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Effect of farm yard manure and zinc on growth and yield of baby corn (*Zea mays* L.)

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Abstract
A field experiment was carried out during *Zaid* season of 2021 at crop research farm of SHUATS, Prayagraj to study about the Effect of FYM and Zinc on growth and yield of Baby corn (*Zea mays* L.) The experiment was laid out in randomized block design with three FYM levels, *i.e.*, F_1 - (FYM 6t/ha), F_2 – (FYM 8t/ha) and F_3 – (FYM 10 t/ha) and Zinc levels *i.e.*, Zn_1 (Zinc 0.25% at 15 DAS), Zn_2 (Zinc 0.5% at 30 DAS) and Zn_3 (Zinc 0.75% at 45 DAS) and which was replicated thrice. Results revealed that FYM 10t/ha + Zinc 0.5% at 30 DAS recorded significantly highest in plant height (177.36 cm), number of leaves per plant (11.48), plant dry weight (88.57 g/plant), cob yield of husked baby corn (9.47 t/ha) and cob yield of dehusked baby corn (2.85 t/ha). However, net returns (173180.00 INR/ha) and B:C ratio (2.85) was also obtained with the application of FYM 10t/ha + Zinc 0.5% at 30 DAS. Therefore, I concluded that FYM 10 t/ha + Zinc 0.5% at 30 DAS produced more grains (2.85 t/ha) and economically effective (3.15).

Keywords: Baby corn, farm yard manure, zinc, yield

Introduction
Maize is popularly called as "Queen of cereals" as well as "miracle crop" because it has greater yield potential. Maize is third most important cereal crop, next to rice and wheat. India stands 5th rank in acreage and 8th rank in production of maize. The novelty of maize is cultivating it predominantly for vegetable purpose as "Baby corn". Baby corn is typically a maize ear (*Zea mays* L.)" produced from regular corn plants which are harvested earlier, particularly when the silks have the size of 1-3 cm.

Baby corn is an important crop of Thailand, Taiwan and India; recently, baby corn has gained popularity in Delhi, Uttar Pradesh, Haryana, Maharashtra, Telangana, Karnataka, Andhra Pradesh and Rajasthan and Meghalaya states. Attention is now being paid to explore its potential in India for earning foreign exchange besides higher economic returns to the farmers. Baby corn is the de husked young cobs of harvested within 2-3 days of silk emergence and are consumed as vegetable due to its sweet flavour.

Farmyard manure (FYM) is an important organic resource for agricultural production in livestock-based farming systems in the semi-arid tropics of India. However, use of FYM has been affected by a shortfall in its supply, by increasing demand for plant nutrients, and by the increasing use of manufactured fertilizers. Organic manures, particularly FYM and Vermicompost, not only supply macronutrients but also meet the requirements of micronutrients, besides improving soil health. The use of organics plays a major role in maintaining soil health due to build-up of soil organic matter, beneficial microbes. To sustain the soil fertility and crop productivity the role of organic manures and fermented organic nutrients are very important. The organic fertilizers in addition to nutrients contain microbial load and growth promoting substances which help in improving the plant growth, metabolic activity and resistant to pest and diseases (Singh *et al.*).

Zinc has turned out to be a limiting factor in Indian agriculture. In the entire alkaline calcareous belt of the country, zinc has assumed considerable importance in balance fertilization for improving crop productivity. Wide spread deficiency of zinc leads to low productivity of dry land crops. Zinc plays a significant role in various enzymatic and physiological activities in the plant system. It performs many catalytic functions in the plant besides transformation of carbohydrates, chlorophyll and protein synthesis. Under conditions where there is a lack of zinc, a decrease of carbonic anhydrase enzyme can lead to diminished

rate of net photosynthesis. The use of zinc serves to increase the density of zinc and protein in seeds, pneumatic organs and overall quality of seed Production. About 50% of Indian soils are deficient in zinc causing low level of zinc and yield losses in fodder crops and effect health of the livestock and crop like maize has been found to respond to zinc application. Currently millions of hectares of crop plants are affected by zinc deficiency and approximately one third of the human population suffer from an inadequate intake of zinc. Low zinc content in grains and straw results in poor zinc nutrition of human beings and animals, which has received considerable attention (Cakmak, 2008).

Materials and Methods

The experiment was conducted during the *Zaid* season 2021, at the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj (U.P.) which is located at 25^0 30' 42''N latitude, 81^0 60' 56" E longitude and 98 m altitude above the mean sea level during *zaid* season 2021 on sandy loam soil, having nearly neutral in soil reaction (pH 7.7), organic carbon (0.44), available nitrogen (171.48 kg/ha K), available phosphorus (27 kg/ha) and available potassium (291.2 kg/ha). The climate of the region is semi- arid subtropical. Treatments comprised of T_1–FYM 6t/ha + Zinc 0.25% at 15 DAS, T_2 – FYM 6t/ha + Zinc 0.5% at 30 DAS, T_3 – FYM 6t/ha + Zinc 0.75% at 45 DAS, T_4 – FYM 8t/ha + Zinc 0.25% at 15 DAS, T_5 - FYM 8t/ha + Zinc 0.5% at 30 DAS, T_6 – FYM 8t/ha + Zinc 0.75% at 45 DAS, T_7 – FYM 10t/ha + Zinc 0.25% at 15 DAS, T_8– FYM 10t/ha + Zinc 0.5% at 30 DAS and T_9 – FYM 10t/ha + Zinc 0.75% at 30 DAS. These were replicated thrice in Randomized Block Design. The recommended dose of fertilizer is 120-60-40 kg/ha NPK. Recommended dose of fertilizer was applied at the time of sowing in the form of Urea, DAP and MOP.

Chemical analysis of soil

Composite soil samples are collected before layout of the experiment to determine the initial soil properties. The soil samples were collected from 0-15 cm depth and were dried under shade, powdered with wooden pestle and mortar, passed through 2 mm sieve and were analyzed for organic carbon by rapid titration method by Nelson (1975) [8]. Available nitrogen was estimated by alkaline permanganate method by Subbiah and Asija (1956) [10], available phophorus by Olsen's method as outlined by Jackson (1967), available potassium was determined by using the flame photometer normal ammonium acetate solution and estimating by using flame photometer (ELICO Model) as outlined by Jackson (1973) [4] and available $ZnSO_4$ was estimated by Atomic Absorption Spectrophotometer method as outlined by Lindsay and Norvell (1978).

Statistical analysis

The data recorded were different characteristics were subjected to statistical analysis by adopting Fishers the method of analysis of varianc (ANOVA) as described by Gomez and Gomez (2010). Critical difference (CD) values were calculated the 'F' test was found significant at 5% level.

Results and Discussion

Plant height (cm)

The Plant height of Baby corn recorded at 15, 30, 45 DAS and at harvest differed significantly as influenced by FYM and Zinc (Table 4.1)

At harvest, maximum plant height (177.36 cm) was recorded with application of FYM 10t/ha + Zinc 0.5% which was significantly superior over all other treatments and statistically at par with treatment of FYM 8t/ha + Zinc 0.5% (176.32 cm). It might be due to observed that application of FYM at 20 t/ha resulted in higher plant height (96.8 cm) and higher dry matter accumulation (128.1 q/ha) compared to RDF (88.5 cm and 114.0 q/ha, respectively). Kler and Walia (2006) [6].

Number of leaves per plant

At harvest, maximum number of leaves per plant (11.48) was recorded with application of of FYM 10t/ha + Zinc 0.5% which was significantly superior over all other treatments and statistically at par with treatment of FYM 8t/ha + Zinc 0.5% (10.99). It might be due to reported that the plant height, number of green leaves plant^{-1}, stem thickness (cm), and leaf area index were recorded highest with application of FYM @ 10 t ha^{-1} followed by FYM @ 10 t ha^{-1} + Azospirillum @ 20 g kg^{-1} seed. Kharusto *et al*., (2016) [5].

Plant dry weight (g/plant)

The Plant dry weight of Baby corn recorded at 15, 30, 45 DAS and at harvest differed significantly as influenced by FYM and Zinc (Table 4.1) At harvest, maximum plant dry weight (88.57) was recorded with application of FYM 10 t/ha + Zinc 0.5% which was significantly superior over all other treatments and statistically at par with treatment of FYM 8 t/ha + Zinc 0.5% (87.8) and FYM 10t/ha + Zinc 0.25% at 15 DAS (87.55 g/plant). It might be due to observed that application of FYM at 20 t/ha resulted in higher plant height (96.8 cm) and higher dry matter accumulation (128.1 q/ha) compared to RDF (88.5 cm and 114.0 q/ha, respectively). Kler and Walia (2006) [6].

Yield

Cob yield of husked baby corn (t/ha) Cob yield of husked baby corn (t/ha), maximum FYM 10 t/ha + Zinc 0.5% at 30 DAS (9.47t/ha) was obtained with application of which was significantly superior over all other treatments and statistically at par with application of FYM 8 t/ha + Zinc 0.5% at 30 DAS (9.32 t/ha). It might be due to the application of FYM at 10 t/ha on an average increased the seed yield of sorghum by 27 per cent as compared to recommended dose of chemical fertilizers. Subbareddy *et al.*, (2004) [9]

Cob yield of dehusked baby corn (t/ha) Cob yield of dehusked baby corn (t/ha), maximum FYM 10 t/ha + Zinc 0.5% (2.85 t/ha) was obtained with application of which was significantly superior over rest of all the treatments except with application FYM 8 t/ha + Zinc 0.5% at 30 DAS (2.74 t/ha). It might be due to the on maize showing that grain yield and stover yield (t/ha) were significantly recorded higher under 10 to 20 t/ha FYM and also had significant and positive effect on green cob yield than control. Mahala and Shaktawat (2004) [7].

Economics

Maximum net reurns (Rs 173180.00 INR/ha) and B:C ratio (3.15) was obtained with application of FYM 10t/ha + Zinc 0.5% at 30 DAS which was significantly superior over rest of the treatments.

Table 1: Effect of sowing dates and plant densities on Growth Attributes of soybean.

Treatments	Plant height (cm)				Number of leaves per plant				Dry weight (g/plant)			
	15 DAS	30 DAS	45 DAS	At harvest	15 DAS	30 DAS	45 DAS	At harvest	15 DAS	30 DAS	45 DAS	At harvest
FYM 6t/ha + Zinc 0.25% at 15 DAS	4.14	24.34	69.36	166.80	3.03	5.32	6.65	7.99	0.4	5.4	35.50	84.83
FYM 6t/ha + Zinc 0.5% at 30 DAS	5.57	24.11	69.95	168.48	3.12	5.09	6.76	8.42	0.5	5.88	35.84	85.84
FYM 6t/ha + Zinc 0.75% at 45 DAS	5.13	24.73	70.91	169.70	3.13	5.53	6.53	8.53	0.6	4.64	34.52	84.19
FYM 8t/ha + Zinc 0.25% at 15 DAS	4.60	26.29	73.39	172.37	3.12	5.78	5.78	8.02	0.5	6.2	36.17	86.17
FYM 8t/ha + Zinc 0.5% at 30 DAS	6.22	28.22	77.48	176.32	3.2	5.91	8.22	10.99	0.6	7.08	37.46	87.8
FYM 8t/ha + Zinc 0.75% at 45 DAS	5.48	26.89	75.48	173.69	3.30	6.18	7.52	9.52	0.5	4.92	34.59	84.59
FYM 10t/ha + Zinc 0.25% at 15 DAS	4.56	22.14	74.91	172.72	3.27	6.01	6.34	8.34	0.7	6.5	36.48	87.55
FYM 10t/ha + Zinc 0.5% at 30 DAS	6.71	28.62	78.12	177.36	3.31	6.68	8.48	11.48	0.6	7.64	37.91	88.57
FYM 10t/ha + Zinc 0.75% at 45 DAS	4.79	27.54	76.29	173.96	3.37	6.22	7.57	9.90	0.6	5.51	35.42	85.42
S.Em (±)	0.549	1.121	0.649	0.744	0.073	0.315	0.160	0.240	0.061	0.215	0.220	0.371
CD (0.05%)	-	3.333	1.931	2.212	-	-	0.477	0.715	-	0.641	0.656	1.103

Table 2: Effect of sowing dates and plant densities on Yield Attributes and Yield of soybean

Treatments	Number of cobs per plant	Length of cob (cm)	Girth of cob (cm)	Weight of husked baby corn (gm)	Weight of dehusked baby corn (gm)	Corn yield of husked baby corn (t/ha)	Corn yield of dehusked baby corn (t/ha)
FYM 6t/ha + Zinc 0.25% at 15 DAS	1.39	16.75	5.37	39.25	7.44	6.54	1.16
FYM 6t/ha + Zinc 0.5% at 30 DAS	1.52	17.15	5.51	41.09	8.14	7.52	1.17
FYM 6t/ha + Zinc 0.75% at 45 DAS	1.75	16.26	5.67	42.90	8.70	7.13	1.40
FYM 8t/ha + Zinc 0.25% at 15 DAS	1.88	18.51	6.15	44.60	9.37	8.47	1.57
FYM 8t/ha + Zinc 0.5% at 30 DAS	2.34	19.17	7.80	45.54	11.29	9.32	2.61
FYM 8t/ha + Zinc 0.75% at 45 DAS	2.13	19.09	7.40	45.32	10.54	8.80	2.14
FYM 10t/ha + Zinc 0.25% at 15 DAS	2.02	18.98	6.27	44.59	10.25	8.28	1.97
FYM 10t/ha + Zinc 0.5% at 30 DAS	2.39	19.20	7.92	45.89	11.42	9.47	2.85
FYM 10t/ha + Zinc 0.75% at 45 DAS	2.25	19.14	7.53	45.16	11.14	9.08	2.51
S.Em (±)	0.056	0.133	0.058	0.371	0.085	0.079	0.050
CD (0.05%)	0.167	0.397	0.174	1.10	0.253	0.237	0.149

Table 3: Effect of sowing dates and plant densities on Economics of soybean

Treatments	Cost of cultivation (INR/ha)	Gross returns (INR/ha)	Net returns (INR/ha)	B:C Ratio
FYM 6t/ha + Zinc 0.25% at 15 DAS	46690	92800	46110	0.98
FYM 6t/ha + Zinc 0.5% at 30 DAS	46820	93600	46780	0.99
FYM 6t/ha + Zinc 0.75% at 45 DAS	46950	112000	65050	1.38
FYM 8t/ha + Zinc 0.25% at 15 DAS	50690	125600	74910	1.47
FYM 8t/ha + Zinc 0.5% at 30 DAS	50820	208800	157980	3.10
FYM 8t/ha + Zinc 0.75% at 45 DAS	50950	171200	120250	2.36
FYM 10t/ha + Zinc 0.25% at 15 DAS	54690	157600	102910	1.88
FYM 10t/ha + Zinc 0.5% at 30 DAS	54820	228000	173180	3.15
FYM 10t/ha + Zinc 0.75% at 45 DAS	54950	200800	145850	2.65

Conclusion

It is concluded that the treatment T_8 FYM 10 t/ha + Zinc 0.5% at 30 DAS was found significantly more productive (2.85 t/ha). It was also recorded that maximum Benefit cost ratio (3.15) as compared to other treatment combinations.

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