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Effect of levels of zinc and spacing on growth and yield of baby corn (*Zea mays* L.)

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Abstract
A field experiment was conducted during *Zaid* 2020 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P). The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.1), low in organic carbon (0.36%), available N (171.48 kg/ha), available P (15.2 kg/ha) and available K (232.5 kg/ha). The experiment was laid out in Randomized Block Design with nine treatments each replicated thrice on the basis of one year experimentation. The treatments which are 15 kg/ha $ZnSO_4$ + 40 cm x 20 cm, 20 kg/ha $ZnSO_4$ + 40 cm x 20 cm, 25 kg/ha $ZnSO_4$ + 40 cm x 20 cm, 15kg/ha $ZnSO_4$ + 50 cm x 20 cm, 20 kg/ha $ZnSO_4$ +50 cm x 20 cm, 25 kg/ha $ZnSO_4$ + 50 cm x 20 cm , 15kg/ha $ZnSO_4$ + 60 cm x 20 cm , 20 kg/ha $ZnSO_4$ + 60 cm x 20 cm , 25 kg/ha $ZnSO_4$ + 60 cm x 20 cm used. The results showed that application of 25 kg/ha $ZnSO_4$ + 60 cm x 20 cm was recorded significantly higher plant height (168.13 cm), number of leaves/plant (13.25), dry weight/plant (90.96 g/plant), no. of cobs/plant (2.37), length of the cob/plant (18.77 cm), cob weight with husk (47.92 g), cob weight without husk (22.70 g) whereas maximum crop growth rate (30.45 g/m^2/day) was recorded with treatment 20 kg/ha $ZnSO_4$ + 40 cm x 20 cm and cob yield with husk (14.63 t/ha), cob yield without husk (5.09 t/ha) and green fodder yield (28.83 t/ha) was recorded maximum with 25 kg/ha $ZnSO_4$ + 40 cm x 20 cm.

Keywords: Baby corn, $ZNSO_4$, Spacing, yield, and economics

Introduction

Baby corn (also known as young corn, mini corn or candle corn) is the ear of maize (*Zea mays* L.) plant harvested young, when the silks have either not emerged or just emerged and no fertilization has taken place. It is one of the most important dual purpose crops grown round the year in India (Singh *et al*., 2015) [14]. Baby corn is becoming popular in domestic and foreign markets and has enormous processing and export potential. An interesting recent development is of growing maize for vegetable purpose (Dass *et al*., 2008) [5]. Currently, Thailand and China are the world leaders in baby corn production. In India, baby corn is being cultivated in Meghalaya, Western Uttar Pradesh, Haryana, Maharashtra, Karnataka and Andhra Pradesh (Rani *et al*., 2017) [13].

Maize is classified into different groups based on the endosperm of kernels among which Baby Corn is grown for vegetable purpose. Baby Corn is de husked maize ear, harvested young especially when the silk has either not emerged or just emerged and no fertilization has taken place or the shank with unpalliated silk is Baby Corn. Baby Corn ears in light yellow colour with regular row arrangement, 10-12 cm long and a diameter of 1.0-1.5 cm arrangement, are preferred in the market. Baby Corn is cultivated in Thailand, Taiwan, Sri Lanka and Myanmar, Guatemala, Zambia, Zimbabwe and South Africa. In India, it is grown in Maharashtra, Karnataka, Andhra Pradesh, Rajasthan and Meghalaya. In India, it is grown on 8.49 m/ha with production and productivity of 21.28 m/t and 2507 kg/ha, respectively. Baby corn is a profitable crop that allows a diversification of production, aggregation of value and increase income (Pandey *et al.*, 2002) [12].

Zn plays a very important role in plant metabolism by influencing the activities of hydrogenase and carbonic anhydrase and stabilization of ribosomal proteins (Tisdale *et al*., 1984) [18]. Amongst crops, maize shows the high sensitivity to Zn deficiency for its physiological requirements. Zinc activates the plant enzymes by carbohydrate metabolism, maintaining the integrity of cellular membranes, protein synthesis and regulation of auxin synthesis (Marschner 1995) [7].

Optimum plant population is one of the important factors for higher productivity, by virtue of which there is efficient utilization of underground resources and also harvesting maximum solar radiation which in turn results in better photosynthesis (Monneveux *et al*., 2005) [8]. An optimum plant population for maximum economic yield exists for all crop species and varies with cultivar and environment (Bruns and Abbas, 2005) [4]. Yield increases with increasing plant density up to a maximum for a corn genotype grown under a set of particular environmental and management conditions and declines when plant density is further increased (Gozobenli *et al*., 2004) [6].

Materials and Methods

The present examination was carried out during *Zaid* 2021 at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj, UP, which is located at 25.57 ^{o}N latitude, 87.19^{o}E longitude and 98 m altitude above the mean sea level. Super godly variety used for sowing yellow mustard. The experiment laid out in Randomized Block Design which consisting of nine treatments with T_1: 15 kg/ha $ZnSO_4$ + 40 cm x 20 cm, T_2: 20 kg/ha $ZnSO_4$ + 40 cm x 20 cm, T_3: 25 kg/ha $ZnSO_4$ + 40 cm x 20 cm, T_4: 15 kg/ha $ZnSO_4$ + 50 cm x 20 cm, T_5: 20 kg/ha $ZnSO_4$ + 50 cm x 20 cm, T_6: 25 kg/ha $ZnSO_4$ + 50 cm x 20 cm, T_7: 15 kg/ha $ZnSO_4$ + 60 cm x 20 cm, T_8: 20 kg/ha $ZnSO_4$ + 60 cm x 20 cm, T_9: 25 kg/ha $ZnSO_4$ + 60 cm x 20 cm were replicated thrice.

The experimental site was uniform in topography and sandy loam in texture, nearly neutral in soil reaction (P^H 7.1), low in Organic carbon (0.72%), medium available N (278.28 kg ha^{-1}), higher available P (27.80 kg ha^{-1}) and medium available K (233.24 kg ha^{-1}). Nutrient sources were Urea, DAP, MOP to fulfill the necessity of Nitrogen, phosphorous and potassium. The application of fertilizers were applied as basal at the time of sowing. In the period from germination to harvest several plant growth parameters were recorded at frequent intervals along with it after harvest several yield parameters were recorded those parameters are growth parameters, plant height, leaves per plant, and plant dry weight are recorded. The yield parameters like cobs per plant, cob length per plant (cm), cob weight, green cob yield (t/ha) and green fodder yield (t/ha) were recorded and statistically analyzed using analysis of variance (ANOVA) as applicable to Randomized Block Design (Gomez K.A. and Gomez A.A. 1984).

Results and Discussion

Growth attributes

Plant height

Data in table 1, tabulated that significantly highest plant height (168.13 cm) was observed in the treatment with (T_9) 25 kg/ha $ZnSO_4$ + 60 cm x 20 cm over all the other treatments. However, the treatments with application of (T_8) 20 kg/ha $ZnSO_4$ + 60 cm x 20 cm (167.57 cm) and (T_6) 25 kg/ha $ZnSO_4$ + 50 cm x 20 cm (167.13 cm) which were found to be at par with treatment (T_8) 25 kg/ha $ZnSO_4$ + 60 cm x 20 cm as compared to all the treatments.

The reduction in row spacing from 60 cm to 40 cm resulted in decreased plant height mainly because of increased competition within the plants in closer spacing as compared to wider spacing. The competition for space, light, nutrients and moisture within the intra-row plants were maximum with low and medium row spacing may be resulted such reduction in thickness of stem girth. The significant reduction in plant growth with reduction in row spacing seems to be the resultant of natural shading due to overcrowding of plants which might have reduced the availability of light within the crop canopy and inhibited elongation of lower internodes. The results were in close accordance to Neupane *et al.* (2011) [10].

Increase in plant height might be the involvement of micronutrients in different physiological processes like enzyme activation, electron transport, chlorophyll formation, stomatal regulation, etc. With the increase in levels of zinc the plant height gradually increased, which might be attributable to greater photosynthetic activity and chlorophyll synthesis due to zinc fertilization resulting into better vegetative growth. The results were in accordance to Arab *et al.* (2018) [2].

Leaves/Plant

The highest number of leaves per plant (13.25) was observed in the treatment with application of (T_9) 25 kg/ha $ZnSO_4$ + 60 cm x 20 cm, which was significantly higher over rest of the treatments. However, the treatments with (T_8) 20 kg/ha $ZnSO_4$ + 60 cm x 20 cm (13.15) and (T_6) 25 kg/ha $ZnSO_4$ + 50 cm x 20 cm (13.07) which were found to be statistically at par with (T_9) 25 kg/ha $ZnSO_4$ + 60 cm x 20 cm.

The number of leaves increased with the increase in zinc levels and decreased with decreasing zinc levels. The higher number of functional leaves under higher fertilizer level might be due to increase in cell division, assimilation rate and metabolic activities in plant. Present findings are consistent with the result of Tariq *et al.* (2014) [17].

Plant dry weight (g/plant)

Treatment with (T_9) 25 kg/ha $ZnSO_4$ + 60 cm x 20 cm was recorded with significantly maximum dry weight (90.96 g/plant) over all the treatments. However, the treatments with (T_8) 20 kg/ha $ZnSO_4$ + 60 cm x 20 cm (90.81 g/plant) and (T_6) 25 kg/ha $ZnSO_4$ + 50 cm x 20 cm (90.46 g/plant) which were found to be statistically at par with (T_9) 25 kg/ha $ZnSO_4$ + 60 cm x 20 cm.

Dry matter accumulation increased from 20 to 80 DAS due to availability of higher sunshine and CO_2 under spacing of 60 x 20 cm might have resulted in higher photosynthetic productivity than 50 x 20 and 40 x 20 cm spacings. This was evident from more dry matter accumulation under spacing of 60 x 20 cm followed by 50 x 20, 40 x 20 cm spacing. Similar results were reported by Sumeria *et al.* (2007) [15].

The highest of biomass increase was observed because of increasing levels of zinc. Although the application of zinc as basal dose to sweet corn increased its dry matter significantly, High dry matter in those treatments is due to long plant height, high stem girth, and high root weights Palai *et al.* (2018) [11].

Yield attributes and yield

No. of Cobs/Plant

Significantly Maximum number of cobs per plant (2.37) was recorded with the treatment of application of (T_9) 25 kg/ha $ZnSO_4$ + 60 cm x 20 cm over all the treatments. However, the treatments 20 kg/ha $ZnSO_4$ + 60 cm x 20 cm (2.34) and 25 kg/ha $ZnSO_4$ + (T_8)50 cm x 20 cm (2.17) which were found to be statistically at par with (T_9) 25 kg/ha $ZnSO_4$ + 60 cm x 20 cm.

Zinc plays a very important role in the metabolism of the plant process by influencing the activity of growth enzymes as well as it is involved in carbohydrate metabolism, maintenance of the integrity of cellular membranes, protein synthesis, and regulation of auxin synthesis and pollen formation which resulted in higher number of cobs. The findings were found to be similar with Anjum *et al.* (2017) [1].

Length of Cob/plant (cm)

Significantly highest length of cob per plant was recorded with the with the treatment of application of (T_9) 25 kg/ha $ZnSO_4$ + 60 cm x 20 cm over all the treatments. However, the treatments (T_8) 20 kg/ha $ZnSO_4$ + 60 cm x 20 cm (2.34) and (T_6) 25 kg/ha $ZnSO_4$ + 50 cm x 20 cm (2.17) which were found to be statistically at par with (T_9) 25 kg/ha $ZnSO_4$ + 60 cm x 20 cm.

Cob weight (g)

a) With husk

Significantly maximum cob weight with husk (47.92 g) was recorded with the treatment application of (T_9) 25 kg/ha $ZnSO_4$ + 60cm x 20 cm over all the treatments. However, the treatments with (47.43 g) in (T8) 20 kg /ha $ZnSO_4$ + 60 cm x 20 cm and (46.87 g) in (T_6) 25 kg/ha $ZnSO_4$ + 50 cm x 20 cm which were found to be statistically at par with and (T_9)25 kg/ha $ZnSO_4$ + 60 cm x 20 cm.

b) Without husk

Significantly maximum cob weight without husk (22.70 g) was recorded with the treatment application of (T_9) 25 kg/ha $ZnSO_4$ + 60cm x 20 cm over all the treatments. However, the treatments with (22.20 g) in (T_8) 20 kg/ha $ZnSO_4$ + 60 cm x 20 cm and (21.72 g) in (T_6) 25 kg/ha $ZnSO_4$ + 50cm x 20 cm which were found to be statistically at par with and (T_9) 25 kg/ha $ZnSO_4$+ 60 cm x 20 cm.

Production of photosynthates and their translocation to sink depends upon availability of mineral nutrients whose availability has increased the zinc uptake also. Most of the photosynthetic pathways are dependent on enzymes and co-enzymes, which are synthesized by mineral nutrients and application of zinc was caused by higher chlorophyll contents, and seed treatment with biofertilizers which had apparently a positive effect on photosynthetic activity, synthesis of metabolites and growth-regulating substances, oxidation and metabolic activities and ultimately better growth and development of crop, which led to increase in yield attributes of baby corn. These results are in agreement with the findings Arab *et al.* (2018) [2] and Naik *et al.* (2020) [9].

Cob yield (t/ha)

a) With husk

Significantly maximum cob yield with husk (14.63 t/ha) was recorded with the treatment application of (T_3) 25 kg/ha $ZnSO_4$ + 40cm x 20 cm over all the treatments. However, the treatments with (14.24 t/ha) in (T_2) 20 kg/ha $ZnSO_4$ + 40 cm x 20 cm and (13.67 t/ha) in (T_6) 25 kg/ha $ZnSO_4$ + 50 cm x 20 cm which were found to be statistically at par with and (T_3) 25 kg/ha + 40 cm x 20 cm.

b) Without husk

Significantly maximum cob yield without husk (5.09 t/ha) was recorded with the treatment application of (T3) 25 kg/ha $ZnSO_4$ + 40cm x 20 cm over all the treatments. However, the treatment with (4.77 t/ha) in (T_2) 20 kg/ha $ZnSO_4$ + 40cm x 20 cm which was found to be statistically at par with and (T_3) 25 kg/ha + 40 cm x 20 cm.

Increase in seed yield might be due to under 40 × 20 cm because the less intra row spacing than other treatments increases competition in solar radiation that ultimately stunt growth of some intra row plant in vegetative phase and they were unable to reach reproductive phase even though the yield contributing variables were high when compared to the recommended spacing, the productivity was low due to the lesser plant population reached to reproductive phase. The findings were in accordance with Ariraman *et al.* (2021) [3].

Application of zinc to baby corn crop generally improves fruit growth by synthesizing tryptophan and auxin. The enhancement effect on cobs/plant and their length and weight attributed to the favourable influence of the Zn application to crops on nutrient metabolism, biological activity and growth parameters and hence, applied zinc resulted in taller and higher enzyme activity which in turn encourage more cobs and resulted in higher cob yield. Similar findings were reported earlier by Naik *et al.* (2020) [9].

Green fodder yield (t/ha)

Significantly higher green fodder yield (28.33 t/ha) was recorded with the treatment application of (T_3) 25 kg/ha $ZnSO_4$ + 40 cm x 20 cm over all the treatments. However, the treatments with (27.87 t/ha) in (T_2) 20 kg/ha $ZnSO_4$ + 40 cm x 20 cm and (27.50 t/ha) in (T_6) 25 kg/ha $ZnSO_4$ + 50 cm x 20 cm which were found to be statistically at par with and (T_3) 25 kg/ha$ZnSO_4$ + 40 cm x 20 cm.

Zinc plays a vital role in increasing green fodder yield because zinc takes place in many physiological process of plant such as chlorophyll formation, stomatal regulation, starch utilization and biomass accumulatio which enhanced green fodder yield. Zinc also converts ammonia to nitrate in crops which contribute to yield. The similar findings were reported by Tamil Amutham *et al.* (2018) [16].

Table 1: Effect of levels of Zinc and Spacing on growth attributes of Baby corn**.**

Sr. no.	Treatments	Plant height (cm)	No. of leaves/plant	Dry weight (g/plant)
1.	15 kg/ha $ZnSO_4$ + 40cm x 20 cm	161.40	12.13	86.02
2.	20 kg/ha $ZnSO_4$ + 40cm x 20 cm	162.77	12.25	87.18
3.	25 kg/ha $ZnSO_4$ + 40cm x 20 cm	164.27	12.70	88.20
4.	15 kg/ha $ZnSO_4$ + 50cm x 20 cm	163.70	12.52	87.84
5.	20 kg/ha $ZnSO_4$ + 50cm x 20 cm	166.30	12.93	89.83
6.	25 kg/ha $ZnSO_4$ + 50cm x 20 cm	167.13	13.07	90.46
7.	15 kg/ha $ZnSO_4$ + 60cm x 20 cm	165.80	12.75	88.67
8.	20 kg/ha $ZnSO_4$ + 60cm x 20 cm	167.57	13.15	90.81
9.	25 kg/ha $ZnSO_4$ + 60cm x 20 cm	168.13	13.25	90.96

	F- test	S	S	S
	S.Em(±)	0.34	0.09	0.09
	C. D. (P = 0.05)	1.03	0.27	0.27

Table 2: Effect of levels of Zinc and Spacing on yield attributes and yield of Baby corn

Sr. no	Treatments	No. of cobs/plant	Length of the cob (cm)		Cob weight (g)		Cob Yield(t/ha)		Green fodder Yield (t/ha)
			With husk	Without husk	With husk	Without husk	With husk	Without husk	
1.	15 kg/ha $ZnSO_4$ + 40cm x 20 cm	1.24	13.20	7.30	41.02	17.64	12.39	3.77	26.15
2.	20 kg/ha $ZnSO_4$+ 40cm x 20 cm	1.43	14.47	7.60	42.05	18.14	14.24	4.77	27.87
3.	25 kg/ha $ZnSO_4$+ 40cm x 20 cm	1.72	15.93	7.83	44.15	19.35	14.63	5.09	28.83
4.	15 kg/ha $ZnSO_4$ + 50cm x 20 cm	1.61	15.20	7.67	43.47	18.38	10.98	3.25	24.97
5.	20 kg/ha $ZnSO_4$+ 50cm x 20 cm	1.95	17.20	8.20	45.57	20.85	12.89	4.09	26.94
6.	25 kg/ha $ZnSO_4$+ 50cm x 20 cm	2.17	17.77	8.27	46.87	21.72	13.67	4.53	27.50
7.	15 kg/ha $ZnSO_4$+ 60cm x 20 cm	1.83	16.63	7.90	44.69	20.46	9.60	2.83	23.78
8.	20 kg/ha $ZnSO_4$+ 60cm x 20 cm	2.34	18.07	8.50	47.43	22.20	10.01	3.02	24.12
9.	25 kg/ha $ZnSO_4$+ 60cm x 20 cm	2.37	18.77	8.58	47.92	22.70	11.82	3.43	25.71
	F test	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
	S.Em (±)	0.07	0.31	0.07	0.39	0.34	0.32	0.20	0.31
	CD (P = 0.05)	0.20	0.94	0.21	1.17	1.01	0.97	0.61	0.94

Conclusion

It is concluded that application of treatment (T_3) 25 kg/ha $ZnSO_4$ + 40 cm x 20 cm was recorded significantly higher cob yield without husk, gross returns, net returns and benefit cost ratio as compared to other treatments. Since, the findings based on the research done in one season.

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References

1. Anjum SA, Saleem MF, Shahid M, Shakoor A, Safeer M, Khan I, *et al.* Dynamics of soil and foliar applied boron and zinc to improve maize productivity and profitability. Pakistan Journal of Agricultural Research. 2017;30(3):294-302.
2. Arab GM, Dina A, Ghazi, El-Ghamry AM. Effect of zinc application on maize grown on alluvial soils. Journal of Soil Science and Agricultural Engineering, Mansoura University. 2018;9(9):419-426.
3. Ariraman R, Selvakumar S, Mansingh MDI, Karthikeyan M, Vasline YA. Effect of zinc application on growth, yield parameters, nutrient uptake, yield and economics of maize. Agricultural Reviews 2021;10:1-6.
4. Bruns HA, Abbas HK. Ultra-high plant populations and nitrogen fertility effects on corn in the Mississippi Valley. Agronomy Journal 2005;97(4):1136.
5. Dass S, Yadav VK, Kwatra A, Jat ML, Rakshit S, Kaul J, *et al*. Baby corn in India. Technical Bulletin, Directorate of Maize Research, Pusa Campus, New Delhi. 2008;6:1-45.
6. Gozobenli H, Kilinc M, Sener O, Konuskan O. Effects of single and twin row planting on yield and yield components in maize. Asian Journal of Plant Science. 2004; 3:203-206.
7. Marschner M. Mineral Nutrition of Higher Plants. 2nd Edition Academic Press, London, New York, ISBN-10:0124735436; c1995. p. 200-255.
8. Monneveux P, Zaidi PH, Sanchez C. Population density and low nitrogen affects yield. Associated Traits in Tropical Maize. Crop Science. 2005;45(2):103-106.
9. Naik C, Meena MK, Ramesha YM, Amaregouda A, Ravi M. V, Dhanoji MM. Morpho-physiological impact of growth indices to Biofortification on growth and yield of sweet corn (*Zea mays* L. *Saccharata*). Bulletin of Environment, Pharmacology and Life Sciences. 2020;9(3):37-43.
10. Neupane MP, Singh RK, Rakesh K, Anupma K. Response of baby corn (*Zea mays* L.) to nitrogen sources and row spacing. Environment and Ecology. 2011;29(3):1176-1179.
11. Palai JB, Sarkar NC, Jena J. Effect of zinc on growth, yields, zinc use efficiency and economics in baby corn. Journal of Pharmacognosy and Phytochemistry. 2018;**7**(2):1641-1645.
12. Pandey AK, Mani VP, Ved Prakash, Singh RD, Gupta HS. Effect of varieties and plant densities on yield, yield attributes and economics of baby corn (*Zea mays*). Indian Journal of Agronomy. 2002;47(2):221-226.
13. Reena Rani, Sheoran RK, Pooja Gupta Soni, Sakshi Kaith, Arpita Sharma. Baby corn: A wonderful vegetable. International Journal of Science, Environment and Technology. 2017;6(2):1407-1412.
14. Singh G, Kumar S, Singh R, Singh SS. Growth and yield of Baby Corn as influenced by varieties, spacings and dates of sowing. Indian Journal of Agriculture Research. 2015;49(4): 353-357.
15. Sumeriya HK, Singh P, Nepalia V, Sharma V, Upadhyay B. Response of elite sorghum genotypes to planting geometry and fertility levels. Research on crops. 2007;8(2):312-315.
16. Tamil Amutham G, Karthikeyan R, Thavaprakaash N, Bharathi C. Agronomic bio-fortification with zinc on growth and yield of baby corn under irrigated condition. Journal of Pharmacognosy and Phytochemistry. 2019;8(3):434-437.
17. Tariq A, Shakeel A, Anjum Mahmood A, Randhawa, Ullah E, Naeem M, Qamar R, Ashraf U, Nadeem M. Influence of zinc nutrition on growth and yield behaviour of maize (*Zea mays* L.) hybrids. American Journal of Plant Sciences. 2014;5:2646-2654.
18. Tisdale SL, Nelson WL, Beaten JD. Zinc In soil Fertility and Fertilizers. Fourth edition, New York: Macmillan Publishing Company; c1984.