International Journal of Plant & Soil Science

Volume 35, Issue 19, Page 79-83, 2023; Article no.IJPSS.104626
ISSN: 2320-7035

Agronomic Evaluation of Nitrogen and Boron on Growth and Yield of Baby Corn (*Zea mays* L.)

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Authors' contributions

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

Article Information

DOI: 10.9734/IJPSS/2023/v35i193524

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/104626

Original Research Article

Received: 08/06/2023
Accepted: 10/08/2023
Published: 14/08/2023

ABSTRACT

The experiment was conducted at CRF, Department of Agronomy (SHUATS, Prayagraj) during Rabi season 2022-2023 on babycorn. Treatments consisting of 3 levels of nitrogen (40,50,60 kg/ha) and 3 levels of boron (5,6,7 kg/ha) and with A control. The experiment was arranged in a randomized block design with 10 treatments and replicated thrice. The result concluded that significantly higher plant height (125.32 cm), dry weight (85.96 g/plant), cob length (20.19 cm), cob girth 10.36 cm, number of cobs (2.17) , yield of cob without husk (1498.59 kg/ha) and yield of cob with husk (3110.46 kg/ha) is observed when applying nitrogen 60 kg/ha + boron 7 kg/ha (125.32 cm).

Keywords: Baby corn; nitrogen; boron; corn yield; economics.

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1. INTRODUCTION

Maize is one of the important cereals in India and is used as human food and animal feed as well. Maize (*Zea mays* L.) which ranks 3rd as a food crop after wheat and rice, not only as a cereal but also as a vegetable and fodder. Maize is an annual short-day cross-pollinated crop belonging to the family Poaceae (Gramineae) and tribe Maydeae. Maize is generally grown in kharif, but as a photo-insensitive crop, it is grown both during rabi and summer. Due to its inherently higher yield potential, it was considered the "Queen of Cereals". The quality of cereal crops and crop yield is strongly dependent on nitrogen fertilizer. A number of researchers reported that nitrogen fertilizer application generally has a positive and significant impact on crop growth and yield (Gasim 2001; Amanullah et al., 2016). Maize plant characteristics such as the number of leaves per plant will increase with nitrogen application, which has improved plant height (Akintoye 1996) by increasing the distance among the internodes and length of the internodes [1-3].

Boron (B) is an essential micronutrient required for normal plant growth and development. It is involved in many plant processes such as sugar transport, cell wall synthesis, lignification, cell division of meristematic tissues, petal and leaf bud formation, integrity of cell wall structure, sugar and carbohydrate metabolism and transport, nucleic acid (RNA) ribose metabolism, respiration, indoleacetic acid (IAA) metabolism, cytokinin production and transport, phenol metabolism, nitrogen fixation, pollen germination, pollen tube formation and seed formation. B deficiency affects photosynthesis indirectly by weakening the vascular tissues responsible for ion transport (Wang et al., 2015). B deficiency activates enzymatic and non-enzymatic oxidation using phenol as a substrate, resulting in increased concentrations of polyphenol oxidase and quinine, which are dangerous for plant growth and development (Hajiboland et al., 2013) [4-6].

2. MATERIALS AND METHODS

The experiment was conducted during rabi season 2022 at Crop Research Farm 2, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (Allahabad) located at 25^o 24"42"N, 81^o 50"56"E and 98 m altitude above mean sea level. This area is located on the right side of the river Yamuna by the Allahabad Rewa Road about 5 km from the city of Prayagraj (Allahabad). Prayagraj belongs to subtropical and semiarid climatic conditions with both extremes of temperature i.e. winter and summer. It receives the south-west monsoon rains which begin in the month of July and recede by the end of September. Meteorological data recorded during the growing season of the experiment including weekly mean maximum and minimum temperature, relative humidity and rainfall recorded at the Agrometeorological Observatory, School of Forestry and Environment Sciences, Sam Higginbottom University of Agriculture Technology & Sciences, Prayagraj during the harvest season. The experiment was arranged in a randomized block design with 10 treatments and replicated three times. Treatments consisting of 3 levels of nitrogen (40,50,60 kg/ha) and 3 levels of boron (5,6,7 kg/ha) and A control.

3. RESULTS AND DISCUSSION

3.1 Plant Height (cm)

At 60 DAS significant and higher plant height is observed with the application of Nitrogen 60 kg/ha + Boron 7 kg/ha (125.32 cm), which is statistically at par with application of Nitrogen 60 kg/ha + Boron 5 kg/ha (124.67 cm).

Plant height was increased in case of treatment (nitrogen 80 kg/ha + 1.00 ppm Boron foliar spray). With the application of nitrogen, the highest plant height was observed, the fertilizer promoted plant vegetative growth, probably positively affected root growth, which may have helped better absorption and transformation of nutrients from the source to the plant's uptake capacity [7]. A significant increase in plant height was observed as a result of soil and foliar application of boron and iron, due to an increase in cellular, cellular enlargement and plant metabolism there by promoting vegetative growth, which positively correlates with the production potential of the plant and confirms the results [8].

3.2 Plant Dry Weight (g)

Higher dry matter (85.96 g/plant) was observed (60 DAS) in Nitrogen 60 kg/ha + Boron 7 kg/ha, which was significantly higher over the other treatments. However, Nitrogen 60 kg/ha + Boron 5 kg/ha (84.94 g/plant) treatments stood statistically at par with Nitrogen 60 kg/ha + Boron 7 kg/ha.

Table 1. Effect of nitrogen and boron on yield attributes of babycorn

Treatment combinations		**Plant height(cm)**	**Plant Dry weight (g)**	**Number of cobs/plants**	**Length of cob (cm)**	**Girth of cob (cm)**
1	Nitrogen 40 kg/ha + Boron 3 kg/ha	122.51	82.06	1.90	18.17	10.31
2	Nitrogen 40 kg/ha + Boron 5 kg/ha	122.53	82.13	2.00	18.38	10.38
3	Nitrogen 40 kg/ha + Boron 7 kg/ha	124.32	84.41	2.01	19.36	10.28
4	Nitrogen 50 kg/ha + Boron 3 kg/ha	122.14	82.67	1.83	18.57	10.38
5	Nitrogen 50 kg/ha + Boron 5 kg/ha	122.18	83.43	1.87	18.53	10.34
6	Nitrogen 50 kg/ha + Boron 7 kg/ha	122.24	83.70	1.83	18.51	10.33
7	Nitrogen 60 kg/ha + Boron 3 kg/ha	123.98	83.67	1.90	19.55	10.34
8	Nitrogen 60 kg/ha + Boron 5 kg/ha	124.67	84.94	2.13	20.08	10.35
9	Nitrogen 60 kg/ha + Boron 7 kg/ha	125.32	85.96	2.17	20.19	10.36
10	Control (100:60:40 NPK kg/ha)	120.54	80.18	1.81	17.23	10.29
	F test	S	S	S	S	NS
	SEm(±)	0.35	0.35	0.05	0.06	0.16
	CD (P=0.05)	1.05	1.05	0.15	0.19	

The maximum dry weight may be due to increase in LAI might be due to significant increase in expansion of leaf, higher rate of the cell division and enlargement of cells and there by improved quality of plant vegetative growth due to boron fertilization. Similar results were also reported by [9].

3.3 Number of Cobs

The maximum number of cobs (2.17) were recorded significantly higher in Nitrogen 60 kg/ha + Boron 7 kg/ha. However, Nitrogen 60 kg/ha + Boron 5 kg/ha (2.13) treatments recorded statistically at par with Nitrogen 60 kg/ha + Boron 7 kg/ha treatment.

3.4 Length of Cob (cm)

Length of cob (20.19 cm) recorded significantly superior over the treatment in Nitrogen 60 kg/ha + Boron 7 kg/ha. However, Nitrogen 60 kg/ha + Boron 5 kg/ha (20.08) treatments recorded statistically at par with Nitrogen 60 kg/ha + Boron 7 kg/ha treatment.

3.5 Girth of Cob (cm)

The maximum girth of cob (10.36 cm) were recorded in Nitrogen 60 kg/ha + Boron 7 kg/ha and lowest was recorded in Control (100:60:40 NPK kg/ha) (10.29).

3.6 Cob Yield without Husk (kg/ha)

The significantly higher cob yield without husk was observed (1498.59 kg/ha) in Nitrogen 60 kg/ha + Boron 7 kg/ha. However, Nitrogen 60 kg/ha + Boron 5 kg/ha (1491.61 t/ha) treatment stood statistically at par with Nitrogen 60 kg/ha + Boron 7 kg/ha.

3.7 Cob Yield with Husk (kg/ha)

The significantly higher cob yield with husk was recorded (3110.46 kg/ha) in Nitrogen 60 kg/ha + Boron 7 kg/ha, rest of two treatments stood statistically at par with Nitrogen 60 kg/ha + Boron 5 kg/ha (3097.89 kg/ha).

Boron fertilization has a beneficial effect on physiological processes, plant metabolism and plant growth, leading to higher yields. An increase in cob yield with boron application was also reported by Rakesh and Bohra [10]. Foliar spray and integrated fertilizer application resulted in significant improvement in overall crop growth by providing the required nutrients from the initial stage and increasing the supply of N, P and K in a more synchronized manner in the treatment with integrated nutrient supply from organic manure, together with inorganic fertilizers and which are expressed as plant height, number of cobs per plant, cob girth, cob length, cob weight with and without husk due to increased photosynthetic efficiency. Thus, it appears that greater availability of plant metabolites and nutrients for the development of reproductive structures resulted in increases in productive plants, cob girth, cob length, and cob weight with these nutrient management adjustments. Similar results were also reported by Rani et al*.* [11] and Roopashree et al*.* [12].

Table 2. Effect of nitrogen and boron on yield attributes of babycorn

Treatment combinations		Cob yield without husk (kg/ha)	Cob yield with husk (kg/ha)
1	Nitrogen 40 kg/ha + Boron 3 kg/ha	1446.10	3033.59
2	Nitrogen 40 kg/ha + Boron 5 kg/ha	1471.99	3046.48
3	Nitrogen 40 kg/ha + Boron 7 kg/ha	1482.23	3094.69
4	Nitrogen 50 kg/ha + Boron 3 kg/ha	1459.04	3038.74
5	Nitrogen 50 kg/ha + Boron 5 kg/ha	1464.89	3041.66
6	Nitrogen 50 kg/ha + Boron 7 kg/ha	1473.61	3061.16
7	Nitrogen 60 kg/ha + Boron 3 kg/ha	1480.33	3091.21
8	Nitrogen 60 kg/ha + Boron 5 kg/ha	1491.61	3097.89
9	Nitrogen 60 kg/ha + Boron 7 kg/ha	1498.59	3110.46
10	Control (100:60:40 NPK kg/ha)	1427.41	3008.54
	F test	S	S
	SEm (±)	2.93	5.25
	CD (P=0.05)	8.78	15.72

4. CONCLUSION

From the experimental findings, it can be concluded that the application of (1498.59 kg/ha) in Nitrogen 60 kg/ha + Boron 7 kg/ha. However, Nitrogen 60 kg/ha + Boron 5 kg/ha (1491.61 t/ha) treatment was stood statistically at par with Nitrogen 60 kg/ha + Boron 7 kg/ha.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/104626