Original Research Article

Influence of iron and bio-fertilizer on growth parameters and yield of baby corn (*Zea mays* L.) Prayagraj condition.

Abstract:

Back ground: Baby corn maize (Zea mays L.) is a highly profitable alternative to farmers due to its short crop duration, being harvested at the juvenile stage. It demands large amounts of nutrients in a short time. Baby corn is not a separate type of corn like sweet corn or popcorn and any corn type can be used as baby corn.

Objectives: Effect of iron and bio-fertilizers on growth and yield of baby corn

Methods: With the goal of studying the effect of iron and bio-fertilizers on growth and yield of Baby corn (Zea mays L.) Var. ABV - 04 under a Randomized block design with 8 treatments (T1-T8).The experimental results revealed that 0.5% $FeSO_4$ (3g/lit of water) + Azotobacter seed inoculation (200 g/10kg of seed) produced maximum plant height (185.27), number of leaves/plant(12.58),plant dry weight (89.28) and yield parameters cobs/plant (2.34), cob weight without husk (12.34g), cob yield with husk(10.81 t/ha), and cob yield without husk(3.91t/ha).

Conclusion: Based on the findings of this study, it is concluded that 0.5 percent $FeSO_4$ (5g/lit of water) + Azotobacter seed inoculation (200 g/10kg of seed) can ensure the profitable production of baby corn. These practises could be passed on to farmers to help them earn more money in this agro-climatic zone. Based on the findings of this study, it is concluded that 0.5 percent $FeSO_4$(5g/lit of water) + Azotobacter seed inoculation (200 g/10kg of seed) can ensure the profitable production of baby corn. These practises could be passed on to farmers to help them earn more money in this agro-climatic zone.

Keywords: ***Growth, yield, iron and bio-fertilizer***

INTRODUCTION

Maize is one of the most important cereal crops next to rice and wheat in world agriculture economy both as food for men and feed for animals. It has high yield potential, there is no crop on earth which has so immense potentiality and that is why it is called queen of cereals. Its botanical name is *Zea mays* L. belonging to the family Gramineae, sub family Poaceae and chromosome number is 20 (2n). Christopher Columbus reported that maize was cultivated in Halti, where it was named “mahiz”. He carried maize from America to Europe and later it was carried by Portuguese and others Europeans to Africa and Asia, during 16th and 17th centuries. Already, this crop has been developed into a multi dollar business in foreign countries (Thailand, Taiwan, Singapore, Malaysia, USA, Canada and Germany) because of its potential as a value added product for export and a good food substitute. During recent times, its potentiality has been extended to the field of vegetable production **[7].**In India, cultivation of baby corn is a recent development and its industry is still at a juvenile stage. Its cultivation is only now picking up seriously in Meghalaya, Western UP, Haryana, Maharashtra, Karnataka and Andhra Pradesh. In India, maize (*Zea mays* L.) is grown on an area of 9.43 m ha, with production and productivity of 24.35 mt and 2583 kg/ha, respectively (GOI, 2014). Baby corn grown for vegetable purpose is successful in countries like Thailand, Taiwan, Srilanka and Burma. It has been developed into a multi-dollar business because of its potential as a value-added product for export and a good food substitute.

Application of micronutrients also play significant role in improvement of grain yield of maize. Among micronutrients iron (Fe) plays an important role in photosynthesis, nitrogen metabolism and regulates auxin concentration in the plant. The Fe deficiency was found wide spread in Indian soil. Iron is most crucial amongst the micronutrients that take part in plant growth and development due to its catalytic action in metabolism of almost all crops[3]. However, micronutrients can be applied directly into the soil as well. Another essential nutrient is iron (Fe), the lack of which causes chlorosis and is responsible for significant decreases in yield and quality of plants.

Bio-fertilizers or bio agents play an important role in the increasing availability of nitrogen and phosphorus. Among several bio agents *Azospirillum* is known to fix atmospheric nitrogen and increased about 10-15 % grain yield in maize[9]. The availability of phosphorous

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Comment [EN2]: Which parameters or processes of growth are affected and how?

Comment [EN3]: What are other methods of application?? What is known about them ? their strengths and limitations?

Comment [EN4]: You have already mentioned Iron , why now say another, would have a expected a different one are also low as compared to that of N and ~~&~~ K. under such situation, the phosphate solubilizing microorganism (PSB) plays significant role in making the phosphorous available to plants by secretion of organic acids and enzyme phosphatase which solubilizes the insoluble phosphate and thereby it helps in increasing the crop production.

The following objectives have been undertaken to study the “Effect of iron and bio-fertilizer on growth and yield of Baby corn (*Zea mays* L.)”

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Materials and Methods

The current study was carried out in the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj, during the *Rabi* season 2021-22, (U.P.). The experimental field is located approximately 9 kilometers from Prayagraj city, near the Yamuna River, on the left side of the Prayagraj-Rewa Road. Prayagraj is located in the subtropical zone of Uttar Pradesh, with hot summers and pleasant winters. The area's average temperature is 23°C to 38°C, with temperatures seldom dropping below 3°C or 4°C. The relative humidity levels range from 26% to 78%. In this location, the average annual rainfall is 1050 mm. The soil chemistry analysis revealed a sandy loam texture with a pH of 7.2, low amounts of organic carbon (0.48 percent) and potassium (215.4 kg/ha), and a low quantity of accessible phosphorus (13.6 kg/ha). The soil was electrically conductive and had a conductivity of 0.26 dS/m. For each of the eight treatment combinations, three replications were employed. The therapy details and treatment combinations are shown in Tables 1 and 2, respectively. Iron and biofertilizer were maintained according to the treatment combinations. Plant height (185.27cm) at harvest, number of leaves (12.58) at harvest, dry weight (89.28) at harvest, number of cobs/plant (2.34), weight of cob (12.34g), baby corn yield with husk (10.81t/ha), and baby corn yield without husk (3.91t/ha) were all successfully measured, and an economic analysis of each treatment was completed to determine the best treatment combination for baby corn cultivation. The statistics were calculated and analyzed using the **Mugalkhod (7)** statistical approach.

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Results and Discussion

Growth parameters at maturity

Plant height (cm) at harvest

Table 1 shows iron and bio-fertilizer on plant height at harvest. The Data indicated that spacing had a significant impact on plant height at harvest during the crop growth period. At harvest maximum plant height (185.27 cm) was recorded with application of 0.5% [5gms/lit of water] Feso4 + Azotobacter seed inoculation [200gm/10kg of seeds] which was significantly superior over rest of the treatments and remained at par with application 0.3% [3gms/lit of water] Feso4 + Azotobacter seed inoculation [200gm/10kg of seeds] (181.19), 0.5% [5gms/lit of water] Feso4 + Azospirilum seed inoculation [200gm/10kg of seeds] (175.54), 25 kg/ha Feso4 (Soil application) + Azotobacter seed inoculation [200gm/10kg of seeds] (173.56). Application of Fe improves photosynthesis and activates many enzymes and helps intransport of assimilates towards stem. Bio fertilizer plays major role in plant physiology and morphology. Plant height was significantly affected by foliar application of Fe [12]. Similar observation was also reported by **(Akongwubel *et al.* 2012) [1].** They observed significant improvement on plant height and leaf area index in corn with ultimate increase in organic manure rates. Bio fertilizer supply essential nutrient elements to promote vigorous growth and physiological activities in the plant system. Increased the rate of bio fertilizer application significantly get higher plant height, leaf area index and dry matter production. Similar result was also observed by **(Igua *et al.* 2009)** and **(Channal, 2017) [4 and 2].**

Comment [EN8]: was photosynthetic capacity measured?

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Number of leaves per plant at harvest

Table 1 shows iron and bio-fertilizer on number of leaves per plant at harvest. The Data indicated that spacing had significant impact on number of leaves per plant at harvest. At harvest, maximum No. of leaves (12.58) was recorded with application of 0.5% [5gms/lit of water] Feso4 + Azotobacter seed inoculation [200gm/10kg of seeds]. There was no significant minimum no.of leaves (10.33) was recorded with application of 0.3 % (3g/lit of water) $FeSO_4$ + Azospirilum seed inoculation (200 g/10kg of seed)Interaction between soil moisture levels and potassium doses had a significant effect on leaf number. Fe is an important element in crops, because it is necessary for synthesize chlorophyll, keeps up the structure of chloroplasts, involved in nitrogen fixation which lead to higher crop production and leaf area increase[12].

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Dry weight per plant At Harvest

Table 1 shows iron and bio-fertilizer on dry weight per plant at harvest. The Data indicated that at harvest, At harvest, maximum dry weight (89.28) was recorded with application of 0.5% [5gms/lit of water] Feso4 + Azotobacter seed inoculation [200gm/10kg of seeds] which was significantly superior over rest of the treatments and remained at par with application 0.3% [3gms/lit of water] Feso4 + Azotobacter seed inoculation [200gm/10kg of seeds] (87.38), 0.5% [5gms/lit of water] Feso4 + Azospirilum seed inoculation [200gm/10kg of seeds] (84.87), 25 kg/ha Feso4 (Soil application) + Azotobacter seed inoculation [200gm/10kg of seeds] (83.28), 15 kg/ha Feso4 (Soil application) + Azotobacter seed inoculation [200gm/10kg of seeds] (82.56). **Jat *et al.* [5]** also reported a significant increase in shoot dry weight by Fe application under both aerobic and flooded plots.

Yield parameters

Number of cobs per plant

Observations regarding the response of different levels of iron and bio-fertilizer on yield and yield attributes of baby corn are given in table 2 the results revealed that there was ear from the data that among different treatments, crop supplied with 0.5% [5gms/lit of water] Feso4 + Azotobacter seed inoculation [200gm/10kg of seeds] recorded highest number of cobs/plant (2.34) was at par with treatment with 0.3% [3gms/lit of water] Feso4 + Azotobacter seed inoculation [200gm/10kg of seeds] (2.26), 0.5% [5gms/lit of water] Feso4 + Azospirilum seed inoculation [200gm/10kg of seeds] (2.24), 25 kg/ha Feso4 (Soil application)+ Azotobacter seed inoculation [200gm/10kg of seeds] (2.16), 15 kg/ha Feso4 (Soil application)+ Azotobacter seed inoculation [200gm/10kg of seeds] (2.08),25 kg/ha Feso4 (Soil application)+ Azospirilum seed inoculation [200gm/10kg of seeds] (2.05). Application of bio fertilizer and inorganic combination along with foliar application of zinc and iron ultimately accrued huge quantity of biomass and partitioned a large fraction of assimilates to the sink, resulting in enhanced yield structures (cobs) as displayed by all the yield attributes. The finding of **Nagavani *et al.* [8]**confirmed these results.

Weight of cob (without husk) (g)

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Table 2 shows iron and bio-fertilizer on weight of cob (without husk). The data revealed that various treatments of the highest weight per cob without husk of baby corn (12.34) was measured with application 0.5% [5gms/lit of water] Feso4 + Azotobacter seed inoculation [200gm/10kg of seeds] which was superior over rest of the treatments followed by 0.3% [3gms/lit of water] Feso4 + Azotobacter seed inoculation [200gm/10kg of seeds] (12.20), 0.5% [5gms/lit of water] Feso4 + Azospirilum seed inoculation [200gm/10kg of seeds] (11.59). From this study, it was inferred that combination of potassium and Iron micronutrients gives higher yield as they play major role in assimilation rate and metabolic activities in plant. The cob weight is increased mainly due to balanced supply of nutrients from Iron in combination with inorganic fertilizers throughout the grain filling and development period **Salomone and Dobereiner [10].**

Comment [EN19]: the study used bio fertilizers

Cob yield with husk (t/ha)

The data on cob yield with husk (t/ha) as influenced by different iron and bio-fertilizers is tabulated in table 2. It is evident from this data the cob yield was significantly influenced by different iron and bio-fertilizers. The highest cob yield with husk of baby corn (10.81 t/ha) was measured with application 0.5% [5gms/lit of water] Feso4 + Azotobacter seed inoculation [200gm/10kg of seeds] which was superior over rest of the treatments followed by 0.3% [3gms/lit of water] Feso4+Azotobacter seed inoculation [200gm/10kg of seeds] (9.81 t/ha) and 0.5% [5gms/lit of water] Feso4 + Azospirilum seed inoculation [200gm/10kg of seeds] (9.12 t/ha). Similar results were found with **Shanmugam *and* Veeraputhran [11].**

Cob yield without husk (t/ha)

The data on cob yield without husk (t/ha) as influenced by different iron and bio-fertilizers is tabulated in table 2. It is evident from this data the cob yield was significantly influenced by different iron and bio-fertilizers. The highest cob yield without husk of baby corn (3.91 t/ha) was measured with application 0.5% [5gms/lit of water] Feso4 + Azotobacter seed inoculation [200gm/10kg of seeds] which was superior over rest of the treatments followed by 0.3% [3gms/lit of water] Feso4 + Azotobacter seed inoculation [200gm/10kg of seeds] (3.74 t/ha), 50kg potassium + 0.1% iron (3.61 t/ha) and 0.5% [5gms/lit of water] Feso4 + Azospirilum seed inoculation [200gm/10kg of seeds] (3.62 t/ha). Similar results were found with **Kumar *et al*. [6].**

Conclusion

On the basis of results obtained in present investigation, it is concluded that the profitable production of baby corn can be secured by 0.5 % $FeSO_4$ (5g/lit of water) + Azotobacter seed inoculation (200 g/10kg of seed). These practices may be passed on to the farmers for obtaining higher returns in this agro-climatic zone.

Comment [EN20]: the study never measured profitability

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Table 1: Effect of iron and bio-fertilizers on growth parameters at maturity of baby corn

Treatment details		Growth Parameters		
		Plant height (cm)	Number of leaves plant^{-1}	Plant dry weight (g/ plant)
1	15 kg/ha $FeSO_4$ (Soil application) + Azospirilum seed inoculation (200 g/10kg of seed)	159.24	10.54	80.27
2	15 kg/ha $FeSO_4$ (Soil application) + Azotobacter seed inoculation (200 g/10kg of seed)	167.28	11.43	82.56
3	25 kg /ha $FeSO_4$ (Soil application) + Azospirilum seed inoculation (200 g/10kg of seed)	163.96	10.95	81.59
4	25 kg /ha $FeSO_4$ (Soil application) + Azotobacter seed inoculation (200 g/10kg of seed)	173.56	11.71	83.28
5	0.3 % $FeSO_4$ (3g/lit of water) + Azospirilum seed inoculation (200 g/10kg of seed)	151.25	10.33	78.43
6	0.3 % $FeSO_4$ (3g/lit of water) + Azotobacter seed inoculation (200 g/10kg of seed)	181.19	12.26	87.38
7	0.5 % $FeSO_4$ (3g/lit of water) + Azospirilum seed inoculation (200 g/10kg of seed)	175.54	11.84	84.87
8	0.5 % $FeSO_4$ (3g/lit of water) + Azotobacter seed inoculation (200 g/10kg of seed)	185.27	12.58	89.28
F Test		S	NS	S
SEd. ($\pm$)		4.604	0.154	2.53
CD (p= 0.05)		13.641		7.59

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Table 2: Effect of iron and bio-fertilizers on yield parameters at maturity of baby corn

Treatment details		Yield Parameters			
		Cobs /plant (No.)	Cob weight (g without husk)	Cob yield (t/ha with husk)	Cob yield without husk (t/ha)
1	15 kg/ha $FeSO_4$ (Soil application) + Azospirilum seed inoculation (200 g/10kg of seed)	1.84	10.13	7.51	3.36
2	15 kg/ha $FeSO_4$ (Soil application) + Azotobacter seed inoculation (200 g/10kg of seed)	2.08	11.07	8.43	3.46
3	25 kg /ha $FeSO_4$ (Soil application) + Azospirilum seed inoculation (200 g/10kg of seed)	2.05	10.83	7.88	3.43
4	25 kg /ha $FeSO_4$ (Soil application) + Azotobacter seed inoculation (200 g/10kg of seed)	2.16	11.23	8.58	3.54
5	0.3 % $FeSO_4$ (3g/lit of water) + Azospirilum seed inoculation (200 g/10kg of seed)	1.65	9.63	7.14	2.95
6	0.3 % $FeSO_4$ (3g/lit of water) + Azotobacter seed inoculation (200 g/10kg of seed)	2.26	12.2	9.81	3.74
7	0.5 % $FeSO_4$ (3g/lit of water) + Azospirilum seed inoculation (200 g/10kg of seed)	2.24	11.59	9.12	3.62
8	0.5 % $FeSO_4$ (3g/lit of water) + Azotobacter seed inoculation (200 g/10kg of seed)	2.34	12.34	10.81	3.91
F Test		S	S	S	S
SEd. ($\pm$)		0.101	0.37	0.632	0.141
CD (p= 0.5)		0.304	1.023	1.896	0.428

B

Fig 1. A and B at the time of sowing and readings at 15DAS
C and D Spraying Feso$_4$ at 40DAS and harvest stage for during trail period