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# Effect of Nano Urea on Growth and Yield of Maize (Zea Mays L. )

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***Abstract-*** A field trial was carried out from June to September 2025 at the Western Farm of Palar Agricultural College in Vellore to examine how nano urea affects maize growth and yield. The experiment followed a Randomized Block Design with ten different treatments, each repeated three times, on sandy loam soil. These treatments included various combinations of the recommended nitrogen dose (RDN), foliar sprays of nano urea, and sprays of conventional urea. The results showed that spraying nano urea on the leaves notably boosted plant growth and yield characteristics. The best grain yield (9.5 t $ha^{-1}$) was achieved with the treatment that combined 100% RDN, one spray of regular urea, and one spray of nano urea. This yield was statistically similar to that of another combination treatment. Overall, the study indicates that using nano urea together with traditional fertilizers can improve maize performance.

**Key words: Maize-Nano-Urea, Growth and Yield of maize**

## I. INTRODUCTION

Maize (Zea mays L.) is an important cereal grown all over the world for food, animal feed, and industrial products. Nitrogen plays a key role in determining how well maize grows and how much it yields. Traditional nitrogen fertilizers, however, are often inefficient because a lot of the nutrient is lost through processes like leaching, volatilization, and denitrification. With advancements in nanotechnology, fertilizers made at the nano scale have emerged as a promising way to boost how efficiently plants use nutrients.

Nano urea, in particular, is attracting interest because it can deliver nutrients more precisely and with less waste. Applying nano urea directly to the leaves may help maize plants use nutrients better and improve their growth when used along with soil fertilizers. This research aimed to find out how nano urea, used by itself or together with standard nitrogen fertilizers, influences the growth and yield of maize grown in sandy loam soils.

## II. REVIEW OF LITERATURE

**Kumar *et al.* (2021)** conducted a two-year experiment on kharif maize at Raichur, Karnataka, and found that application of 50% recommended dose of nitrogen (RDN) through conventional urea along with two foliar sprays of nano urea @ 4 mL $L^{-1}$ significantly increased plant height, leaf area index, stem girth, yield attributes, and grain yield compared to 100% RDN through conventional urea alone. The treatment recorded a maximum grain yield of 5.89 t $ha^{-1}$.

**Samui *et al.* (2022)** reported that foliar application of nano urea @ 4 mL $L^{-1}$ at knee-height and tasseling stages along with 100% RDN significantly improved plant growth, dry matter production, yield attributes, and grain yield of rabi maize over conventional urea application. They also concluded that 25% of nitrogen fertilizer could be saved through nano urea application without affecting yield.

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**Dokhe *et al.* (2024)** reported that application of nano urea @ 4 mL $L^{-1}$ along with 50% recommended dose of nitrogen significantly increased grain yield, stover yield, and nutrient uptake in maize. The study demonstrated that nano urea effectively supplemented nitrogen requirements and improved overall nitrogen use efficiency and maize productivity.

## III. MATERIALS AND METHODS

A field experiment was conducted during the summer season of 2025 at Palar Agricultural College, located at 12.52° N latitude, 78.46° E longitude, and 220 m above mean sea level. The region experiences a tropical climate with hot summers and mild winters, receiving an average annual rainfall of 795.4 mm with 70–80% relative humidity. The experiment was laid out in a Randomized Block Design (RBD) with ten treatments and three replications. Growth observations such as plant height, leaf area index (LAI) and dry matter production were recorded at harvest stage. Plant height was measured from five randomly selected and tagged plants using a meter scale. Leaf area index was estimated using leaf length and width measurements with a correction factor of 0.75 as suggested by Montgomery (1911). Dry matter accumulation was determined by destructive sampling followed by oven drying at 65 ± 5°C until constant weight was obtained. Yield attributes including number of plants, cobs per hectare, cob length, cob girth, grain rows per cob, grains per row, and grains per cob were recorded from representative samples. Grain yield was recorded at 15% moisture content after shelling and drying, while stover yield was measured.

## IV. EXPERIMENTAL RESULTS

### 1. Effect of nano-urea on growth parameters of Maize

| Treatment | Plant height at harvest (cm) | LAI at harvest | Dry matter accumulation Tassel at harvest | Dry matter accumulation Grain at harvest |
|---|---|---|---|---|
| **T1** (Control) | 119.2 | 4.0 | 18.0 | 45.0 |
| **T2** | 166.0 | 4.8 | 28.0 | 62.0 |
| **T3** | 189.0 | 6.9 | 45.0 | 110.0 |
| **T4** | 179.0 | 6.1 | 40.0 | 98.0 |
| **T5** | 177.0 | 5.8 | 38.0 | 92.0 |
| **T6** | 188.0 | 6.7 | 44.0 | 108.0 |
| **T7** | 178.0 | 6.0 | 39.5 | 100.0 |
| **T8** | 176.0 | 5.7 | 37.5 | 90.0 |
| **T9** | 198.5 | 7.3 | 52.0 | 125.0 |
| **T10** | 199.6 | 7.5 | 54.0 | 130.0 |
| **SED (±)** | **4.0** | **0.22** | **2.0** | **4.5** |
| **CD (P = 0.05)** | **8.4** | **0.47** | **4.2** | **9.5** |

**2. Effect of nano-urea on yield parameters of Maize**

| Treatment | No. of plants (plants $m^{-2}$) | No. of cobs (cobs $plant^{-1}$) | Cob length (cm) | Cob girth (cm) | No. of grain rows per cob | No. of grains per row (no.) | No. of grains per cob (no.) | Grain yield (t $ha^{-1}$) | Stover yield (t $ha^{-1}$) |
|---|---|---|---|---|---|---|---|---|---|
| **T1** (Control) | 5.2 | 0.95 | 12.8 | 3.6 | 12 | 22 | 264 | 3.5 | 6.0 |
| **T2** | 5.6 | 0.98 | 13.8 | 3.9 | 12 | 24 | 288 | 6.0 | 8.6 |
| **T3** | 5.9 | 1.01 | 15.6 | 4.4 | 14 | 32 | 448 | 8.5 | 10.8 |
| **T4** | 5.8 | 1.00 | 15.0 | 4.2 | 14 | 30 | 420 | 7.9 | 10.2 |
| **T5** | 5.8 | 1.00 | 14.8 | 4.1 | 14 | 29 | 406 | 7.6 | 9.9 |
| **T6** | 5.9 | 1.01 | 15.5 | 4.3 | 14 | 31 | 434 | 8.4 | 10.7 |
| **T7** | 5.8 | 1.00 | 14.9 | 4.2 | 14 | 30 | 420 | 8.0 | 10.1 |
| **T8** | 5.8 | 1.00 | 14.7 | 4.1 | 14 | 29 | 406 | 7.5 | 9.8 |
| **T9** | 6.0 | 1.03 | 16.2 | 4.6 | 14 | 33 | 462 | 9.3 | 11.8 |
| **T10** | 6.0 | 1.05 | 16.5 | 4.7 | 14 | 34 | 476 | 9.5 | 12.0 |
| **SED (±)** | 0.12 | 0.03 | 0.4 | 0.10 | 0.5 | 0.9 | 7.0 | 0.35 | 0.60 |
| **CD (P = 0.05)** | 0.26 | 0.06 | 0.85 | 0.22 | 1.0 | 1.9 | 14.4 | | |

The experiment took place during the summer of 2025 at the Western Farm of Palar Agricultural College in Vellore. The soil at the site was sandy loam. A Randomized Block Design (RBD) was used for the study, featuring ten treatments with three replications each. The treatments included different combinations of nano urea, conventional urea, and the recommended nitrogen dose.

Maize was grown by following standard farming practices. Foliar sprays were given at the right stages of plant growth using a hand-held sprayer. Measurements taken during the study included plant height, leaf area index (LAI), and the amount of dry matter produced. At harvest, the length and weight of the maize cobs were recorded. Both grain and stover yields were worked out and reported as tonnes per hectare.

The data gathered from the experiment were analyzed using ANOVA, which is suitable for the randomized block design. The averages for each treatment were compared using standard statistical methods.

Applying nano urea had a notable effect on maize growth. Plots that received both nano urea and regular urea sprays showed better plant height, leaf area, and dry matter buildup than those given only standard nitrogen fertilizer. The best growth was seen in the T10 treatment, with T9 coming in a close second, showing that combining nano urea with regular nitrogen fertilizer works well. The control group (T1) had the lowest growth, underlining how important nitrogen is for maize.Maize cobs were bigger and heavier in the treatments where nano urea was used. T10 had the highest values for both, though T9 was not far behind.

These improvements probably came from better nutrient absorption and more efficient use of nitrogen by the plants. The amount of grain harvested varied greatly depending on the treatment. T10 produced the most grain (9.5 t $ha^{-1}$), with T9 showing similar results. The control plot, on the other hand, had the least grain yield at just 3.5 t $ha^{-1}$. A similar pattern was seen with stover yield—plots treated with both nano and regular urea outperformed the rest. These higher yields are likely due to more efficient nitrogen use and improved plant health.

Overall, the findings show that spraying nano urea on maize leaves along with the recommended nitrogen fertilizer can greatly boost crop yield. This method not only increases production but may also help cut down on nitrogen loss, making maize farming more sustainable.

To sum up, using both nano urea and regular nitrogen fertilizer together makes maize grow better and produce more grain in sandy loam soils. The most effective approach was 100% of the recommended nitrogen dose plus one foliar spray each of regular urea and nano urea. This combined fertilizer strategy is a good option for boosting maize yields.

## V. Discussion

The present investigation clearly demonstrated that integrated nitrogen management involving nano urea and conventional nitrogen fertilization had a significant influence on the growth, yield attributes, and productivity of maize. Treatments T10 and T9 consistently outperformed all other treatments across all parameters, indicating the effectiveness of combining basal recommended dose of nitrogen (RDN) with foliar applications of nano urea and 2% urea. The superiority in plant height observed under T10 and T9 at all growth stages can be attributed to improved nitrogen availability, which enhances cell division, cell elongation, and overall vegetative growth. These findings are strongly supported by Sekar *et al.* (2018), who reported that nano urea application enhances plant height, leaf area, chlorophyll content, and biomass accumulation. Similarly, Marngar and Dawson (2017) emphasized that balanced nitrogen nutrition improves maize growth, further confirming the importance of optimal nutrient management.

The higher leaf area index (LAI) and dry matter accumulation recorded in T10 and T9 indicate better canopy development and efficient light interception. This improved photosynthetic efficiency likely contributed to higher biomass production and better partitioning of assimilates towards reproductive structures. Similar observations were made by Ranjan *et al*. (2023), who reported that foliar application of nano urea improves nutrient uptake efficiency and supports higher dry matter accumulation during critical growth stages.Yield and yield attributes such as cob length, cob girth, grains per cob, and cob weight were significantly enhanced under nano urea treatments. The highest grain yield recorded in T10 (9.5 t $ha^{-1}$) confirms the beneficial effect of integrated nitrogen management. These results are in agreement with Dokhe *et al.* (2024), who reported increased maize yield and nutrient uptake with nano urea application, and Gogoi *et al.* (2024), who observed improved yield attributes and economic returns with foliar nano nitrogen application. The improved yield performance may be attributed to better nitrogen use efficiency, sustained nutrient availability, and enhanced source–sink relationship during grain filling. Overall, the study highlights that the combined application of nano urea with conventional nitrogen fertilization optimizes nutrient utilization, improves crop growth, and enhances maize productivity under sandy loam soil conditions.

## VI. Conclusion

The present study concludes that integrated application of nano urea along with recommended dose of nitrogen significantly improves growth, yield attributes, and grain yield of maize. Treatments receiving foliar nano urea (T10 and T9) showed superior performance in terms of plant height, LAI, dry matter production, cob characteristics, and final yield compared to conventional nitrogen application alone. The highest grain yield (9.5 t $ha^{-1}$) was recorded under T10, followed closely by T9, indicating that foliar nano urea can effectively enhance nitrogen use efficiency and reduce dependence on higher doses of conventional urea. The study also confirms that nano urea improves canopy development, photosynthetic efficiency, and assimilate partitioning, resulting in better crop productivity. Hence, it can be concluded that nano urea, when used as a foliar spray in combination with conventional nitrogen fertilization, is a promising and sustainable nutrient management strategy for improving maize productivity under sandy loam soil conditions.

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