

## **Effect of Nano urea and Zinc on Growth and Yield of Baby Corn (*Zea mays* L.) under Prayagraj Condition**

### **Abstract**

A field experiment was conducted at the Crop Research Farm (CRF), Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of *Kharif* season 2022. The experiment comprised of ten treatments of different combinations of Nanourea and Zinc nutrient management replicated thrice in a Randomized Block Design. The main objective of the experiment was to evaluate the “Response of Nano urea and Zinc on growth and yield of Baby corn (*Zea mays* L.)” Prayagraj condition. The three level of nano urea levels N<sub>1</sub>- 1 ml/l foliar spray nano urea, N<sub>2</sub> -2 ml/l foliar spray nano urea and N<sub>3</sub> - 3 ml/l foliar spray nano urea. Whereas three levels of zinc include like Z<sub>1</sub>- 20 kg/ha zinc, Z<sub>2</sub>- 25 kg/ha zinc and Z<sub>3</sub>- 30 kg/ha zinc. From the present investigation it may be concluded that the profitable production of baby corn can be secured by ZnSO<sub>4</sub> 30 kg/ha + Nanourea 3 ml/l. (T<sub>9</sub>). Highest Gross returns (92087.17 ₹/ha), Net returns (61352.17 ₹/ha) and B:C ratio (2.00) were recorded significantly high with the application of ZnSO<sub>4</sub> 30 kg/ha + Nano urea 3 ml/l.

**Keywords:** Growth, yield, nano urea spray and zinc levels

### **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 Hali, 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 16<sup>th</sup> and 17<sup>th</sup> centuries. During recent times, its potentiality has been extended to the field of vegetable production” (Mugalkhod *et al.* 2011). “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”. (Kumar and Sanodiya, 2022)

Nitrogen, a key vital ingredient needed for a plant's healthy growth and development, may be found in Nano Urea (Liquid). A plant's amino acids, enzymes, genetic material, photosynthetic pigments, and energy transfer molecules are all heavily reliant on nitrogen. As it supports precise and sustainable agriculture, nano urea is a potential part of the 4 R approach to nutrient stewardship. According to testing carried out by NABL approved and GLP certified laboratories, Nano urea has been deemed safe for both users and the environment. Therefore, Nano Urea represents a potential, long-term, and environmentally benign alternative to bulk nitrogenous fertilizers like Urea. An important nutrient for plants is zinc (Zn). After nitrogen, phosphorus, and potassium, zinc is now ranked as the fourth most significant nutrient in India that limits crop yields. In many enzymatic and physiological processes that occur in plants, zinc and iron play a vital role. Zinc catalysis the oxidation process in plant cells, which is essential for the transformation of carbohydrates, controls the consumption of sugar, increases the energy source for chlorophyll synthesis, aids in the formation of auxins, which leads to the production of more plant cells and more dry matter, which is then stored in seeds as a sink and encourages water absorption. **Ojha et al. (2018)**

The following objectives have been undertaken to study the “Effect of nano urea and zinc on growth and yield of baby corn (*Zea mays* L.) Under prayagraj condition”

## **Materials and Methods**

The current study was carried out at Crop Research Farm of Sam Higginbottom University, Prayagraj, Uttar Pradesh during the *Kharif* season 2022. The experimental field is situated on the left side of the Prayagraj-Rewa Road, about seven kilometers from Prayagraj city and close to the Yamuna River, at 25.57° N latitude, 87.19° E longitude and at an altitude of 98m above mean sea level. The relative humidity levels range from 79.11% and 37.60%. In this location, the average annual rainfall is of 3.42 mm in June and zero rainy days were occurred in

July and August months, respectively. The soil chemistry analysis revealed a sandy loam texture with a pH of 7.20, low amounts of organic carbon (0.72 percent) and potassium (233.24 kg/ha), and a low quantity of accessible phosphorus (27.80 kg/ha). “The soil was electrically conductive and had a conductivity of 0.187 dS/m. For each of the ten treatment combinations, three replications were employed. The therapy details and treatment ombinations are shown in Tables 1 and 2, respectively. Nano urea and zinc were maintained according to the treatment combinations. Plant height (cm) at harvest, dry weight at harvest, number of cobs/plant, weight of cob (g), baby corn yield (t/ha) and fodder yield (t/ha) were all successfully measured, and an economic analysis of each treatment was completed to determine the best treatment combination for baby corn cultivation”. (Kumar and Sanodiya, 2022) The collected data was subjected to statistical analysis by analysis of varience method (**Gomez and Gomez, 1976**).

## **Result and Discussion**

### **Growth parameters**

#### **Plant height (cm)**

Table 3 shows nano urea and zinc on plant height at harvest. The Data indicated that significant impact on plant height during the crop growth period. Application of T<sub>9</sub>- ZnSO<sub>4</sub> 30 kg/ha + Nano urea 3 ml/lit. significantly influenced the plant height in baby corn at 60 DAS. The maximum plant height (175.25 cm) was recorded in T<sub>10</sub>- ZnSO<sub>4</sub> 30 kg/ha + Nano urea 3 ml/lit, which was statistically at par with T<sub>8</sub>,T<sub>7</sub>,T<sub>6</sub> and minimum plant height (120.33 cm) was recorded in application of T<sub>10</sub> : Control (RDF). Application of Zn enhances hotosynthesis, activates several enzymes, and aids in assimilate transport to the stem. The physiology and morphology of plants are greatly influenced by zinc. Foliar spraying of nano urea drastically reduced plant height. A similar finding was also made by (**Akongwubel et al. 2012**). They observed a significant improvement in maize plant height and leaf area index with an increase in organic manure rates. The essential nutrients for supporting healthy growth and physiological functions in the plant system are provided by nitrogen. When the rate of bio fertilizer application is raised, plant height, leaf area index, and dry matter output are all significantly increased. (**Igua et al. 2009**) and both observed the same result (**Channal, 2017**). The availability of sufficient space, nutrients, and sunlight may have encouraged plants to grow vertically, leading to higher plant

height. The current findings closely resemble those of **Qodliiyati et al. (2018)**, **Ojha et al. (2018)**, and **Ganvit et al. (2017)**.

### **Dry weight of plant (g)**

Application of T<sub>9</sub>: ZnSO<sub>4</sub> 30 kg/ha + Nano urea 3 ml/lt. significantly influenced the dry weight in Table 3 shows nano urea and zinc on dry weight per plant at harvest. The Data indicated that, baby corn at 60 DAS. The maximum dry weight (70.50 g) was recorded in T<sub>9</sub>: ZnSO<sub>4</sub> 30 kg/ha + Nano urea 3 ml/lt. Were statically at par with T<sub>8</sub> and lowest dry weight (46.99 g) was recorded in Farmers practice- urea (120:60:40 kg/ha N, P and K). The therapies did not differ significantly from one another. “When nano urea were applied, the physico-chemical characteristics of the soil may have improved, giving the soil a favorable structure for root growth and soil enzymes (which continue to decompose organic matter in the soil to release nutrients and make them available near the rhizosphere for absorption by plant roots, thus improving quality)” (**Chaoui et al. 2003**). Moreover, the impact of organic fertilization by vermicompost on LAI may be attributed to an increase in plant metabolism that seems to have supported meristematic activities that resulted in apical growth. This results supports what Atarzadeh and colleagues found. Dry weight is the result of photosynthetic activity. The efficiency of photosynthesis and the number of photosynthetic organisms produced depend on how much sunshine a plant receives. Increased photosynthetic activity will lead to larger plant organs, which will also result in a rise in the dry weight of plants. According to **Meena et al. (2012)**, **Kumar et al. (2014)**, **Shahid et al. (2015)**, others, proper nutrition and spacing promote higher vegetative development and more sunshine to plants.

### **Yield parameters**

#### **Number of cobs per plant**

The information on the number of cobs per plant impacted by treatments is reported in a table for in general. The number of cobs per plant rose with crop stage progression regardless of treatment and peaked at harvest. Number of cobs per plant recorded non-significant difference among the treatments. ZnSO<sub>4</sub> 30 kg/ha + Nano urea 3 ml/lt. recorded maximum number of cobs (2.47/plant) and minimum was recorded in control plot (1.15/plant), respectively.

The overall growth of the crop was significantly enhanced by providing the crop with the nutrients it requires from the start and increasing the supply of N, P, and K in a more coordinated manner at the treatment receiving an integrated supply of nutrients from nano urea, as measured by plant height, cobs per plant, cob girth, cob length, and cob weight with and without husk by virtue of inorganic fertiliser, chemical fertiliser, and integrated use of fertilizer, **singh et al., (2015)**. The decrease in cobs might be due to more fertilizer per plot in the experiment. As a result cobs present in less fertilizer was found to be more than the highest fertilizer. Similar findings were under the conformity of Longchar *et al.* (2021). Findings, increased availability of photosynthetic, metabolites, and nutrients to develop reproductive structures appears to have led to an increase in the number of cobs/plant, length of cobs, weight of cobs, and yield of cobs with these integrated nutrient management treatments similar result found **Wailare and Kesarwani (2017) and Kour et al. (2017)**.

#### **Cob length (cm)**

Maximum cob length (17.83 cm) was recorded in ZnSO<sub>4</sub> 30 kg/ha + Nano urea 3 ml/lt. However, treatments of ZnSO<sub>4</sub> 30 kg/ha + Nano urea 2 ml/lt., ZnSO<sub>4</sub> 30 kg/ha + Nano urea 1 ml/lt. and ZnSO<sub>4</sub> 25 kg/ha + Nano urea 3 ml/lt. (16.13, 15.58 and 15.33 cm) were found to be at par with the treatment of ZnSO<sub>4</sub> 30 kg/ha + Nano urea 3 ml/lt.

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 Longchar *et al.* (2021).

#### **Cob girth (cm)**

A significant difference was appeared in relation to cob girth. Significantly higher cob girth (8.65 cm) was recorded in ZnSO<sub>4</sub> 30 kg/ha + Nano urea 3 ml/lt. which was on par with ZnSO<sub>4</sub> 30 kg/ha + Nano urea 2 ml/lt., ZnSO<sub>4</sub> 30 kg/ha + Nano urea 1 ml/lt. and ZnSO<sub>4</sub> 25 kg/ha + Nano urea 3 ml/lt. (8.46, 8.06 and 7.56 cm) treatment combinations.

Higher chlorophyll contents were the cause of the increase in yield attributes brought on by the application of zinc, and this appeared to have a favorable impact on photosynthetic activity, the synthesis of metabolites and growth-regulating substances, oxidation and metabolic

activities, and ultimately better crop growth and development, which brought about the increase in yield attributes of baby corn. The results were in conformity with **Meena *et al.* (2013)**.

### **Cob weight (g)**

#### **With husk**

Cob weight per plant with husk recorded a significant difference among treatment combinations. However, cob weight (45.22 g) recorded significantly higher in ZnSO<sub>4</sub> 30 kg/ha + Nano urea 3 ml/lt. and at par values were observed in ZnSo<sub>4</sub> 30 kg/ha + Nano urea 2 ml/lt., ZnSo<sub>4</sub> 30 kg/ha + Nano urea 1 ml/lt. and ZnSo<sub>4</sub> 25 kg/ha + Nano urea 3 ml/lt. (42.12, 38.31 and 33.54 g/plant), respectively.

#### **Without husk**

Significantly higher cob weight without husk was (17.77 g) recorded significantly higher in ZnSO<sub>4</sub> 30 kg/ha + Nano urea 3 ml/lt. which was followed by ZnSo<sub>4</sub> 30 kg/ha + Nano urea 2 ml/lt., ZnSo<sub>4</sub> 30 kg/ha + Nano urea 1 ml/lt. and ZnSo<sub>4</sub> 25 kg/ha + Nano urea 3 ml/lt. (16.10, 15.55, 15.30 and 14.84 g/plant), respectively.

Chemical fertilizer and integrated use of fertilizer did significantly improve yields by providing the crop with the nutrients it needs from the start and increasing the supply of N, P, and K in a more coordinated manner at the treatment receiving an integrated supply of nutrients from organic manure and inorganic fertilizer, as measured by plant height, cobs per plant, cob girth, cob length, and cob weight with and without husk by virtue of inorganic fertilizer Zn of the In accordance with **Singh *et al.* (2015)**, findings, increased availability of photo-synthases, metabolites, and nutrients to develop reproductive structures appears to have led to an increase in the number of cobs/plant, length of cobs, weight of cobs, and yield of cobs with these integrated nutrient management treatments, similar result found **Wailare and Kesarwani (2017) and Kour *et al.* (2017)**.

### **Green cob yield (t/ha)**

#### **With husk**

Significantly higher green cob yield with husk was noticed in ZnSO<sub>4</sub> 30 kg/ha + Nano urea 3 ml/lt. (6.38 t/ha) which was on par with followed by ZnSo<sub>4</sub> 30 kg/ha + Nano urea 2 ml/lt., ZnSo<sub>4</sub> 30 kg/ha + Nano urea 1 ml/lt. and ZnSo<sub>4</sub> 25 kg/ha + Nano urea 3 ml/lt. (5.98, 5.65, 5.42 and 5.06 t/ha), respectively.

### **Without husk**

However, green cob yield without husk (8.88 t/ha) was found to be significantly higher in treatment combination of ZnSO<sub>4</sub> 30 kg/ha + Nano urea 3 ml/lt. which was statistically at par with ZnSo<sub>4</sub> 30 kg/ha + Nano urea 2 ml/lt., ZnSo<sub>4</sub> 30 kg/ha + Nano urea 1 ml/lt. and ZnSo<sub>4</sub> 25 kg/ha + Nano urea 3 ml/lt. (8.48, 8.15, 7.92 and 7.56 t/ha), respectively.

Baby corn yield may have increased due to the beneficial effects of applied zinc on plant physiological and metabolic processes. Although wider intra-row spacing was found to significantly increase all growth and yield attributes, it was determined that narrower spacing could outperform others in terms of yield. It was found that crops with tight intra-row spacing produced better yields than those with wider intra-row spacing. Higher zinc applications were also found to be strongly associated to the crop's vegetative and reproductive growth phases. Similar results were obtained by **Kumar *et al.* (2014)**. In case of green fodder yield, almost the same trend was observed in case of green cob yield. Plant population showed significant differences in green fodder yield the lowest being recorded with the wider spacing. The present findings are well in agreement with that of **Kumar *et al.* (2016) and Kour *et al.* (2017)**.

### **Conclusion**

On the basis of results obtained in present investigation, it is concluded that the profitable production of baby corn can be secured by ZnSO<sub>4</sub> 30 kg/ha + Nano urea 3 ml/lt. (T<sub>9</sub>). These practices may be passed on to the farmers for obtaining higher returns in this agro-climatic zone. It has also recorded the maximum gross return, net return and benefit cost ratio.

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**Table 1: Effect of nano urea and zinc on growth parameters of baby corn**

Treatment details	Growth Parameters	
	Plant height (cm)	Plant dry weight (g/plant)
ZnSo4 20 kg/ha + Nanourea 1 ml/lt	123.11	49.79
ZnSo4 20 kg/ha + Nanourea 2 ml/lt.	126.36	53.03
ZnSo4 20 kg/ha + Nanourea 3 ml/lt.	128.69	54.57
ZnSo4 25 kg/ha + Nanourea 1 ml/lt.	131.13	55.56
ZnSo4 25 kg/ha + Nanourea 2 ml/lt.	131.61	56.74
ZnSo4 25 kg/ha + Nanourea 3 ml/lt.	138.29	58.29
ZnSo4 30 kg/ha + Nanourea 1 ml/lt.	140.04	60.04
ZnSo4 30 kg/ha + Nanourea 2 ml/lt.	147.21	67.21
ZnSO4 30 kg/ha + Nanourea 3 ml/lt.	175.25	70.25
Control (RDF)	120.33	46.99
<b>F Test</b>	S	S
<b>SEm (<math>\pm</math>)</b>	4.03	3.82
<b>CD (p= 0.05)</b>	11.97	11.36

**Table 2: Effect of nano urea and zinc on yield attribute and yield of baby corn**

Treatment details	Yield attribute and yield						Cob Yield with husk (t/ha)
	No. of cobs/plant	Cob length (cm)	Cob grith (cm)	Cob weight with husk (g)	Cob weight without husk (g)	Cob Yield without husk (t/ha)	
ZnSo4 20 kg/ha + Nanourea 1 ml/lit	1.56	11.37	5.25	26.38	11.34	4.37	6.43
ZnSo4 20 kg/ha + Nanourea 2 ml/lit.	1.61	12.62	6.06	27.68	12.59	4.30	6.47
ZnSo4 20 kg/ha + Nanourea 3 ml/lit.	1.71	13.80	6.27	28.59	13.77	4.51	6.68
ZnSo4 25 kg/ha + Nanourea 1 ml/lit.	1.99	14.03	6.69	30.15	14.00	4.69	6.86
ZnSo4 25 kg/ha + Nanourea 2 ml/lit.	2.11	14.87	7.24	32.49	14.84	5.06	7.56
ZnSo4 25 kg/ha + Nanourea 3 ml/lit.	2.22	15.33	7.56	33.54	15.30	5.42	7.92
ZnSo4 30 kg/ha + Nanourea 1 ml/lit.	2.42	15.58	8.06	38.31	15.55	5.65	8.15
ZnSo4 30 kg/ha + Nanourea 2 ml/lit.	2.43	16.13	8.46	42.12	16.10	5.98	8.48
ZnSO4 30 kg/ha + Nanourea 3 ml/lit.	2.47	17.83	8.65	45.22	17.77	6.38	8.88
Control (RDF)	1.15	9.60	4.23	24.86	9.57	4.24	6.42
<b>F Test</b>	S	S	S	S	S	S	S
<b>SEm (<math>\pm</math>)</b>	0.22	1.20	0.78	4.33	1.21	0.48	0.50
<b>CD (p= 0.05)</b>	0.66	3.59	2.32	12.89	3.60	1.43	1.49

