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Effect of basal application of zinc and foliar application of boron on growth, yield and economics of maize (*Zea mays* L.)

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Abstract

A field experiment was conducted during the *Kharif* season of 2025 at the Instructional Farm, College of Agriculture, Bhilwara, Rajasthan, to evaluate “Effect of Basal Application of Zinc and Foliar Application of Boron on Growth and Yield of Maize (*Zea mays* L.)”. The experiment was laid out in a Factorial Randomized Block Design (FRBD) with three replications comprising fifteen treatment combinations. The experiment comprised of 16 treatment combinations and 3 replications comprising four levels of zinc Zn₀ (Control), Zn₁ (5 kg ha⁻¹), Zn₂ (10 kg ha⁻¹) and Zn₃ (15 kg ha⁻¹) and four levels of boron. B₀ (Control), B₁ (0.5%), B₂ (1.0%), B₃ (1.5%). The results revealed that basal application of zinc and foliar application of boron significantly improved growth, yield attributes, yield, quality, nutrient content, nutrient uptake and economics of maize. Among the treatment combinations basal application of zinc @ 15 kg ha⁻¹ along with foliar application of boron @ 1.5% recorded the highest dry matter accumulation (204.33g), grain yield (5596.52 kg ha⁻¹) and net return (136446 Rs ha⁻¹), indicating better crop performance and higher economic profitability under the experimental conditions.

Keywords: Basal application, foliar application, zinc, boron, grain yield, economics

Introduction

Maize (*Zea mays* L.) belongs to the Poaceae family, a cross-pollinated and short-day crop that grows well in tropical and subtropical climatic conditions. Maize (*Zea mays* L.) is the third most important cereal crop after wheat and rice both in India and globally. Often referred to as the “miracle crop” due to its high genetic yield potential compared to other Poaceae family members (Jose *et al.*, 2022) [1]. Nutritionally, maize grain contains around 60 per cent carbohydrates, 10 per cent protein, 4.5 per cent oil, 3.5 per cent fibre and 2 per cent minerals. In minerals it provides 348 mg of phosphorus, 286 mg of potassium, 114 mg of magnesium, 10 mg of calcium, 2.3 mg of iron and 90 micrograms of carotene 100-1 grams of grain (Nikhel and Salakinkop, 2018) [2]. It contains vitamin C, vitamin E, vitamin K, vitamin B1 (thiamine), vitamin B2 (niacin), vitamin B3 (riboflavin), vitamin B5 (pantothenic acid), vitamin B6 (pyridoxine), folic acid and selenium. It serves as a key cereal for livestock feed and is also a staple food for people in Asia, Africa and Latin America. Maize grains are used in various forms such as roti, rawa, maida, popcorn and industrial products like protein foods, glucose powder and starch. Maize stover is an excellent cattle fodder, earning it the titles “queen of cereals” and “king of fodder crops.”

The current consumption pattern of maize in India includes poultry feed 52 percent, human food 24 per cent, animal feed 11 per cent and more than 22 per cent going towards industrial processing, with the growing demand of poultry feed the demand for maize is also going up in the country. Zinc is essential for early crop growth, achieving full yield and timely harvest, as it improves pollen quality, giving more and heavier kernels, especially at the top of the ear which improve growth, yield and grain quality.

Studies conducted in Malaysia found that zinc increased ear diameter, length and kernel rows. Zinc also helps in chlorophyll formation, photosynthesis, protein production and nutrient uptake, thereby promoting better crop and resulting more and heavier kernels. Zinc (Zn) regulates various physiological and biochemical processes in plants, plant growth-promoting bacteria (PGPB) help in increasing Zn absorption and nutrient utilization efficiency (Jalal *et al.*, 2024) [3].

Deficiency of Zn in soil causes deficiency in crops and altogether this has become a problem all over the world with acute zinc deficiency ranges in arid to semi-arid regions of the world. Zinc deficiency in maize is characterized by yellow or whitish bands along the leaf midrib, while the leaf margins remain green and newly emerging leaves may develop a characteristic “white bud” appearance. In severe cases, reddish-brown dead patches can appear on lower leaves or stems and affected plants often exhibit stunted. Maize needs all essential plant nutrients but zinc is especially important. The application of Zn as a foliar spray helps increase zinc in the grain. To increase zinc in maize grain, the first step is fertilizing the crop but zinc from the soil is often hard for roots to absorb. Soils may naturally lack zinc or it may be “locked” and unavailable. The high organic matter, alkaline soils (high pH) or high phosphorus make the problem worse. Cold, wet weather and drought also reduce zinc availability.

Currently, various methods of Zn application are used in maize production. These methods have been shown to significantly increase total biomass and maize grain yield by more than 22% and enhance Zn concentration in the grain. The main application methods include seed soaking, foliar spraying, and soil application. Among these, soil application allows for higher Zn input, offers residual availability in soils that do not strongly fix Zn and helps establish a long-term nutrient reservoir (Khongchiu *et al.*, 2025) [4].

Boron (B) is an important micro-element and due to its importance as a structural element of the cell wall, it is regularly required for plants throughout their life. Boron during flower pollination is required for the pollen tube growth and is therefore essential for better fruit development. Its application activated enzymes and subsequently enhanced carbon fixation. Thus, increasing photosynthesis and improving the accumulation of dry matter in vegetative parts. It is important for cell wall and cytokinin formation, cell division, sugar metabolism and transportation, indole acetic acid (IAA) and ribose nucleic acid metabolism, seed germination and formation. B helps to maintain the integrity of plant cell membranes, which increases the ability of membranes to transport essential nutrients, different B treatments had a substantial impact on micronutrient uptake. Boron deficiency in crops is more widespread than that of the other micronutrients. Deficiency symptoms of boron can be observed in vegetative and reproductive parts such as inhibition of growth of shoot and root tips, flower development, reduced setting and malformation of seeds.

Materials and Methods

Location and Climate of the Experimental Site

Bhilwara district has semi-arid climate with an average annual rainfall of 657 mm, mostly occurring during the South-West monsoon from July to October. Mean weekly meteorological data for the crop season was gathered from the Agro Meteorological Observatory of Dryland Farming Research Station (DFRS), Arjia, Bhilwara. During the crop growth season, the mean maximum and minimum temperatures varied from 28.0 to 40.9 °C and 19.3 to 27.5 °C, respectively. On the other side, the mean maximum and minimum relative humidity was 84.7 to 64.0 per cent and 26.0

to 81.1 per cent, respectively. During the kharif season in 2025, the mean sunshine hours ranged from 1.0 to 8.7 and evaporation fluctuated between 0.0 to 9.0 mm. The total amount of rainfall recorded during the crop growing season was 1,009 mm.

Physico-Chemical Characteristics of the Soil

The soil texture in the experimental field was clay-loam soil, slightly alkaline in reaction, medium in organic carbon, low in available nitrogen, medium in available phosphorus and high in available potassium status. The soil pH was 7.32, indicating an alkaline reaction. In 2025-26, the soil had a medium level of organic carbon (0.56%), low level of available nitrogen (220.50 kg ha⁻¹), medium level of available phosphorus (15.70 kg ha⁻¹), high level of available potassium (310.60 kg ha⁻¹), low level of Available zinc content (0.60 mg kg⁻¹) and low level of available boron content (0.29 mg kg⁻¹).

Table 1: Treatment details

A.	Zinc levels (04)		Symbols
1.	Control	:	Zn ₀
2.	5 kg ha ⁻¹	:	Zn ₁
3.	10 kg ha ⁻¹	:	Zn ₂
4.	15 kg ha ⁻¹	:	Zn ₃
B.	Boron Levels (04)		
1.	Control	:	B ₀
2.	0.5%	:	B ₁
3.	1.0%	:	B ₂
4.	1.5%	:	B ₃

Results and Discussion

Growth parameters

Effect of basal application of zinc

Basal application of different zinc levels greatly influenced Plant height, dry matter accumulation, crop growth rate (CGR) and net assimilation rate (NAR) were, however, significantly influenced by zinc levels at almost every stage of crop growth. Application of Zn @ 15 kg ha⁻¹ consistently produced the tallest plants (48.70, 178.04 and 190.03 cm at 25, 50 and at harvest) and the highest dry matter accumulation (13.14, 46.73, 95.04 and 191.06 g plant⁻¹ at 25, 50, 75 DAS and harvest, respectively), remained statistically at par with Zn @ 10 kg ha⁻¹ at all stages. The CGR followed a similar trend, being maximum during 50-75 DAS and 75 DAS-harvest under Zn @ 15 kg ha⁻¹ (14.14 and 22.70 g m⁻² day⁻¹), although during the early 25-50 DAS Zn @ 10 kg ha⁻¹ recorded the highest value (9.71 g m⁻² day⁻¹), statistically at par with Zn @ 15 kg ha⁻¹. The NAR was found maximum under Zn @ 15 kg ha⁻¹ throughout the growth period and relative growth rate (RGR), in contrast, during 25-50 DAS, highest RGR (0.057 g g⁻¹ day⁻¹) was recorded under Zn @ 5 and 10 kg ha⁻¹, 50-75 DAS, the maximum RGR (0.030 g g⁻¹ day⁻¹) was recorded under Zn @ 15 kg ha⁻¹ which remained statistically at par with Zn @ 5 and 10 kg ha⁻¹ and during 75 DAS to harvest, the highest RGR (0.026 g g⁻¹ day⁻¹) was observed under Zn @ 10 kg ha⁻¹. Days to 50 per cent tasselling and silking remained statistically unaffected by zinc levels, indicating that phenological development in maize is governed more by genetic make-up and prevailing agro-climatic conditions than by zinc nutrition.

The marked improvement in growth parameters under higher zinc levels may be attributed to the pivotal physiological role of zinc as an essential micronutrient. Zinc is a structural and catalytic component of several enzymes, including carbonic anhydrase and various dehydrogenases and it is indispensable for the biosynthesis of tryptophan, the precursor of the growth hormone indole-3-acetic acid (IAA). Adequate zinc supply thus promotes

cell division and cell elongation, resulting in greater plant height. Zinc is also intimately associated with chlorophyll synthesis and the integrity of ribosomes, which favours higher photosynthetic efficiency, more vigorous cell metabolism and consequently, greater dry matter accumulation, CGR and NAR because zinc mainly influences metabolic efficiency rather than the ratio of new growth to existing biomass. Its effect on RGR remained largely non-significant and because tasselling and silking are strongly governed by the genetic constitution of the hybrid variety and by temperature and photoperiod, these phenological traits were unaffected by zinc nutrition. Similarly, improvement in growth attributes of maize with graded zinc application has been reported by Kumar *et al.* (2019) [5], who recorded taller plants and higher dry matter accumulation with soil-applied zinc, by Reddy *et al.* (2019) [6], who observed maximum plant height, functional leaves and dry matter accumulation with combined N and Zn application and by Ram *et al.* (2023) [7], who reported the highest plant height and dry matter accumulation in maize with basal Zn @ 15 kg ha⁻¹.

Effect of foliar application of boron

Basal application of different zinc levels greatly influenced Plant height, dry matter accumulation, crop growth rate (CGR) and net assimilation rate (NAR) were, however, significantly influenced by zinc levels at almost every stage of crop growth. Application of Zn @ 15 kg ha⁻¹ consistently produced the tallest plants (48.70, 178.04 and 190.03 cm at 25, 50 and at harvest) and the highest dry matter accumulation (13.14, 46.73, 95.04 and 191.06 g plant⁻¹ at 25, 50, 75 DAS and harvest, respectively), remained statistically at par with Zn @ 10 kg ha⁻¹ at all stages. The CGR followed a similar trend, being maximum during 50-75 DAS and 75 DAS-harvest under Zn @ 15 kg ha⁻¹ (14.14 and 22.70 g m⁻² day⁻¹), although during the early 25-50 DAS Zn @ 10 kg ha⁻¹ recorded the highest value (9.71 g m⁻² day⁻¹), statistically at par with Zn @ 15 kg ha⁻¹. The NAR was found maximum under Zn @ 15 kg ha⁻¹ throughout the growth period and relative growth rate (RGR), in contrast, during 25-50 DAS, highest RGR (0.057 g g⁻¹ day⁻¹) was recorded under Zn @ 5 and 10 kg ha⁻¹, 50-75 DAS, the maximum RGR (0.030 g g⁻¹ day⁻¹) was recorded under Zn @ 15 kg ha⁻¹ which remained statistically at par with Zn @ 5 and 10 kg ha⁻¹ and during 75 DAS to harvest, the highest RGR (0.026 g g⁻¹ day⁻¹) was observed under Zn @ 10 kg ha⁻¹. Days to 50 per cent tasselling and silking remained statistically unaffected by zinc levels, indicating that phenological development in maize is governed more by genetic make-up and prevailing agro-climatic conditions than by zinc nutrition.

The favourable response of growth parameters to increasing boron levels can be explained by the essential and largely non-substitutable role that boron plays in cell-wall synthesis and structural integrity, cell division and the maintenance of membrane function. Boron forms borate-diol complexes with cell-wall polysaccharides, which are essential for normal cell elongation and division, and it also facilitates the translocation of sugars across cell membranes by forming sugar-borate complexes, thereby improving the movement of photosynthates to actively growing regions. This would explain the consistent improvement in plant height and dry matter accumulation with increasing boron supply. The slightly declining trend in RGR with higher boron levels during the later growth phase is a common physiological pattern in fast-growing crops, since RGR is expressed relative to existing biomass as boron-treated plants had already accumulated substantially more biomass by this stage, any further absolute increment represents a smaller proportional (relative) gain, even though the absolute CGR remained higher.

As with zinc, tasselling and silking dates, being largely under genetic and environmental control remained unaffected by boron nutrition. These results are consistent with the findings of Ram *et al.* (2023) [7], who recorded the highest plant height, number of leaves plant⁻¹ and dry matter accumulation in maize with foliar boron @ 1.5% and of Haque (2025) [8], who reported that foliar boron improved plant height, dry matter accumulation and crop growth rate of maize.

Yield attributes and yield

Effect of basal application of zinc

Zinc application significantly improved grain yield (5508 kg ha⁻¹), stover yield (6144 kg ha⁻¹) and biological yield (11653 kg ha⁻¹) under Zn @ 15 kg ha⁻¹, which remained statistically at par with Zn @ 10 kg ha⁻¹. Harvest index was not significantly affected by zinc levels, although the highest value (47.36%) was recorded under Zn @ 15 kg ha⁻¹. The significant enhancement in yield attributes and yield with increasing zinc levels may be ascribed to the fact that yield is ultimately the cumulative expression of growth achieved during the vegetative phase. Zinc, by improving auxin synthesis, cell division, chlorophyll formation and photosynthetic efficiency during the vegetative stage, created a larger source (greater leaf area and dry matter) capable of supplying more assimilates to the developing sink (cob), which is reflected in a greater number of grain rows, grains row⁻¹ and heavier, longer cobs. Zinc also plays a key role in pollen viability, fertilisation and grain-filling processes through its involvement in auxin metabolism and enzyme activation, which is consistent with the improvement in cobs plant⁻¹ and test weight. The harvest index reflects the proportion of biomass partitioned to the economic sink. Zinc improved both biological yield and grain yield proportionately. Therefore, the non-significant response of harvest index indicates that zinc increased overall productivity without altering the fundamental source-sink partitioning pattern. These findings corroborate the reports of Wasaya *et al.* (2017) [9], who recorded improved cob length, grains cob⁻¹, test weight, biological yield and harvest index of maize with foliar and soil zinc application, Ladumor *et al.* (2019) [10], who observed the highest cobs plant⁻¹, rows cob⁻¹, cob weight and grain yield with zinc seed treatment and Ram *et al.* (2023) [7], who reported the maximum cob length, cob girth, rows cob⁻¹, grains row⁻¹ and test weight of maize with soil-applied Zn @ 15 kg ha⁻¹.

Effect of foliar application of boron

Foliar application of boron significantly improved the grain yield (5378 kg ha⁻¹ and 17.63% over control), stover yield (6238 kg ha⁻¹ and 16.51% over control) and biological yield (11616 kg ha⁻¹ and 17.02% over control) were all significantly higher under B @ 1.5%, statistically at par with B @ 1.0%. Harvest index did not differ significantly among boron levels. The pronounced improvement in yield attributes with foliar boron application may primarily be ascribed to the well-established role of boron in reproductive biology. Boron is essential for pollen germination and pollen-tube elongation for the viability of the male gametophyte and for proper fertilisation and its deficiency is a well-documented cause of poor grain set in cereals. Adequate boron supply at the critical reproductive stages of maize would therefore be expected to improve cob-filling, the number of grain rows⁻¹ and grains row⁻¹ and ultimately cob weight and test weight as observed in the present investigation. Boron also promotes the translocation of photosynthates from source leaves to the developing cob by facilitating sugar transport across membranes which would further explain the concurrent increase in cob weight, grain weight cob⁻¹ and consequently, grain yield. The

parallel improvement in stover and biological yield, coupled with a non-significant response of harvest index, suggests that boron enhanced overall dry-matter production and its efficient conversion into economic yield without appreciably altering the proportion of assimilates partitioned to the grain. These findings are in agreement with those reported by Tahir *et al.* (2018) ^[11], who recorded the highest cob length, cob weight, grains cob⁻¹, grain yield and biological yield of maize with foliar borax application, Ram *et al.* (2023) ^[14], who observed the maximum grains cob⁻¹, cob length, cob girth, rows cob⁻¹, grains row⁻¹ and test weight of maize with foliar boron @ 1.5% and Haqua (2025), who reported a gradual improvement in grain yield, stover yield and yield-contributing characters of maize with increasing foliar boron levels.

Economics

Effect of basal application of zinc

Basal application of zinc significantly influenced the economics of maize cultivation. The highest net return (₹ 131837 ha⁻¹ and 24.52% over control) and B-C ratio (3.66) were recorded under Zn @ 15 kg ha⁻¹, remaining statistically at par with Zn @ 10 kg ha⁻¹ (net return ₹ 124842 ha⁻¹ and B-C ratio 3.53).

The higher profitability associated with increasing zinc levels was primarily a consequence of the substantial improvement in grain and stover yield described above which more than compensated for the relatively small additional cost incurred on zinc fertiliser. Since the cost of basal zinc application is comparatively low in relation to the value of the additional produce obtained, the marginal increase in cultivation cost was outweighed by the marginal increase in gross return, resulting in a progressively better B-C ratio with increasing zinc levels. Similar improvement in net return and B-C ratio with zinc application has been reported by Humtsoe *et al.* (2018) ^[12], who recorded higher gross returns, net returns and B-C ratio in maize with basal zinc @ 25 kg ha⁻¹ and by Ram *et al.* (2023) ^[7], who reported that soil-applied zinc significantly improved the economics of maize.

Effect of foliar application of boron

Foliar application of boron significantly improved the economics of maize cultivation. The highest net return (₹ 129846 ha⁻¹ and 22.47% over control) and B-C ratio (3.68) were recorded under B @ 1.5%, remaining statistically at par with B @ 1.0% (net return ₹ 126097 ha⁻¹ and B-C ratio 3.60).

Since foliar boron sprays involve a relatively low input cost compared with the substantial gain in grain and stover yield they generated, the additional expenditure on boron was more than offset by the value of the additional produce, resulting in a favourable B-C ratio that improved progressively with increasing boron level. These findings corroborate the reports of Kumar *et al.* (2019) ^[5], who recorded the highest gross returns, net returns and B-C ratio in maize with combined zinc and boron application and of Saleem *et al.* (2020) ^[13], who reported the maximum net return and B-C ratio with foliar boron @ 1.5% in a cereal crop grown on calcareous soil.

This expectation is well supported by earlier work in which zinc and boron were applied together to maize. Wasaya *et al.* (2017) ^[9] reported that the combined foliar and soil application of zinc and boron improved the overall productivity and net return of maize grown under rainfed conditions of the Pothwar plateau more than either nutrient alone. Kumar *et al.* (2019) ^[5] found that soil application of Zn @ 5 kg ha⁻¹ together with B @ 0.5 kg ha⁻¹ produced the highest gross return, net return and B-C ratio in maize among all the treatments tested, indicating a favourable joint effect of the two micronutrients. Similarly, Ram *et al.* (2023)

^[14] recorded the highest profitability in maize - the maximum gross return, net return and B-C ratio -under the combined treatment of Zn @ 15 kg ha⁻¹ with foliar B @ 1.5%, superior to either nutrient applied at a lower level. These reports lend strong support to the expectation of a synergistic zinc-boron interaction in the present investigation once the corrected interaction data are confirmed.

Table 1: Effect of basal application of zinc and foliar application of boron on DMA of maize

Treatments	Dry matter accumulation (gm plant ⁻¹)			
	25 DAS	50 DAS	75 DAS	At harvest
Zinc levels (kg ha⁻¹)				
Control	10.08	40.70	80.70	143.86
Zn@05	11.07	45.39	93.01	174.93
Zn@10	11.50	47.93	98.61	187.48
Zn@15	12.21	48.27	101.30	191.06
S.Em. ±	0.25	1.02	1.81	2.76
C.D. at 5%	0.72	2.96	5.25	8.01
Boron levels (%)				
Control	9.25	39.39	81.82	159.48
B@0.5	11.04	44.81	89.60	168.82
B@1.0	12.01	47.32	99.95	183.70
B@1.5	12.57	50.78	102.26	185.32
S.Em. ±	0.25	1.02	1.81	2.76
C.D. at 5%	0.72	2.96	5.25	8.01

Table 1a: Interaction effect of zinc and boron levels on dry matter accumulation at harvest

Treatments	Boron levels (%)			
	Control	0.5 %	1.0 %	1.5 %
Zinc levels (kg ha⁻¹)				
Control	137.06	140.89	146.04	151.45
5 kg ha ⁻¹	159.54	163.52	188.25	188.40
10 kg ha ⁻¹	170.14	195.75	186.92	197.12
15 kg ha ⁻¹	171.17	175.15	213.60	204.33
S. Em.±	5.52			
CD at 5%	16.02			

Table 2: Effect of basal application of zinc levels and foliar application of boron levels on yield and harvest index of maize

Treatments	Yield (kg ha ⁻¹) HI (%)			
	Grain yield	Stover yield	Biological yield	
Zinc levels (kg ha⁻¹)				
Control	4518.9	5430.9	9949.8	45.38
Zn@05	4992.6	5782.8	10775.5	46.26
Zn@10	5243.9	5912.3	11156.2	47.02
Zn@15	5508.4	6144.2	11652.5	47.36
S.Em. ±	107.7	126.3	164.5	0.78
C.D. at 5%	312.7	366.6	477.4	NS
Boron levels (%)				
Control	4571.8	5354.0	9925.8	46.01
B@0.5	5037.1	5731.6	10768.7	46.75
B@1.0	5276.9	5946.3	11223.2	46.97
B@1.5	5377.9	6238.3	11616.2	46.29
S.Em. ±	107.7	126.3	164.5	0.78
C.D. at 5%	312.7	366.6	477.4	NS

Table 2a: Interaction effect of zinc and boron levels on grain yield

Treatments	Boron levels (%)			
	B ₀ : Control	B ₁ : 0.5	B ₂ : 1.0	B ₃ : 1.5
Zinc levels (kg ha⁻¹)				
Zn ₀ : Control	4271.33	4629.62	4434.36	4740.10
Zn ₁ : 5	4253.41	4795.49	5530.67	5390.97
Zn ₂ : 10	4446.94	5010.15	5734.41	5784.00
Zn ₃ : 15	5315.64	5713.19	5408.18	5596.52
S. Em.±	215.49			
C. D. (P= 0.05)	625.38			

Table 3: Effect of basal application of zinc levels and foliar application of boron levels on economics of maize

Treatments	Economics		
	Gross return (₹ ha ⁻¹)	Net return (₹ ha ⁻¹)	B-C ratio
Zinc levels (kg ha ⁻¹)			
Control	139674.1	105881.6	3.13
Zn@05	153230.8	118688.3	3.43
Zn@10	160134.1	124841.6	3.53
Zn@15	167879.5	131837.0	3.66
S.Em. ±	2744.6	2744.8	0.079
C.D. at 5%	7965.2	7965.9	0.229
Boron levels (%)			
Control	140608.7	106028.7	3.06
B@0.5	154081.9	119276.9	3.42
B@1.0	161126.5	126096.5	3.60
B@1.5	165101.4	129846.4	3.68
S.Em. ±	2744.6	2744.8	0.079
C.D. at 5%	7965.2	7965.9	0.229

Table 3a: Interaction effect of zinc and boron levels on net return (Rs ha⁻¹) of maize

Treatments	Boron levels (%)			
Zinc levels (kg ha ⁻¹)	B ₀ : Control	B ₁ : 0.5	B ₂ : 1.0	B ₃ : 1.5
Zn ₀ : Control	98418	109399	103203	112507
Zn ₁ : 5	100750	111763	132846	129394
Zn ₂ : 10	100581	118011	139736	141039
Zn ₃ : 15	124367	137935	128600	136446
S. Em. ±	5490			
C. D. (P= 0.05)	15932			

Conclusion

The present investigation revealed that different nutrient management treatments significantly influenced the growth, yield attributes, productivity, nutrient uptake, nutrient use efficiency and economics of Maize. Based on the findings of the present investigation concluded that basal application of zinc @ 15 kg ha⁻¹ superior and recorded the highest grain yield, stover yield, biological yield, protein content, nutrient uptake, net return and B-C ratio (3.66). However, its effect remained statistically at par with Zn @ 10 kg ha⁻¹ for most of the parameters studied. Similarly, with B @ 1.5% recorded maximum growth, productivity, quality parameters, nutrient uptake and economic return, resulting in the highest seed yield, stover yield, biological yield, net return and B-C ratio (3.68), though it remained statistically at par with B @ 1.0% (B₂), for most of the observations. The combined application of 10 kg Zn ha⁻¹ + 1.5% boron recorded highest grain yield (5784.00 kg ha⁻¹) and net return (₹141039 ha⁻¹) which was superior to the control.

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