses of Nitrogen fertilizer; But, its responsiveness toward other nutrient source is still obscure. In the same light, there is a need to carry out multi-location trials, assessing soil nutrients and FYM, while using varying fertilizer doses of Nitrogen, Phosphorus, and Potassium to evaluate the performance of the given variety. Since our comparison was limited to a single variety, there is significant potential for comparing it to other commonly grown varieties that might exhibit superior performance under similar fertilizer conditions.

Policy Recommendation

- 150kg/ha Nitrogen was found sufficient to give maximum cob weight and acceptable cob length and number cob per plant therefore, with sufficient multilocation trial and preliminary trial can be suggested for baby corn production for Hybrid maize variety.
- Nitrogen above 150kg/ha resulted in increased husk and stover yield resulting lower harvest index which can also be suggested to farmers, if they are also focused on forage yield.
- In a nutshell, environmental feasibility and profitable yield of GK-3140 was also found at 150 kg/ha which can be suggested as baseline research on this variety along with that, this variety, coupled with further research, can be suggested for production of Baby corn in Parbat District.

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Conflict of Interest

This research paper solely belongs to me, and no one has any kind of right over this research conducted, and the paper submitted except those mentioned above. Also, this research was self- funded by me.

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