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INFLUENCE OF NANO UREA PLUS AND NANO DAP ON THE VEGETATIVE GROWTH AND EARLINESS PARAMETERS OF TOMATO (*SOLANUM LYCOPERSICUM* L.)

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ABSTRACT

Tomato (*Solanum lycopersicum* L.) is one of the most important vegetable crops globally, but its productivity is often constrained by low nutrient-use efficiency of conventional fertilizers. Nano fertilizers are emerging as an eco-friendly alternative that can enhance nutrient uptake and crop performance. The present investigation entitled "Influence of Nano Urea Plus and Nano DAP on the vegetative growth and earliness parameters of tomato (*Solanum lycopersicum* L.)" was conducted during spring–summer 2025 at the Centre of Excellence, Mulugu, Siddipet district, Telangana, India. The experiment was laid out in a randomized block design with nine treatments and three replications using the hybrid tomato variety 'US-440'. Treatments comprised combinations of the recommended dose of fertilizers (RDF) with one or two foliar sprays of Nano Urea Plus and Nano DAP at pre-flowering and fruit development stages.

Results revealed that foliar application of nano fertilizers exerted a significant influence on growth and phenological traits. At 60 and 90 days after transplanting, maximum plant height (69.17 cm and 74.67 cm), compound leaves (30.57 and 41.17 per plant) and primary branches (6.27 and 9.80 per plant) were recorded with T_6 (RDF + two sprays of Nano Urea Plus and Nano DAP). Earliness was observed in T_5 (0% NP + 100% K + one spray), which showed the minimum days to first flowering (18.40), 50% flowering (34.13), fruit set (37.00) and first harvest (64.20). The enhanced growth performance under T_6 may be attributed to improved nitrogen and phosphorus availability, higher absorption efficiency of nano formulations, and better metabolic activity, while the earliness under T_5 resulted from nutrient stress accelerating phenological events.

The study concludes that RDF in combination with two foliar sprays of Nano Urea Plus and Nano DAP enhances vegetative growth and overall productivity of tomato, whereas nutrient-deficient treatments induced early flowering and harvest. Adoption of this integrated nutrient strategy can improve tomato yields while promoting resource-use efficiency under Telangana conditions.

Key words : *Solanum lycopersicum*, Nano Urea Plus, Nano DAP, Vegetative growth, Earliness.

Introduction

Tomato (*Solanum lycopersicum* L.) is one of the most important vegetable crops worldwide, valued for its nutritional and industrial significance. In India, tomato production during 2023–24 was 21.32 MT from 864 thousand ha, with Telangana contributing 3.93 lakh MT from 12,694 ha (Anonymous, 2023). Tomatoes are rich in vitamins (A, C, B-complex), minerals and antioxidants such as lycopene, which confer health benefits including reduced risk of cardiovascular diseases and cancer (Khan *et al*, 2021; Ali *et al*, 2020).

Nanotechnology in agriculture has emerged as a promising tool for sustainable intensification by enhancing nutrient delivery and use efficiency while minimizing

environmental impacts (Raliya *et al*., 2017; Barzana *et al*., 2022). Among nano fertilizers, IFFCO Nano DAP (8% N, 16% P_2O_5) and Nano Urea Plus (16–20% N) have shown efficiency through foliar application, ensuring rapid absorption and utilization (Chamuah *et al*., 2023; Maloth *et al*., 2024). Unlike conventional fertilizers that cause nutrient losses and environmental hazards, nano formulations improve uptake, reduce application frequency and promote sustainable farming (Abdel *et al*., 2017; Kumar *et al*., 2020).

Considering the limited research on combined use of Nano Urea Plus and Nano DAP in tomato, the present study was conducted to evaluate their effect on vegetative growth and earliness of tomato under Telangana conditions.

Materials and Methods

The experiment was conducted at the Centre of Excellence, Mulugu, Siddipet district, Telangana, geographically located at 17°43'02'' N, 78°37'34'' E and 451 m above mean sea level, during spring–summer 2025. The study was laid out in a randomized block design (RBD) with nine treatments and three replications. The tomato variety 'US-440', a semi-determinate hybrid tolerant to tomato leaf curl virus and heat, was used. Each plot measured 3.0 × 2.7 m, accommodating 30 plants at a spacing of 60 × 45 cm.

A basal dose of 150:60:60 kg N: P_2O_5: K, O ha^{-1} was applied, with one-third N, full P and K as urea, single superphosphate and muriate of potash, respectively. Foliar sprays of Nano Urea Plus and Nano DAP were applied at pre-flowering (4 ml L^{-1}) and fruit development (3 ml L^{-1}) stages.

Treatments

T_1 – RDF (100% NPK)

T_2 – RDF + one foliar spray of Nano Urea Plus + Nano DAP

T_3 – 75% NP + 100% K + one spray

T_4 – 50% NP + 100% K + one spray

T_5 – 0% NP + 100% K + one spray

T_6 – RDF + two sprays of Nano Urea Plus + Nano DAP

T_7 – 75% NP + 100% K + two sprays

T_8 – 50% NP + 100% K + two sprays

T_9 – 0% NP + 100% K + two sprays

Observations were recorded on vegetative growth, earliness, yield attributes and yield.

Results and Discussion

Vegetative growth parameters

Effect of Nano Urea Plus and Nano DAP on growth parameters of tomato is depicted in Table 1. The results showed that the at 30 DAT, differences in plant height among treatments were non-significant, with the maximum height observed in T_1 : RDF (43.80 cm). Significant variation was recorded at 60 and 90 DAT, where T_6 : RDF + two foliar sprays of Nano Urea Plus and Nano DAP registered the maximum plant height (69.17 cm and 74.67 cm, respectively). At 30 DAT, the maximum number of compound leaves was observed in T_1 : RDF (20.80). At later stages, T_6 : RDF + two foliar sprays of Nano Urea Plus and Nano DAP recorded the maximum number of leaves (30.57 at 60 DAT and 41.17 at 90 DAT). The number of primary branches did not differ significantly among treatments at 30, 60 and 90 DAT. However, the maximum values were recorded in T_1 : RDF (4.00 at 30 DAT) and in T_6 : RDF + two foliar

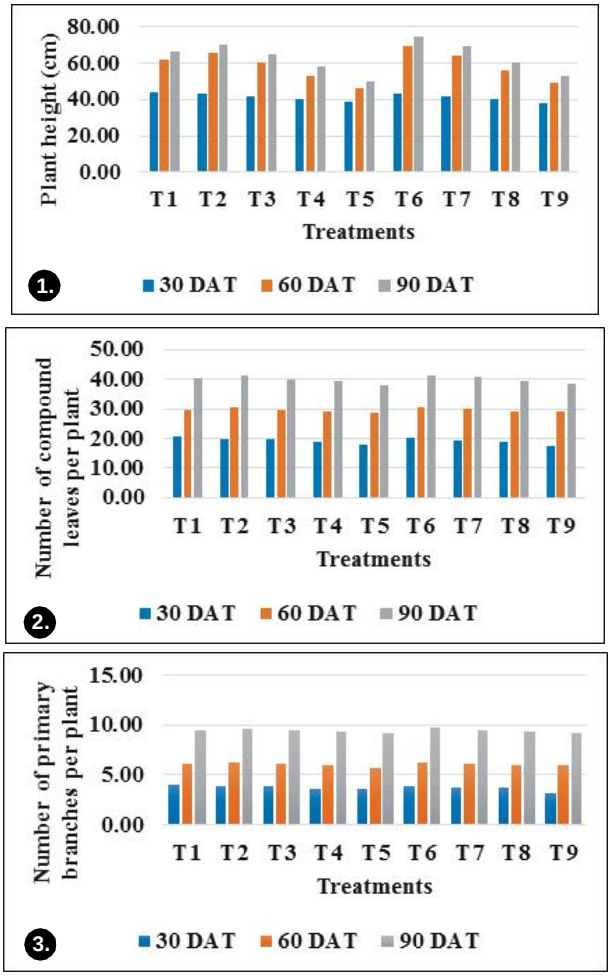

Fig. 1 : Effect of foliar application of Nano Urea Plus and Nano DAP on vegetative growth parameters of Tomato 1. Plant height 2. Number of compound leaves per plant 3. Number of primary branches per plant.

Table 1 : Effect of foliar application of nano urea plus and nano DAP with RDF Combinations on vegetative growth parameters in Tomato.

Treatments	Plant height (cm)			Number of compound leaves per plant			Number of primary branches per plant		
	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT	30 DAT	60 DAT	90 DAT
T_1: RDF	43.80	62.13^{b}	66.57^{bc}	20.80	29.83	40.33	4.00	6.13	9.47
T_2: RDF + one foliar spray	43.07	65.60^{ab}	70.40^{ab}	19.87	30.53	41.07	3.80	6.20	9.60
T_3: 75% NP + 100% K + one spray	42.14	60.20^{bc}	64.87^{bcd}	19.73	29.67	39.73	3.83	6.07	9.43
T_4: 50% NP + 100% K + one spray	40.19	52.67^{de}	58.30^{de}	18.67	29.27	39.27	3.60	5.93	9.33
T_5: 0% NP + 100% K + one spray	38.50	46.00^{f}	50.07^{f}	17.73	28.73	38.10	3.53	5.67	9.13
T_6: RDF + two sprays	43.47	69.17^{a}	74.67^{a}	20.40	30.57	41.17	3.87	6.27	9.80
T_7: 75% NP + 100% K + two sprays	42.00	64.33^{ab}	69.33^{ab}	19.47	30.00	40.60	3.73	6.17	9.53
T_8: 50% NP + 100% K + two sprays	40.24	55.67^{cd}	60.67^{cd}	18.87	29.33	39.60	3.67	6.00	9.40
T_9: 0% NP + 100% K + two sprays	38.26	49.10^{ef}	53.33^{ef}	17.40	28.93	38.67	3.20	5.93	9.27
S.E(m) ±	**1.73**	**1.82**	**2.17**	**1.09**	**1.36**	**1.89**	**0.20**	**0.18**	**0.27**
CD @ 5%	**NS**	**5.46**	**6.50**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Table 2 : Effect of foliar application of nano urea plus and nano DAP with RDF Combinations on earliness parameters in tomato.

Treatments	Days to first flowering	Days to 50% flowering	Days to first fruit set	Days to first harvest
T_1: RDF	23.87^{c}	39.64^{c}	41.33^{ab}	70.93^{bc}
T_2: RDF + one foliar spray	23.90^{c}	39.83^{c}	43.40^{c}	73.73^{cd}
T_3: 75% NP + 100% K + one spray	22.80^{bc}	38.73^{bc}	40.33^{ab}	68.42^{abc}
T_4: 50% NP + 100% K + one spray	20.94^{b}	36.74^{ab}	38.63^{a}	66.93^{ab}
T_5: 0% NP + 100% K + one spray	18.40^{a}	34.13^{a}	37.00^{a}	64.20^{a}
T_6: RDF + two sprays	24.10^{c}	40.23^{c}	43.47^{c}	74.80^{d}
T_7: 75% NP + 100% K + two sprays	22.47^{b}	38.52^{bc}	42.17^{bc}	72.03^{bcd}
T_8: 50% NP + 100% K + two sprays	20.80^{b}	36.21^{ab}	39.50^{ab}	67.47^{abc}
T_9: 0% NP + 100% K + two sprays	19.80^{ab}	35.35^{a}	37.33^{a}	65.79^{ab}
S.E(m)±	0.76	1.22	1.31	2.27
CD @ 5%	2.27	3.66	3.92	6.82

sprays of Nano Urea Plus and Nano DAP (6.27 and 9.80 at 60 and 90 DAT, respectively).

The increased plant height observed in the treatments can be ascribed to the adequate and timely supply of nitrogen and phosphorus, which play a vital role in auxin metabolism, enzymatic activity and photosynthesis. These processes enhance cell division and elongation, thereby promoting vigorous vegetative growth (Elshamy *et al*., 2019). The efficient absorption and utilization of nutrients from nano fertilizers further improve physiological functions, leading to better biomass accumulation and overall plant vigor. These findings are in close agreement with earlier reports by Ajirloo *et al*. (2015), Raliya *et al*. (2015), Mishra *et al*. (2020), Merghany *et al*. (2019), Nandini *et al*. (2022) and Malica *et al*. (2023), who demonstrated that nano fertilizer application significantly improved nutrient use efficiency, metabolic activity and growth parameters in various crops.

Earliness parameters

Effect of Nano Urea Plus and Nano DAP on earliness parameters of tomato is depicted in Table 2. Significant differences were recorded among the treatments with respect to phenological parameters. For days to first flowering, the earliest was observed in T_5 : 0% N, P and 100% K + one foliar spray of Nano Urea Plus and Nano DAP (18.40 days). For days to 50% flowering, T_5 recorded the minimum (34.13 days). Similarly, days to first fruit set was earliest in T_5 (37.00 days) and days to first harvest was also minimum in T_5 (64.20 days).

The earliness observed in T_5 may be attributed to nutrient stress, particularly nitrogen deficiency, which restricted vegetative growth and hastened flowering and

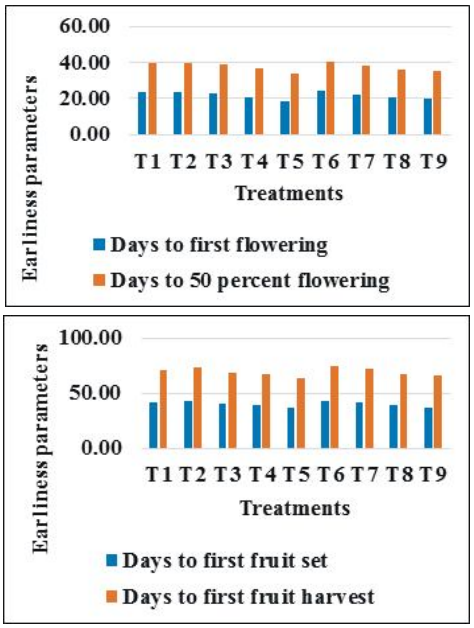

Fig. 2 : Effect of foliar application of Nano Urea Plus and Nano DAP on earliness parameters of tomato.

fruiting. Similar findings were reported by Raliya *et al*. (2015), Gajc-Wolska *et al*. (2018), Elshamy *et al*. (2019), Mishra *et al*. (2020) and Chauhan and Hu (2023), who noted that nutrient imbalance or deficiency can trigger early phenological responses in crops.

Conclusion

The study demonstrated that foliar application of Nano Urea Plus and Nano DAP in combination with RDF significantly improved vegetative growth, earliness, yield attributes and yield of tomato. Among treatments, T_6 (RDF + two foliar sprays of Nano Urea Plus and Nano DAP) was the most effective and is recommended for tomato cultivation in Telangana.

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