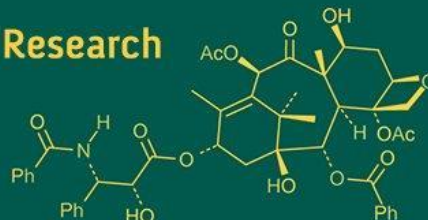
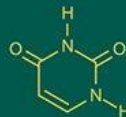
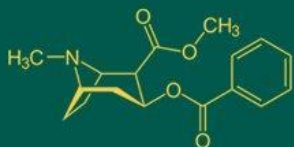


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## Effect of NPK and foliar application of zinc on soil health of baby corn (*Zea mays* L.)

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### Abstract

A field experiment was conducted during the *Rabi* season of 2025–26 at the Research Farm of the Department of Soil Science, Prof. Rajendra Singh (Rajju Bhaiya) University, Prayagraj, Uttar Pradesh, to evaluate the effect of NPK and zinc application on soil health under Baby corn (*Zea mays* L.) cultivation. The experiment was laid out in a Randomized Block Design (RBD) comprising nine treatments with three replications. The treatments consisted of different levels of NPK along with soil and foliar application of zinc. Soil samples collected after harvest were analyzed for physical and chemical properties of soil. The results revealed that the application of NPK and Zinc significantly improved soil health parameters. The lowest bulk density ( $1.16$  and  $1.20 \text{ Mg m}^{-3}$ ) and particle density ( $2.42$  and  $2.49 \text{ Mg m}^{-3}$ ) were recorded under  $T_9$  ( $100\% \text{ NPK} + 0.5\% \text{ Zn foliar spray}$ ). The same treatment also recorded the highest pore space ( $54.78$  and  $52.15\%$ ) and water holding capacity ( $43.20$  and  $41.20\%$ ) at  $0-15 \text{ cm}$  and  $15-30 \text{ cm}$  soil depths, respectively. Among the chemical properties,  $T_7$  ( $100\% \text{ NPK} + 5 \text{ kg Zn ha}^{-1}$ ) recorded the highest organic carbon ( $0.42$  and  $0.37\%$ ), available nitrogen ( $286.28$  and  $212.30 \text{ kg ha}^{-1}$ ), available phosphorus ( $27.93$  and  $23.87 \text{ kg ha}^{-1}$ ), available potassium ( $205.10$  and  $202.30 \text{ kg ha}^{-1}$ ) and available zinc ( $18.06$  and  $15.85 \text{ ppm}$ ). Soil pH showed a slight decrease, whereas electrical conductivity increased with increasing levels of nutrient application.

**Keywords:** Baby corn, NPK, zinc, soil health, soil fertility

### Introduction

Baby corn (*Zea mays* L.) is one of the most popular and economically viable specialty corn crops belonging to the family Poaceae (Prasad *et al.*, 2018) [20]. It refers to the young, fresh, and unfertilized ear of the maize plant, harvested prematurely within 2–3 days of silk emergence (Thakur *et al.*, 2019) [33]. Unlike standard grain maize, baby corn is cultivated primarily as a highvalue vegetable crop due to its sweet taste and crunchy texture (Mishra *et al.*, 2021) [15]. It is considered a powerhouse of nutrition, being exceptionally rich in dietary fiber, Vitamin A, Vitamin C, iron, phosphorus, and calcium (Singh *et al.*, 2021a) [30]. Because it is consumed entirely along with the cob, it provides a significantly higher amount of fibrous nutrients compared to mature grain kernels (Joshi *et al.*, 2020) [9]. This rich nutritional profile makes it an ideal and healthy dietary component, particularly gaining immense popularity among urban and vegetarian populations globally (Sharma *et al.*, 2022) [26]. In the global agricultural economy, India is recognized as one of the fastest-growing producers and exporters of baby corn (Des *et al.*, 2023) [5]. The crop is widely preferred by farmers due to its short growth duration of only 60 to 75 days (Kumar *et al.*, 2020) [10]. This short life cycle allows it to fit efficiently into intensive multi-cropping systems, enabling farmers to harvest 3 to 4 crops in a single year from the same piece of land (Rao *et al.*, 2021) [21]. Furthermore, baby corn cultivation offers a highly lucrative dual-purpose utility to agrarian economies (Kumar *et al.*, 2019) [13]. While the primary harvest provides tender cobs for human consumption, the remaining biomass yields highly nutritious, succulent green fodder for livestock (Singh *et al.*, 2020) [29]. This green fodder is highly palatable and easily digestible, thereby significantly improving the milk yield and overall health of dairy animals (Verma *et al.*, 2022) [35]. The growth, quality, and economic productivity of baby corn are heavily influenced by precise nutrient management practices (Sharma *et al.*, 2020) [27].

Balanced application of primary chemical fertilizers, specifically nitrogen, phosphorus, and potassium (NPK), is fundamental to boosting the photosynthetic capacity and vegetative vigor of the plant (Patel *et al.*, 2021) <sup>[19]</sup>. Adequate nitrogen application accelerates early vegetative growth, whereas phosphorus plays a crucial role in root development and early cob initiation (Reddy *et al.*, 2019) <sup>[22]</sup>. Consequently, shifting towards integrated nutrient management (INM) systems has become imperative for sustaining long-term agricultural productivity (Reddy *et al.*, 2022) <sup>[23]</sup>. INM combines optimal doses of inorganic fertilizers with organic manures and microbial biofertilizers to maintain ecological balance (Choudhary *et al.*, 2023) <sup>[3]</sup>.

## Materials and methods

The present study entitled “Effect of NPK and Foliar application of Zinc on Soil Health of Baby Corn (*Zea mays* L.)” Variety G-5417 comprise of a field experiment which was carried out at the Soil Science Research Farm Prof. Rajendra Singh (Rajju Bhaiya) University Naini Prayagraj during Rabi season 2025-2026. The maximum temperature of the location reaches up to 46°C - 48°C and seldom falls as 4°C – 5°C. The relative humidity ranged between 20 to 94%. The average rainfall in this area is around 1100 mm annually. It comes under subtropical climate receiving the mean annual rainfall of about 1100 mm, major rainfall from July to end of September. However, occasional precipitation was also not uncommon during winter. The winter months were cold while summer months were very hot and dry. The minimum temperature during the crop season was to be 5.4 °C and the maximum was to be 41.2 °C. The minimum humidity was 48.2% and maximum was 87.6%. Experiment was laid out in randomized block design with Different levels of NPK and Foliar application of Zinc on Soil Health. Plot size was 3 x 3 m<sup>2</sup> for crop seed rate is 25 kg ha<sup>-1</sup> (*Zea mays* L.) Var G-5417. Basal dose of fertilizer was applied in respective plots according to treatment allocation uniform furrows opened by about 5 cm. All the agronomic practices were carried out uniformly to raise the crop. They provide fertilizer NPK (120:60:40:5) Source of Urea, SSP, MOP and Zinc Sulphate. Row to row spacing 50cm and plant to plant 30 cm. The experimental site had initial soil properties including a bulk density of 1.30 g cm<sup>-3</sup>, particle density of 2.45 g cm<sup>-3</sup>, pore space 46.50%, water holding capacity 38.66%, pH (7.21), EC (0.314 dSm<sup>-1</sup>), and organic carbon (0.31%). Available nitrogen (215.4 kg ha<sup>-1</sup>), phosphorus (17.91 kg ha<sup>-1</sup>), potassium (182.67 kg ha<sup>-1</sup>) and zinc (9.11 ppm). Treatment data, including a 12-day irrigation interval and Intercultural operations at 25 and 50 days, were analyzed using ANOVA in OPSTAT to assess their significant effects on crop growth and yield parameters. The crop was harvested in March. Treatment combination for T<sub>1</sub> Absolute control, T<sub>2</sub> NPK @ 50%, T<sub>3</sub> NPK @ 50% + 5 Kg Zn ha<sup>-1</sup>, T<sub>4</sub> NPK @ 100%, T<sub>5</sub> NPK @ 50% + 0.2% Zn foliar Spray, T<sub>6</sub> NPK @ 50% + 0.5% Zn foliar Spray, T<sub>7</sub> NPK @ 100% + 5 Kg Zn ha<sup>-1</sup>, T<sub>8</sub> NPK @ 100% + 0.2% Zn foliar Spray, T<sub>9</sub> NPK @ 100% + 0.5% Zn foliar Spray. Bulk density, Particle density, Pore space and Water holding capacity analyze Measuring cylinder method given by Muthuvel *et al.*, 1992 <sup>[16]</sup>, Soil pH analyze Digital pH meter given by M. L. Jackson, 1958 <sup>[8]</sup>. Electrical conductivity analyze Digital conductivity meter given by Wilcox, 1950 <sup>[37]</sup>, Organic carbon analyze Wet oxidation method given by Walkley and Black, 1947 <sup>[36]</sup>, Available Nitrogen analyze Modified alkaline permanganate oxidation

method given by Subbiah and Asija 1956 <sup>[31]</sup>, Available Phosphorus. analyze Olsen's extraction followed by Spectrophotometric method given by Olsen *et al.*, 1954 <sup>[17]</sup>, Available Potassium analyze Neutral normal ammonium acetate extraction followed by Flame photometric given by Toth and Prince, 1949 <sup>[34]</sup>. Available Zinc analyze: DTPA extraction followed by Atomic Absorption Spectrophotometry (Lindsay and Norvell in 1978).

## Results and discussion

The Results and Discussion section presents the data generated during the investigation and provides a scientific explanation of the observed results by relating them to treatment effects, underlying mechanisms, and findings of previous studies.

### Bulk Density (Mg m<sup>-3</sup>)

The data presented in Table and fig. 1 revealed that bulk density was not significantly influenced by different nutrient management practices. The lowest bulk density was recorded under T<sub>9</sub> (100% NPK + 0.5% Zn foliar spray) with values of 1.16 and 1.20 Mg m<sup>-3</sup> at 0–15 and 15–30 cm soil depths, respectively. This was followed by T<sub>7</sub> (NPK @ 100% + 5 Kg Zn/ha) 1.19 and 1.23 Mg m<sup>-3</sup> at 0–15 and 15–30 cm. The highest bulk density was observed under T<sub>1</sub> (Absolute Control) with values of 1.29 and 1.32 Mg m<sup>-3</sup> at 0–15 and 15–30 cm soil depths, respectively. The lower bulk density under T<sub>9</sub> may be attributed to improved soil aggregation, enhanced root growth and increased biological activity resulting from balanced nutrient application. The extensive root system and greater organic matter addition improved soil structure and reduced soil compaction. (Singh *et al.*, 2021a) <sup>[28, 30]</sup> (Mallipeddi *et al.*, 2025) <sup>[14]</sup>.

### Particle Density (Mg m<sup>-3</sup>)

The particle density of soil was found to be non-significantly affected by different treatments. The lowest particle density was recorded under T<sub>9</sub> (100% NPK + 0.5% Zn foliar spray) with values of 2.42 Mg m<sup>-3</sup> and 2.49 Mg m<sup>-3</sup> at 0–15 cm and 15–30 cm depths, respectively. This was followed by T<sub>8</sub> (100% NPK + 0.2% Zn foliar spray) and T<sub>7</sub> (100% NPK + 5 kg Zn ha<sup>-1</sup>). The highest particle density was observed under T<sub>1</sub> (Absolute Control) with values of 2.44 Mg m<sup>-3</sup> and 2.49 Mg m<sup>-3</sup>, respectively. The lower particle density under T<sub>9</sub> may be attributed to increased organic matter accumulation and enhanced root biomass production, which improved soil structure and reduced the proportion of dense mineral particles. (Kumar *et al.*, 2018) <sup>[11]</sup> and (Hekmat *et al.*, 2019) <sup>[7]</sup>.

### Pore Space (%)

The pore space was significantly influenced by different nutrient management practices. The highest pore space was recorded under T<sub>9</sub> (100% NPK + 0.5% Zn foliar spray) with values of 54.78% and 52.15% at 0–15 cm and 15–30 cm soil depths, respectively. This was followed by T<sub>8</sub> (100% NPK + 0.2% Zn foliar spray) and T<sub>7</sub> (100% NPK + 5 kg Zn ha<sup>-1</sup>). The lowest pore space was observed under T<sub>1</sub> (Absolute Control) with values of 48.50% and 46.53%, respectively. The higher pore space under T<sub>9</sub> may be attributed to better soil aggregation, enhanced root proliferation and increased microbial activity, which promoted the formation of stable soil pores and improved soil aeration. (Singh *et al.*, 2021) <sup>[28, 30]</sup>, (Mallipeddi *et al.*, 2025) <sup>[14]</sup> and (Kumar *et al.*, 2014) <sup>[12]</sup>

### Water Holding Capacity (%)

The water holding capacity of soil was significantly affected by different treatments. The highest water holding capacity was recorded under T<sub>9</sub> (100% NPK + 0.5% Zn foliar spray) with values of 43.20% and 41.20% at 0–15 cm and 15–30 cm depths, respectively. This was followed by T<sub>8</sub> (100% NPK + 0.2% Zn foliar spray) and T<sub>7</sub> (100% NPK + 5 kg Zn ha<sup>-1</sup>).

The lowest water holding capacity was observed under T<sub>1</sub> (Absolute Control) with values of 39.70% and 36.40%, respectively. The increase in water holding capacity under T<sub>9</sub> may be due to improved soil aggregation, greater pore space and increased organic matter content, which enhanced the moisture retention capacity of the soil. (Singh *et al.*, 2021)<sup>[28, 30]</sup>, (Mallipeddi *et al.*, 2025)<sup>[14]</sup> and (Kumar *et al.*, 2014)<sup>[12]</sup>

**Table 1:** Effect of NPK and Foliar application of Zinc on bulk density (Mg m<sup>-3</sup>), Particle density (Mg m<sup>-3</sup>), Pore space (%) and Water holding capacity (%) of soil

| Treatments     |                                       | Bulk density (Mg m <sup>-3</sup> ) |          | Particle density (Mg m <sup>-3</sup> ) |          | Pore space (%) |          | Water holding capacity (%) |          |
|----------------|---------------------------------------|------------------------------------|----------|----------------------------------------|----------|----------------|----------|----------------------------|----------|
|                |                                       | 0-15 cm                            | 15-30 cm | 0-15 cm                                | 15-30 cm | 0-15 cm        | 15-30 cm | 0-15 cm                    | 15-30 cm |
| s              | Absolute control                      | 1.29                               | 1.32     | 2.44                                   | 2.49     | 48.50          | 46.53    | 39.7                       | 36.4     |
| T <sub>2</sub> | NPK @ 50%                             | 1.22                               | 1.26     | 2.43                                   | 2.48     | 49.01          | 47.03    | 41.7                       | 38.7     |
| T <sub>3</sub> | NPK @ 50% + 5 Kg Zn/ha <sup>-1</sup>  | 1.27                               | 1.30     | 2.43                                   | 2.48     | 49.45          | 47.46    | 40.3                       | 37.1     |
| T <sub>4</sub> | NPK @ 100%                            | 1.25                               | 1.28     | 2.42                                   | 2.49     | 50.28          | 48.27    | 40.4                       | 37.3     |
| T <sub>5</sub> | NPK @ 50% + 0.2% Zn foliar Spray      | 1.20                               | 1.25     | 2.43                                   | 2.48     | 51.69          | 49.65    | 41.8                       | 39.4     |
| T <sub>6</sub> | NPK @ 50% + 0.5% Zn foliar Spray      | 1.19                               | 1.23     | 2.43                                   | 2.49     | 51.94          | 49.90    | 42.7                       | 39.7     |
| T <sub>7</sub> | NPK @ 100% + 5 Kg Zn/ha <sup>-1</sup> | 1.24                               | 1.28     | 2.42                                   | 2.49     | 52.60          | 50.37    | 40.6                       | 38.1     |
| T <sub>8</sub> | NPK @ 100% + 0.2% Zn foliar Spray     | 1.23                               | 1.27     | 2.42                                   | 2.49     | 53.27          | 51.20    | 40.8                       | 38.2     |
| T <sub>9</sub> | NPK @ 100% + 0.5% Zn foliar Spray     | 1.16                               | 1.20     | 2.42                                   | 2.49     | 54.78          | 52.15    | 43.2                       | 41.2     |
| F-Test         |                                       | NS                                 | NS       | NS                                     | NS       | S              | S        | S                          | S        |
| S.Ed. (±)      |                                       | -                                  | -        | -                                      | -        | 0.33           | 0.31     | 0.48                       | 0.53     |
| C.D. at 5%     |                                       | -                                  | -        | -                                      | -        | 0.79           | 0.66     | 0.102                      | 0.107    |

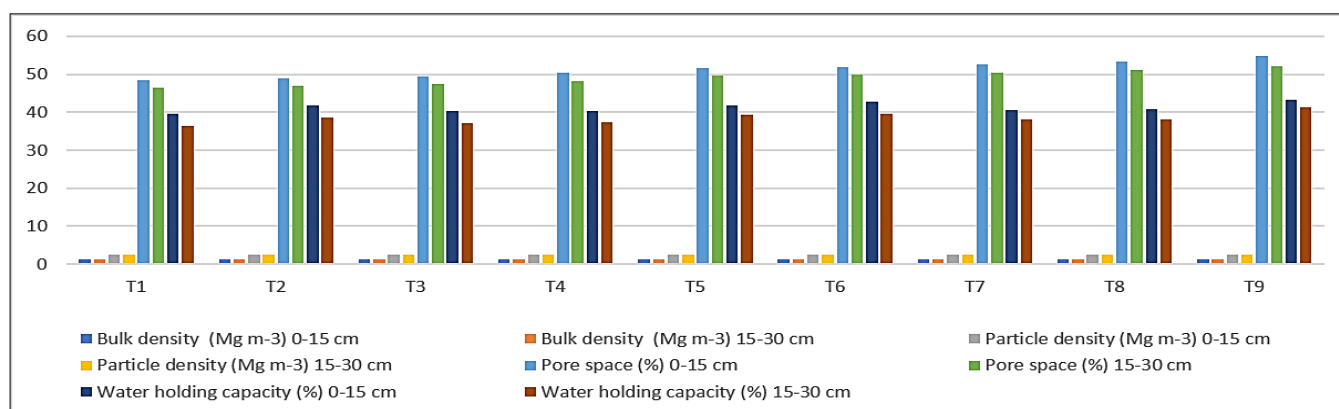


**Fig 1:** Effect of NPK and foliar application of zinc on bulk density (mg m<sup>-3</sup>), particle density (mg m<sup>-3</sup>) pore space (%) and water holding capacity (%) of soil

### Soil pH

The soil pH was non-significantly influenced by different nutrient management practices. The lowest pH was recorded under T<sub>7</sub> (100% NPK + 5 kg Zn ha<sup>-1</sup>) with values of 6.29 and 6.37 at 0–15 and 15–30 cm soil depths, respectively. This was followed by T<sub>9</sub> (100% NPK + 0.5% Zn foliar spray) with values of 6.58 and 6.79 at 0–15 and 15–30 cm soil depths. The highest pH was observed under T<sub>1</sub> (Absolute Control) with values of 7.24 and 7.39, respectively. The slight reduction in pH under T<sub>7</sub> may be attributed to nitrification of applied nitrogen fertilizers and increased microbial activity. (Singh *et al.*, 2021b)<sup>[28]</sup>, (Kumar *et al.*, 2014)<sup>[12]</sup>, (Kumar *et al.*, 2018)<sup>[11]</sup> and (Hekmat *et al.*, 2019)<sup>[7]</sup>.

### Electrical Conductivity (dSm<sup>-1</sup>)

The electrical conductivity of soil was non-significantly affected by nutrient management practices. The highest EC was recorded under T<sub>7</sub> (100% NPK + 5 kg Zn ha<sup>-1</sup>) with values of 0.41 and 0.43 dS m<sup>-1</sup> at 0–15 and 15–30 cm depths, respectively. This was followed by T<sub>8</sub> (100% NPK + 0.2% Zn foliar spray) with values of 0.37 and 0.39 at 0–15 and 15–30 cm soil depths. The lowest EC was observed under T<sub>1</sub>

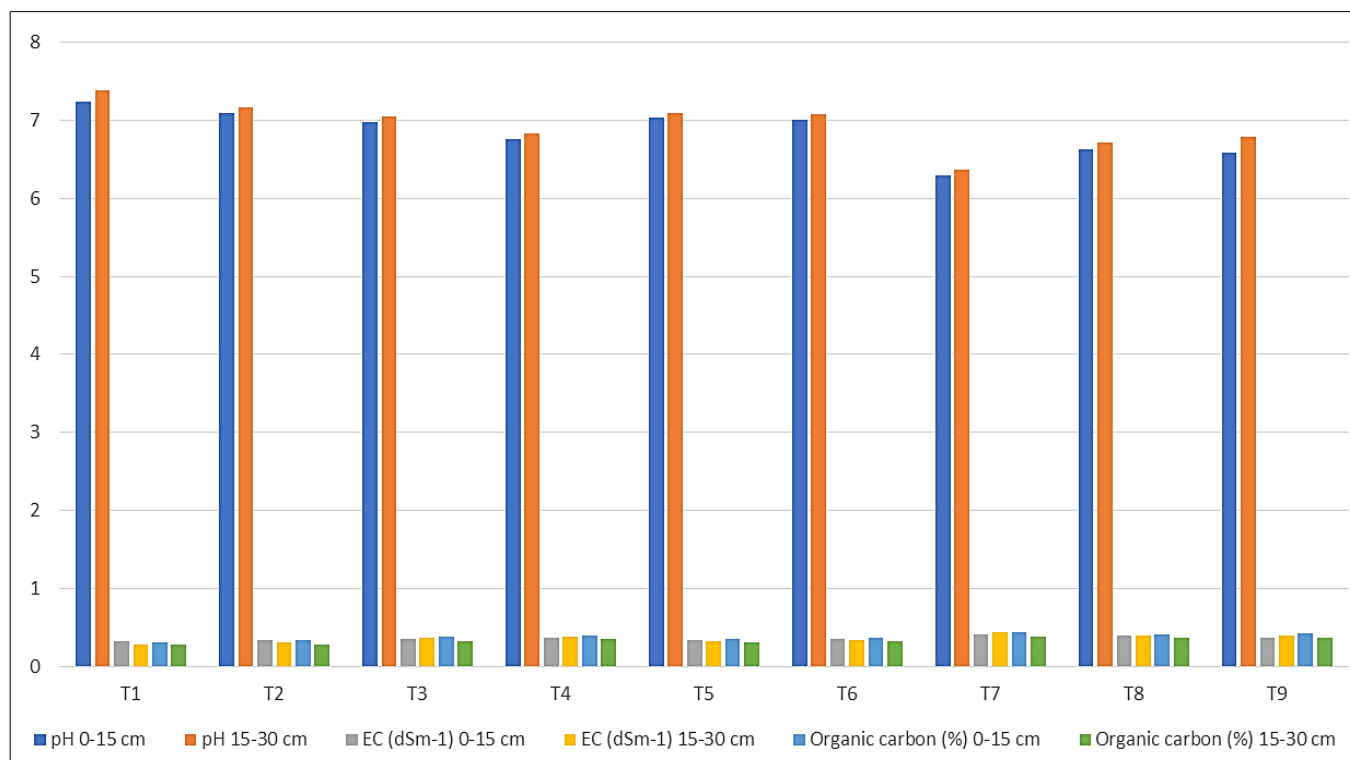
(Absolute Control) with values of 0.32 dS m<sup>-1</sup> and 0.28 dS m<sup>-1</sup>, respectively. The increase in EC under T<sub>7</sub> may be attributed to the addition of soluble nutrient ions through fertilizer application, which increased the ionic concentration of the soil solution. (Singh *et al.*, 2021)<sup>[28, 30]</sup> and (Tahani *et al.*, 2026)<sup>[32]</sup>.

### Organic Carbon (%)

The organic carbon content of soil was non-significantly influenced by different nutrient management practices. The highest organic carbon content was recorded under T<sub>7</sub> (100% NPK + 5 kg Zn ha<sup>-1</sup>) with values of 0.43 and 0.38% at 0–15 and 15–30 cm depths, respectively. This was followed by T<sub>9</sub> (100% NPK + 0.5% Zn foliar spray) with values of 0.42 and 0.37 at 0–15 and 15–30 cm soil depths. The lowest organic carbon content was recorded under T<sub>1</sub> (Absolute Control) with values of 0.31% and 0.28%, respectively. The increase in organic carbon under T<sub>7</sub> may be attributed to enhanced biomass production, vigorous root growth and greater incorporation of crop residues into the soil. (Singh *et al.*, 2021b)<sup>[30]</sup> and (Tahani *et al.*, 2026)<sup>[32]</sup>

**Table 2:** Effect of NPK and Foliar application of Zinc on pH, EC (dSm<sup>-1</sup>), and Organic carbon (%) of soil.

| Treatments     |                                       | pH      |          | EC (dSm <sup>-1</sup> ) |          | Organic carbon (%) |          |
|----------------|---------------------------------------|---------|----------|-------------------------|----------|--------------------|----------|
|                |                                       | 0-15 cm | 15-30 cm | 0-15 cm                 | 15-30 cm | 0-15 cm            | 15-30 cm |
| T <sub>1</sub> | Absolute control                      | 7.24    | 7.39     | 0.32                    | 0.28     | 0.31               | 0.28     |
| T <sub>2</sub> | NPK @ 50%                             | 7.10    | 7.16     | 0.34                    | 0.31     | 0.33               | 0.28     |
| T <sub>3</sub> | NPK @ 50% + 5 kg Zn/ha <sup>-1</sup>  | 6.98    | 7.05     | 0.35                    | 0.36     | 0.38               | 0.32     |
| T <sub>4</sub> | NPK @ 100%                            | 6.76    | 6.83     | 0.36                    | 0.38     | 0.40               | 0.35     |
| T <sub>5</sub> | NPK @ 50% + 0.2% Zn foliar Spray      | 7.04    | 7.10     | 0.34                    | 0.32     | 0.35               | 0.31     |
| T <sub>6</sub> | NPK @ 50% + 0.5% Zn foliar Spray      | 7.00    | 7.08     | 0.35                    | 0.34     | 0.36               | 0.32     |
| T <sub>7</sub> | NPK @ 100% + 5 kg Zn/ha <sup>-1</sup> | 6.29    | 6.37     | 0.41                    | 0.43     | 0.43               | 0.38     |
| T <sub>8</sub> | NPK @ 100% + 0.2% Zn foliar Spray     | 6.63    | 6.72     | 0.39                    | 0.40     | 0.41               | 0.36     |
| T <sub>9</sub> | NPK @ 100% + 0.5% Zn foliar Spray     | 6.58    | 6.79     | 0.37                    | 0.39     | 0.42               | 0.37     |
| F-Test         |                                       | NS      | NS       | NS                      | NS       | NS                 | NS       |
| S.Ed. (±)      |                                       | -       | -        | -                       | -        | -                  | -        |
| C.D. at 5%     |                                       | -       | -        | -                       | -        | -                  | -        |

**Fig 2:** Effect of NPK and foliar application of Zinc on pH, EC (dSm<sup>-1</sup>), and organic carbon (%) of soil.**Available Nitrogen (kg ha<sup>-1</sup>)**

The available nitrogen content of soil was significantly influenced by nutrient management practices. The highest available nitrogen content was recorded under T<sub>7</sub> (100% NPK + 5 kg Zn ha<sup>-1</sup>) with values of 286.28 and 212.30 kg ha<sup>-1</sup> at 0–15 and 15–30 cm depths, respectively. This was followed by T<sub>9</sub> (NPK @ 100%+0.5Zinc foliar spray) with values of 283.73 and 211.35 kg ha<sup>-1</sup>. The lowest available nitrogen content was recorded under T<sub>1</sub> (Absolute Control) with values of 219.88 kg ha<sup>-1</sup> and 194.15 kg ha<sup>-1</sup>, respectively. The higher nitrogen content under T<sub>7</sub> may be attributed to the combined application of NPK and zinc, which improved nutrient retention, microbial activity and nitrogen-use efficiency. (Kumar *et al.*, 2014)<sup>[12]</sup>, (Kumar *et al.*, 2018)<sup>[11]</sup> and (Hekmat *et al.*, 2019)<sup>[7]</sup>.

**Available Phosphorus (kg ha<sup>-1</sup>)**

The available phosphorus content of soil was significantly affected by different treatments. The highest available

phosphorus content was recorded under T<sub>7</sub> (100% NPK + 5 kg Zn ha<sup>-1</sup>) with values of 27.93 and 23.87 kg ha<sup>-1</sup> at 0–15 and 15–30 cm depths, respectively. This was followed by T<sub>9</sub> (100% NPK + 0.5% Zn foliar spray) with values of 27.67 and 23.53 kg ha<sup>-1</sup>. The lowest available phosphorus content was recorded under T<sub>1</sub> (Absolute Control) with values of 20.19 and 19.79 kg ha<sup>-1</sup>, respectively. The increase in available phosphorus under T<sub>7</sub> may be attributed to enhanced nutrient availability, improved root growth and increased phosphorus mobilization in the rhizosphere. (Singh *et al.*, 2021)<sup>[28, 30]</sup>, (Tahani *et al.*, 2026)<sup>[32]</sup> and (Hekmat *et al.*, 2019)<sup>[7]</sup>.

**Available Potassium (kg ha<sup>-1</sup>)**

The available potassium content of soil was significantly influenced by nutrient management practices. The highest available potassium content was recorded under T<sub>7</sub> (100% NPK + 5 kg Zn ha<sup>-1</sup>) with values of 205.10 and 202.30 kg ha<sup>-1</sup> at 0–15 and 15–30 cm depths, respectively. This was followed by T<sub>9</sub> (100% NPK + 0.5% Zn foliar spray) with

values of 204.52 and 201.35 kg ha<sup>-1</sup> at 0–15 and 15–30 cm depths. The lowest available potassium content was recorded under T<sub>1</sub> (Absolute Control) with values of 188.85 and 184.15 kg ha<sup>-1</sup>, respectively. The higher potassium content under T<sub>7</sub> may be attributed to balanced fertilization, enhanced nutrient cycling and improved root activity. (Singh *et al.*, 2021)<sup>[28, 30]</sup>, (Tahani *et al.*, 2026)<sup>[32]</sup>, (Mallipeddi *et al.*, 2025)<sup>[14]</sup> and (Kumar *et al.*, 2014)<sup>[12]</sup>.

### Available Zinc (ppm)

The available zinc content of soil was significantly influenced by zinc application. The highest available zinc content was

recorded under T<sub>7</sub> (100% NPK + 5 kg Zn ha<sup>-1</sup>) with values of 18.06 and 15.85 ppm at 0–15 and 15–30 cm depths, followed by T<sub>9</sub> (100% NPK + 0.5% Zn foliar spray) with values of 17.46 and 14.50 ppm at 0–15 and 15–30 cm depths. The lowest available zinc content was recorded under T<sub>1</sub> (Absolute Control) with values of 9.91 and 6.49 ppm, respectively. The higher zinc content under T<sub>7</sub> may be attributed to the direct soil application of zinc, which increased zinc availability and improved nutrient uptake efficiency in baby corn. (Mallipeddi *et al.*, 2025)<sup>[14]</sup>, (Kumar *et al.*, 2014)<sup>[12]</sup>, (Kumar *et al.*, 2018)<sup>[11]</sup> and (Hekmat *et al.*, 2019)<sup>[7]</sup>.

**Table 3:** Effect of NPK and Foliar application of Zinc on Available nitrogen (kg ha<sup>-1</sup>), Available phosphorus (kg ha<sup>-1</sup>), and Available potassium (kg ha<sup>-1</sup>) of soil.

| Treatments     |                                       | Available nitrogen (kg ha <sup>-1</sup> ) |          | Available phosphorus (kg ha <sup>-1</sup> ) |          | Available potassium (kg ha <sup>-1</sup> ) |          | Available Zinc (ppm) |         |
|----------------|---------------------------------------|-------------------------------------------|----------|---------------------------------------------|----------|--------------------------------------------|----------|----------------------|---------|
|                |                                       | 0-15 cm                                   | 15-30 cm | 0-15 cm                                     | 15-30 cm | 0-15 cm                                    | 15-30 cm | 0-15cm               | 15-30cm |
| T <sub>1</sub> | Absolute control                      | 219.88                                    | 194.15   | 20.19                                       | 19.79    | 188.85                                     | 184.15   | 09.91                | 06.49   |
| T <sub>2</sub> | NPK @ 50%                             | 249.47                                    | 202.96   | 24.11                                       | 21.51    | 196.74                                     | 192.96   | 11.84                | 09.46   |
| T <sub>3</sub> | NPK @ 50% + 5 kg Zn/ha <sup>-1</sup>  | 252.46                                    | 204.43   | 25.03                                       | 21.91    | 197.77                                     | 194.43   | 13.13                | 11.48   |
| T <sub>4</sub> | NPK @ 100%                            | 283.73                                    | 210.05   | 27.50                                       | 23.11    | 204.05                                     | 200.05   | 15.77                | 12.34   |
| T <sub>5</sub> | NPK @ 50% + 0.2% Zn foliar Spray      | 253.21                                    | 203.05   | 24.36                                       | 21.59    | 196.84                                     | 193.05   | 12.05                | 10.50   |
| T <sub>6</sub> | NPK @ 50% + 0.5% Zn foliar Spray      | 254.26                                    | 205.16   | 24.62                                       | 21.72    | 196.93                                     | 193.16   | 12.77                | 10.89   |
| T <sub>7</sub> | NPK @ 100% + 5 kg Zn/ha <sup>-1</sup> | 286.28                                    | 212.3    | 27.93                                       | 23.87    | 205.10                                     | 202.30   | 18.06                | 15.85   |
| T <sub>8</sub> | NPK @ 100% + 0.2% Zn foliar Spray     | 282.56                                    | 209.76   | 27.59                                       | 23.41    | 204.35                                     | 201.10   | 16.73                | 13.49   |
| T <sub>9</sub> | NPK @ 100% + 0.5% Zn foliar Spray     | 283.31                                    | 211.35   | 27.67                                       | 23.53    | 204.52                                     | 201.35   | 17.46                | 14.50   |
|                | F-Test                                | S                                         | S        | S                                           | S        | S                                          | S        | S                    | S       |
|                | S.Ed. (±)                             | 0.038                                     | 0.046    | 0.033                                       | 0.023    | 0.033                                      | 1.06     | 0.018                | 0.016   |
|                | C.D. at 5%                            | 0.081                                     | 0.099    | 0.070                                       | 0.049    | 0.072                                      | 2.26     | 0.039                | 0.035   |

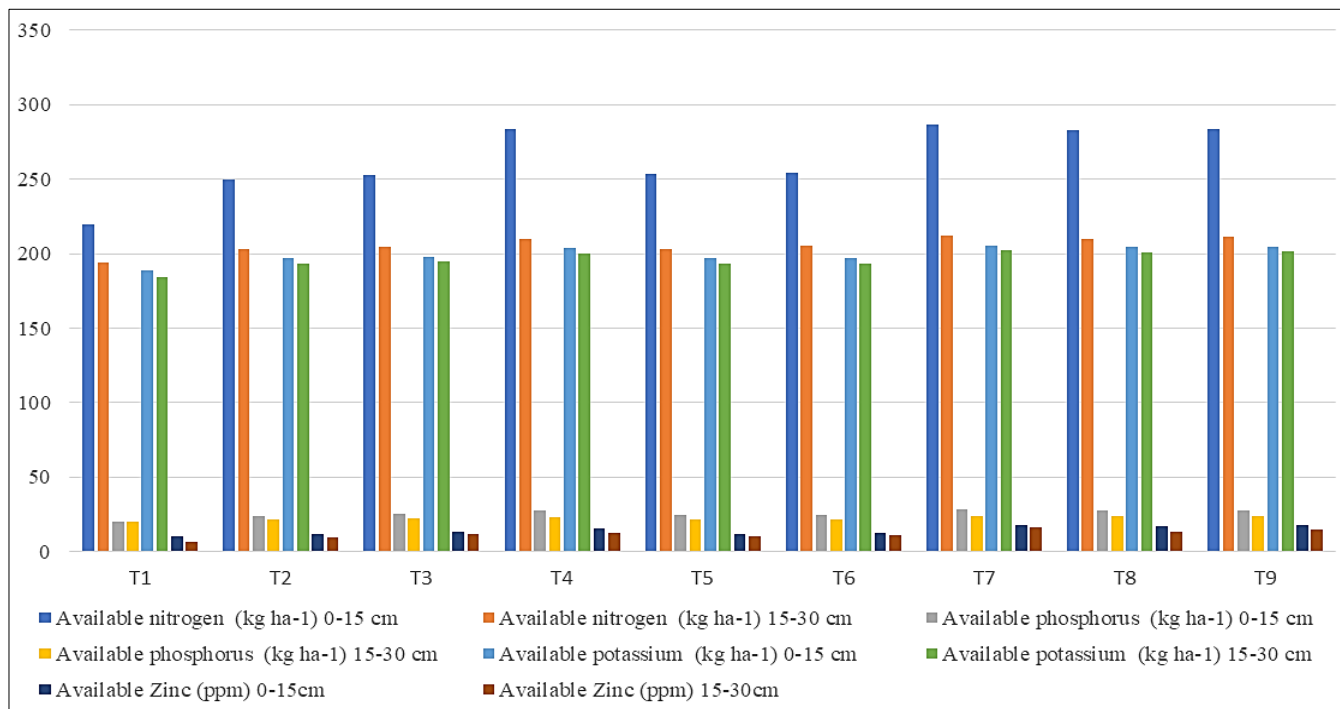


**Fig 3:** Effect of NPK and Foliar application of Zinc on available nitrogen (kg ha<sup>-1</sup>), available phosphorus (kg ha<sup>-1</sup>) and available potassium (kg ha<sup>-1</sup>) of soil

### Conclusion

Based on the results of the present investigation, it can be concluded that the application of NPK fertilizers in combination with zinc significantly improved the physical and chemical properties of soil under baby corn (*Zea mays*

L.) cultivation. Among the various treatments, T<sub>9</sub> (100% NPK + 0.5% Zn foliar spray) recorded the lowest bulk density (1.16 and 1.20 Mg m<sup>-3</sup>) and particle density (2.22 and 2.31 Mg m<sup>-3</sup>), along with the highest pore space (54.78 and 52.15%) and water holding capacity (43.20 and 41.20%),

indicating a substantial improvement in soil physical condition. On the other hand, T<sub>7</sub> (100% NPK + 5 kg Zn ha<sup>-1</sup>) recorded the highest organic carbon (0.53 and 0.48%), available nitrogen (286.28 and 212.30 kg ha<sup>-1</sup>), available phosphorus (27.93 and 23.87 kg ha<sup>-1</sup>), available potassium (205.10 and 202.30 kg ha<sup>-1</sup>) and available zinc (18.06 and 15.85 ppm), demonstrating its superiority in enhancing soil fertility and nutrient availability.

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