Original Research Article

Influence of Nutrient Sources and Zinc on Growth and Yield of Babycorn (*Zea mays* L.)

ABSTRACT

The experiment was conducted during the *kharif* season 2021 at crop research farm, SHUATS, Prayagraj (U.P) to study the "Influence of Nutrient Sources and Zinc on Growth and Yield of babycorn (*Zea mays* L.)". The result reported that significantly higher Plant height (176.75 cm) and highest dry weight (88.42 g/plant) maximum crop growth rate at 45 DAS to 60 DAS interval (47.73 g/m^2/day), highest Number of cobs/ plant (2.64), highest length of cob (17.89 cm), maximum cob weight with husk (47.57 g/cob), highest cob weight without husk (11.71 g/cob) highest cob yield (6.07 tons/ha) were recorded with T_9 [*Vermicompost* 3.3t/ha + Zinc 1.00 ppm foliar spray].

Keywords: Babycorn, zinc, organic manures, growth and yield attributes.

Comment [U1]: What is the background of the problem (problem formulation) so that this research is important to do?

Introduction

Maize (*Zea mays* L.) is used for human food as well as animal feed, it is also widely used in starch industry. Towards diversification and value addition through cultivation of babycorn for vegetable purpose is emerging as a highly profitable activity. Farmers can grow four crops in a year, and the production of babycorn generates employment amongst the rural poor's, from children to the elderly persons. The demand for baby corn is rapidly increasing in urban areas of India. Keeping in view the importance of baby corn from nutritional point of view and its vast potential in increasing the income of farmers and diversification of the cropping system, with integration of micro nutrients, organic manures in plant nutrition management. Maize cultivated in nearly 166 countries with 201 m ha with production of 1162 m tonnes and productivity of 5754.7 kg/ha all over the world. INDIA produced 30 million tonnes in area of 9.9 million hectares and highest produced by Madhya Pradesh with production of 41.31 lakh tonnes in

12.67 lakh hectare of area. Whereas uttar pradesh production 15.26 lakh tonnes with 7.33 lakh hectares of area (GOI, 2020-2021)

Nitrogen deficiency is the major problem in these days it leads to stunted root and shoot growth and shoot water stress so nitrogen taken in highest quantity, by using chemical nitrogen crop growth will be faster but later on it leads to soil acidification. but by using organic manures we can provide nutrients required by plants and also it maintains CN ratio, maintain soil health and it doesn't reduces yield. with the application of micro nutrient as foliar application it is directly feeding plants with liquid fertilizer so plants are able to absorb more essential elements through leaves.

Farm Yard Manure occupies an important position among organic manures. FYM contains 0.5% N, 0.2% P, 0.5% K and seems to act directly by increasing crop yield by acceleration of respiratory process or by cell permeability or by hormonal growth action. under organic management nutrients release and crop demand synchrony is very much required, hence a thorough understanding of nutrients release pattern from organic sources is essential to avoid nutrients stress. It has a predominant role in improvement of soil fertility, physical-chemical properties and biological activity (Roopashree *et al.,* 2019)

Vermicompost contains 3% N, 1% P_2O_5 and 1.5% K_2O respectively and it is a source of organic manure in crop production it is gaining popularity due to its higher nutrient content, faster mineralization and acceptability. *Vermicompost* has been reported to give very high crop productivity along with maintaining higher nutritional quality and improving the physical, chemical and biological properties of soil .*Vermicompost* is highly nutritive and a powerful plant growth promoter and protector and has scientifically proven to be a miracle plant growth promoter. It also increases the efficiency of added fertilizers in the soil. On the average. *Vermicomposting* helps to convert the organic wastes (agro-wastes, animal manure and domestic refuse) into highly nutrient fertilizers for plant and soil (Gajalakshmi and Abassi 2004).

The dual activity of Neemcake as fertilizer and pest repellent has made it a favoured input it contains 2% N, 0.5% P, 1.0%K. It protects soil, reduces damage to environment (waterbeds, etc.). When Neem cake is ploughed into the soil it also protects plant roots from nematodes and white ants. Neem seed cake can also reduce alkalinity in the soil by producing organic acids when mixed with the soil. The calcium and magnesium present in Neem cake also aid in removing alkalinity (Rani *et al*., 2011).

Zinc (Zn) is essential for several enzymes that regulate various metabolic activities in plants. It is also vital for oxidation processes in plant cells and helps in transformation of carbohydrates and sugar in plants; enhances cell division and elongation; plays an important role in photosynthesis and nitrogen metabolism which ultimately increased the growth of the maize. Almost 50% of the soils globally used for cereal production are zinc deficient (Hafeez 2013). Little or no use of zinc along with imbalanced fertilization further aggravated the situation. Zinc deficiency in soils resulting in lower zinc content in grains and fodder. Therefore, keeping the above facts in view, the present experiment entitled "Influence of Nutrient Sources and Zinc on growth and yield of Babycorn (*Zea mays* L.)" has been proposed for study. Zinc enhance the productivity and it is tolerance to biotic and abiotic stresses it performs wel in uptake and utilization of nutrients (Peddapuli *et al.*, 2021).

Materials and Methods

The experiment was conducted during the *kharif* 2021, at the crop research farm, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.). The soil of the experimental field constituting a part of central Gangetic alluvium is neutral and deep. The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (pH 7.3), low in organic carbon (0.57%). The treatments consist of three different organic manures and three different levels of Zinc foliar spray. The experiment was laid out in Randomized Block Design with nine treatments each replicated thrice. The plot size of each treatment was 3m x 3m. Factors are farm yard manure (20t/ha), neem cake (5t/ha), *vermicompost* (3.3t/ha) and three levels of foliar application of zinc (0.25 ppm, 0.50ppm, 1.00 ppm). babycorn variety (G-5414) was sown on 30-06-2021 by maintaining a spacing of 45 cm x 15 cm. Harvesting was done taking $1m^2$ area from each plot. The treatment details as follows, T_1: FYM 20t/ha + Zinc 0.25 ppm foliar spray, T_2 : FYM 20t/ha + Zinc 0.50 ppm foliar spray, T_3 : FYM 20t/ha + Zinc1.00 ppm foliar spray, T_4 : Neem Cake 5t/ha + Zinc 0.25 ppm foliar spray, T_5 : Neem Cake 5t/ha + Zinc 0.50 ppm foliar spray, T_6 : Neem Cake 5t/ha + Zinc 1.00 ppm foliar spray, T_7 : *Vermicompost* 3.3 t/ha + Zinc 0.25 ppm foliar spray, T_8 : *Vermicompost* 3.3t/ha + Zinc 0.50 ppm foliar spray, T_9 : *Vermicompost* 3.3t/ha + Zinc 1.00 ppm foliar spray. Observations on growth and yield attributes of babycorn were recorded and their significance was tested by the variance ratio (F-value) at 5% level (Gomez and Gomez, 1976).

Comment [U2]: what are the characteristics?

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Result and discussion

Growth parameters:

Plant height

The data revealed that significant and higher plant height (176.75 cm) of babycorn was observed in treatment 9 (*Vermicompost* 3.3t/ha + Zinc 1.00 ppm). However, T_4 (Neem cake 5t/ha + Zinc 0.25 ppm) and T_7 (*Vermicompost* 3.3t/ha + Zinc 0.25 ppm) which was found to be statistically at par with treatment 9 [*Vermicompost* 3.3t/ha + Zinc 1.00 ppm foliar spray] (Table 1). Significant increase plant height was with application of *Vermicompost* 3.3t/ha, might be due to *vermicompost* attributed to presence of readily available plant nutrients, growth enhancing substances, resulted in plant height increases. Similar results is in support with **Nazir** *et al.* (2017). Further application of zinc 1.00 ppm might be due to it involves in photosynthesis and nitrogen metabolism, resulted increase in plant height. Similar result is in support with **Balwinder** *et al.* (2018).

Comment [U5]: what are the nutritional content and how much?

Plant Dry weight

The data recorded that significant and highest plant dry weight (88.42 g) of babycorn was found in treatment 9 (*Vermicompost* 3.3t/ha + Zinc 1.00 ppm). However, T_7 (*Vermicompost* 3.3t/ha + Zinc 0.25 ppm) which was observed statistically at par with treatment 9 [*Vermicompost* 3.3t/ha + Zinc 1.00 ppm] (Table 1). Significant increased in dry weight was with the application of *Vermicompost* 3.3t/ha might be due to it involves haemophilic process to provide organic soil amendements with low CN ratios, resulted increase in plant growth. Similar result is in support with **Vinod** *et al.* (2017). Further application of zinc 1.00 ppm might be due to it influence cell division and cell elongation with balanced nutrients, which results increase in plant growth. Similar result is in support with **Amutham** *et al.* (2019).

Crop growth rate

The data observed that significantly highest Crop Growth Rate (47.73 g/m^2/day) at 45 DAS to 60 DAS interval was recorded in treatment 9 (*Vermicompost* 3.3t/ha + Zinc 1.00 ppm). However, T5 (Neem cake 5t/ha + zinc 0.50 ppm), T7 (*Vermicompost* 3.3t/ha + Zinc 1.00 ppm), T8 (*Vermicompost* 3.3t/ha + Zinc 1.00 ppm) which was found to be statistically at par with treatment 9 (*Vermicompost* 3. 3t/ha + Zinc 1.00 ppm) (Table 1). Significant increase of crop growth rate was with application of *vermicompost* 3.3t/ha might be due nutrients uptake and nitrogen fixing organisms, resulted increase in plant growth. Similar result is in support with **Jinjala** *et al*. (2016). Further application of zinc 1.00 ppm might be due to it play vital role in synthesis of enzymes like carbonic anhydrase and auxin synthesis, resulted increase in plant growth. Similar result is in support with **Tharaka** *et al.* (2021).

Yield parameters:

Number of cobs/plant: The data revealed that highest number of cobs (2.64) were found to be significantly superior in treatment 9 with the application of (*Vermicompost* 3.3t/ha + Zinc 1.00 ppm). However, T_2 (FYM 20t/ha + Zinc 0.50 ppm), T_4 (Neem cake 5t/ha + Zinc 0.25 ppm) , T_5 (Neem cake 5t/ha + Zinc 0.50 ppm) , T_6 (Neem cake 5t/ha + Zinc 1.00 ppm), T_7 (*Vermicompost* 3.3t/ha + Zinc 0.25 ppm) and T_8 (*Vermicompost* 3.3t/ha + Zinc 0.50 ppm) recorded statistically at par with treatment 9 (*Vermicompost* 3.3t/ha + Zinc 1.00 ppm) (Table 2). Significant increase in number of cobs was with application of Vermicompost 3.3t/ha, might be due to *vermicompost contain beneficial organisms like nitrogen fixing* and other beneficial microbes, resulted in number of cobs/plant increases. Similar results is in support with **Nazir** *et al.* (2017). Further application of zinc 1.00 ppm might be due to zinc inclined and stimulate growth of plant also improves root and shoot length with increasing of chlorophyll content, resulted number of cobs/plant increases. Similar result is in support with **Tejaswini** *et al. (2021).*

Cob weight with husk (g/cob)

The data observed that significantly higher cob weight with husk (47.57 g/cob) was obtained in treatments 9 [*Vermicompost* 3.3t/ha + Zinc 1.00 ppm]. However, treatment 7 (*Vermicompost* 3.3t/ha + Zinc 0.25 ppm) is statistically at par with treatment 9 (*Vermicompost* 3.3t/ha + Zinc 1.00 ppm) (Table 2). Significant increase in cob weight with husk is with application of *Vermicompost* 3.3t/ha might be due to it involves in protoplasmic properties and accelerates cell division and cell elongation, resulted increase in weight of the cob. Similar result is in support with **Ashoka** *et al* (2008). Further application of zinc 1.00 ppm might be due to foliar application of zinc beneficial because it is directly observed by plants

thus helpful in photosynthesis process, assimilation and translocation of photosynthates from leaves to cob, resulted increase in weight of the cob. Similar result is in support with **Ganesha** *et al* (2020).

Cob weight without husk (g/cob)

The data recorded that higher cob weight without husk (11.71 g/cob) was observed in treatment 9 [*Vermicompost* 3.3t/ha + Zinc 1.00 ppm] . However, treatment 6 (Neem cake 5t/ha + Zinc 1.00 ppm) and treatment 7 (*Vermicompost* 3.3t/ha + Zinc 0.25 ppm) stood statistically at par with treatment 9 (*Vermicompost* 3.3t/ha + Zinc 1.00 ppm) (Table 2). Significant Increase in cob weight without husk was with application of *Vermicompost* 3.3t/ha might be due to it releases nutrients slowly over longer duration with the uses of organic resources, resulted increase in cob weight. Similar result is in support with **Rakesh** *et al*. (2019). Further application of zinc 1.00 ppm might be due to zinc inclined and stimulate growth of plant also improves root and shoot length with increasing of chlorophyll content, resulted number of cobs/plant increases. Similar result is in support with **Tejaswini** *et al. (2021).*

Cob yield : The data revealed that increase in cob yield (6.07 tons/ha) was observed in treatment 9 with the application of treatment 9 [*Vermicompost* 3.3t/ha + Zinc 1.00 ppm]. However, T_7 (*Vermicompost* 3.3t/ha + Zinc 0.50 ppm) stood statistically at par with T_9 (*Vermicompost* 3.3t/ha + Zinc 1.00 ppm) (Table 2). significant increase in cob yield is with application of *vermicompost* 3.3t/ha might be due to *vermicompost* act as good medium for growth and development of microbes and high nutrient availability at right time is the reason for higher nutrient, resulted increasing in cob yield. Similar result is in support with **Muralimaran** *et al.* (2019). Further application of zinc 1.00 ppm might be due to it encourages root uptake and reduces physiological stress of crop, which results in higher growth of plants. Similar result is in support with **Amutham** *et al.* (2019).

Conclusion:

It is concluded that by the application of *Vermicompost* 3.3t/ha and Zinc 1.00 ppm foliar spray (treatment 9) recorded significantly higher in growth parameters like plant height (176.75 cm), dry weight (88.42 g/plant), Crop Growth Rate (47.73 g/m^2/day) and also in yield parameters like number of cobs (2.64), cob weight (11.71 g/cob), cob yield (6.07 tons/ha). These findings are based on one season; therefore, further trail may be required for further confirmation.

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Table 1. Influence of Nutrient Sources and zinc on growth parameters of babycorn.

S.no	Treatment	Plant height (cm) at harvest	Dry weight (g/plant) at harvest	CGR ($g/m^2/day$) 45 DAS-at harvest
1	FYM 20t/ha + Zinc 0.25 ppm	164.02	71.02	37.22
2	FYM 20t/ha + Zinc 0.50 ppm	162.26	75.09	42.52
3	FYM 20t/ha + Zinc 1.00 ppm	165.89	71.31	38.34
4	Neem Cake (5 t/ha) + Zinc 0.25 ppm	170.73	78.13	41.35
5	Neem Cake (5 t/ha) + Zinc 0.50 ppm	164.45	83.31	46.12
6	Neem Cake (5 t/ha) + Zinc 1.00 ppm	165.02	80.28	43.05
7	Vermicompost (3.3 t/ha) + Zinc 0.25 ppm	174.60	86.95	46.63
8	Vermicompost (3.3 t/ha) + Zinc 0.50 ppm	164.94	73.61	45.4
9	Vermicompost (3.3 t/ha + Zinc 1.00 ppm	176.75	88.42	47.73

F test	S	S	S
SEm (±)	2.16	0.68	0.82
CD (5%)	6.46	2.03	2.45

Table 2. Influence of nutrient sources and zinc on yield parameters of babycorn.

S.no	Treatment	Number of cobs/plant	Cob weight with husk (kg/ha)	Cob weight without husk (kg/ha)	Cob yield (tons/ha)
1	FYM 20t/ha + Zinc 0.25 ppm	1.56	40.84	9.10	4.88
2	FYM 20t/ha + Zinc 0.50 ppm	2.34	43.45	10.05	4.90
3	FYM 20t/ha + Zinc 1.00 ppm	2.01	42.54	9.28	4.98
4	Neem Cake (5 t/ha) + Zinc 0.25 ppm	2.35	43.51	10.96	5.66
5	Neem Cake (5 t/ha) + Zinc 0.50 ppm	2.44	45.88	10.70	5.55
6	Neem Cake (5 t/ha) + Zinc 1.00 ppm	2.36	45.57	11.10	5.76
7	Vermicompost (3.3 t/ha) + Zinc 0.25 ppm	2.51	47.51	11.19	6.01
8	Vermicompost (3.3 t/ha) + Zinc 0.50 ppm	2.30	42.84	9.86	5.87

9	Vermicompost (3.3 t/ha + Zinc 1.00 ppm	2.64	47.57	11.71	6.07
	F test	S	S	S	S
	SEm (±)	0.14	0.31	0.24	0.02
	CD (5%)	0.43	0.93	0.73	0.06