Original Research Article

Effect of organic manures and Nano Zinc on growth and yield of baby corn (*Zea mays* L.)

Abstract

A field experiment was conducted during *kharif* 2022 at CRF (Crop Research Farm), Department of Agronomy, SHUATS, Prayagraj, (UP.). To study the " Effect of organic manure and Nanozinc on Growth and Yield of Babycorn".The soil of the experimental field is sandy loam in texture. The experiment was laid out in Randomized Block Design with ten treatments three replications. The treatments consisted of three levels of Nano zinc (0.5ml/l, 1ml/l, 1.5ml/l) and three levels of organic manure whose effect is observed in baby corn. The results revealed that the treatment with application of poultry manure 3.3t/h + Nano zinc 1.5ml/l recorded higher plant height (191 cm), plant dry weight (99.60 g), number of cobs (3.73), Cob length 21.95, cm cob weight with husk 10.88 t/h Cob yield without husk 6.38 t/h, green fodder yield 36.10 t/h and Harvest index (39.03%). The economics viz., maximum gross returns (1,81, 170.00 /ha INR/ha), net returns (1,20,155.00 /ha INR/ha) and B:C (1.97) was also recorded in treatment 9 with application of poultry manure 3.3t/h + Nano zinc 1.5ml/l.

Keywords: *Baby corn,Nano zinc, Organic manure, Growth, Yield.*

INTRODUCTION:

Maize ***(Zea mays*** L.) is the most versatile crop with wider adaptability in varied agro- ecological conditions. It is an annual C4 plant belonging to the family- poaceae" with its origin Central America. Maize being one of the most important cereals crop in the world agricultural economy, it is cultivated throughout the world as it has highest genetic yield potential than any other cereals crop and there is no cereals on earth which has so immense potential and hence referred to as "Queen of cereals" or miracle crop **(Ranjan*et al.*, 2013).**

Baby corn (also known as young corn, mini corn or candle corn) is the ear of maize (***Zeamays*** L.) plant harvested young, when the silks have either not emerged or just emerged and no fertilization has taken place. Baby corn is one of the most important dual-purpose crops grown round the year in India **(Singh *et al.*, 2015**).

Neem cake known as non edible oil cake organic manure. The composition of Neem cake is 5.2 % N, 1.0 % P, 1.4 % K. Neem cake also act as a nematocide. Neem cake act as a nitrogen inhibitor means

reduce the nitrification. It supplies the available nitrogen for a long time in the soil. (**Katyayan, A. 2012)**

vermicompost provides all nutrients in readily available form and also enhances uptake of nutrients by plants **(Sreenivas*et al.*, 2000).** vermicomposting is a chemical and biological process for recycling nutrients with the aid of earthworms and microorganisms. Thus,vermicompost is considered as a high nutrient biofertilizer with diverse microbial communities (**Pathma and Sakthivel, 2013).**

Poultry manure is the faces of chickens used as an organic fertilizer, particularly for nitrogen-deficient soil; it contains the most nitrogen, phosphate, and potassium of any animal manure. The samples include 0.8 per cent potassium, 0.4 per cent to 0.5 per cent phosphorus and

0.9 per cent to 1.5 per cent nitrogen (**Deksissa*et al.*, 2008).**

The nano fertilizers or nano encapsulated nutrients might have the properties that are effective to crops, release the nutrients on demand, controlled release of chemical fertilizers that regulate the plant growth and enhanced target activity **(DeRosa*et al.* 2010**). Foliar application of Zn may significantly increase Zn accumulation in the grain as compared to soil fertilization. Foliar Zn application has been proved to be an effective practice to overcome the problems of Zn binding, and fixation in soil though the timing of application is of prime concern. The efficacy of the applied Zn fertilizer after the appearance of the Zn-deficiency symptoms in the crop plant can be limited. Therefore, zinc oxide nanoparticles (ZnONPs), a product of a multidisciplinary field of science, nanotechnology (NT) can be a possible assertive alternative Zn-deficiency remediation fertilizer. Application of ZnONPs is anticipated to provide zine to plants effectively due to their small size, easy solubility, and diffusible nature that renders for rapid and complete absorption/uptake by the plant catering the nutritional needs and deficiencies in the crop plant.

MATERIALS AND METHODS:

The present field experiment entitled, **"Influence of Organic Mannure and Nanozinc on Growth and Yield of Baby Corn (*Zea mays* L.)",** was conducted during *Kharif* season of 2022 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculure, Technology and Sciences, Prayagraj (U.P.).

The experiment was conducted during *Kharif* season of 2022 at the Crop Research Farm, Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.). The Crop Research Farm is situated at 25.570 N latitude, 87.190 E longitude and at an altitude of 98 m above mean sea level. The soil of the experimental field constituting a part of central Gangetic alluvium and is neutral and deep. The soil was sandy loam in texture, low in organic carbon and medium in available nitrogen, phosphorus and low in potassium. The experiment was conducted in Randomized Block Design with 10 treatments each replicated thrice. The plot size of each treatment was 3m x 3m. Factors are three levels of Organic manure (Neem cake 2t/ha, Vermicompost 6.6 t/ha and Poultry manure 3.3t/ha) and the

nanozinc 0.5 ml/l, 1 ml/l and 1.5 ml/l and a control. The treatment details are as follows, T1 -(Neem cake 2t/ha + Nanozinc0.5ml/l), T2 -(Neem cake 2t/ha + Nanozinc 1ml/l), T3 – (Neem cake 2t/ha + Nanozinc 1.5ml/l), T4 -(Vermicompost 6.6t/ha +Nanozinc 0.5ml/l) T5 -(Vermicompost 6.6t/ha +Nanozinc 1ml/l), T6 -(Vermicompost 6.6t/ha +Nanozinc 1.5ml/l), T7 -(Poulty manure 3.3t/ha + Nanozinc 0.5ml/l), T8 -(Poulty manure 3.3t/ha + Nanozinc 1ml/l), and T9 -(Poulty manure 3.3t/ha + Nanozinc 1.5ml/l), T10 - (Control – N:P:K 100:60: 40). The observations were recorded for plant height, dry weight, Crop growth rate, Relative growth rate, number of cobs per plant, cob length (cm), cob weight (g) with husk, cob weight (g) without husk, Cob yield (t/ha) with husk, Cob yield (t/ha) without husk, Green fodder yield (t/ha), net return and B:C ratio.

RESULT AND DISCUSSION:

Growth parameters

Plant height (cm): At 60 DAS, significantly and higher plant height (191.08 cm) was recorded in treatment 9(Poultry manure 3.3t/h + Nanozinc 1.5ml/l). However, treatment 5([Vermicompost 6.6 t/h + NanoZinc 1ml/l) , treatment 6 (Vermicompost 6.6 t/h + NanoZinc 1.5ml/l), treatment 7 (Poultry manure 3.3t/h + Nanozinc 0.5ml/l), treatment 8 (Poultry manure 3.3t/h + Nanozinc 1 ml/l) were statistically at par with treatment 9 (Poultry manure 3.3t/h + Nanozinc 1.5ml/l).

Significant and maximum plant height was observed with the application of (Poultry manure 3.3t/h + Nanozinc 1.5ml/l). might be because Zinc plays a critical role because it is needed to produce chlorophyll and is necessary for cell elongation. The synthesis of growth hormones and certain cell proteins also relies on sufficient zinc levels**.** Improvement in plant height with significant variation is due to in time availability of the needed nutrients to the plant by application of zinc which has led to production of IAA resulting in increased plant height **Meena*et al.*(2013)**and **Iqbal*et al.*(2016**).

Plant dry weight (g/plant):. At 60 DAS, significantly and higher plant dry weight (99.60 g/ plant) was recorded in treatment 9 (Poultry manure 3.3t/h+ Nano zinc 1.5ml/l). However, treatment 5 (Vermicompost 6.6 t/h + NanoZinc 1ml/l), treatment 7 (Poultry manure 3.3t/h + Nanozinc 0.5ml/l), treatment 8 (Poultry manure 3.3t/h + Nanozinc 1 ml/l) were statistically at par with treatment 9 (Poultry manure 3.3t/h + Nanozinc 1.5ml/l).

Significant and maximum plant dry weight was observed with the application of treatment 9 (Poultry manure 3.3t/h + Nanozinc 1.5ml/l). The production of more dry matter per plant might be due to higher levels of zinc application which might have helped in utilizing the natural resources *viz.*, light, nutrients and soil moisture more efficiently which may converted into organic constituents and also attributed to enhanced plant height and leaf area led to attain dry mass. These findings were

reported by **Alka Jyoti Sharma *et al*. (2019); Meena *et al.* (2013); Balwinder kumar *et al.* (2013) and Rakesh kumar and Bohra (2014).**

Crop Growth Rate (g/m^2/day): At 45-60 DAS, significantly and higher crop growth rate (55.80 g/ m^2 / day) was recorded in treatment 9 (Poultry manure 3.3t/h + Nanozinc (1.5ml/l). However treatment 2 (Neemcake 2t/h + Nanozinc 1ml/l), treatment 3 (Neemcake 2t/h + Nanozinc 1.5ml/l) , treatment 5 (Vermicompost 6.6t/h + NanoZinc 1ml/l) , treatment 6 (Vermicompost 6.6 t/h + NanoZinc 1.5ml/l), treatment 7 (Poultry manure 3.3t/h + Nanozinc 0.5ml/l), treatment 8 (Poultry manure 3.3t/h + Nanozinc 1 ml/l) were statistically at par with treatment 9 (Poultry manure 3.3t/h + Nanozinc 1.5ml/l).

Relative growth rate (g/m^2/day)

At 45-60 DAS, highest relative growth rate (0.056 g/g/day) was recorded in treatment 8 (Poultry manure 3.3t/h + Nanozinc 1 ml/l) and lowest (0.035g/g/day) in treatment 10 (Control-N:P:K (100:60:40) kg/ha). There was no significant difference among the treatments.

Yield parameters:

Number of cobs/plant:

The significantly and higher number of cobs/ plant (3.73) was recorded in treatment 9 (Poultry manure 3.3t/h + Nanozinc 1.5ml/l). However, treatment 7 (Poultry manure 3.3t/h + Nanozinc 0.5ml/l), treatment 8 (Poultry manure 3.3t/h + Nanozinc 1 ml/l) were statistically at par with treatment 9 (Poultry manure (3.3t/h + Nanozinc 1.5ml/l).

Significant and maximum number of cobs/ plant was observed with the application of (Poultry manure 3.3t/h + Nanozinc 1.5ml/l). The decrease in cobs might be due to more space per plot in the experiment. As a result cobs present in Nanozinc was found to be more. Similar findings were under the conformity of **Sharma*et al*. (2020).**

Cob length (cm)

The significantly and higher cob length (21.95) was recorded in treatment 9 (Poultry manure 3.3t/h + Nanozinc 1.5ml/l). However, treatment 5 (Vermicompost 6.6 t/h + NanoZinc 1ml/l), treatment 6 (Vermicompost 6.6 t/h + NanoZinc 1.5ml/l), treatment 7 (Poultry manure 3.3t/h + Nanozinc 0.5ml/l), treatment 8 (Poultry manure 3.3t/h + Nanozinc 1 ml/l) were statistically at par with treatment 9 (Poultry manure 3.3t/h + Nanozinc 1.5ml/l).

The use of micronutrients (Zn) increased cob length significantly which results in synergism and improvement of nutrient which leads to the formation of better cob and corn length. These findings corroborate the results of **Shivay and Prasad (2014); Badiyala and Chopra *et al*. (2011).**

Cob weight with husk (g)

The significantly and higher cobs weight with husk (45.72g) was recorded in treatment 9 (Poultry manure 3.3t/h + Nanozinc 1.5ml/l). However, treatment 5 (Vermicompost 6.6 t/h + NanoZinc 1ml/l), treatment 6 (Vermicompost 6.6 t/h + NanoZinc 1.5ml/l), treatment 7 (Poultry manure 3.3t/h + Nanozinc 0.5ml/l), treatment 8 (Poultry manure 3.3t/h + Nanozinc 1 ml/l) were statistically at par with treatment 9 (Poultry manure 3.3t/h + Nanozinc 1.5ml/l).

Cob weight without husk (g)

The significantly and higher cobs weight without husk (22.60g) was recorded in treatment 9 (Poultry manure 3.3t/h + Nanozinc 1.5ml/l) .However, treatment 5 (Vermicompost 6.6 t/h + NanoZinc 1ml/l) , treatment 6 (Vermicompost 6.6 t/h + NanoZinc 1.5ml/l), treatment 7 (Poultry manure 3.3t/h + Nanozinc 0.5ml/l), treatment 8 (Poultry manure 3.3t/h + Nanozinc 1 ml/l) were statistically at par with treatment 9 (Poultry manure 3.3t/h + Nanozinc 1.5ml/l).

.The increase in yield attributes due to application of Nanozinc was caused by higher chlorophyll contents, and this 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. The results were in conformity with **Meena*et al.*** **(2013)** and**Rakesh Kumar** and**Bohra (2014).**

Cob yield with husk (t/ha)

The significantly and higher cobs yield with husk (10.88t/h) was recorded in treatment 9 Poultry manure 3.3t/h + Nanozinc 1.5ml/l) .However, treatment 7 (Poultry manure 3.3t/h + Nanozinc 0.5ml/l), treatment 8 (Poultry manure 3.3t/h + Nanozinc 1 ml/l) were statistically at par with treatment 9 (Poultry manure 3.3t/h + Nanozinc 1.5ml/l).

Cob yield without husk (t/ha)

The significantly and higher cobs yield without husk (6.38t/h) was recorded in treatment 9 (Poultry manure 3.3t/h + Nanozinc 1.5ml/l) .However, treatment 5 (Vermicompost 6.6 t/h + NanoZinc 1ml/l), treatment 6 (Vermicompost 6.6 t/h + NanoZinc 1.5ml/l), treatment 7 (Poultry manure 3.3t/h + Nanozinc 0.5ml/l), treatment 8 (Poultry manure 3.3t/h + Nanozinc 1 ml/l) were statistically at par with treatment 9 (Poultry manure 3.3t/h + Nanozinc 1.5ml/l).

Increase in cob and corn yield in baby corn might be owing to the favourable influence of applied zinc on physiological and metabolic process of the plants, which ultimately enhanced baby cob and corn yield and found significant increase in all growth and yield attributes in wider intra-row spacing, yet concluded that narrower spacing could outstand others in yield. It was observed that narrow intra-row spacing resulted higher yield than wider intra-row spacing and also application of higher levels zinc directly related to the vegetative and reproductive growth phases of the crop.

Similar results were obtained by **Ganesha *et al.* (2018).**

Green fodder yield

The significantly and higher Green fodder yield (36.10t/h) was recorded in treatment 9 (Poultry manure 3.3t/h + Nanozinc 1.5ml/l) .However, treatment 6 (Vermicompost 6.6 t/h + NanoZinc 1.5ml/l), treatment 7 (Poultry manure 3.3t/h + Nanozinc 0.5ml/l), treatment 8 (Poultry manure 3.3t/h + Nanozinc 1 ml/l) were statistically at par with treatment 9 (Poultry manure 3.3t/h + Nanozinc 1.5ml/l).

Application of zinc reduces the fibre and soluble carbohydrate content in fodders thereby increases digestibility **(Alloway, 2008).** Increase in green fodder yield might be due to the enhanced translocation of photosynthates with applied zinc, which resulted in higher production of green fodder in the respective levels of nutrient **(S.W. Chand *et al.*, 2017).** Similar results of significantly higher fodder yield with Zn application were also reported by **Mahdi *et al.* (2012).**

Harvest index (%): The significantly and higher Harvest index (39.03) was recorded in treatment 2 (Neemcake 2t/h + Nanozinc 1ml/l) and lowest (35.61) was recorded in treatment 7(Poultry manure 3.3t/h + Nano zinc 0.5ml/l). There was no significant difference among the treatments.

Economics: The maximum net return (59183.00 INR/ha) and highest benefit cost ratio (1.86) was also recorded in treatment 9 with the application of Poultry manure 3.3 t/ha + Nano zinc 1.5ml/l.($T_{9)}$ when compared to other treatments.

CONCLUSION:

It is concluded that among different organic manure and nano zinc studied in baby corn, soil application of Poultry manure 3.3 t/ha + Nano zinc 1.5ml/l.(T_9) recorded higher.

Maximum gross returns (Rs. 1,81,170.00/ha), net returns (Rs. 1,20,155.00/ha) and benefit: cost ratio (1.97) was also obtained with Poultry manure 3.3 t/ha + Nano zinc 1.5ml/l. These findings are based on one season therefore; further trials may required for further confirmation.

Table 1 Effect of organic manure and nano zinc on growth parameters of baby corn.

S.No.	Treatmentcombination	60 DAS		45-60 DAS	
		Plant Height (cm)	Plant Dry Weight (g)	Crop growth rate ($g/m^2/day$)	Relative growth rate (g/g/day)
1.	Neem cake 2 t/ha + Nano zinc 0.5 ml/l.	160.98	66.43	30.16	0.041
2.	Neem cake 2 t/ha + Nano zinc 1 ml/l.	171.18	83.37	45.13	0.052
3.	Neem cake 2 t/ha + Nano zinc 1.5 ml/l.	171.14	83.67	44.15	0.051
4.	Vermicompost 6.6 t/ha + Nano zinc 0.5 ml/l.	174.08	82.33	42.04	0.048
5.	Vermicompost 6.6 t/ha + Nano zinc 1 ml/l.	181.11	88.97	47.55	0.051
6.	Vermicompost 6.6 t/ha + Nano zinc 1.5 ml/l.	176.78	84.50	42.93	0.048
7.	Poultry manure 3.3 t/ha + Nano zinc 0.5 ml/l.	184.90	94.70	52.64	0.055
8.	Poultry manure 3.3 t/ha + Nano zinc 1 ml/l.	186.08	97.77	54.88	0.056
9.	Poultry manure 3.3 t/ha + Nano zinc 1.5 ml/l.	191.08	99.60	55.80	0.055
10	Control (RDF)	158.24	62.10	25.32	0.035
	F-test	S	S	S	NS
	SEm(±)	6.12	3.93	4.41	0.004
	CD(P=0.05)	18.21	11.70	13.12	-

Table 2 Effect of organic manure and nano zinc on yield attributes of baby corn.

S.No.	Treatment combination	Yield attributes and yield							
		Cob/ plant (No)	Cob length (cm)	Cob weight with husk (g)	Cob weight without husk (g)	Cob yield with husk (t/ha)	Cob yield without husk (t/ha)	Green fodder yield (t/ha)	Harvest index (%)
1.	Neem cake 2 t/ha + Nano zinc 0.5 ml/l.	1.66	15.48	26.88	16.17	6.68	4.37	26.27	38.74
2.	Neem cake 2 t/ha + Nano zinc 1ml/l.	1.81	16.74	28.18	17.42	6.86	4.30	28.63	39.03
3.	Neem cake 2 t/ha + Nano zinc 1.5ml/l.	1.96	17.92	29.09	18.60	7.56	4.51	29.17	37.13
4.	Vermicompost 6.6 t/ha + Nano zinc 0.5 ml/l.	2.16	18.15	30.65	18.83	7.92	4.69	29.73	37.11
5.	Vermicompost 6.6 t/ha + Nano zinc 1 ml/l.	2.60	18.99	32.99	19.67	8.15	5.06	30.42	38.36
6.	Vermicompost 6.6 t/ha + Nano zinc 1.5 ml/l.	2.67	19.45	34.04	20.13	8.48	5.42	31.63	38.86
7.	Poultry manure 3.3 t/ha + Nano zinc 0.5 ml/l.	3.46	19.69	38.81	20.38	10.15	5.65	32.07	35.61
8.	Poultry manure 3.3 t/ha + Nano zinc 1 ml/l.	3.69	20.25	42.62	20.93	10.48	5.98	35.63	36.24
9.	Poultry manure 3.3 t/ha + Nano zinc 1.5 ml/l.	3.73	21.95	45.72	22.60	10.88	6.38	36.10	36.92
10.	Control (RDF)	1.61	13.72	25.36	14.40	6.63	4.24	24.22	36.82
	F-test	S	S	S	S	S	S	S	NS
	SEm(±)	0.28	1.20	4.33	1.21	0.68	0.48	1.62	9.29
	CD(P=0.05)	0.85	3.59	12.89	3.60	2.02	1.43	4.83	-

Table-3 Economics of baby corn as influenced by organic manure and nano zinc.

S.No.	Treatmentcombination	Economics	
		Net return (₹/ha)	B:C ratio
1.	Neem cake 2 t/ha + Nano zinc 0.5 ml/lil.	68595.00	1.37
2.	Neem cake 2 t/ha + Nano zinc 1 ml/lil.	70681.67	1.40
3.	Neem cake 2 t/ha + Nano zinc 1.5 ml/lil.	76745.00	1.50
4.	Vermicompost 6.6 t/ha + Nano zinc 0.5 ml/lil.	76575.00	1.35
5.	Vermicompost 6.6 t/ha + Nano zinc 1 ml/lil.	85775.00	1.50
6.	Vermicompost 6.6 t/ha + Nano zinc 1.5 ml/lil.	94738.33	1.64
7.	Poultry manure 3.3 t/ha + Nano zinc 0.5 ml/lil.	101825.00	1.70
8.	Poultry manure 3.3 t/ha + Nano zinc 1 ml/lil.	109955.00	1.82
9.	Poultry manure 3.3 t/ha + Nano zinc 1.5 ml/lil.	120155.00	1.97
10.	Control (RDF)	59771.67	1.33

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