International Journal of Environment and Climate Change

Volume 12, Issue 12, Page 1701-1707, 2022; Article no.IJECC.96330
ISSN: 2581-8627
(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)

Nutrient Content, Nutrient Uptake and Soil Nutrient Status of Baby Corn as Influenced by Varieties and Levels of Fertilizers

Dhabanita Medhi [a++*] and Rinjumoni Dutta [a#*]

[a] Department of Agronomy, Assam Agricultural University, Jorhat, India.

Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJECC/2022/v12i121613

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/96330

Original Research Article

Received: 24/10/2022
Accepted: 30/12/2022
Published: 31/12/2022

ABSTRACT

A field experiment was conducted to find out the performance of different baby corn varieties at different levels of fertilizers. The experiment was conducted using three baby corn varieties viz., VL Baby corn-1, CMVL Baby corn-2, and G-5414 and four fertilizer levels viz., 60-40-40 N-P_2O_5-K_2O kg.ha-1, 75-50-50 N-P_2O_5-K_2O kg.ha-1, 90-60-60 N-P_2O_5-K_2O kg.ha-1 and 105-70-70 N-P2O5-K2O kg.ha-1 replicated thrice at the Instructional-cum-Research Farm of Assam Agricultural University, Jorhat during the summer season of 2018 using split plot design. The uptake of N, P and K in cob and total uptake was recorded as the highest for G-5414 and in baby corn Stover it was highest for CMVL Baby corn -2. Application of 105-70-70 N-P_2O_5-K_2O kg.ha-1 resulted in the highest nutrient content and uptake in cob as well as in baby corn Stover. The available soil nutrient after harvest was recorded significantly higher with the application of 105-70-70 N-P_2O_5-K_2O kg.ha-1. The lowest available nutrient was found with the application of 60-40-40 N-P_2O_5-K_2O kg.ha-1. The nutrient content and uptake by baby corn cob as well as by Baby corn stover differs with varieties and increases with increasing levels of fertilizer doses.

[++] *M.sc Scholar;*
[#] *Associate Professor;*
**Corresponding author: E-mail: dhabninitamedhi18@gmail.com;*

Keywords: Baby corn; nutrient content; nutrient uptake; varieties; fertilizer levels.

1. INTRODUCTION

"Growing maize as a vegetable commonly known as baby corn is gaining wide popularity. It is grown almost throughout the world for its young, fresh, finger-like green ears, harvested at the time of silk emergence and before pollination and fertilization" [1]. "Baby corn ears 10 to 12 cm long and 1.0 to 1.5 cm diameter in light yellow color with regular row arrangement are mostly preferred in the market" [2].

Cultivation of baby corn provides tremendous avenues for diversification, value addition and revenue generation. After a successful venture in many south-east Asian countries, it is gaining fast popularity in the Indian market and also has the capacity of grabbing a market in Assam. Good quality and higher green fodder yield from its cultivation add enormously to total economic returns besides higher profit per unit area compared with grain. Different varieties respond differently under different agro-climatic conditions which affect the suitability of a particular cultivar. Similarly, an adequate supply of plant nutrients is also one of the most important factors of crop production. Nitrogen, phosphorus and potassium are three major nutrients required for the proper growth, development, yield and quality of baby corn. An adequate dose of nutrients helps in achieving the potential yield as well as quality produce. For efficient and economic crop production it is necessary to optimize the fertilizer doses based on soil testing for different soils. Maize is a very exhaustive crop and as such adequately supplied balanced nutrients have a positive influence in increasing the yield of the crop [3,4]. "Amongst the essential plant nutrients N, P and K play the key role in governing the quantity as well as quality production. Nitrogen (N) is one of the vital plant nutrients and is a major determining factor required for baby corn production. It is a component of protein and nucleic acids and it should be available in sufficient quantity throughout the growing season for optimizing its growth. Nitrogen deficiency or excess supply results in failure to achieve the desired production. Phosphorus is another essential nutrient that is needed to boost growth parameters and increase baby corn yield" [5,6]. Phosphorus plays an important part in many physiological processes that occur within a developing and maturing plant. It is involved in enzymatic reactions in the plant. It also affects the quality of the grains and it may increase the plant's resistance to diseases. Potassium is another essential nutrient and plays essential roles in various biochemical processes like enzyme activation, protein synthesis, photosynthesis, osmoregulation, stomatal movement, energy transfer, phloem transport etc. With the increasing levels of applied nitrogen [7] and phosphorous [8] increased yield was observed by different workers.

2. MATERIALS AND METHODS

2.1 Area Study

The experiment was conducted on a well-drained, uniform topography land at the instructional-cum-research farm of Assam Agricultural University, Jorhat during the summer season of 2018.The soil of the experimental plot was sandy loam in texture, acidic in reaction (pH-5.15), medium in organic carbon (0.68%), low in available N (198.19 kg.ha-1), medium in available P_2O_5 (27.48kg.ha-1) and available K_2O (158.23 kg.ha-1).

2.2 Experimental Design

The experiment was laid out in a split-plot design replicated thrice having each unit plot size of 4.00 m X 3.6 m. In the main plot three baby corn varieties viz., VL Baby corn-1, CMVL Baby corn-2 and G-5414 were set and in the sub-plot four different fertilizer levels viz., 60-40-40 N-P_2O_5-K_2O kg.ha-1, 75-50-50 N-P_2O_5-K_2O kg.ha-1, 90-60-60 N-P_2O_5-K_2O kg.ha-1 and 105-70-70 N-P_2O_5-K_2O kg.ha-1 were set.

2.3 Field Preparation

The field was prepared for sowing by first ploughing with a tractor-drawn disc plough followed by two harrowings and then leveling. All the stubbles and debris were thoroughly removed. The treatment combinations were applied randomly as per the statistical design. The seeds were sown on 23rd February 2018 maintaining a spacing of 45 cm X 20 cm. Half of the nitrogenous fertilizers (urea), a full dose of phosphate (Single Superphosphate) and Potassic (Muriate of Potash) fertilizers were applied as uniformly as possible before sowing the seeds as per the treatment design. The rest half of the nitrogenous fertilizer (urea) was top-dressed during the time of earthing up. The crops were raised in accordance to the recommended package of practices.

Table 1. Chemical properties of soil (initial)

Sl. No.	Particulars	Value	Method employed	Inference
1.	Soil pH	5.15	Glass electrode pH meter [9]	Acidic
2.	Organic carbon (%)	0.68	Walkley and Black's method [9,10]	Medium
3.	Available N (kg.ha-1)	198.19	Alkaline potassium permanganate method [11]	Low
4.	Available P_2O_5 (kg.ha-1)	27.48	Bray's I method [9]	Medium
5.	Available K_2O (kg.ha-1)	178.32	Neutral normal ammonium acetate extractable K using flame photometer [9]	Medium

2.4 Data Collection Methods and Measurement of Research Results

Random samples of cobs and plants were collected during the harvesting stage from each plot. Then the samples were oven dried and finely grounded with a grinding machine to powder and sieved through a 40 mesh sieve. These samples were then subjected to chemical analysis separately for N, P and K (%) content. Nitrogen content (%) in cob and plant samples was estimated by the modified Kjeldahl method as described by Jackson [9]. Phosphorus content (%) was determined calorimetrically by tri-acid digestion and Vanadomolybdate phosphoric acid method for both cobs as well as plant samples as prescribed by Jackson [9]. The color intensity was measured in spectronic 20 colorimeters at 470 nm wavelengths and potassium content (%) in cob and plant samples was determined by flame photometer as described by Jackson [9]. The uptake of N, P and K by the cob and Baby corn stover at harvest was estimated by multiplying the N, P and K (%) content of cob and Baby corn stover with their total dry matter yield (kg.ha-1). The total uptake (kg.ha-1) was calculated for each treatment separately by adding the uptake of nutrients obtained in cob and baby corn Stover.

For estimating the available N, P_2O_5, and K_2O (kg.ha-1) soil samples were collected from the experimental plots after harvest from 0-15 cm soil depth from each plot and were air dried separately. The samples were grounded, sieved through a 2 mm diameter sieve and were used for the estimation of available nitrogen, phosphorus and potassium as per the methods detailed Table 1.

3. RESULTS AND DISCUSSION

Selection of a suitable genotype having higher nutrient uptake capacity is very important especially in the case of baby corn as the crop is harvested both for green cob at a short duration and Baby corn Stover after harvest. Varieties respond differently to different levels of fertilizers. A balanced supply of nutrients through the application of adequate doses of fertilizers is an important factor to be considered for boosting the growth as well as yield of a crop. Nitrogen is an essential constituent of chlorophyll, protoplasm and enzymes. Phosphorous plays a key role in energy transfer and is essential for photosynthesis and other chemical-physiological processes in plants. Potassium plays an essential role in enzyme activation and stress resistance. Corn being an exhaustive crop responds well to the application of fertilizers. The results of the investigation and possible reasons for such variations have been explained in the light of scientific evidences as well as explanations stated by earlier researchers working in the similar areas of experimentation in different location.

3.1 Nutrient Content and Uptake of Baby Corn Cob and Baby Corn Stover

3.1.1 Effect of varieties

Nutrient content both in the cob as well as in the Stover did not differ significantly among the varieties tested but the uptake of nutrients applied differed significantly. The uptake of N, P and K in the cob was recorded highest for the variety G-5414 and lowest for the variety VL-baby corn-1. The nutrient uptake in the cob is a function of yield and nutrient concentration in the cob. As the variety G-5414 recorded the highest cob yield, and dry matter production as well as the highest N, P and K concentration this might be the most valid reason for stating the results recorded. The uptake of N, P and K in baby corn Stover was recorded highest for the variety CMVL Baby corn -2 and lowest for the variety VL-baby corn 1. This might be because of higher N, P and K concentration and dry matter

production as well as higher Baby corn stover yield of in CMVL-baby corn-2 variety. The total uptake of the nutrient is the result of both nutrient concentrations in the cob as well as in the baby corn Stover and this was recorded highest for the variety G-5414. These differences are due to differences in morphological characters of different varieties. A similar difference in the uptake of applied nutrients by different corn varieties owing to differences in genetic makeup was also noted by Sobhana et al. [12] ,Kumari [13] and Kumer et al. [14].

3.1.2 Effect of levels of fertilizers

Analysis of the cob and Stover after harvest of the crop revealed that the nutrient content and uptake by baby corn cob as well as by Baby corn Stover increased with each successive increase in levels of fertilizer doses. The highest nitrogen, phosphorous and potassium content was obtained with the application of 105-70-70 N-P_2O_5-K_2O kg.ha^{-1} which were at par with the application of 90-60-60 N-P_2O_5-K_2O kg.ha^{-1}.

Higher levels of fertilizers applied could have made available more amounts of nutrients in the soil environment to be taken up by the plant. Increased levels of fertilizers in balance doses consequently improve the nutrient concentration in cob as well as in plants. This in turn attributed to better mobility of metabolites to the roots and better root system resulting in better uptake. Nutrient uptake is a function of yield and nutrient concentration. An increase in nutrient concentrations depicts more nutrient uptake by the plant. Higher yield accompanied by higher N, P, and K concentrations could have ascertained greater uptake of nutrients by the plant from the soil. Increase in nutrient uptake by corn and subsequent increase in nutrient content with successive increase in fertility level was also reported by Tak [15], Panwar & Munda [16], Singh et al. [17], and Suther et al. [18].

3.3 Soil nutrient Status after Harvest of Baby Corn

Availability of residual nitrogen, phosphorous and potassium in the soil after harvest of the crop was recorded as significantly lowest in the treatment 60-40-40 N-P_2O_5-K_2O kg.ha-1. Application of lower doses of fertilizers resulted in lower available nitrogen, phosphorous and potassium in the soil and after the harvest of the crop gave lower available residual nutrients compared to the application of higher fertilizer doses. This might be due to the uptake of nutrients by the crop and variations in fertilizer doses. The results are in accordance with the findings of Jyothi et al. [19] Kalyani [20], Prathuyusha et al. [21] which reported lower available nutrient content in the soil in low levels of fertilizers applied.

Table 2. Effect of varieties and levels of fertilizers on nitrogen content and uptake by cob and baby corn Stover and total nitrogen uptake

Treatments	N content (%)		N uptake (kg.ha^{-1})		Total N uptake (kg.ha^{-1})
	Cob	Baby corn Stover	Cob	Baby corn Stover	
Varieties					
VL Baby corn-1	1.67	0.62	4.78	60.16	64.94
CMVL Baby corn -2	1.70	0.64	5.75	63.36	67.90
G-5414	1.72	0.63	6.07	62.70	68.77
S.Em.±	0.02	0.01	0.09	0.64	0.63
C.D.(P=0.05)	NS	NS	0.33	2.51	2.45
Levels of fertilizers (N-P_2O_5-K_2O kg.ha-1)					
60-40-40	1.62	0.56	4.82	54.59	59.42
75-50-50	1.68	0.61	5.36	60.01	64.77
90-60-60	1.74	0.66	5.87	65.12	71.01
105-70-70	1.76	0.68	6.08	68.55	73.64
S.Em.±	0.01	0.01	0.10	1.30	1.11
C.D.(P=0.05)	0.04	0.04	0.28	3.85	3.30
Interaction	NS	NS	NS	NS	NS

Table 3. Effect of varieties and levels of fertilizers on phosphorous content and uptake by cob and fodder and total phosphorous uptake

Treatments	P content (%)		P uptake (kg.ha^{-1})		Total P uptake (kg.ha^{-1}
	cob	Fodder	Cob	fodder	
Varieties					
VL Baby corn -1	0.38	0.14	1.08	14.22	14.77
CMVL Baby corn -2	0.42	0.18	1.48	15.69	16.21
G-5414	0.45	0.17	1.49	15.50	16.95
S.Em.±	0.02	0.01	0.07	0.24	0.23
C.D.(P=0.05)	NS	NS	0.30	0.92	0.81
Levels of fertilizers (N-P_2O_5-K_2O kg/ha)					
60-40-40	0.36	0.11	1.09	12.81	12.91
75-50-50	0.40	0.15	1.29	14.86	15.68
90-60-60	0.44	0.19	1.50	16.28	17.25
105-70-70	0.45	0.20	1.54	16.60	18.07
S.Em.±	0.01	0.01	0.05	0.37	0.40
C.D.(P=0.05)	0.04	0.03	0.13	1.09	1.16
Interaction	NS	NS	NS	NS	NS

Table 4. Effect of varieties and levels of fertilizers on potassium content and uptake by cob and fodder and total potassium uptake

Treatments	K content (%)		K uptake (kg.ha^{-1})		Total K uptake (kg.ha^{-1})
	cob	fodder	cob	Fodder	
Varieties					
VL Baby corn -1	0.55	0.85	1.60	82.78	84.10
CMVL Baby corn -2	0.57	0.89	1.94	89.20	91.13
G-5414	0.59	0.87	2.03	88.39	92.96
S.Em.±	0.01	0.01	0.03	1.38	1.52
C.D.(P=0.05)	NS	NS	0.11	5.42	5.97
Levels of fertilizers (N-P_2O_5-K_2O kg/ha)					
60-40-40	0.51	0.79	1.51	77.27	78.80
75-50-50	0.56	0.86	1.74	84.68	86.46
90-60-60	0.60	0.91	2.03	90.98	94.46
105-70-70	0.61	0.92	2.13	94.40	96.54
S.Em.±	0.01	0.02	0.05	1.11	1.82
C.D.(P=0.05)	0.03	0.05	0.14	3.30	5.40
Interaction	NS	NS	NS	NS	NS

Table.5. Effect of varieties and levels of fertilizers on available N, P_2O_5, and K_2O content of soil after harvest.

Treatments	N (kg.ha^{-1})	P_2O_5 (kg.ha^{-1})	, K_2O (kg.ha^{-1})
Varieties			
VL Baby corn -1	201.81	31.70	125.37
CMVL Baby corn -2	200.24	31.08	123.12
G-5414	197.72	30.12	122.37
S.Em.±	2.26	0.54	1.41
C.D.(P=0.05)	NS	NS	NS
Levels of fertilizers (N-P_2O_5-K kg.ha^{-1})			
60-40-40	188.44	26.41	118.72
75-50-50	197.57	29.50	122.04
90-60-60	203.73	32.55	125.28
105-70-70	209.96	35.40	128.44
S.Em.±	1.89	0.92	0.83
C.D.(P=0.05)	5.61	2.70	2.45
Interaction	NS	NS	NS

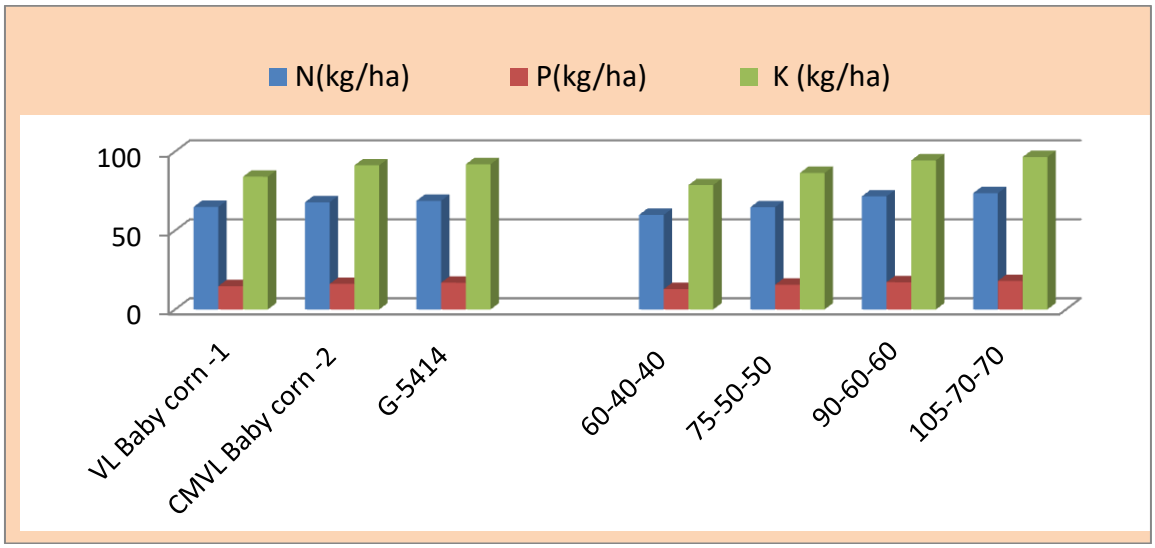

Fig. 1. Effect of varieties and levels of fertilizers on total N, P and K uptake by baby corn

4. CONCLUSION

The uptake of N, P and K in cob was recorded as the highest for the variety G-5414 and lowest for the variety VL-baby corn 1 and the uptake of N, P and K in Baby corn stover was highest for the variety CMVL Baby corn -2 and lowest uptake was recorded for the variety VL-baby corn-1. The total uptake was recorded as the highest for the variety G-5414. The available N, P_2O_5 and K_2O in the soil did not differ significantly upon the cultivation of different varieties.

The nutrient content and uptake by baby corn cob as well as by Baby corn stover increased with increasing levels of fertilizer doses. With each successive increase in fertilizer level, there was a gradual increase in the N, P and K content as well as uptake. The highest nutrient content and uptake was obtained with the application of 105-70-70 N-P_2O_5-K_2O kg.ha-1 which was at par with the application of 90-60-60 N-P_2O_5-K_2O kg.ha-1.

The available soil nutrient after harvest was recorded significantly higher with the application of 105-70-70 N-P_2O_5-K_2O kg.ha-1. The lowest available nutrient was noticed with the application of 60-40-40 N- P_2O_5-K_2O kg.ha-1.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ramachandrapa BK, Nanjappa HV, Shivakumar HK. Yield and quality of baby corn (*Zea mays* L.) as influenced by spacing and fertilizer levels. Acta Agron Hung. 2004;52(3):237-43.
2. Shankar LG, Ganpat LS, HKJ. Performance of baby corn (*Zea mays* L.) as influenced by spacing, nitrogen fertilization and plant growth regulators under sub humid condition in Rajasthan, India. Afr J Agric Res. 2013;8(12): 1100-7.
DOI: 10.5897/AJAR12.1920
3. Gosavi SP, Bhagat SB. Effect of nitrogen levels and spacing on yield attributes, yield and quality parameters of baby corn (*Zea mays*). Ann Agric Res. 2009;30(3-4):125-8.
4. Shrivastava VK, Sinha NK. Response of maize (*Zea mays*. L.) and wheat (*Tricum aestivum*) to azotobacter inoculation and fertilizer application. Ind J Agron. 1992;37(2):356-7.
5. Pellerin S, Mollier A, Plénet D. Phosphorous deficiency affects the rate of emergence and number of maize adventitious nodal roots. Agron J. 2000; 92(4):690-7.
DOI: 10.2134/agronj2000.924690x
6. Sahoo SC, Panda MM. Effect of P and detasseling on yield of baby corn. Ind J Agric Sci. 2001;71:21-2.
7. Das S, Ghosh G, Kaleem MD, Bahadur V. Effect of different levels of nitrogen and crop geometry on growth, yield and quality

of baby corn (*Zea mays* L.) cv. 'golden baby'. Acta Hortic. 2009;(809):161-6-166. DOI: 10.17660/ActaHortic.2009.809.14
8. Amanullah M, Asif K, Nawab Z, Shah M, Hassan AZ, Khan SK, et al. Impact of planting density and P-fertilizer source on the growth and analysis of maize. Pak J Bot. 2010;42(4):2349-57.
9. Jackson ML. Soil chemical analysis. Pub. New Delhi: Prentica Hall of India Pvt. Ltd.; 1973.
10. Walkely A, Black CA. An examination of the method for determination of soil organic matter and proposed modification of the chromic acid titration method. Soil Sci. 1934;37:29-38.
11. Subbiah BV, Asija GL. A rapid procedure for the determination of available nitrogen in soils. Curr Sci. 1956;25:256-60.
12. Sobhana V, Kumar A, Idnani LK, Singh I, Shivadhar. Plant population and requirement for baby corn hybrids (*Zea mays*). Indian J Agron. 2012;57(3):294-6.
13. Kumari A. Planting geometry effects on productivity of baby corn (*Zea mays* L.) varieties [MSc thesis], Dept. of Agronomy, College of Agriculture. Hyderabad: Professor Jayashankar Telangana State Agricultural University Rajendranagar; 2015.
14. Kumer M, Sukhchan, Brar SPS. Evaluation of baby corn varieties for forage yield and various other traits in maize. Forage Res. 2015;41(1):53-5.
15. Tak RC. Effect of zinc fertilization at different levels of nitrogen in conjunction with FYM on nutrient availability and yield of Maize in alfisol. PhD [thesis] submitted to Maharana Pratap University of Agriculture and Technology. Udaipur, Rajasthan; 2000.
16. Panwar AS, Munda GC. Response of baby corn (*Zea mays*. L) to nitrogen and land configuration Meghalaya. Indian J Agric Sci. 2006;76(5):293-6.
17. Singh MK, Singh RN, Singh SP, Yadav MK, Singh VK. Integrated nutrient management for higher yield, quality and profitability of baby corn (*Zea mays* L.). Indian J Agron. 2010;55(2):100-4.
18. Suther M, Singh D, Nepalia V, Singh AK. Performance of sweet corn (*Zea mays*) varieties under varying fertility levels. Indian J Agron. 2014;59(1):168-70.
19. Jyothi KJ, Ramana AV, Murthy KVR. Nutrient uptake and postharvest soil nutrient status of rabi maize as affected by different nutrient levels. J Soils Crops. 2015;25(2):253-8.
20. Kalyani DL. Agro – Techniques for higher yield and quality of popcorn (*Zea mays* l. Indurata) [PhD thesis]. Hyderabad, India: Acharya N G Ranga Agricultural University; 2011.
21. Prathyusha C, Hemalatha S, Praveen R, Jayasree G, G. Nitrogen response, nutrient uptake by the crop and post harvest soil fertility status in specialiaty corn as influenced by nitrogen fertilization under Pongamia + Maize Agri-Silvi system. Int J Plant Anim Environ Sci. 2014;4(1): 276-9.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/96330