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# Studies on the influence of foliar application of nano fertilizers on sesame growth parameters

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## ABSTRACT

A field experiment was carried out in sandy clay loam soils at Agricultural College Farm, Naira, Acharya N.G. Ranga Agricultural University, Andhra Pradesh to investigate the influence of nano fertilizers on growth parameters of Sesame (*Sesamum indicum* L) during *Rabi*, 2024. The experiment was set up in randomized block design with eight treatments, which included the use of varied levels of RDF as basal and foliar application of nano fertilizers, 19:19:19 and $KNO_3$. The results demonstrated that treatment combination, 100% N + 75% P + nano DAP @ 3 ml $lit^{-1}$ at flowering and capsule formation stage ($T_3$) recorded significantly higher plant height (109.1 cm), dry matter accumulation (2905 Kg $ha^{-1}$), LAI (1.9 $dm^2$) and was deemed as the most effective treatment over the rest of all treatments aside from treatment combination, 75% N + 100% P + nano urea @ 4 ml $lit^{-1}$ at flowering and capsule formation stage ($T_2$) as it produced significantly succeeding best result. Lowest growth parameter observations were found with the application of 50% N + 100% P + nano urea @ 4 ml $lit^{-1}$ at flowering and capsule formation stage ($T_4$) and it is hinged as the inferior among all the treatments.

**Keywords:** *Dry matter accumulation, Growth parameters, Nano urea, Nano DAP and Sesamum*

Sesame (*Sesamum indicum L.*) is the oldest indigenous oilseed crop, considered the "queen of oilseed crops" with the longest history of cultivation in India. It belongs to the family Pedaliaceaea and its center of origin is in South Western Africa (Indu and Savithri 2003). It is also known as til, gingelly, or benne. Sesame seeds have grown in popularity over the past two decades due to their high oil quality, protein content, antioxidant content, and resilience to challenging climatic conditions (Myint *et al*., 2020).

On a global scale, India leads the nation in sesame output with 8.02 lakh tons in an area of 15.23 lakh ha (Indiastat 2023). Sesame is farmed on approximately 33,000 hectares in Andhra Pradesh, with production and productivity of 8.00 thousand tons and 252 kg ha-1, respectively (Indiastat 2023).

Sesame is typically grown on residual fertility in Andhra Pradesh; nonetheless, adequate fertilization is required for the crop to produce a good yield. Many physiological constraints, such as excessive flower loss, minimal dry matter building, and poor assimilate partitioning from source to sink, hinder sesame production. (Teja *et al*., 2022). Hence the present study focuses on growth parameters of sesame by foliar application of nano fertilizers.

## MATERIAL AND METHODS

A field experiment was conducted on sandy clay loam soil of the Agricultural College Farm, Naira, during the *Rabi* season of 2024. The site is situated at an altitude of 27 meters above Mean Sea Level (MSL), at 18.240 N latitudes and 83.840 E longitudes. The experimental site's soil was slightly acidic, low in available nitrogen, medium in organic carbon, medium in available phosphorus and medium in available potassium. During the crop growth period, a total rainfall of 21.00 mm was received over one rainy day.

The experiment was laid out in a randomized block design comprising 8 treatments: 50:25:25 Kg NPK ha-1 (T1), 75% N + 100% P + Nano Urea 4ml L-1 at flowering and capsule formation stage (T2), 100% N + 75% P + Nano DAP 3ml l-1 at flowering and capsule formation stage (T3), 50% N + 100% P + Nano Urea 4ml l-1 at flowering and capsule formation stage (T4), 100% N + 50% P +

Nano DAP 3ml l-1 at flowering and Nano Urea 4ml l-1 at capsule formation stage (T5), 75% N + 75% P + + Nano DAP 3ml l-1 at flowering and Nano Urea 4ml l-1 at capsule formation stage (T6), 100% NPK +1% 19:19:19 at flowering and 1% KNO3 at capsule formation stage (T7) and 75% NPK + 1% 19:19:19 at flowering and 1% KNO3 at capsule formation stage (T8), each replicated three times. The row-to-row distance was 30 cm and the plant-to-plant distance was 10 cm. The recommended doses of 50 kg N, 25 kg P2O5, and 25 kg K2O per hectare were applied through urea, single super phosphate and muriate of potash respectively. Thinning and gap filling were done as needed and weeding & hoeing were carried out depending on weed intensity at critical stages of crop weed competition.

Observations were recorded on five randomly selected plants from each replication. The readings from these five plants were averaged replication-wise and the mean data were used for statistical analysis. Data were collected on various characters such as plant height, number of branches per plant, dry matter accumulation (kg ha-1), LAI (leaf area index), weed count and weed dry weight (kg ha-1), days to 50% flowering and days to maturity. These growth parameters were recorded at 30, 60 DAS and harvest stages during the crop growth season.

## RESULTS AND DISCUSSION

### Growth attributes

Growth parameters were remarkably influenced by nano fertilizers at flowering and capsule formation stages. (Table 1). Among the treatments, 100% N + 75% P + Nano DAP 3ml l-1 at flowering and capsule formation stage (T3) produced significantly higher plant height (109.1 cm), dry matter accumulation (2905 Kg ha-1) and LAI (1.90) outperforming the other treatments apart from 75% N + 100% P + Nano Urea 4ml l-1 at flowering and capsule formation stage (T2) which produced significantly better results following T3. While weed count, dry weight, days to 50% flowering and days to maturity were not significantly influenced by varied foliar fertilizer applications (Table 2). Improvement in growth parameters can be attributed to the application of nano DAP and nano urea by which, encapsulated nitrogen and phosphorus effectively released the nutrients, increased rate of N and P translocation to leaves which ultimately regulated the plant development, vigor of leaves, more chlorophyll development, cell division, elongation of cells and greater dry matter accumulation in the entire vegetative plant. Similar findings have been reported by Meena *et al.* (2023), Agnihotri *et al.* (2023), Kumar and Dayal (2023) and Singh *et al.* (2023). The least growth parameter observations were recorded with 50% N + 100% P + Nano Urea 4ml l-1 at flowering and capsule formation stage (T4).

## CONCLUSION

Among the different combinations of foliar fertilizations to the Sesamum, nano DAP and nano urea showed their superiority over the other treatments due to their efficient nutrient liberation ability *via* encapsulated N and P, direct absorption of nutrients, higher translocation rate of nutrients, enhanced plant height and leaf absorption area surface and ultimately the dry matter accumulation.

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**Table 1. Plant height, number of branches plant$^{-1}$, dry matter accumulation and LAI (dm$^2$) during different growth stages of sesame as influenced by nano fertilizers during *rabi*, 2024**

| Treatments | Plant height (cm) | | | Branches plant$^{-1}$ | | | Dry matter accumulation (Kg ha$^{-1}$) | | | LAI (dm$^2$) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 30 DAS | 60 DAS | Harvest | 30 DAS | 60 DAS | Harvest | 30 DAS | 60 DAS | Harvest | 30 DAS | 60 DAS |
| $T_1$: RDF (50 : 25 : 25 NPK Kg ha$^{-1}$) | 24.3 | 80.1 | 92.4 | 2 | 3.5 | 4.2 | 531 | 1594 | 2354 | 0.45 | 1.51 |
| $T_2$: 75% N + 100% P + Nano urea 4 ml l$^{-1}$ at flowering and capsule formation stage | 19.4 | 96.9 | 107.6 | 1.7 | 3.9 | 4.5 | 439 | 1902 | 2771 | 0.37 | 1.8 |
| $T_3$: 100% N + 75% P + Nano DAP 3 ml l$^{-1}$ at flowering and capsule formation stage | 21 | 101.6 | 109.1 | 1.9 | 4.3 | 4.6 | 502 | 2244 | 2905 | 0.45 | 1.9 |
| $T_4$: 50% N + 100% P + Nano urea 4 ml l$^{-1}$ at flowering and capsule formation stage | 18 | 75.5 | 84.5 | 1.3 | 3.2 | 3.7 | 386 | 1345 | 1960 | 0.31 | 1.02 |
| $T_5$: 100% N + 50% P + Nano DAP 3 ml l$^{-1}$ at flowering and Nano urea 4 ml l$^{-1}$ % at capsule formation stage | 20.5 | 76 | 87.2 | 1.8 | 3.3 | 4 | 487 | 1434 | 2218 | 0.43 | 1.26 |
| $T_6$: 75% N + 75% P + Nano DAP 3 ml l$^{-1}$ at flowering and Nano urea 4 ml l$^{-1}$ % at capsule formation stage | 19.1 | 85.4 | 95.9 | 1.5 | 3.7 | 4.4 | 413 | 1697 | 2394 | 0.35 | 1.61 |
| $T_7$: 100% NPK + 1% 19:19:19 at flowering and 1% $KNO_3$ at capsule formation stage | 26.7 | 90.8 | 97.1 | 2.1 | 3.8 | 4.5 | 543 | 1730 | 2406 | 0.46 | 1.63 |
| $T_8$: 75% NPK + 1% 19:19:19 at flowering and 1% $KNO_3$ at capsule formation stage | 20.2 | 78.2 | 90.3 | 1.7 | 3.4 | 4.1 | 459 | 1550 | 2268 | 0.421 | 1.398 |
| SEm (±) | 1.77 | 3.57 | 3.92 | 0.16 | 0.26 | 0.34 | 42.65 | 149.38 | 152 | 0.033 | 0.079 |
| CD (P=0.05) | NS | 10.85 | 11.89 | NS | NS | NS | NS | 453.1 | 461.2 | NS | 0.24 |

**Table 2. Days to 50% flowering, days to maturity, weed count (No. $m^2$) and weed dry weight (Kg $ha^{-1}$) during different growth stages of sesame as influenced by nano fertilizers during *rabi*, 2024**

| Treatments | Days to 50% flowering | Days to maturity | Weed count (No. $m^2$) | | | Weed dry matter (Kg $ha^{-1}$) | | |
|---|---|---|---|---|---|---|---|---|
| | | | 30 DAS | 60 DAS | Harvest | 30 DAS | 60 DAS | Harvest |
| $T_1$: RDF (50:25:25 NPK Kg $ha^{-1}$) | 35 | 77 | 37.3 | 63.7 | 69.1 | 71.7 | 197.3 | 222.4 |
| $T_2$: 75% N + 100% P + Nano urea 4 ml $l^{-1}$ at flowering and capsule formation stage | 36 | 80 | 27.9 | 49.9 | 57.2 | 51.5 | 145.4 | 160.0 |
| $T_3$: 100% N + 75% P + Nano DAP 3 ml $l^{-1}$ at flowering and capsule formation stage | 37 | 80 | 29.4 | 56.1 | 61.4 | 58.7 | 168.9 | 182.8 |
| $T_4$: 50% N + 100% P + Nano urea 4 ml $l^{-1}$ at flowering and capsule formation stage | 34 | 74 | 28.1 | 52.3 | 60.4 | 54.2 | 159.4 | 170.4 |
| $T_5$: 100% N + 50% P + Nano DAP 3 ml $l^{-1}$ at flowering and Nano urea 4 ml $l^{-1}$ % at capsule formation stage | 34 | 75 | 35.8 | 60.9 | 68.3 | 66.7 | 178.2 | 194.2 |
| $T_6$: 75% N + 75% P + Nano DAP 3 ml $l^{-1}$ at flowering and Nano urea 4 ml $l^{-1}$ % at capsule formation stage | 35 | 78 | 26.5 | 46.8 | 55.5 | 46.5 | 129.8 | 149.3 |
| $T_7$: 100% NPK + 1% 19:19:19 at flowering and 1% $KNO_3$ at capsule formation stage | 35 | 79 | 33.2 | 59.0 | 66.3 | 62.3 | 176.2 | 190.7 |
| $T_8$: 75% NPK + 1% 19:19:19 at flowering and 1% $KNO_3$ at capsule formation stage | 34 | 76 | 32.7 | 57.4 | 64.0 | 60.0 | 169.8 | 186.3 |
| S.Em+ | 0.64 | 1.77 | 2.68 | 4.68 | 4.54 | 5.23 | 13.18 | 15.87 |
| CD (p=0.05) | NS | NS | NS | NS | NS | NS | NS | NS |

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