E-ISSN: 2618-0618
P-ISSN: 2618-060X

NAAS Rating (2025): 5.20
www.agronomyjournals.com
2025; 8(8): 994-996
Received: 25-06-2025
Accepted: 27-07-2025

Gaikwad JS
PG Scholar, Department of Agronomy, College of Agriculture, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

VP Suryavanshi
Associate Professor (Extension Agronomist), RAEEC, Latur (MS), Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

MJ Patange
Assistant Professor, Department of Agronomy, College of Agriculture, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

DJ Patil
PG Scholar, Department of Agronomy, College of Agriculture, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

PS Ahale
PG Scholar, Department of Agronomy, College of Agriculture, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Corresponding Author:
Gaikwad JS
PG Scholar, Department of Agronomy, College of Agriculture, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Influence of nano DAP on growth and yield attributes of Sunflower (*Helianthus annuus* L.) during *kharif* season

Gaikwad JS, VP Suryavanshi, MJ Patange, DJ Patil and PS Ahale

DOI: https://www.doi.org/10.33545/2618060X.2025.v8.i8n.3696

Abstract
A field experiment was carried out during *kharif*, 2024 at Experimental Farm of Agronomy section, College of Agriculture, Latur to study the influence of nano-DAP on growth and yield attributes of sunflower (*Helianthus annuus* L.) during *kharif* season. The soil of experimental plot was clayey in texture. The experiment was laid out in Randomized Block Design (RBD) with eight treatments replicated thrice. The treatments were T_1 - Control (No Fertilizer), T_2 - 100% RDF, T_3 - 100% RDF + Two spray of 2% DAP, T_4 - 100% RDF + Two spray of 0.4% Nano DAP, T_5 - 75% RDF + Two spray of 2% DAP, T_6- 75% RDF + Two spray of 0.4% Nano DAP, T_7 - 75% RDF + One spray of 2% DAP @ 30 DAS + One spray of 0.4% Nano DAP @ 45 DAS and T_8 - 75% RDF + One spray of 0.4% Nano DAP @ 30 DAS + One spray of 2% DAP @ 45 DAS. The result revealed that the growth and yield attributes of sunflower were influenced significantly due to the different treatments. Application of 100% RDF + Two spray of 0.4% Nano DAP (T_4) recorded significantly highest plant height (199.33 cm), number of functional leaves plant^{-1} (31.23), leaf area plant^{-1} (63.87 dm^2), stem girth plant^{-1} (8.57 cm), head diameter plant^{-1} (18.74 cm), dry matter accumulation plant^{-1} (133.52 g) and seed yield (2443 Kg ha^{-1}), being at par with the application of 100% RDF + Two spray of 2% DAP (T_3) and superior over rest of the treatments.

Keywords: Sunflower, RDF, DAP, nano DAP, foliar spray

Introduction
Sunflower (*Helianthus annuus* L.) serves as an important oilseed and ornamental crop cultivated extensively across India. It is commonly known as 'Surajmukhi' throughout the region. The crop origin reported in southern regions of the United States and Mexico (Heiser, 1978) [1]. It was introduced to India in 1969 to fill the gap in the nation's ongoing edible oil production (Shankergoud *et al.*, 2006) [2]. The seeds of sunflower contain approximately 45-50% oil content, 14-19% protein, 21-27% hull material, 7-9% soluble sugars, and 30-35% carbohydrates. India's sunflower cultivation is 0.28 million hectares, yielding 0.25 million tonnes with an average productivity of 905 kg per hectare (Anonymous, 2023a) [3]. Maharashtra holds the fourth position in both area and production, following Karnataka, Haryana, and Odisha. In Maharashtra, during 2023-24 recorded 6.14 thousand hectares under sunflower cultivation, generating 2.37 thousand tonnes of production with productivity reaching 387 kg per hectare (Anonymous, 2023b) [4]. Effective nutrient management, particularly focusing on essential nutrients like nitrogen, phosphorus, and potassium, significantly influences sunflower growth and development. Nano fertilizers are required in smaller amount, thereby minimizing adverse impacts associated with excessive conventional fertilizer usage. These nano fertilizers (NFs) decrease overall fertilizer requirements in agriculture while enhancing nutrient uptake efficiency and reducing fertilizer losses through runoff and leaching. Consequently, nano fertilizers present a superior alternative to conventional fertilizers due to their eco-friendly nature, economic benefits, and ability to preserve soil fertility and plant health. Traditional synthetic phosphorus fertilizers have poor uptake rates and undergo rapid soil fixation, whereas nano phosphorus formulations help to reduce nutrient losses through direct plant absorption. Diammonium phosphate (DAP) is the most widely used phosphatic fertilizer owing to its favorable physical properties and high nutrient concentration. Therefore, applying this fertilizer in nano form offers considerable advantages (Chamuah *et al.*, 2023) [5]. Nano DAP consists of nano size particles

that improve phosphorus availability, promote superior root growth, increased flowering, and enhances seed formation. Accordingly, this research was conducted to evaluate impact of nano-DAP on growth and yield attributes of sunflower.

Materials and Methods

The field experiment was conducted during the *kharif* season of 2024 at Experimental farm of Agronomy Section, College of Agriculture, Latur, Maharashtra. The soil of experimental site was clayey in texture, well drained which was favourable for optimum growth of the crop. The soil samples from 0 to 30 cm depth were taken from randomly selected plots all over the experimental field before laying out the experiment. The soil was slightly alkaline in reaction having pH (7.31), low in available nitrogen (137.98 kg ha^{-1}), low in available phosphorous (9.65 kg ha^{-1}) and very high in available potassium (522.8 kg ha^{-1}). The field experiment was laid out in a Randomized Block Design (RBD) with and eight treatments replicated thrice. The treatments were T_1 - Control (No Fertilizer), T_2 - 100% RDF, T_3 - 100% RDF + Two spray of 2% DAP, T_4 - 100% RDF + Two spray of 0.4% Nano DAP, T_5 - 75% RDF + Two spray of 2% DAP, T_6- 75% RDF + Two spray of 0.4% Nano DAP, T_7 - 75% RDF + One spray of 2% DAP @ 30 DAS + One spray of 0.4% Nano DAP @ 45 DAS and T_8 - 75% RDF + One spray of 0.4% Nano DAP @ 30 DAS + One spray of 2% DAP @ 45 DAS. Each plot had a gross size of 5.4 m × 4.5 m and a net size of 4.2 m × 3.9 m. Sunflower hybrid LSFH-171 was planted on July 1st, 2024, with spacing of 60 cm × 30 cm by using the dibbling method and a seed rate of 5 kg ha^{-1}. The recommended cultural practices and plant protection measures were undertaken. The recommended dose of fertilizer 90:45:45 NPK kg ha^{-1} was applied as per treatments through urea, SSP and MOP. The foliar application of DAP and nano DAP were taken as per the treatments. Growth and yield parameters were recorded periodically on tagged plants. The crop was harvested on 5th October, 2024. Data on various variables were statistically analysed by analysis of variance (Panse and Sukhatme, 1967) [6].

Results and Discussion

Growth attributes

Plant height (cm)

Among the various treatments, the application of 100% RDF + Two spray of 0.4% Nano DAP (T_4) recorded significantly highest plant height (199.33 cm) which was at par with the application of 100% RDF + Two spray of 2% DAP (T_3) (191.60 cm) and found significantly superior over rest of the treatments (Table 1). However, significantly lowest plant height was recorded in Control (No Fertilizer) (T_1) (158.93 cm). The increase in plant height due to nano DAP is influenced by its efficient nutrient delivery, ensuring rapid absorption of nutrients through stomata of leaves and utilization of phosphorus and nitrogen. This enhances chlorophyll synthesis, photosynthetic ability, enzymatic activity and auxin metabolism in plant, leading to cell enlargement and elongation. Additionally, nano fertilizer improves carbohydrate transfer from source to sink, providing continuous energy for vegetative growth, ultimately resulting in taller plant height. These results are in accordance with the findings of Vadlamudi *et al.* (2022) [7] and Rajanikanthreddy *et al.* (2024) [8] in sunflower.

Number of functional leaves plant^{-1}

Perusal of data in Table 1 showed that, among the various treatments, the application of 100% RDF + Two spray of 0.4% Nano DAP (T_4) recorded maximum number of functional leaves plant^{-1} (31.23) which was at par with the application of 100% RDF + Two spray of 2% DAP (T_3) (28.38) and found significantly superior over rest of the treatments. The rise in leaf production observed due to improved nutrient availability with the application of nano DAP, especially phosphorus, which is crucial for promoting growth of plant and leaf development. The adequate nutrients supply in a balanced proportion to the plant enhanced the number of functional leaves plant^{-1}. Similar results were observed by Sanjayakumar *et al.* (2024) [9] in cowpea and Kumar *et al.* (2025) [10] in sunflower.

Leaf area plant^{-1}(dm^2)

Among the various treatments, the maximum leaf area plant^{-1} was recorded with the application of 100% RDF + Two spray of 0.4% Nano DAP (T_4) (63.87 dm^2) which was found at par with the application of 100% RDF + Two spray of 2% DAP (T_3) (58.82 dm^2) and found significantly superior over rest of the treatments (Table 1). However, the minimum leaf area plant^{-1} was recorded in control (No Fertilizer) (T_1) (35.10 dm^2). It might be due to better nutrient availability and uptake with nano DAP which leads to enhanced photosynthesis, energy transfer, cell division and multiplication ultimately contributing to greater leaf area. The results are confirmative with the findings of Vadlamudi *et. al.,* (2022) [7] in sunflower, Mahalakshmi *et al.* (2024) [11] in maize and Sanjayakumar *et al.* (2024) [9] in cowpea.

Stem girth plant^{-1} (cm)

Among various treatments, the maximum stem girth plant^{-1} is reported with the application of 100% RDF + Two spray of 0.4% Nano DAP (T_4) (8.57 cm) which was found at par with the application of 100% RDF + Two spray of 2% DAP (T_3) (8.13 cm) and found significantly superior over rest of the treatments (Table 1). It might be due to efficient and targeted nutrient supply, especially nitrogen and phosphorous which enhanced nutrient uptake, improves photosynthesis, likely promotes cell division and expansion, and it also influences the formation of vascular tissue which contributes to higher stem girth. These findings are in accordance with Kaundal *et al.* (2024) [12] in maize and Rajanikanthreddy *et al.* (2024) [8] in sunflower.

Head diameter plant^{-1}(cm)

Among various treatments, the maximum head diameter plant^{-1} was reported with the application of 100% RDF + Two spray of 0.4% Nano DAP (T_4) (18.74 cm) which was found at par with the application of 100% RDF + Two spray of 2% DAP (T_3) (17.85 cm) and found significantly superior over rest of the treatments(Table 1).This enhancement is likely due to improved nutrient uptake, photosynthesis, enhanced translocation of carbohydrate from source (leaves) to sink (flower head) and effective nutrient delivery system of nano fertilizers which may have positively influenced the cell division and expansion in the capitulum (flower head). These findings are in accordance with the Rajanikanthreddy *et al.* (2024) [8] and Kumar *et al.* (2025) [10] in sunflower.

Dry matter accumulation plant^{-1} (g)

Among various treatments, the maximum dry matter accumulation plant^{-1} was obtained with the application of 100% RDF + Two spray of 0.4% Nano DAP (T_4) (133.52 g) which was found at par with the application of 100% RDF + Two spray of 2% DAP (T_3) (126.11 g) and found significantly superior over rest of the treatments (Table 1). Basal application of conventional fertilizers to the soil, followed by a foliar spray of

nano fertilizers, significantly enhanced taller heights of plant, a higher number of green leaves, and higher leaf area resulted in higher total dry matter production of crop. Similar results were reported in the findings of Girigoud *et al.* (2023) [13] in Pigeon pea, Prakash *et al.* (2023) [14] in soybean and Nandeesh *et al.* (2024) [15] in finger millet.

Seed yield

Perusal of data in Table 1 showed that, among the various treatments, the application of 100% RDF + Two spray of 0.4% Nano DAP (T_4) recorded maximum seed yield (2443 Kg ha^{-1}), which was at par with the application of 100% RDF + Two spray of 2% DAP (T_3) (2185) and found significantly superior over rest of the treatments. It might be due to due to quicker absorption of nano fertilizer by the plant and easiness of translocation, which helped in better rates of photosynthesis thereby more dry matter accumulation and stronger source sink relationship, resulting in higher seed yield. These results are in accordance with the findings of Prakash et. al. (2023) [14] in soybean, Sanjayakumar et. al. (2024) [9] in cowpea, Kumar et. al. (2025) [10] in sunflower.

Table 1: Growth and yield attributes of sunflower as influenced by different treatments.

Treatments	Plant height plant^{-1} (cm)	Number of functional leaves plant^{-1}	Leaf area plant^{-1} (dm^2)	Stem girth plant^{-1} (cm)	Head diameter (cm)	Dry matter at harvest	Seed yield (kg/ha)
T_1- Control (No Fertilizer)	158.93	19.27	35.10	6.52	13.04	97.54	1288
T_2- 100% RDF	173.70	25.36	52.74	7.43	15.91	115.22	1952
T_3- 100% RDF + Two spray of 2% DAP	191.60	28.38	58.82	8.13	17.85	126.11	2185
T_4- 100% RDF + Two spray of 0.4% Nano DAP	199.33	31.23	63.87	8.57	18.74	133.52	2443
T_5- 75% RDF + Two spray of 2% DAP	160.37	20.45	44.99	6.73	14.07	101.74	1631
T_6- 75% RDF + Two spray of 0.4% Nano DAP	167.93	22.83	48.98	7.05	14.87	111.82	1850
T_7- 75% RDF + One spray of 2% DAP @ 30 DAS + One spray of 0.4% Nano DAP @ 45 DAS	163.20	21.80	47.59	6.85	14.52	110.54	1749
T_8- 75% RDF + One spray of 0.4% Nano DAP @ 30 DAS + One spray of 2% DAP @ 45 DAS	170.36	23.98	50.68	7.26	15.44	113.32	1902
SE	7.16	1.42	2.53	0.33	0.75	5.49	113
C.D.at 5%	21.73	4.32	7.67	0.99	2.27	16.65	344
G. Mean	173.18	24.16	50.35	7.32	15.56	113.73	1875

Conclusion

From above investigation it can be concluded that application of 100% RDF + Two spray of 0.4% Nano DAP found to be more beneficial for getting higher plant height, number of functional leaves plant^{-1}, leaf area plant^{-1}, stem girth plant^{-1}, head diameter plant^{-1}, dry matter accumulation plant^{-1} and seed yield of sunflower, followed by application of 100% RDF + Two spray of 2% DAP.

Acknowledgement

We are grateful to College of Agriculture, Latur, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani for the financial assistance and infrastructure facilities provided for the conduct of this work.

References

1. Heiser CB. Taxonomy of Helianthus and origin of domesticated sunflower. Sunflower science and technology. 1978;19:31-53.
2. Shankergoud I, Shadakshari YG, Parameshwarappa KG, Chandranath HT, Katti P, Mesta RK. Sunflower and castor research in Karnataka – An overview. University of Agricultural Sciences, Dharwad; 2006. p. 41.
3. Anonymous. Agricultural Statistics at a Glance 2023-24. Directorate of Economics and Statistics, Ministry of Agriculture & Farmers Welfare, Govt. of India; 2023.
4. Anonymous. Krishi Vibhag, Maharashtra Sashan. 2023.
5. Chamuah S, Gogoi S, Bhattacharjee D, Barman D, Dutta S, Sharma S, Das K. Effect of nano-DAP on soil characteristics and qualities of cabbage. International Journal of Plant and Soil Science. 2023;35(13):52-59.
6. Panse VG, Sukhatme PV. Statistical methods for Agricultural Workers. ICAR; 1967.
7. Vadlamudi JS, Anitha S, Sawargaonkar GL, Prameela P. Effect of Combined Application of Non–Nano and Nano Fertilizers on the Growth, Yield and Oil Content of Sunflower under Semi-arid Conditions. International Journal of Plant & Soil Science. 2022;34(24):1102-1111.
8. Rajanikanthreddy, Ganigara BS, Shakuntala NM, Hiremath U, Satihal D, Kulkarni S, Nivedita. Effect of seed treatment and foliar spray of nano DAP on plant growth and seed yield in RSFH-700 sunflower hybrid seed production. International Journal of Research in Agronomy. 2024;7(11):292-295.
9. Sanjayakumar, Kulkarni S, Siddaram, Chavan M, Patil RP. Growth and productivity of cowpea (*Vigna unguiculata* L.) as affected by different levels of nano DAP in the northeastern dry zone of Karnataka. International Journal of Research in Agronomy. 2024;SP-7(10):548-552.
10. Kumar VH, Shivamurthy D, Aravind Kumar BN, Badiger BA, Prasanna PM. Performance of sunflower (*Helianthus annuus* L.) under different levels of granular fertilizers and nano fertilizers. International Journal of Research in Agronomy. 2025;8(2):33-39.
11. Mahalakshmi, Chavan M, Kulkarni S, Vishwanatha S, Barikara U. Effect of nano DAP on growth and yield of maize (*Zea mays* L.). International Journal of Research in Agronomy. 2024;SP-7(10):344-348.
12. Kaundal A, Gill R, Pandey R, Khan JA. The influence of nano DAP and nano zinc foliar application on maize growth, with or without Bioneema application under Punjab region. The Pharma Innovation Journal. 2024;13(6):79-85.
13. Girigoud A, Naik A, Siddaram, Bhat SN, Bellakki MA. Effect of Nano-DAP on growth and yield of pigeonpea under rainfed condition. The Pharma Innovation Journal. 2023;12(12):1536-1539.
14. Prakash, Naik A, Siddaram, Ravi MV, Bellakki MA. Response of nano DAP on growth, yield and quality of soybean. The Pharma Innovation Journal. 2023;12(12):2002-2005.
15. Nandeesh MU, Gaddi AK, Veeresh H, Ravi S, Ajayakumar MY. Effect of nano DAP on growth and yield of finger millet. International Journal of Research in Agronomy. 2024;7(10):521-524.