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EFFECT OF AGRONOMIC BIOFORTIFICATION OF IRON ON THE GROWTH, YIELD AND QUALITY OF MAIZE (*ZEA MAYS* L.)

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A B S T R A C T

Managing nutrients is a crucial aspect of achieving optimal growth, yield, and quality characteristics. A field experiment was carried out to assess the impact of agronomic bio-fortification with iron on the growth, yield, and quality of maize. The experiment was laid out in RCBD with three replications. The maize variety Akbar was subjected to thirteen treatments alone and in combination of soil and foliar treatments. The present results showed that all growth, yield, and quality traits of the maize crop were significantly ($P<0.05$) influenced by different soils and foliar applications of iron. The maximum weight per cob (113.89 g) was achieved with the combination of soil and foliar iron at a rate of 4 kg ha-1 + 0.2%, statistically comparable to the treatment at 4 kg ha-1 + 0.1%, which yielded 112.87 g per cob. Similarly, the heaviest 1000 grain weights (277.17 g) were obtained with soil and foliar iron at 4 kg ha-1 + 0.2%, closely followed by the 4 kg ha-1 + 0.1% treatment, producing 276.43 g per 1000 grains. Both these iron application treatments at 4 kg ha-1 + 0.2% and 4 kg ha-1 + 0.1% resulted in higher biological yields (14400.11 and 13389.31 kg ha-1, respectively) of maize, with no significant difference observed compared to treatments at 3 kg ha-1 + 0.2% and 3 kg ha-1 + 0.1% yielding 12196.37 and 12164.55 kg ha-1, respectively. The maximum grain yield of 4596.26 kg ha-1 was attained with the application of soil and foliar iron nutrients at 4 kg ha-1 + 0.2%, a result statistically similar to the treatment at 4 kg ha-1 + 0.1%, which yielded 4574.13 kg ha-1 for maize. However, minimum results of all investigated traits of maize were observed in the control treatment. Based on the results of this study, it is concluded that applying iron at 4 kg ha-1 + 0.2% and 4 kg ha-1 + 0.1% to maize crops yielded more beneficial outcomes in terms of both quantity and quality traits compared to other treatments.

Keywords: Fertilizers; Growth; Maize; Iron; Quality; Yield

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INTRODUCTION

Maize (*Zea mays* L.) holds the distinction of being the third most significant cereal crop globally, following rice and wheat, within the agricultural economy. It serves as both a staple food for humans and a crucial feed for livestock. Earning the title of the 'queen of cereals,' maize stands out due to its remarkable yield potential, reaching up to 22 tons per hectare, surpassing other cereals. Its versatile application in various agro-industries further enhances its importance. Recognized as a prominent commercial crop with substantial economic value, maize is cultivated across the globe, covering approximately 185 million hectares. The global production amounts to 1018 million metric tons, with a productivity rate averaging 5.49 metric tons per hectare (FAO, 2021). In Pakistan, maize holds the third position in agricultural importance, following wheat and rice, with approximately 98% of the crop cultivated in Punjab and NWFP. The country dedicates around 1.11 million hectares to maize cultivation, resulting in an annual grain production of 4.04 million tons and an average yield of 3.62 tons per hectare (Pandey et al., 2021). The optimal nutritional balance of plants stands as a primary factor influencing both

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crop yield and quality. Several factors contribute to the constrained average yield of maize crops, including insufficient use of fertilizers, water stress, suboptimal plant density, weed infestation, insect pest attacks, and inadequate selection of suitable varieties (Huang et al., 2021). Low soil fertility is a primary factor affecting crop productivity across different agronomic zones (Otieno et al., 2023), which cannot supply the required nutrients in sufficient quantities to plants for growth and development (Folorunso et al., 2023). Hence, it is increasingly crucial to utilize the appropriate or necessary quantities of macro and micronutrients sourced from various fertilizers to address this requirement (Zubairu et al., 2023). Conversely, it is widely acknowledged that micronutrient deficiencies in the soil of arid and semi-arid regions can constrain yields and significantly disrupt both plant productivity and quality (Kumar et al., 2023). One of the most significant limitations to agricultural production worldwide is the continuous need for plants to receive an adequate supply of iron to sustain proper growth (Younas et al., 2023). Moreover, iron deficiency chlorosis is a nutritional disorder characterized by a significant decrease in chlorophyll levels in the leaves. This condition is frequently seen in plants grown in alkaline and calcareous soils (Zuluaga et al., 2023). In this context, the iron nutrient is essential for healthy growth and life cycle completion of crop plants, and it plays an active role in several enzymatic activities of photosynthesis (Toor et al., 2023). Furthermore, iron plays a role in plant energy transfer within the plant, enters root cells, is involved in nitrogen fixation, and is a constituent of certain enzymes and proteins (Nisar et al., 2019). Therefore, iron (Fe) is heavily required for the proper growth and yield of maize plants (Goredema-Matongera et al., 2023). The impact of foliar iron application has shown variability, with instances of success in reducing chlorosis symptoms in crops and enhancing yield reported at certain locations (Iqbal et al., 2022). This field study was structured to assess the impact of foliar applications of zinc, boron, and iron on the seed yield and quality of sweet corn.

MATERIALS AND METHODS

Experimental site

The field experiment was located in the lower region of Sindh, Pakistan, and has a geographical location of 25.4299° N latitude and 68.5426° E longitude.

Meteorological condition

The maximum average temperature of 42.41 °C and 39.92 °C was recorded in the months of May and June, respectively. The minimum average temperature of 24.74 °C and 23.04 °C was observed in the months of August and September. Further, the data on average monthly mean relative humidity and rainfall are also shown in Figure 1.

Soil characteristics

Composite soil samples were collected from different depths before maize sowing and before fertilization (0–15 cm). The samples were ground and air dried before being run through a 2 mm sieve for their determination of physical and chemical characteristics such as total N (%), available P and K (mg kg-1), soil pH, soil EC, and organic matter at the Central Analytical Laboratory, Directorate of Soil Salinity and Reclamation Research Institute, Tandojam, as given in Table 1.

Table 1. The physical and chemical properties of the soil used in the experiment were evaluated.

Soil characteristics	Pre-sowing soil analysis	Post-harvest soil analysis
Soil texture class	Silty clay loam	Silty clay loam
EC (dS m^{-1})	1.21	0.99
Soil pH	7.8	7.7
Total N (%)	0.07	0.09
Available P (mg kg^{-1})	0.83	0.85
Available K (mg kg^{-1})	74. 0	111
Organic matter (%)	0.67	0.72

Land preparation and cultural practices

The current experiment was organized using a randomized complete block design, employing three replications. The experimental treatments were comprised of soil + foliar iron application, such as T1: Control, T2: 3 kg ha^{-1}, T3: 4 kg ha^{-1}, T4: 5 kg ha^{-1}, T5: 6 kg ha-^{1}, T6: 0.1%, T7: 0.2%, T8: 0.3%, T9: 0.4%, T10: 3 kg ha^{-1} + 0.1%, T11: 3 kg ha^{-1} + 0.2%, T12: 4 kg ha^{-1} + 0.1%, T13: 4 kg ha^{-1} + 0.2%. The recommended dose of fertilizer for inorganic NPK (200–100–80 kg ha1) was applied. The land was Initially done properly at recommended depth ploughs to remove the hard pan for better root penetration and for equal distribution of irrigation and fertilizer. After crushing the clods, the dry weeds and stubbles were removed. Furthermore, a disc harrow was used to break the hard pan, followed by final precision land leveling and planking. The rotavator was used to finalize the seedbed. Plots were developed according to the layout plan. A total of twelve irrigations were applied; the first irrigation was applied at sowing time, the second irrigation was applied after the fifth day of sowing, and the remaining irrigations were applied at 15-day intervals. The crop was kept free of weeds by mechanical means and had no chemical control. In this regard, five hoeing practices were applied throughout the growing season. First, second, and third hoeing practices were applied before 2nd, 3rd, and 4th irrigation. Fourth and fifth hoeing were done before and after the tasselling of the maize crop. The entire mineral fertilizers, such as phosphorus, potassium, and 1/4th of nitrogen in the form of DAP, SOP, and urea, respectively, were applied at sowing time, and the remaining 1/4th was reached at the knee height stage, 1/4th at the pollination stage, and the remaining 1/4th was applied at the grain filling stage.

Evaluation of growth and yield traits

Plant height (cm)

The height of the plant was measured through a measuring tape and was considered from ground level to the collar of the upper leaf.

Leaves plant^{-1}

The average number of leaves per plant was determined by randomly selecting 25 plants from each treatment and counting their leaves.

Stem girth (cm)

At the time of harvest, the stem girth (in centimeters) was measured using a measuring tape at the top, middle, and bottom of the stem, and the average was calculated.

Cobs plant^{-1}

The average cob number plant^{-1} was computed by counting the number of cobs plant-1 from each plot.

Cob girth (cm) and cob length (cm)

After harvesting, cob girth and cob length (cm) were noted by the measuring tape, and cob girth was measured for randomly selected cobs from each plot.

Grains cob^{-1}

Grains cob^{-1} were separated and then counted from selected randomly selected cobs of each treatment plot.

1000 grain weight (g)

Thousand-grain weight was assessed by randomly selecting shelled ears from each treatment, and then the average weight was recorded using an electric balance.

Biological yield (kg/ha) to ascertain the biological yield per plot, the weight of all foliage and grains from each plot of the maize crop was measured. Subsequently, this measurement was converted into biological yield per hectare in kilograms the formula employed to calculate the biological yield (kg/ha) was

$$\text{Biological yield}\left(\frac{\text{kg}}{\text{ha}}\right) = \frac{\text{Biological yield per plot (kg)}}{\text{Plot size (m}^2)} \times 10{,}000$$

Grain yield (kg ha^{-1})

Upon reaching full physiological maturity, each treatment plot was harvested. The ears were dehusked, dried, and subsequently threshed. The total grain weight of the sampled material was recorded and converted into grain yield per hectare.

$$\text{Grain yield (kg/ha)} = \frac{\text{grain yield per plot (kg)}}{\text{plot size (m} - 2)} \times 10{,}000$$

Statistical analysis

The data collected during the research were statistically analyzed using the analysis of variance technique (Fisher, 1950) to assess the effects of combined fertilizers on the growth and yield parameters of maize. To assess the statistical significance of the mean differences between treatments, a least significant difference (LSD) test was performed at a 0.05 probability level (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Leaves plant^{-1}

The results of leaf plant^{-1} under different levels of iron applications as soil and foliar were applied are depicted in table 2. Analysis of the data revealed that the applications of soil and foliar iron treatments were significantly affected on leaf plant 1 of maize. The increasing level of iron in the soil and foliar application produced significantly higher leaves per plant as compared to the decreasing level of iron application. Maximum leaves plant^{-1} (14.96 and 14.83) were observed under the application of soil and foliar iron nutrients at 4 kg ha^{-1} + 0.2% and @ 4 kg ha^{-1} + 0.1%; these were statistically at par with @ 3 kg ha^{-1} + 0.2% and @ 3 kg ha^{-1} + 0.1% of soil and foliar iron nutrient, respectively, which provided higher leaves plant^{-1} (13.73 and 13.02) of maize crop than lower leaves plant^{-1} (10.26) were observed where fertilizer was not applied (control). This was primarily attributed to a heightened metabolic rate, leading to a greater number of leaves per plant during the entire growth period of maize (Jolli et al., 2020). Our results are confirmed by the findings of those who observed that improving all the growth attributes is a result of increased activity of many enzymes and photosynthesis, leading to an increased number of leaves per plant.

Stem girth (cm)

Stem girth (cm) is an important parameter that determines the growth of maize plants, while stem girth (cm) of maize was significantly affected by both soil and foliar application of iron nutrient (Table 2). The present data indicated that the maximum stem girth (8.02 cm) of maize was observed under the use of iron as soil and foliar applied at 4 kg ha1 + 0.2%, closely followed by stem girth (7.99 cm) of maize also noted under the application of soil and foliar of iron at 4 kg ha1 + 0.1%. Moreover, a slight reduction in stem girth (7.49 and 7.35 cm) of maize was observed with the use of iron in the form of soil and foliar at 3 kg ha^{-1} + 0.2% and at 3 kg ha^{-1} + 0.1%, respectively. However, the minimum stem girth (5.12 cm) of maize was recorded in the control treatment. The increased stem diameter and plant height could be credited to an ample supply of micronutrients. This supply may have facilitated enhanced root growth, enabling more effective extraction of nutrients and moisture from deeper layers of the soil (Jolli et al., 2020).

Table 2. Plant height, leaves $plant^{-1}$, stems girth, cobs $plant^{-1}$ and cob length of maize as affected by soil and foliar application of iron.

Treatments	Plant height (cm)	Leaves $plant^{-1}$	Stem girth (cm)	Cobs $plant^{-1}$	Cob length (cm)
T1: Control	140.03 g	10.26 g	5.12 h	1.09 k	10.16 h
T2: 3 kg ha^{-1}	179.78 d	12.33 d	6.36 e	1.43 g	13.13 e
T3: 4 kg ha^{-1}	181.82 d	12.50 d	6.56 d	1.50 f	13.40 d
T4: 5 kg ha^{-1}	191.51 c	12.63 d	6.83 c	1.64 e	13.86 c
T5: 6 kg ha-[1]	194.11 c	12.80 cd	6.95 c	1.68 d	13.93 c
T6: 0.1%	150.11 f	11.16 fg	5.98 g	1.18 j	12.16 g
T7: 0.2%	154.14 f	11.30 ef	6.00 g	1.28 i	12.50 f
T8: 0.3%	167.38 e	11.96 def	6.08 fg	1.38 h	13.07 e
T9: 0.4%	173.30 de	12.20 de	6.17 f	1.44 g	13.11 e
T10: 3 kg ha^{-1} + 0.1%	206.67 b	13.02 bc	7.35 b	1.73 c	14.18 b
T11: 3 kg ha^{-1} + 0.2%	208.11 b	13.73 b	7.49 b	1.88 b	14.66 b
T12: 4 kg ha^{-1} + 0.1%	220.56 a	14.83 a	7.99 a	1.95 a	15.52 a
T13: 4 kg ha^{-1} + 0.2%	221.77 a	14.96 a	8.02 a	2.06 a	16.36 a
SE	4.4687	0.4401	0.0748	0.0153	0.0899
LSD	9.2229	0.9083	0.1543	0.0316	0.1856

Cobs $plant^{-1}$

The cobs $plant^{-1}$ of maize is a means of major yield components and is linearly affected by the grain yield of maize. The present results of cobs plant [1] of maize were remarkably influenced by different levels of iron nutrient as soil and foliar applied, as presented in Table 2. The highest number of cobs plant $^{-1}$ (2.04) was recorded in the treatment where soil and foliar of iron @ 4 kg ha^{-1} + 0.2% were applied; that was statistically at par with @ 4 kg ha^{-1} + 0.1%, which also recorded (1.95) cobs plant $^{-1}$ of maize. Moreover, the application of iron nutrient in the form of soil and foliar at 3 kg ha^{-1} + 0.2% and @ 3 kg ha^{-1} + 0.1% to maize crop resulted in higher cobs plant $^{-1}$ (1.84 and 1.73) respectively, which were higher than (1.09) obtained from where micronutrient soil with foliar spray of iron was not applied. This could also be attributed to improved uptake of iron by maize through enhanced availability of micronutrients in soil as well as the mineralization process. These results agree with the findings of Kumar et al. (2023). As reported, iron serves as a metallic component within various enzymes and is closely linked to photosynthesis and protein synthesis. Iron plays vital roles in plant metabolism, such as activating catalytic enzymes.

Cob length (cm)

The cob length of the maize crop is considered a major yield component, a source of increasing yield, and an important part of the quantity and quality of maize. The cob length of maize was significantly impacted by the use of different levels of soil and foliar iron (Table 2). The highest cob length (16.26 cm) of maize was found in plots where soil and foliar iron at 4 kg ha1 + 0.2% were applied; this was statistically similar to at 4 kg ha1 + 0.1%, which also produced 15.52 cm of cob length of maize. Both treatments were statistically on par with each other. Further, slightly reduced cob length (14.66 and 14.18 cm) of maize was observed under the use of soil and foliar iron nutrient at 3 kg ha^{-1} + 0.2% and at 3 kg ha^{-1} + 0.1%, respectively. However, the lowest cob length (10.16 cm) of maize was recorded in untreated plots (control). This increment in cob length may be due to better crop growth in the plant on account of an adequate supply of iron with RDF NPK fertilizers. These results accord with the reports of Abebe (2006), who investigated the increased photosynthetic activity and its assimilation that led to the increased cob girth and cob length of the maize crop.

Grains cob^{-1}

Grains per cob are a genetically controlled factor, but nutritional factors may influence the grains and grain yield of maize. Statistical analysis of the data indicated that different rates of iron in the form of soil and foliar applications caused significant variation in grain cob -1 of the maize crop (Table 3). The application of iron in the form of soil and foliar at 4 kg ha1 + 0.2% produced the maximum number of grains cob^{-1} (367.10) of maize, closely followed by grains cob-1 (365.07). The use of soil and foliar iron at 4 kg ha1 + 0.1%. Further, slightly lower values of grain cob^{-1} (340.13 and 333.03) of maize were observed with the application of soil and foliar iron nutrient at 3 kg ha^{-1} + 0.2% and at 3 kg ha^{-1} + 0.1%, respectively. Beyond, the minimum grain cob^{-1} (226.93) of maize was obtained from areas where micronutrients like iron were not applied. The rise in the number of grains per cob might be a result of the positive impact of the iron nutrient, which could be credited to its involvement in metabolic activities, particularly protein synthesis, nitrogen fixation, pollen viability, N and P metabolism, carbohydrate synthesis, and lipid metabolism in the plant (Bascuñán-Godoy et al., 2023).

Table 3. Grains cob-1, grains weight cob-1, 1000 grain weight, biological yield and grain yield of maize as affected by soil and foliar application of iron.

Treatments	Grains cob^{-1}	Grains weight cob^{-1}	1000 Grains weight (g)	Biological yield (kg ha^{-1})	Grain yield (kg ha^{-1})
T1: Control	226.93 g	73.22 g	192.13 h	8167.62 g	3561.19 g
T2: 3 kg ha^{-1}	288.30 d	90.51 d	230.77 e	10120.17 d	4016.43 d
T3: 4 kg ha^{-1}	290.43 d	91.26 d	232.43 e	10084.21 d	4082.32 d
T4: 5 kg ha^{-1}	308.07 c	98.49 c	245.23 d	10269.78 c	4242.28 c
T5: 6 kg ha-^{1}	310.80 c	100.36 c	248.83 cd	10289.78 c	4276.73 c
T6: 0.1%	245.03 f	78.48 f	203.37 g	8553.45 f	3755.22 f
T7: 0.2%	250.57 f	80.63 f	208.53 g	8584.31 f	3795.37 f
T8: 0.3%	267.47 e	84.33 e	220.17 f	8729.09 e	3892.52 e
T9: 0.4%	274.77 e	85.83 e	225.07 ef	8784.18 e	3909.31 e
T10: 3 kg ha^{-1} + 0.1 %	333.03 b	102.39 b	256.23 bc	12164.55 b	4375.00 b
T11: 3 kg ha^{-1} + 0.2%	340.13 b	107.76 b	262.87 b	12196.37 b	4396.08 b
T12: 4 kg ha^{-1} + 0.1%	365.07 a	112.87 a	276.43 a	14389.31 a	4574.13 a
T13: 4 kg ha^{-1} + 0.2%	367.10 a	113.89 a	277.17 a	14400.11 a	4596.26 a
SE	5.9279	1.6846	4.4340	68.954	45.742
LSD	12.234	3.4768	9.1513	142.31	94.408

Grain weight cob^{-1} (g)

The increasing rate of iron nutrient in the form of soil and foliar significantly enhanced grain weight cob^{-1} while being reduced with the decreasing rate of iron nutrient (Table 3). Maximum grain weight cob^{-1} (113.89 g) was observed under the application of soil and foliar iron at 4 kg ha^{-1} + 0.2%; this was statistically at par with at 4 kg ha^{-1} + 0.1%, which also produced grain weight cob^{-1} (112.87 g) of maize. Both treatments were non-significant with each other. Additionally, a steady decrease in grain weight cob^{-1} (107.76 and 102.39 g) of maize was found in the treatment of iron at 3 kg ha^{-1} + 0.2% and at 3 kg ha^{-1} + 0.1%, respectively. Whereas the lowest grain weight cob^{-1} (73.22 g) of maize was obtained from untreated plots. The conjunctive use of soil and foliar iron resulted in heaver grains of corn, mainly due to the adequate supply of micronutrients as iron with RDF of NPK fertilizers. The present results are in agreement with the findings of

Kawikhonliu (2022). The increase in grain yield and weight cob^{-1} can be credited to the enhanced production of assimilates and improved allocation of photosynthesis towards reproductive and economically valuable grains.

1000 grain weight (g)

The obtained results showed that the 1000 grain weight of maize was significantly influenced by different treatments of iron as soil and foliar applied (Table 3). The heavier 1000 grain weights (277.17 g) were produced by soil and foliar application of iron at 4 kg ha^{-1} + 0.2%, closely followed by at 4 kg ha^{-1} + 0.1%, which also recorded (276.43 g) 1000 grain weights of maize. Further, the application of iron nutrient in the form of soil and foliar at 3 kg ha^{-1} + 0.2% and at 3 kg ha^{-1} + 0.1% to the maize crop resulted in a higher grain weight (262.87 and 256.23 g), respectively, which was higher than the 192.13 g obtained from the soil and foliar application of iron. Such effects were more pronounced for the 1000 grain weight of the maize crop in alluvial soil. Our finding is in accordance with the study of Kumari et al. (2023) who reported that the increase in yield could be due to the favorable nutritional environment in the rhizosphere’s continuous supply of micronutrients (Fe) to the crop and higher absorption of nutrients by plants, which influence photosynthesis, assimilation, and translocation of photosynthesis grain in the cob.

Biological yield (kg ha^{-1})

Present results concerning the biological yield (kg ha^{-1}) of maize are presented in Table 3. Statistical analysis of the data revealed that the various treatments of iron nutrient had a significant effect on the biological yield (kg ha^{-1}) of maize. The different levels of iron nutrient in the form of soil and foliar at 4 kg ha^{-1} + 0.2% and @ 4 kg ha^{-1} + 0.1% resulted in higher biological yields (14400.11 and 13389.31 kg ha^{-1}, respectively) of maize; both treatments were statistically at par with @ 3 kg ha^{-1} + 0.2% and @ 3 kg ha^{-1} + 0.1%, which recorded 12196.37 and 12164.55 kg ha^{-1} biological yields of maize. Whereas the minimum biological yield (8167.62 kg ha^{-1}) of maize was observed in the control treatment. The increase in biological yield was attributed to the profuse Growth of plants and higher total dry matter accumulation, as well as increased number of leaves per plant throughout the growing period (Wang et al., 2023).

Grain yield (kg ha^{-1})

The grain yield (kg/ha) of maize crops stands as the ultimate objective in all research concerning grain crops. It is an important trait that is related to many other factors, such as cobs $plant^{-1}$, number of grains cob^{-1}, seed index, and other yield-related traits. The various treatments of iron nutrient as soil and foliar application caused a significant difference in the grain yield of maize (Table 3). The highest grain yield (4596.26 kg ha^{-1}) was observed in treatments where soil and foliar iron nutrient at 4 kg ha^{-1} + 0.2% were applied; this was statistically similar to at 4 kg ha^{-1} + 0.1%, which produced a grain yield of 4574.13 kg ha^{-1} for maize. Additionally, a gradual reduction in grain yield (4396.08 and 4375.00 kg ha^{-1}) of maize was observed with the application of soil and foliar iron nutrient at 3 kg ha^{-1} + 0.2% and at 3 kg ha^{-1} + 0.1%, respectively. Beyond the lowest grain yield (3561.19 kg ha^{-1}) of maize, it was obtained from untreated plots. The increase in grain yield resulting from iron application may have been attributed to the elevated chlorophyll content and enhanced activity of antioxidant enzymes observed throughout the maize's growth period. These findings are supported by the research of Chen et al. (2023), which demonstrated that the combined application of iron with nitrogen, phosphorus, and potassium fostered robust root development. This promoted overall plant growth and development, leading to enhanced photosynthetic activity, improved development of yield-related traits, and ultimately higher grain yield.

CONCLUSION AND RECOMMENDATIONS

It was concluded from the findings of the present research work that the application of iron (4 kg ha^{-1}) + 0.2% and 4 kg ha^{-1} + 0.1%, respectively, to the maize crop was found to be beneficial compared to the rest of the treatments in the sense of all quantity and quality contributing traits.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHORS’ CONTRIBUTION

All authors contributed and supported in this manuscript.

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