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Efficacy of Nano Fertilizers on growth, yield attributes and yield of Maize (*Zea mays* L.)

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Abstract

A field experiment entitled "Efficacy of Nano Fertilizers on growth and yield attributes of Maize (*Zea mays* L.)" was conducted at the College Farm, Agricultural College, Polasa, Jagtial, during the *Rabi* season of 2025-26. The experiment was laid out in Randomized block design with twelve treatments and three replications. The results revealed that the treatment T₃ - 100% Recommended NPK + two sprays of Nano Urea Plus @ 4 ml l⁻¹ each at 25-30 and 40 - 45 DAS recorded significantly higher plant height (243.5 cm), leaf area (3099 cm²), dry matter production (10754 kg ha⁻¹), cob length (22.0 cm), cob girth (47.5 mm), kernel rows cob⁻¹ (20.7), kernels cob⁻¹ (577), test weight (36.6 g), grain yield (7959 kg ha⁻¹) and stover yield (8696 kg ha⁻¹). The treatment remained statistically comparable with T₂, T₁, T₄ and T₇ for most growth and yield parameters. Harvest index was not significantly influenced by the treatments. The findings indicated that application of the recommended fertilizer dose along with two foliar sprays of Nano Urea Plus effectively enhanced crop growth and productivity under the agro-climatic conditions of Northern Telangana.

Keywords: Maize, Nano Urea Plus, Nano DAP, growth, yield attributes, grain yield

Introduction

Maize (*Zea mays* L.), popularly known as the "Queen of Cereals," is one of the most important cereal crops owing to its high genetic yield potential, wide adaptability and diverse uses as food, feed, fodder and industrial raw material. In India, maize plays a significant role in ensuring food and nutritional security while supporting the poultry, livestock, starch, ethanol and food processing industries. During 2024 - 25, maize was cultivated on about 113 - 115 lakh hectares with a production of 420 - 435 lakh tonnes and an average productivity of 3600 - 3800 kg ha⁻¹. In Telangana, the crop is grown on approximately 5.5 - 6.0 lakh hectares with a productivity exceeding 5600 kg ha⁻¹, which is considerably higher than the national average (MoA&FW, 2025; Indiatat, 2025; PJTSAU, 2025).

Despite its high yield potential, maize productivity is often constrained by poor nutrient use efficiency, particularly of nitrogen and phosphorus. Conventional fertilizers exhibit low nutrient use efficiency due to losses through leaching, volatilization, denitrification and fixation, resulting in increased production costs and environmental concerns. Improving nutrient use efficiency has therefore become an important objective in sustainable maize production.

Nano-fertilizers have emerged as an innovative nutrient management strategy because of their small particle size, high surface area and controlled nutrient release characteristics. Foliar application of Nano Urea Plus improves nitrogen availability, chlorophyll synthesis and photosynthetic efficiency, while Nano DAP enhances phosphorus availability during early crop growth, leading to improved nutrient uptake and crop performance. Several studies have reported the beneficial effects of nano-fertilizers on crop growth and yield, however information on their combined use with conventional fertilizers under the agro-climatic conditions of Northern Telangana is limited.

Therefore, the present investigation entitled "Efficacy of Nano Fertilizers on Growth and Yield of Maize (*Zea mays* L.)" was undertaken to evaluate the effect of Nano Urea Plus and Nano DAP, in combination with different levels of conventional fertilizers, on the growth, yield attributes and yield of maize under irrigated conditions.

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Materials and Methods

The field experiment was conducted during *Rabi*, 2025-26 at the College Farm, Agricultural College, Polasa, Jagtial, Telangana, India, to evaluate the “Efficacy of Nano Fertilizers on growth and yield attributes of Maize (*Zea mays* L.)” The experiment comprised of eight treatments:- T₁ - 100% Recommended NPK, T₂ - 100% Recommended NPK + one spray of Nano Urea Plus @ 4 ml l⁻¹ at 25–30 DAS, T₃ - 100% Recommended NPK + two sprays of Nano Urea Plus @ 4 ml l⁻¹ at 25–30 and 40–45 DAS, T₄ - 100% Recommended NPK + Seed treatment with Nano DAP @ 5 ml kg⁻¹ seed + one spray of Nano DAP @ 2.5 ml l⁻¹ at 25 - 30 DAS, T₅ - 80% Recommended N and 100% P & K + two sprays of Nano Urea Plus, T₆ - 60% Recommended N and 100% P & K + two sprays of Nano Urea Plus, T₇ - 80% Recommended P and 100% N & K + Seed treatment with Nano DAP + one spray of Nano DAP, T₈ - 60% Recommended P and 100% N & K + Seed treatment with Nano DAP + one spray of Nano DAP, T₉ - 80% Recommended N & P and 100% K + Seed treatment with Nano DAP @ 5 ml kg⁻¹ seed + one spray of Nano DAP @ 2.5 ml l⁻¹ at 25-30 DAS + two sprays of Nano Urea Plus @ 4 ml l⁻¹ at 25 - 30 and 40 - 45 DAS, T₁₀ - 60% Recommended N & P and 100% K + Seed treatment with Nano DAP + one spray of Nano DAP + two sprays of Nano Urea Plus, T₁₁ - 100% Recommended PK and T₁₂ - 100% Recommended NK. These treatments were evaluated under a randomized block design (RBD) with three replications. The experiment field was characterized by well drained sandy clay loam soil with a composition of 62.8% sand, 6.5% silt and 29.85% clay. The available nitrogen was low with 137 kg ha⁻¹. The available phosphorus was medium 22.1 kg ha⁻¹ and potassium was medium with 215.8 kg ha⁻¹. During the experimental period, the average maximum and minimum temperatures were 31.3 °C and 14.2 °C, respectively. The crop variety used was maize variety ‘DHM-117, which has a duration of 105 - 110 days. Sowing was done at a spacing of 60 cm × 20 cm using a seed rate of 20 kg ha⁻¹ on 25th October, 2025. The recommended dose of fertilizers (240:80:80 kg ha⁻¹ of N, P₂O₅, and K₂O) was applied using urea, SSP and MOP. Nitrogen was applied in four equal splits. The first split was applied as a basal dose at sowing, the second at the knee-high stage (30 - 35 DAS), the third at the flag leaf emergence stage (50 - 55 DAS), and the fourth at the tasseling-silking stage (60 - 65 DAS). Phosphorus was applied entirely as a basal dose at the time of sowing. Potassium was applied in two equal splits, with half as a basal application and the remaining half at the tasseling-silking stage (60 - 65 DAS). Foliar application of Nano Urea Plus and Nano DAP was given by knapsack sprayer at 25 and 45 days after sowing. Data was recorded from five plants selected randomly from each replication of treatment. Data on growth parameters such as plant height, leaf area, dry matter production, cob length, cob girth, kernel rows cob⁻¹, kernels cob⁻¹, test weight, Grain and stover yields of maize were analysed statistically using ANOVA.

Results and Discussion

Effect of Nano fertilizer treatments on growth parameters of maize

1. Plant height (cm)

Plant height was significantly influenced by application of Nano fertilizer treatments recorded at 30, 60, 90 DAS and at harvest. At 30 DAS, there was no significant difference observed among the different nano fertilizer treatments in terms of plant height. Among the different treatments, T₃ (100% Recommended NPK + 2 sprays of Nano Urea Plus @ 4 ml l⁻¹ each at 25 - 30 and 40 - 45 DAS) recorded significantly higher plant height of 194.4, 236.8 and 243.5 cm at 60 DAS, 90 DAS and harvest, respectively,

compared with the remaining treatments. However, it was statistically on par with T₂ (185.5, 223.1 and 228.2 cm), T₁ (183.0, 220.4 and 227.4 cm), T₄ (177.3, 219.3 and 225.5 cm) and T₇ (173.6, 213.6 and 221.2 cm) at the respective stages. The lowest plant height was recorded under T₁₁ (100% Recommended PK), with values of 135.1, 187.5 and 195.8 cm at 60 DAS, 90 DAS and harvest, respectively. These results are in agreement with those reported by Srivani *et al.* (2022) ^[16], Arun kumar *et al.* (2024) ^[1] and Kundu and Chhabra (2023) ^[8].

2. Leaf Area (cm²)

Leaf area increased progressively from 30 DAS to 90 DAS and declined thereafter up to harvest. The differences among the treatments were significant at all the growth stages. Treatment T₃ (100% Recommended NPK + 2 sprays of Nano Urea Plus @ 4 ml l⁻¹ each at 25-30 and 40-45 DAS) recorded significantly higher leaf area of 1319, 4790, 5480 and 3099 cm² at 30 DAS, 60 DAS, 90 DAS and harvest, respectively, compared to the remaining treatments. However, it was statistically on par with T₂ (1275, 4591, 5267 and 2871 cm²), T₁ (1224, 4352, 4884 and 2863 cm²), T₄ (1211, 4299, 4864 and 2859 cm²) and T₇ (1117, 4290, 4789 and 2802 cm²) at the respective growth stages. The lowest leaf area was recorded under T₁₁ (100% Recommended PK) with 1006, 3578, 3978 and 2376 cm² at 30 DAS, 60 DAS, 90 DAS and harvest, respectively. Results analogous to this have also been reported by Rajesh *et al.* (2021) ^[14] and Hasanain *et al.* (2024) ^[6].

3. Dry matter Production (kg ha⁻¹)

Dry matter production increased progressively with crop growth and reached its maximum at harvest. Significant differences among the treatments were observed at all growth stages. Treatment T₃ (100% Recommended NPK + 2 sprays of Nano Urea Plus @ 4 ml l⁻¹ each at 25 - 30 and 40 - 45 DAS) recorded significantly higher dry matter production of 1260, 6227, 9496 and 10754 kg ha⁻¹ at 30 DAS, 60 DAS, 90 DAS and harvest respectively, compared with the remaining treatments. However, it was statistically on par with T₂ (1230, 6198, 9338 and 10407 kg ha⁻¹), T₁ (1200, 6137, 9240 and 10332 kg ha⁻¹), T₄ (1170, 5935, 8937 and 10213 kg ha⁻¹) and T₇ (1143, 5567, 8591 and 9973 kg ha⁻¹) at the respective growth stages. The lowest dry matter production was recorded under T₁₁ (100% Recommended PK) with 930, 4682, 7257 and 8262 kg ha⁻¹ at 30 DAS, 60 DAS, 90 DAS and harvest, respectively. These findings are in close agreement with the reports of Midde *et al.* (2022) ^[11].

Effect of Nano fertilizer treatments on yield attributes of maize

4. Cob length (cm)

Cob length was significantly influenced by the different nano-fertilizer treatments. Treatment T₃ (100% Recommended NPK + 2 sprays of Nano Urea Plus @ 4 ml l⁻¹ each at 25 - 30 and 40 - 45 DAS) recorded the maximum cob length (22.0 cm), which was significantly superior to the remaining treatments. However, it was statistically on par with T₂ (21.7 cm), T₁ (21.0 cm), T₄ (20.7 cm) and T₇ (18.3 cm). The lowest cob length (15.0 cm) was recorded under T₁₁ (100% Recommended PK). The present findings are in accordance with Gopinath *et al.* (2025) ^[4] and Dokhe *et al.* (2024) ^[3].

5. Cob girth (mm)

Cob girth was significantly influenced by the different nano-fertilizer treatments. Treatment T₃ (100% Recommended NPK + 2 sprays of Nano Urea Plus @ 4 ml l⁻¹ each at 25 - 30 and 40 - 45 DAS) recorded the highest cob girth (47.5 mm), which was

significantly superior to the remaining treatments. However, it was statistically on par with T₂ (46.7 mm), T₁ (44.0 mm), T₄ (43.5 mm) and T₇ (42.3 mm). The lowest cob girth (32.0 mm) was recorded under T₁₁ (100% Recommended PK). Similar findings were reported by Khardia *et al.* (2024)^[9] and Muchhadiya *et al.* (2024)^[12].

6. Number of kernel rows cob⁻¹

The number of kernel rows cob⁻¹ was influenced by the different nutrient management treatments. Treatment T₃ (100% Recommended NPK + 2 sprays of Nano Urea Plus @ 4 ml l⁻¹ each at 25 - 30 and 40 - 45 DAS) recorded the highest number of kernel rows cob⁻¹ (20.7), which was statistically on par with T₂ (19.3), T₁ (18.7), T₄ (18.7) and T₇ (18.0). The lowest number of kernel rows cob⁻¹ (13.3) was recorded under T₁₁ (100% Recommended PK). Similar findings were reported by Meena *et al.* (2023)^[13].

7. Number of kernel cob⁻¹

The number of kernels cob⁻¹ was significantly influenced by the different nano-fertilizer treatments. Treatment T₃ (100% Recommended NPK + 2 sprays of Nano Urea Plus @ 4 ml l⁻¹ each at 25 - 30 and 40 - 45 DAS) recorded the highest number of kernels cob⁻¹ (577), which was significantly superior to the remaining treatments and remained statistically on par with T₂ (533), T₁ (521), T₄ (512) and T₇ (505). The lowest number of kernels cob⁻¹ (318) was recorded under T₁₁ (100% Recommended PK). These results align with the findings of Meena *et al.* (2023)^[13] and Sharma *et al.* (2023)^[15].

8. Test weight (g)

Test weight was significantly influenced by the different nano-fertilizer treatments. Treatment T₃ (100% Recommended NPK + 2 sprays of Nano Urea Plus @ 4 ml l⁻¹ each at 25 - 30 and 40 - 45 DAS) recorded the highest test weight (36.6 g), which was significantly superior to the remaining treatments and remained statistically on par with T₂ (35.2 g), T₁ (34.9 g), T₄ (34.1 g) and T₇ (32.2 g). The lowest test weight (25.6 g) was recorded under

T₁₁ (100% Recommended PK). These findings are in close agreement with Hemanth *et al.* (2025)^[7], Kashyap and Bainade (2022)^[10].

9. Grain yield (kg ha⁻¹)

Grain yield was significantly affected by different nutrient management treatments. Treatment T₃ produced the highest grain yield (7959 kg ha⁻¹), which was significantly superior to the remaining treatments and remained statistically on par with T₂ (7465 kg ha⁻¹), T₁ (7379 kg ha⁻¹), T₄ (7235 kg ha⁻¹) and T₇ (7096 kg ha⁻¹). The lowest grain yield was recorded under T₁₁, followed by T₁₂, primarily because of inadequate nitrogen supply that restricted vegetative growth and reproductive development. These findings are in close agreement with those reported by Rajesh *et al.* (2021)^[14], Kundu and Chhabra (2023)^[8], Borana *et al.* (2024)^[2], Hasanain *et al.* (2024)^[6] and Muchhadiya *et al.* (2024)^[12].

10. Stover yield (kg ha⁻¹)

Stover yield was also significantly influenced by different nutrient management treatments. Treatment T₃ recorded the highest stover yield (8696 kg ha⁻¹) and remained statistically on par with T₂ (8473 kg ha⁻¹), T₁ (8200 kg ha⁻¹), T₄ (8295 kg ha⁻¹) and T₇ (8073 kg ha⁻¹). The lowest stover yield was recorded under T₁₁, followed by T₁₂, owing to reduced vegetative growth under nutrient-deficient conditions. These findings corroborate the reports of Midde *et al.* (2022)^[11], Sharma *et al.* (2023)^[15], Borana *et al.* (2024)^[2] and Gogoi *et al.* (2024)^[5].

11. Harvest index%

Harvest index was not significantly influenced by different nutrient management treatments. Although slight numerical differences were observed among the treatments, the harvest index remained statistically comparable, indicating that nano fertilizer application enhanced both grain yield and biological yield proportionately without altering the partitioning efficiency of assimilates between economic and vegetative plant parts.

Table 1: Plant height (cm) of maize as influenced by nano fertilizer treatments during Rabi - 2025-26

Treatments	30DAS	60DAS	90DAS	Harvest
T ₁ -100% Recommended NPK	49.1	183.0	220.4	227.4
T ₂ -100% Recommended NPK + 1 spray of nano urea plus @ 4 ml l ⁻¹ each at 25-30 DAS	48.9	185.5	223.1	228.2
T ₃ -100% Recommended NPK + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	52.3	194.4	236.8	243.5
T ₄ -100% Recommended NPK + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ at 25-30 DAS	47.8	177.3	219.3	225.5
T ₅ -80% Recommended N and 100% P&K + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	41.0	167.3	207.1	213.6
T ₆ -60% Recommended N and 100% P&K + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	36.1	161.5	203.9	209.9
T ₇ -80% Recommended P and 100% N&K + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ at 25-30 DAS	44.4	173.6	213.6	221.2
T ₈ -60% Recommended P and 100% N&K + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ at 25-30 DAS	42.7	135.1	187.5	195.8
T ₉ -80% Recommended N&P and 100% K + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ during 25-30 DAS + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	43.5	161.8	206.5	211.7
T ₁₀ -60% Recommended N&P and 100% K + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ during 25-30 DAS + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	41.9	156.5	195.8	202.3
T ₁₁ -100% Recommend PK	35.0	135.1	187.5	195.8
T ₁₂ -100% Recommended NK	40.2	153.2	193.3	196.3
S.Em±	3.6	7.0	8.4	7.9
CD (p=0.05)	NS	20.8	24.7	23.4
CV(%)	12.2	7.4	7.0	6.4

Table 2: Leaf area (cm²) of maize as influenced by nano fertilizer treatments during *Rabi* -2025-26

Treatments	30DAS	60DAS	90DAS	Harvest
T ₁ -100% Recommended NPK	1224	4352	4884	2863
T ₂ -100% Recommended NPK + 1 spray of nano urea plus @ 4 ml l ⁻¹ each at 25-30 DAS	1275	4591	5267	2871
T ₃ -100% Recommended NPK + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	1319	4790	5480	3099
T ₄ -100% Recommended NPK + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ at 25-30 DAS	1211	4299	4864	2859
T ₅ -80% Recommended N and 100% P&K + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	1065	4016	4479	2742
T ₆ -60% Recommended N and 100% P&K + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	1046	3867	4242	2722
T ₇ -80% Recommended P and 100% N&K + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ at 25-30 DAS	1117	4290	4789	2802
T ₈ -60% Recommended P and 100% N&K + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ at 25-30 DAS	1071	4044	4612	2376
T ₉ -80% Recommended N&P and 100% K + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ during 25-30 DAS + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	1082	4206	4650	2710
T ₁₀ -60% Recommended N&P and 100% K + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ during 25-30 DAS + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	1056	3997	4317	2651
T ₁₁ -100% Recommend PK	1006	3578	3978	2376
T ₁₂ -100% Recommended NK	1064	3990	4381	2568
SEm±	67	208	203	118
CD (p=0.05)	198	613	599	347
CV(%)	10.3	8.6	7.5	7.5

Table 3: Dry matter production (kg ha⁻¹) of maize as influenced by nano fertilizer treatments during *Rabi* -2025-26

Treatments	30DAS	60DAS	90DAS	Harvest
T ₁ -100% Recommended NPK	1200	6137	9240	10332
T ₂ -100% Recommended NPK + 1 spray of nano urea plus @ 4 ml l ⁻¹ each at 25-30 DAS	1230	6198	9338	10407
T ₃ -100% Recommended NPK + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	1260	6227	9496	10754
T ₄ -100% Recommended NPK + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ at 25-30 DAS	1170	5935	8937	10213
T ₅ -80% Recommended N and 100% P&K + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	1050	5375	8117	9013
T ₆ -60% Recommended N and 100% P&K + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	960	4780	7425	8592
T ₇ -80% Recommended P and 100% N&K + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ at 25-30 DAS	1143	5567	8591	9973
T ₈ -60% Recommended P and 100% N&K + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ at 25-30 DAS	1080	5437	8143	9364
T ₉ -80% Recommended N&P and 100% K + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ during 25-30 DAS + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	1103	5442	8210	9401
T ₁₀ -60% Recommended N&P and 100% K + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ during 25-30 DAS + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	990	4978	7518	8519
T ₁₁ -100% Recommend PK	930	4682	7257	8262
T ₁₂ -100% Recommended NK	1020	5145	7803	9251
SEm±	65	320	429	456
CD (p=0.05)	191	944	1267	1345
CV(%)	10.3	10.1	8.9	8.0

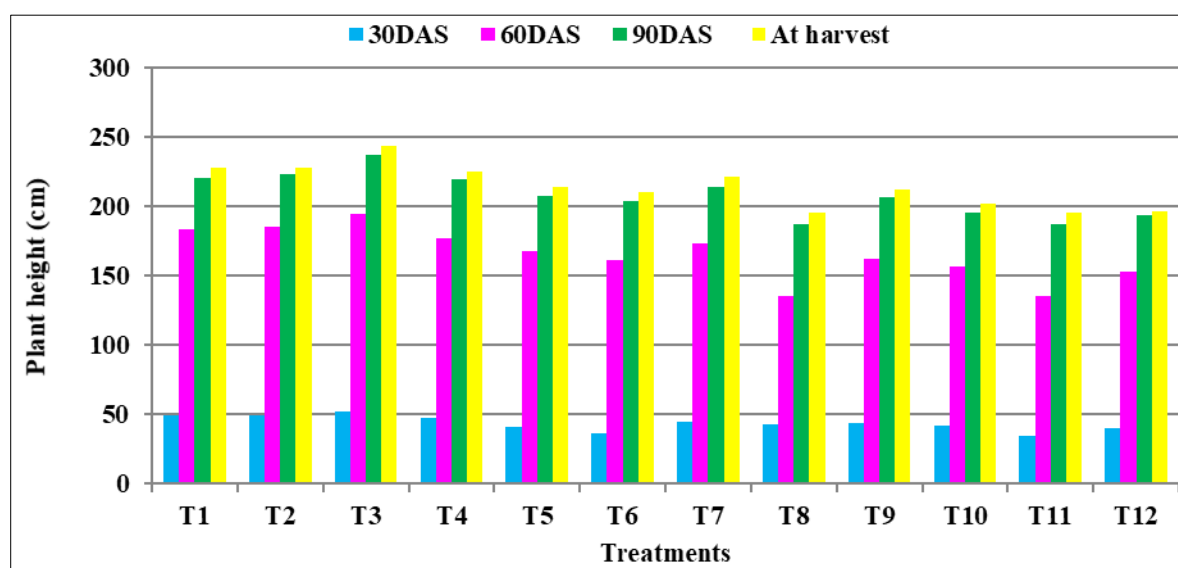
Table 4: Yield attributes of maize as influenced by nano fertilizer treatments during *Rabi*, 2025-26

Treatments	Cob length (cm)	Cob girth (mm)	Number of kernel rows cob ⁻¹	Number of kernels cob ⁻¹	Test weight (g)
T ₁ -100% Recommended NPK	21.0	44.0	18.7	521	34.9
T ₂ -100% Recommended NPK + 1 spray of nano urea plus @ 4 ml l ⁻¹ each at 25-30 DAS	21.7	46.7	19.3	533	35.2
T ₃ -100% Recommended NPK + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	22.0	47.5	20.7	577	36.6
T ₄ -100% Recommended NPK + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ at 25-30 DAS	20.7	43.5	18.7	512	34.1
T ₅ -80% Recommended N and 100% P&K + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	16.7	38.0	17.3	382	28.4
T ₆ -60% Recommended N and 100% P&K + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	15.7	34.7	14.7	357	27.8
T ₇ -80% Recommended P and 100% N&K + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ at 25-30 DAS	18.3	42.3	18.0	505	32.2
T ₈ -60% Recommended P and 100% N&K + Seed treatment with Nano DAP @ 5 ml	17.0	40.0	17.3	388	28.6

kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ at 25-30 DAS					
T ₉ -80% Recommended N&P and 100% K + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ during 25-30 DAS + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	17.3	41.7	18.0	427	29.7
T ₁₀ -60% Recommended N&P and 100% K + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ during 25-30 DAS + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	16.0	36.0	15.3	361	28.2
T ₁₁ -100% Recommended PK	15.0	32.0	13.3	318	25.6
T ₁₂ -100% Recommended NK	16.3	36.7	15.3	372	28.3
SEm±	1.4	2.0	0.9	22.3	1.7
CD (p=0.05)	4.2	6.0	2.5	65.8	5.1
CV(%)	13.7	8.5	8.6	8.8	9.8

Table 5: Grain yield, Stover yield and Harvest index of maize as influenced by nano fertilizer treatments during *Rabi*-2025-26

Treatments	Grain yield (kg ha ⁻¹)	Stover yield (kg ha ⁻¹)	Harvest index (%)
T ₁ -100% Recommended NPK	7379	8200	47.4
T ₂ -100% Recommended NPK + 1 spray of nano urea plus @ 4 ml l ⁻¹ each at 25-30 DAS	7465	8473	46.9
T ₃ -100% Recommended NPK + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	7959	8696	47.8
T ₄ -100% Recommended NPK + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ at 25-30 DAS	7235	8295	46.5
T ₅ -80% Recommended N and 100% P&K + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	6250	6933	47.3
T ₆ -60% Recommended N and 100% P&K + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	5990	6778	46.9
T ₇ -80% Recommended P and 100% N&K + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ at 25-30 DAS	7096	8073	46.7
T ₈ -60% Recommended P and 100% N&K + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ at 25-30 DAS	6112	7067	46.3
T ₉ -80% Recommended N&P and 100% K + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ during 25-30 DAS + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	6229	7152	46.5
T ₁₀ -60% Recommended N&P and 100% K + Seed treatment with Nano DAP @ 5 ml kg ⁻¹ seed + 1 spray of nano DAP @ 2.5 ml l ⁻¹ during 25-30 DAS + 2 sprays of nano urea plus @ 4 ml l ⁻¹ each at 25-30 and 40-45 DAS	5923	6813	46.5
T ₁₁ -100% Recommend PK	4995	6433	43.9
T ₁₂ -100% Recommended NK	5903	6873	46.3
SEm±	403	461	1.0
CD (p=0.05)	1189	1361	NS
CV(%)	11	11	4.0

**Fig 1:** Plant height (cm) of of maize as influenced by nano fertilizer treatments During *Rabi* - 2025-26

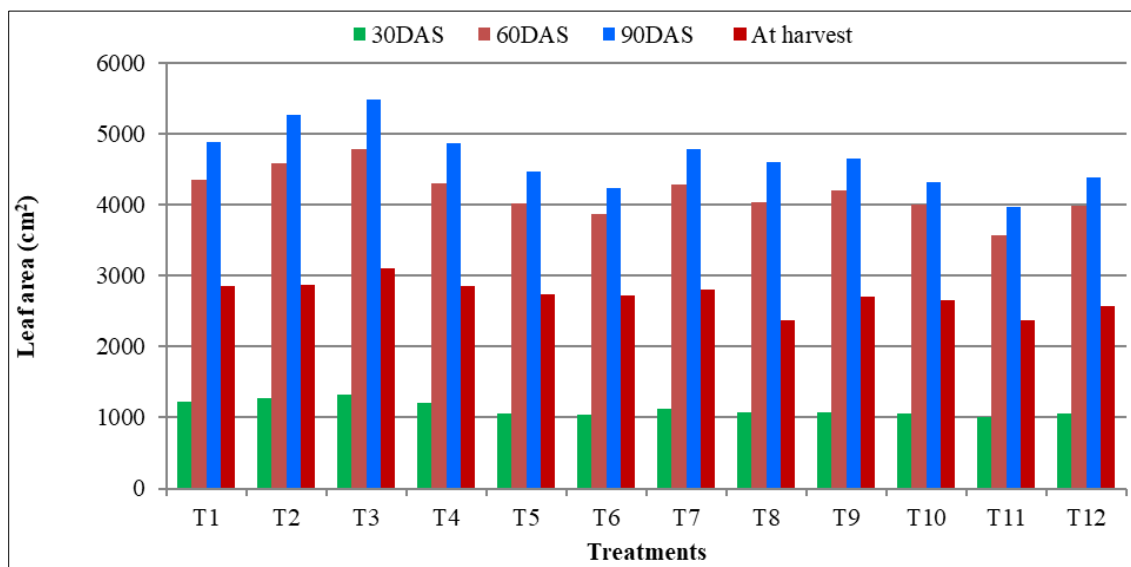


Fig 2: Leaf area (cm²) of maize as influenced by nano fertilizer treatments during Rabi - 2025-26

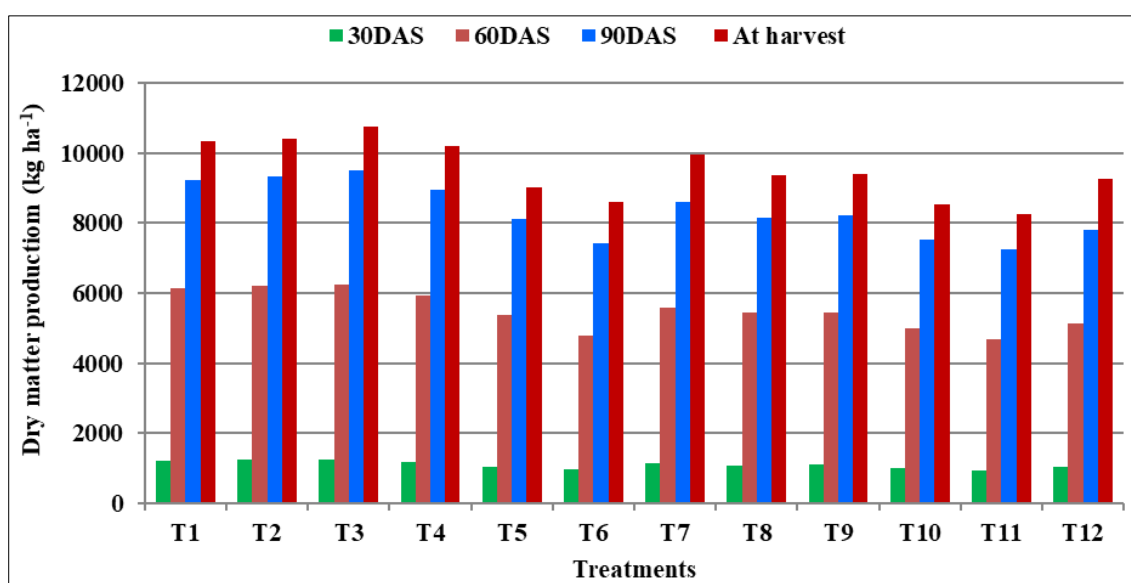


Fig 3: Dry matter production (kg ha⁻¹) of maize as influenced by nano fertilizer treatments during Rabi-2025-26

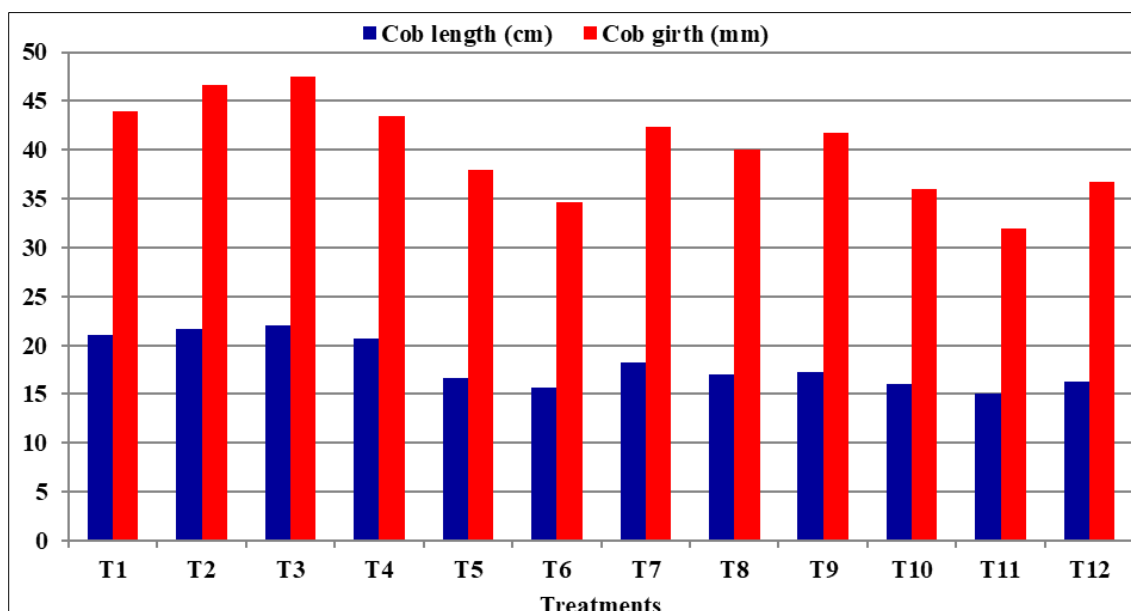


Fig 4: Cob length (cm) and Cob girth(mm) of maize as influenced by nano fertilizer treatments during Rabi-2025-26

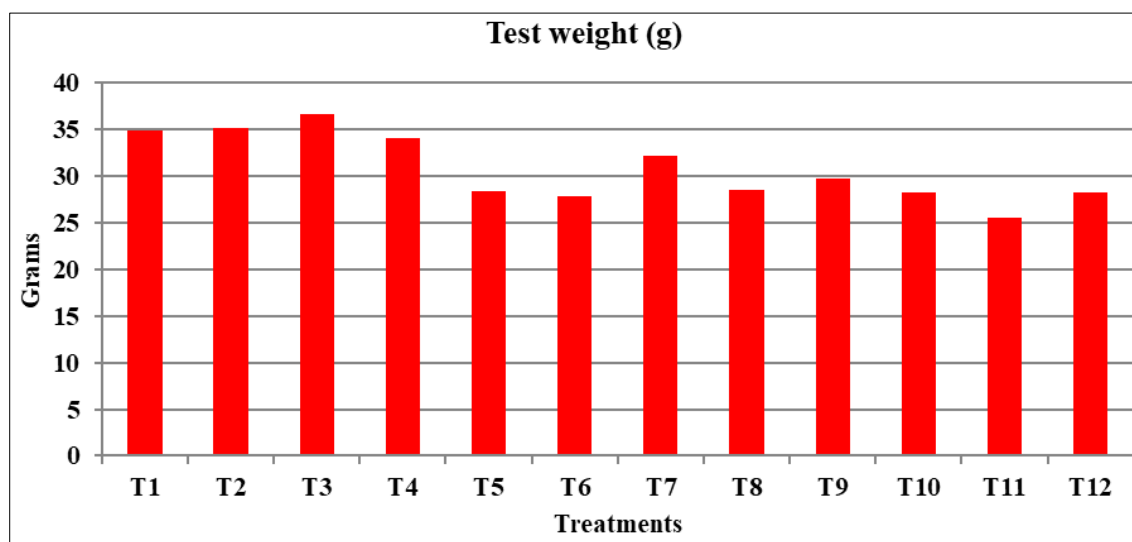


Fig 5: Test weight (g) of maize as influenced by nano fertilizer treatments during Rabi-2025-26

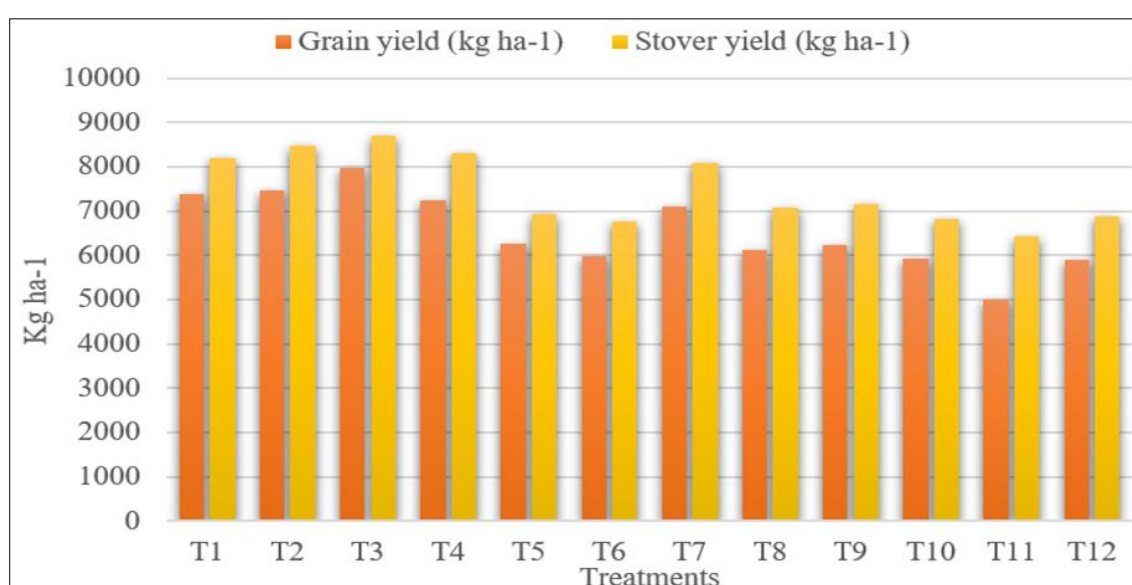


Fig 6: Grain and Stover yields of maize as influenced by nano fertilizer treatments during Rabi-2025-26

Conclusion

Plant height, leaf area, dry matter production, cob length, cob girth, kernels cob⁻¹ and test weight were significantly influenced by the different nano-fertilizer treatments. Among the treatments, T₃ (100% Recommended NPK + 2 sprays of Nano Urea Plus @ 4 ml l⁻¹ each at 25–30 and 40–45 DAS) recorded the highest values for most of the growth, yield attributes and yield parameters and was found to be on par with T₂, T₁, T₄ and T₇. The superior performance of T₃ may be attributed to improved nitrogen availability, enhanced nutrient use efficiency, increased chlorophyll synthesis, higher photosynthetic activity and efficient translocation of assimilates, resulting in better vegetative growth, yield attributes and grain yield of maize.

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