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INFLUENCE OF NANO UREA AND NANO DAP ON GROWTH DYNAMICS, YIELD PERFORMANCE AND QUALITY TRAITS OF CHILLI (*CAPSICUM ANNUUM* L.)

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ABSTRACT

The present study investigates the effectiveness of nano- fertilizers-Nano Urea and Nano DAP-on the growth dynamics, yield performance and quality attributes of chilli (*Capsicum annuum* L.). A field experiment was conducted at Experimental Farm, MGM Nanasaheb Kadam College of Agriculture, Gandheli, Chhatrapati Sambhajinagar (M.S), India using a randomized block design with nine treatments replicated thrice during the *Kharif* season of 2023-2024. It is observed that the growth, yield and quality parameters chilli were significantly influenced by RDF with nano urea and DAP. The results revealed that the highest plant height at 60, 90 and 120 DAT (59.84, 64.84 and 75.05 cm), number of leaves per plant at 60, 90 and 120 DAT (178.27, 251.33 and 305.00), fruit length of fruit at harvest (7.84 cm), average fruit girth of fruit at harvest (2.94 cm), average fruit weight per plant at harvest (8.54 g), number of fruit per plant at harvest (276.00 plant^{-1}), total chlorophyll content in fresh tissue (2.30 mg g^{-1}), green fruit yield of chilli (25.33 t ha^{-1}), total soluble solid (4.65 ^{0}Brix) and ascorbic acid content (136.07 mg/100 g) were observed with the application RDF + Nano DAP @ 0.4 % spraying at 30 DAT & 45 DAT.

Key words : Nano urea, Nano DAP, Spraying, Growth, Yield, Quality and Chilli.

Introduction

Chilli (*Capsicum annuum* L.) is one of the most economically important spice and vegetable crops cultivated worldwide for its pungency, flavour, nutritional value and industrial applications. India is among the leading producers, consumers and exporters of chilli, contributing significantly to the global spice market. The crop is valued not only for its culinary uses but also for its rich content of bioactive compounds such as capsaicin, vitamins and antioxidants. However, attaining optimum productivity and superior fruit quality in chilli remains challenging due to nutrient-limited soils, imbalanced fertilizer use and declining input-use efficiency under conventional production systems.

Nano-fertilizers such as Nano Urea and Nano DAP have gained attention for their potential to supply nutrients in a highly efficient, controlled-release, and crop-responsive manner. Their extremely small particle size enables greater leaf penetration, improved nutrient absorption, and reduced losses compared to conventional granular fertilizers. Nano Urea provides nitrogen in a more available and targeted form, while Nano DAP supplies nitrogen and phosphorus nanoparticles capable of enhancing metabolic processes, enzyme activity, root development, and photosynthetic capacity. Several studies indicate that nano-nutrients may significantly influence plant growth dynamics, improve yield attributes and enhance produce quality through better nutrient assimilation and improved physiological efficiency (Maske *et al.*, 2025).

Therefore, the present investigation aims to evaluate the “Influence of Nano Urea and Nano DAP on growth dynamics, yield performance and quality traits of chilli” was conducted at the Experimental Farm of MGM Nanasaheb Kadam College of Agriculture, Gandheli, Chhatrapati Sambhajinagar (M.S), India. The findings of this research will contribute to developing improved

fertilizer regimes that enhance productivity, reduce input costs and support environmentally sustainable chilli cultivation.

Materials and Methods

The field experiment was conducted during *Kharif* season of 2023. The present investigation was done to understand the ''Influence of Nano Urea and Nano DAP on Growth Dynamics, Yield Performance and Quality Traits of Chilli (*Capsicum annuum* L.)'' variety Prachi with spacing 6 × 1 ft. (R × P), which was carried out at Experimental Farm, MGM Nanasaheb Kadam College of Agriculture, Gandheli, Chhatrapati Sambhajinagar (M.S), India. The experiment was laid out in Randomized block design (RBD) with nine treatments and three replications. The treatments were comprises *viz.*, T_1: RDF, T_2: RDF + Nano Urea @ 0.2% spraying at 30 DAT, T_3: RDF + Nano DAP @ 0.2% spraying at 30 DAT, T_4: RDF + Nano Urea @ 0.4% spraying at 30 DAT ,T_5: RDF + Nano DAP @ 0.4% spraying at 30 DAT ,T_6: RDF + Nano Urea @ 0.2% spraying at 30 DAT & 45 DAT, T_7: RDF + Nano DAP @ 0.2 % spraying at 30 DAT & 45 DAT, T_8: RDF + Nano Urea @ 0.4% spraying at 30 DAT & 45 DAT ,T_9: RDF + Nano DAP @ 0.4% spraying at 30 DAT & 45 DAT. The soils of the experimental site were belonged to order Inceptisol (*Vertic Haplustept*). The experimental soils were moderately alkaline in nature and low insoluble salts content. Medium in $CaCO_3$, low in organic carbon, available N, P and very high in K. The available Zn and Fe was deficient and available Mn and Cu were sufficient. The nutrients were applied through fertilizers (urea, single super phosphate, muriate of potash and diammonium phosphate). The recommended dose of fertilizer (RDF) applied to chilli was 100:50:50 kg N, P_2O_5 and K_2O $ha^{-1.}$ Observations were recorded at different stages of growth periods and studied for growth parameters like plant height, number of leaves per plant, fruit length, fruit girth, average fruit weight, yield and quality parameters TSS, Chlorophyll and ascorbic acid content following the standard procedure. The height of five randomly selected plants from each plot was measured in cm with of a 100 cm meter scale from ground level to tip of the shoot at 60, 90 and 120 DAT stage. The results obtained were statistically analyzed and appropriately interpreted as per the methods described in "Statistical method for Agricultural Workers" by Panse and Sukhatme (1985). Appropriate standard error (S.E.) critical differences (C.D.) at 5 per cent levels were worked out for interpretation of results.

Results and Discussion

Effect of nano urea and DAP on growth parameters

The growth parameters of green chilli *viz.*, plant height, number of leaves per plant, fruit girth, fruit length, average fruit weight per plant, number of fruits per plant and total chlorophyll content were significantly influenced by application of nano urea and DAP.

The application of RDF with nano DAP @ 0.4 % spraying at 30 DAT & 45 DAT significantly increased plant height at 60, 90 and 120 DAT (59.84, 64.84 and 75.05cm) in chilli. The lowest plant height at 60, 90 and 120 DAT were recorded (38.05, 44.31 and 51.07 cm) in control (T_1). Increased plant height is attributed to an adequate supply of nitrogen and phosphorus, which enhance enzyme activity and auxin metabolism. This, in turn, promotes cell division and elongation, leading to taller plants. These results are in conformity with the results findings by Ajirloo *et al*. (2015) in tomato, Gusain *et al*. (2015), Drostkar *et al*. (2016) in chickpea, Merghany *et al*. (2019) in cucumber, AJabri *et al*. (2020) in okra, Chauhan *et al*. (2023) in chilli, Rajeshwari Neeruggi (2024) in chilli and Maske *et al*. (2025).

The application of RDF with nano DAP @ 0.4 % spraying at 30 DAT & 45 DAT significantly increased number of leaves per plant at 60, 90 and 120 DAT (178.27, 251.33 and 305.00) in chilli. The lowest number of leaves per plant at 60, 90 and 120 DAT were recorded (150.07, 217.00 and 251.00) in control (T_1). The increased number of leaves per plant is due to the nanosized particle's large surface area and smart delivery system, which enables a controlled release of nutrients, enhancing nutrient use efficiency. Additionally, the improved availability of nitrogen and phosphorus, essential components of chlorophyll and proteins, supports efficient photosynthesis, further promoting leaf growth. These results are in conformity with Ajirloo *et al*. (2015) in tomato, Gusain *et al*. (2015). Drostkar *et al*. (2016) in chickpea, Merghany *et al*. (2019) in cucumber, Jabri *et al*. (2020) in okra, Mishra *et al*. (2020) in tomato and Maske *et al*. (2025).

The maximum average fruit length of fruit at harvest (7.84 cm) was observed with treatment T_9. Minimum average fruit length of fruit at harvest (6.34 cm) was observed in T_1. The maximum average fruit girth of fruit at harvest (2.94 cm) was observed with treatment T_9. Minimum average fruit girth of fruit at harvest (2.12 cm) was observed in T_1. The maximum average fruit weight per plant at harvest (8.54 g) was observed with treatment T_9. Minimum average fruit weight per plant at harvest (4.32 g) was observed in T_1. The maximum number of fruits per plant at harvest (276.00 $plant^{-1}$) was observed

Table 1 : Effect of Nano Urea and Nano DAP on Growth parameters of Chilli.

Treatment	Plant height (cm)			Number of leaves plant^{-1}			Fruit girth (cm)	Fruit length (cm)	Average fruit weight plant^{-1} (g)	Number of fruit plant^{-1}	Total chlorophyll content (mg g^{-1} fruit wt.)
	60 DAT	90 DAT	120 DAT	60 DAT	90 DAT	120 DAT					
T_1	38.05	44.31	51.07	150.07	217.00	251.00	2.12	6.34	4.32	173.67	1.59
T_2	40.23	51.08	59.62	166.37	222.33	264.33	2.39	7.09	4.82	190.00	1.77
T_3	46.09	58.41	68.96	171.70	237.67	287.67	2.63	7.44	6.57	228.33	2.05
T_4	40.54	54.31	61.80	166.40	227.33	273.33	2.49	7.21	5.03	199.00	1.82
T_5	49.70	60.83	70.76	174.33	243.00	292.33	2.72	7.58	7.32	246.00	2.21
T_6	42.39	54.35	63.94	167.00	230.67	277.00	2.56	7.29	5.41	207.00	1.86
T_7	52.64	62.38	72.95	176.10	246.67	298.33	2.78	7.66	7.78	260.00	2.25
T_8	44.09	56.72	66.57	169.77	235.67	284.33	2.61	7.37	6.25	224.00	1.94
T_9	59.84	64.84	75.05	178.27	251.33	305.00	2.94	7.84	8.54	276.00	2.30
S. Em (±)	**0.64**	**0.74**	**0.43**	**2.00**	**1.46**	**3.01**	**0.04**	**0.04**	**0.21**	**4.07**	**0.04**
CD at 5 %	**1.93**	**2.25**	**1.29**	**6.03**	**4.41**	**9.08**	**0.14**	**0.14**	**0.63**	**12.26**	**0.12**

with treatment T_9. Minimum number of fruits per plant at harvest (173.67 plant^{-1}) was observed in T_1. Nano fertilizers significantly enhance fruit length and girth in chilli crops. Their small particle size ensures efficient nutrient absorption and uptake, supplying essential elements for fruit development. By improving nutrient availability, nano fertilizers promote better fruit growth and quality, ultimately boosting overall yield potential. These results are in close conformity with the findings of Parani and Nanthini (2021), Rather *et al.* (2022), Chauhan *et al.* (2023) in chilli and Maske *et al.* (2025).

Total chlorophyll content in fresh tissue of chilli crop showed significantly the highest response to soil application of RDF + Nano DAP @ 0.4 % spraying at 30 DAT & 45 DAT (2.30 mg g^{-1}) and statistically on par with soil application of RDF + Nano DAP @ 0.2% drenching at 30 DAT & 45 DAT (2.25 mg g^{-1}) at flowering stage. Significantly lowest chlorophyll content of leaves was recorded in control (1.59 mg g^{-1}). This may be due to the enhanced absorption and utilization of nutrients like nitrogen and phosphorus by nanosized particles, which have a large surface area and a smart delivery system. Their controlled nutrient release improves nutrient use efficiency in crops, leading to better growth and development as concluded by Ajirloo *et al.* (2015) in tomato, Merghany *et al.* (2019) in cucumber, Jabri *et al.* (2020) in okra, AL-Kaby *et al.* (2021) in okra, Rajeshwari neeruggi (2024) in chilli and Maske *et al.* (2025).

Effect of nano urea and DAP on yield

The treatment, soil application of RDF + Nano DAP @ 0.4% spraying at 30 DAT & 45 DAT recorded significantly higher green fruit yield of chilli (25.33 t ha^{-1}). It was on par with soil application of RDF + Nano DAP @ 0.2% spraying at 30 DAT & 45 DAT recorded significantly higher green fruit yield of chilli (23.97 t ha^{-1}). The lowest green fruit yield observed in T_1 control (20.16 t ha^{-1}). Increases in fruit yield per hectare in treatment T_9: RDF + Nano DAP @ 0.4% spraying at 30 DAT & 45 DAT followed by T_7: RDF + Nano DAP @ 0.2% spraying at 30 DAT & 45 DAT might be due to increase in the number of flowers per plant may, in turn, lead to higher fruit production. The application of an adequate and optimal dose of nitrogen and phosphorus enables the crop to reach its full growth potential by improving nutrient availability, uptake, and use efficiency throughout the cropping period. This may have enhanced the translocation of photosynthates from source to sink, promoting greater flower production and, consequently, more fruits. Additionally, nitrogen, a key macronutrient, may have supported beneficial microbial activity, further

Table 2 : Effect of Nano Urea and Nano DAP on yield and Quality parameters of Chilli.

Treatment	Green fruit yield Ton ha^{-1}	TSS (^{0}Brix)	Ascorbic acid content (mg/100 g)
T_1	20.16	3.15	99.17
T_2	20.72	3.88	106.20
T_3	22.64	4.20	122.40
T_4	21.17	3.94	108.08
T_5	23.35	4.51	127.47
T_6	21.72	4.03	113.50
T_7	23.97	4.56	131.66
T_8	22.30	4.09	118.12
T_9	25.33	4.65	136.07
S. Em (±)	**0.27**	**0.04**	**0.94**
CD at 5 %	**0.84**	**0.12**	**2.83**

contributing to increased flower production. This ultimately results in a higher number of fruits per plant, maximizing harvest yield per square meter and boosting overall fruit production. Ajirloo *et al.* (2015) in tomato, Merghany *et al*. (2019) in cucumber. Panda *et al*. (2020), Mishra *et al.* (2020) in tomato, Rajeshwari neeruggi (2024) in chilli and Maske *et al.* (2025).

Effect of nano urea and DAP on quality parameters

The significantly highest total soluble solid (4.65 ^{0}Brix) recorded in soil application of RDF + Nano DAP @ 0.4% spraying at 30 DAT & 45 DAT and statistically on par with soil application of RDF + Nano DAP @ 0.2% spraying at 30 DAT & 45 DAT (4.56 ^{0}Brix). The lowest total soluble solid was observed in control T_1 (3.15 ^{0} Brix). This might be due to nano fertilizers, with their small particle size, ensure efficient nutrient uptake and utilization, providing essential elements for metabolic processes. Balanced application in nano form improves nutrient availability, leading to increased TSS content in chilli fruits. This enhancement in TSS contributes to improved fruit quality and overall market value of chilli crops. Similar inferences were also concluded by Mishra *et al.* (2020) in chilli, Chauhan *et al.* (2023) in chilli and Maske *et al.* (2025).

The ascorbic acid content in chilli crop showed significantly the highest response to soil application of RDF + Nano DAP @ 0.4 % spraying at 30 DAT & 45 DAT (136.07 mg/100 g) and statistically on par with soil application of RDF + Nano DAP @ 0.2 % spraying at 30 DAT & 45 DAT (131.66 mg/100 g). The lowest ascorbic acid content was observed in control T_1 (99.17mg/100 g). Quality parameter of chilli is ascorbic acid, which act as a natural protector of pigment stability. The application of nano fertilizer increase in the availability and utilization of plant available nutrients. The application of nano fertilizer have significant effect on ascorbic acid which act as an antioxidant and also natural protector. Al-juthery *et al.* (2020) in potato, Chauhan *et al.* (2023) in chilli and Maske *et al.* (2025).

Conclusion

From the findings of present investigation, it is concluded that the recommended dose of fertilizer with application of Nano DAP @ 0.4% spraying at 30 DAT & 45 DAT was significantly superior over control with respect to growth, yield and quality parameters.

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References

Ajirloo, A.R., Shaaban M. and Motlagh Z.R. (2015). Effect of K nanofertilizer and N bio-fertilizer on yield and yield components of tomato (*Lycopersicon esculentum* L.). *Int. J. Adv. Biolog. Biomed. Res*., **3**, 138-143.

Al-juther, H.W.A. and Al-Maamouri E.H.O. (2020). Effect of Urea and Nano-nitrogen fertigation and foliar application of nano-boron and nano molybdenum on some growth and yield parameters of potato. *QJAS Al-Qadisiyah J. Agricult. Sci*., **10**, 253-263.

AL-Kaby, AH.J., AL-Jarah T.M.M. and Haji J.H. (2021). The response of okra plants (*Abelmoschus esculentus* L.) cultivated in greenhouses for foliar spraying with nano fertilizer NPK. *IOP Conf. Ser.: Earth Environ. Sci*., **735**, 012044.

Chauhan, R. and Deepanshu (2023). Effect of Traditional Fertilizer, Nano Fertilizer and Micronutrient on Growth, Yield and Quality of Chilli (*Capsicum annum* L). *Int. J. Environ. Clim. Change*, **13**, 2740-2746

Drostkar, E., Talebi R. and Kanouni H. (2016). Foliar application of Fe, Zn and NPK nano fertilizers on seed yield and morphological traits in chickpea under rainfed condition. *J. Res. Ecol*., **4**, 221-228.

Gusain, M.S., Singh D.K. and Rana D.K. (2015). Response of foliar feedings of urea and zinc on growth and yield of chilli *cv*. Pant C-3. *Indian J. Horticult*., **72**, 441-443.

Jabri, A.R., Raheem A.H. and Jabar A.K. (2020). The effect of nano nitrogen and biofertilizer types on NPK concentrations in soil and okra plant. *Plant Archives*, **20**, 4031-4037.

Maske, N.M., Ajabe M.A. and Mhaske B.G. (2025). Effect of Nano Urea and Nano DAP on the Growth, Yield and Quality of Chilli (*Capsicum Annuum*. L). *Int. J. Plant Soil Sci*., **37(4)**, 316-322.

Merghany, M.M., Shahein M.M., Silem M.A., Abdelgawad K.F. and Radwan A.F. (2019). Effect of nano fertilizers on cucumber plant growth, fruit yield and its quality. *Plant Archievs*, **19**, 165-172.

Mishra, B., Sahu G.S., Mohanty L.K., Swain B.C. and Hati S. (2020). Effect of nano fertilizers on growth, yield and economics of tomato variety Arka Rakshak. *Indian J. Pure Appl. Biosci.*, **8**, 200-204.

Panda, J., Nandi A., Mishra S.P., Pal A.K., Pattnaik A.K. and Jena N.K. (2020). Effects of nano fertilizer on yield, yield attributes and economics in tomato (*Solanum lycopersicum* L). *Int. J. Curr. Microbiol. Appl. Sci*., **9**, 2583-2591.

Panse, V.A. and Sukhatme P.V. (1985). *Statistical methods for Agricultural Workers*, Revised Edition. ICAR, New Delhi.

Parani, K. and Nanthini M. (2021). Effect of inorganic fertilizers on growth of chilli (*Capsicum annuum* L.). *Res. J. Agricult. Sci*., **12**, 1298-1301.

Rajeshwari, N. (2024). Effect of nano DAP and urea on growth, yield and quality of chilli (*Capsicum annuum* L.) *M.Sc. Thesis*. Department of Vegetable Science College of Horticulture, Mudigere Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences Shivamogga.

Rather, A.M., Hussain N.S., Khan F.A., Mir S.A., Malik A.A and Bhat J. (2022). Influence of nitrogen, copper and zinc nano fertilizers on growth characteristics of chilli (*Capsicum annuum* var. annuum L.). *The Pharma Innov. J*., **11**, 946-949.