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Effect of Nitrogen and Crop Geometry on Growth and Yield of Baby Corn

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The field experiment was conducted to investigate the Effect of Nitrogen and Crop Geometry on Growth and Yield ofBaby Corn during *Zaid* season of 2023 at the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) India. The main objectives of experiment is to studythe efficacy of nitrogen and crop geometry on growth and yield of baby corn. The experiment was executed using Randomized Block Design with ten treatments and replicated thrice. The treatments combinations are T1:Nitrogen 60kg/ha + Crop Geometry 40cm × 20cm T2: Nitrogen 80kg/ha + Crop Geometry40cm × 20cm T3: Nitrogen 100kg/ha + Crop Geometry 40cm × 20cm T4: Nitrogen 60kg/ha + Crop Geometry 50cm × 20cm T5: Nitrogen 80kg/ha + Crop Geometry 50cm × 20cm T6: Nitrogen 100kg/ha + Crop Geometry 50cm × 20cm T7: Nitrogen 60kg/ha + Crop Geometry 60cm × 20cm. T8: Nitrogen 80kg/ha + Crop Geometry 60cm × 20cm T9: Nitrogen 100kg/ha + Crop Geometry 60cm × 20cm, T10: Control (RDF-60- 40-40 NPK kg/ha) are used. The result of the study

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revealed that the higher plant height (173.47 cm), higher plant dry weight (29.3 g/plant), number of cobs/plant (2.1), green fodder yield (33.32 t/ha), cob yield with husk (12.30 t/ha), andcob yield without husk (4.33 t/ha) were significantly showed significant difference with application of Nitrogen100kg/ha + Crop Geometry 50cm × 20cm. It was concluded that for obtaining higher yield components with better quality of baby corn with Nitrogen 100 kg/ha + Crop Geometry 50cm × 20cm was recommended.

Keywords: Nitrogen; crop geometry; Zea mays; growth parameters; baby corn; yield attribute.

1. INTRODUCTION

Baby corn is an ear of maize (*Zea mays* L.) that has been harvested when it is still young, typically before the silks have fully emerged or have just begun. Maize cobs which are used as a vegetable is known as baby corn. The crop requires well-drained and sandy loam to silty loam soils for optimum growth and development. The cobs from a baby corn crop takes about 50–55 days to mature, and the rest of the plant can be utilized as green fodder. Presently baby corn is gaining popularity among Indian farming communities mainly due to its short duration, high market rate, nutritive value and also its multiuse.

“These are consumed by human beings as a source of vegetable and after harvest the plant canbe used as green fodder. One hundred grams of baby corn contains 89.1% moisture, 1.9 g protein, 0.2 g fat, 0.06 g ash, 8.2 mg carbohydrate, 28 mg calcium, 86 mg phosphorus and 11 mg ascorbic Acid” [1]. “It is a warm weather crop and grows from sea level 3000 m altitude and optimum temperature for better growth is 28-32ºC. It grows well in areas with annual rainfall 250-400 mm. It can be grown successfully in soils with pH ranging from 6.5-7.5. The alluvial soils of Uttar Pradesh are well suitable for raising baby corn. The soils with sandy loam to silty loam texture are best for the crop” (Tomar et al., 2011).

“Nitrogen is a key element for achieving higher productivity of maize in southern Rajasthan” [2]. “Maize is an exhaustive crop and requires high quantities of nitrogen during the period of efficient utilization, for higher productivity. Nitrogen is indispensable for increasing crop production as a constituent of protoplasm and chlorophyll and is associated with the activity of every living cell. The different levels of nutrition on corn plants greatly affected. Maximum and minimum nitrogen content differed in plants and also in different partsof the individual plant. The amount of nitrogen is generally much higher in leaves than in stems,leaf sheaths and roots, and it changes with plant age. More than a minimum level of nitrogen supply is necessary for N from vegetative parts to contribute to the formation of seed protein” (Venekamps et al., 1985). “Maize is an exhaustive crop and requires high quantities of nitrogen during the period of efficient utilization, for higher productivity. Nitrogen is indispensable for increasing crop production as a constituent of protoplasm and chlorophyll and is associated with the activity of every living cell. An increased response to applied nitrogen was observed in baby corn” [3].

“Optimum crop geometry is one of the main factors for higher productivity, whereby underground resources are used efficiently and maximum solar radiation is collected which in effect contributes to better photosynthesis” (Monneveux et al., 2005). Yield increases with N levels up to a certain point but the optimum economic N dose is independent of the plant density. Keeping all the points in view the above fact, the experiment was conducted to find out the “Effect of Nitrogen and Crop Geometry on Growth and Yield of Baby corn:” was carried out withfollowing objectives.

2. MATERIALS AND METHODS

The experiment were conducted during Zaid 2023. The experiment was executed using Randomized Block Design with ten treatments and replicated thrice.

was laid out with the different treatments allocated randomly in each replication. The soil of the experimental field was sandy loam in texture, slightly alkaline reaction (pH 8) with low level of organic carbon (0.28%), available N (219 Kg/ha), P (11.6 kg/ha) and K (217.2 kg/ha).

List 1. The treatment combinations

No	N rates	Crop Geometry	No	N rates	Crop Geometry
1	60kg/ha	40cm × 20cm	6	100kg/ha	50cm × 20cm
2	80kg/ha	40cm × 20cm	7	60kg/ha	60cm × 20cm
3	100kg/ha	40cm × 20cm	8	80kg/ha	60cm × 20cm
4	60kg/ha	50cm × 20cm	9	100kg/ha	60cm × 20cm
5	80kg/ha	50cm × 20cm	10	Control RDF 60-60-40 NPK kg/ha	40cm × 10cm

The average height of plants was recorded at an interval of 10 DAS. The height if the plant was measured from the base of the plant up to the tip of the plant. Height of the five randomly selected plants was recorded at 10, 20, 30 & 40 DAS from each plot. The height was measured in cm. Plant dry weight were recorded without root at intervals days after sowing by uprooting one plant from last row in each plot. These plants were first dried then wrapped with paper and then kept in oven for drying at 70^0 c for 24 – 48 hours. The dry weight os samples were recorded, averaged and expressed in (g). Total number of cobs from tagged plants was separated and cobs were counted from each plant and averaged and number of cobs/plant. The cob weight with husk of each net plot was recorded and finally expressed in t/ha. The plants from net plot area were harvested and de-husked. After de-husked, the weight of cob was recorded. Thereafter, cob yield was recorded treatment wise and expressed in t/ha.

3. RESULTS AND DISCUSSION

3.1 Growth Parameters

3.1.1 Plant height

Higher plant height (173.87 cm) was observed in treatment-6 (Nitrogen 100kg/ha + Crop Geometry 50cm × 20cm), which was significantly superior over the rest of the treatments. However, treatment-5 (Nitrogen 80kg/ha + Crop Geometry 50cm × 20cm) was found to be statistically at par with treatment- 6. Wider space availability between the rows and closer intra-rows might have increased the root spread which eventually utilized the resources such as water, nutrients, CO2 and light very effectively and leads higher plant height. The similar line of results was also reported by Dutta et al. [4]. The increase in plant height at narrow intra-row spacing supplied with higher rate of nitrogen fertilizer could

be attributed to positive effect of nitrogen on vigorous vegetative growth and inter-nodal extension. These results were supported by Dangariya et al. [5] and Muhammad et al. (2015).

3.1.2 Dry weight

At 40 DAS, the significantly higher plant dry weight (29.3 gm/plant) was observed in treatment-6 (Nitrogen 100kg/ha + Crop Geometry 50cm × 20cm) However, treatment-5 (Nitrogen 80kg/ha + Crop Geometry 50cm × 20cm) was found to be statistically at par with treatment- 6.

“The significant and higher plant dry weight recorded with application of Nitrogen (N) fertilizer affects corn dry matterproduction by influencing leaf area development, leaf area maintenance, photosynthetic capacity, and consequently yield and grain quality” by Muchow et al. [6]. Maximum diameter might be due to rapid photosynthetic rate by more leaf area exposure to sunlight that helped accumulation of dry matter in plant by crop geometry Thakur et al. [7].

3.2 Yield Parameters

3.2.1 Number of Cobs/plant

The significant and maximum number of cobs/plant (2.1) was observed in treatment-6 with (Nitrogen 100kg/ha + Crop Geometry 50cm × 20cm) However, treatment-5 (Nitrogen 80kg/ha + Crop Geometry 50cm × 20cm) was found to be statistically at par with treatment- 6. Significant and higher number of cobs/plant was observed with application of nitrogen might be due to it’s positive effect that play’s key role inplant metabolism and in the synthesis of nucleic acid. Similar results were reported by Muthukumar et al. [8] in baby corn. Increase in number of cobs per plant with increase in spacing i.e. decrease in plant population might be due to minimum competition among the plants for the absorption of water and nutrients from the soil. This finding is supported by Sobhana et al. [9].

3.2.2 Green fodder yield (t/ha)

“The significant and higher green fodder yield (33.33 t/ha) were observed in treatment-6 with (Nitrogen 100kg/ha + Crop Geometry 50cm × 20cm). However, treatment-5 (Nitrogen 80kg/ha + Crop Geometry 50cm × 20cm) was found to be statistically at par with treatment- 6. Significant and higher green fodder yield was observed with the application of nitrogen might be due to cell division, elongation" Tharaka et al. [10]. "The favourable effect of wider row crop geometry in promoting the green fodder yield might be due to the fact that baby corn grown at wider row crop geometry had helped the individual plants to make better spatial utilization of moisture, nutrients and light which in turn increased the plant height and ultimately green fodder yield as compared to narrow row crop geometry in baby corn" Thavaprakaash et al. [1].

3.2.3 Cob yield with husk(t/ha)

The significant and maximum cob yield with husk (12.30 t/ha) were observed in treatment-6 with (Nitrogen 100kg/ha + Crop Geometry 50cm × 20cm). However, treatment-5 (Nitrogen 80kg/ha + Crop Geometry 50cm × 20cm) was found to be statistically at par with treatment- 6. Significant and higher cob yield with husk was observed with the application of nitrogen stimulates vegetative growth, including leaf area expansion and photosynthetic activity. This enhanced foliage development can contribute to greater overall vigor, which may positively influence cob yield. Similar findings were observed by Swamy et al. [11] in sweet corn. In addition, significantly higher cob yield with husk was with the adequate row to row and plant to plant spacing may be due to higher production by better utilization of resources and in turn higher production of photosynthesis. Similar results were reported by Thavaprakash and Velayudham (2007) in rice.

Table.1 Effect of Nitrogen and Crop Geometry on growth parameters of Baby Corn

Treatment No	Treatments	Plant height (cm) At 40 DAS	Plant dry weight (g/plant) At 40 DAS
1	Nitrogen 60 kg/ha + Spacing 40cm × 20cm	156.00	15.7
2	Nitrogen 80 kg/ha + Spacing 40cm × 20cm	156.26	21.3
3	Nitrogen 100 kg/ha + Spacing 40cm × 20cm	159.93	25.1
4	Nitrogen 60 kg/ha + Spacing 50cm × 20cm	157.39	22.7
5	Nitrogen 80 kg/ha + Spacing 50cm × 20cm	165.30	27.2
6	Nitrogen 100 kg/ha + Spacing 50cm × 20cm	173.47	29.3
7	Nitrogen 60 kg/ha + Spacing 60cm × 20cm	155.36	16.7
8	Nitrogen 80 kg/ha + Spacing 60cm × 20cm	155.43	17.8
9	Nitrogen 100 kg/ha + Spacing 60cm × 20cm	154.46	20.1
10	Control (RDF 60-60-40 NPK Kg/ha)	152.42	14.8
	F-test	S	S
	SEm(±)	3.92	1.91
	CD (P=0.05)	11.65	5.69

- *S : Significant*
- *Sem : Standard error of mean*
- *CD : Critical difference*

Table 2. Effect of Nitrogen and Crop Geometry on yield and yield attributes

S. No.	Treatments	Number of cobs/plant	Green fodder yield (t/ha)	Cob yield with husk (t/ha)	Cob yield without husk (t/ha)
1.	Nitrogen 60 kg/ha at 40 cm × 20 cm spacing	1.2	21.00	11.23	3.14
2.	Nitrogen 80 kg/ha at 40 cm × 20 cm spacing	1.4	25.01	11.48	3.30
3.	Nitrogen 100 kg/ha at 40 cm × 20 cm spacing	1.8	28.01	12.09	3.83
4.	Nitrogen 60 kg/ha at 50 cm × 20 cm spacing	1.7	27.01	11.88	3.60
5.	Nitrogen 80 kg/ha at 50 cm × 20 cm spacing	2.0	30.70	12.16	4.01
6.	Nitrogen 100 kg/ha at 50 cm × 20 cm spacing	2.1	33.32	12.30	4.33
7.	Nitrogen 60 kg/ha at 60 cm × 20 cm spacing	1.9	20.67	11.03	3.14
8.	Nitrogen 80 kg/ha at 60 cm × 20 cm spacing	1.2	22.00	11.27	3.25
9.	Nitrogen 100 kg/ha at 60 cm ×20 cm spacing	1.6	25.69	11.72	3.48
10.	Control RDF(NPK)60-60-40 kg/ha	1.1	19.67	10.24	3.14
	F-test	S	S	S	S
	SEm(±)	0.07	0.87	0.34	0.14
	CD (p=0.05)	0.22	2.59	1.01	0.43

- *S : Significant*
- *SEm : Standard error of mean*
- *CD : Critical difference*

3.2.4 Cob yield without husk(t/ha)

"The significant and maximum cob yield without husk (4.33t/ha) were observed in treatment-6 with (Nitrogen 100kg/ha + Crop Geometry 50cm × 20cm). However, treatment-5 (Nitrogen 80kg/ha + Crop Geometry 50cm × 20cm) was found to be statistically at par with treatment- 6. Increased cob yield may be partly related to less intra row spacing, which encourages competition in sun energy and ultimately stunts growth of some intra row plants in vegetative phase, preventing them from reaching reproductive phase, attributing factors were high relative to the recommended spacing" by Ashwini et al. [12]. Significant and higher cob yield without husk was observed with the application of nitrogen might be due to improved photosynthetic activity resulting in increased carbohydrate production and better grain filling, ultimately leading to higher cob yield without husk. Similar results were found by Neupane et al. [13].

Tables 1&2 reveals that maximum plant height (173.47 cm), higher plant dry weight (29.3 g/plant), number of cobs/plant (2.1), green fodder yield (33.32 t/ha), cob yield with husk (12.30 t/ha), andcob yield without husk (4.33 t/ha) recorded significantly higher under treatment 6 (Nitrogen 100 kg N/ha and Crop geometry 50 cm x 20 cm) among all the treatments but it was significantly at par with treatment 5 (Nitrogen 100 kg N/ha and Crop geometry 50 cm x 20 cm) [14,15]. Lowest plant height, dry weight, number of cobs per plant, green fodder yield, cob yield with husk and cob yield without husk recorded in treatment 10 (Control RDF(NPK)60-60-40 kg/ha).

4. CONCLUSION

Nitrogen application up to 100 kg N/ha and Crop geometry 50 cm x 20 cm in Treatment-6 significantly improved growth and yield parameters like plant height, dry weight, number of cobs per plant, green fodder yield, cob yield with husk and cob yield without husk of baby corn.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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