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Growth response of summer sesame (*Sesamum indicum* L.) to foliar nutrition

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Abstract

A field experiment was carried out during the summer season of 2026 at the College Farm, Agricultural College, Polasa, Jagtial, to study the growth response of summer sesame (*Sesamum indicum* L.) to foliar nutrition. The experiment was laid out in a Randomized Block Design with nine treatments and three replications. The results revealed that the treatment T₉- 100% RDF + 2 foliar sprays of 2% 19:19:19 at flowering and capsule formation stages recorded the maximum plant height of (83.3 and 109.8 cm), Dry matter production (189.0 and 331.2 gm⁻²), leaf area (534.7 and 468.9 cm² plant⁻¹) and SPAD chlorophyll meter reading (48.9 and 34.0) at 60 DAS and at harvest and these values were statistically on par with those recorded under T₅- RDF + 2 foliar sprays of 2% DAP at flowering stage and capsule formation stages and T₃- RDF + 2 foliar sprays of 2% Urea at flowering stage and capsule formation stages.

Keywords: Foliar nutrition, Sesame, RDF, Urea, DAP, KCl and 19:19:19

1. Introduction

Sesame (*Sesamum indicum* L.) popularly known as “til”, is one of the oldest cultivated oilseed crops belonging to the family Pedaliaceae. It is valued for its high-quality edible oil, rich nutritional composition and medicinal properties and is therefore known as the “Queen of Oilseeds” (Sudha Bharathi *et al.*, 2025) ^[14]. The seeds contain about 50% oil, 18–20% protein and are rich in essential fatty acids (Chaturvedi *et al.*, 2025) ^[4].

Despite its economic importance, sesame productivity remains low due to cultivation on nutrient-deficient soils, inadequate nutrient management and poor nutrient use efficiency. Conventional soil application of fertilizers alone is often insufficient because a considerable proportion of applied nutrients is lost through leaching and other processes, resulting in reduced nutrient availability and uptake by the crop (Preetha and Balakrishnan, 2017) ^[9].

Foliar nutrition has emerged as an effective strategy to supplement soil fertilization by providing essential nutrients directly to plant leaves during critical growth stages. Foliar application enhances nutrient absorption, improves photosynthetic activity, reduces flower shedding, promotes efficient translocation of assimilates and ultimately increases crop growth and yield (Sharma *et al.*, 2013) ^[11].

Among different foliar nutrient sources, foliar application of nitrogen (urea) promotes vegetative growth and protein synthesis, phosphorus (DAP) improves root activity and energy transfer, while potassium (KCl) regulates stomatal activity, water use efficiency and stress tolerance. Water-soluble fertilizers such as 19:19:19 supply balanced nutrients and help sustain physiological activity by replenishing nutrients rapidly translocated from leaves to developing seeds (Monika *et al.*, 2021) ^[7]. Considering the above facts, the present investigation was undertaken to evaluate the “Growth Response of Summer Sesame (*Sesamum indicum* L.) to Foliar Nutrition”.

2. Materials and Methods

The field experiment was conducted during summer, 2026 at the College Farm, Agricultural College, Polasa, Jagtial, Telangana, India to evaluate the growth response of summer sesame (*Sesamum indicum* L.) to foliar nutrition”. The soil at the experimental site had clay loam in texture with 10.4% sand, 32.4% silt and 57.2% clay. The soil was low in organic carbon (0.47%), neutral in reaction (pH 7.28) with electrical conductivity of 0.35 dS m⁻¹, which is low in available

nitrogen (174.6 Kg ha⁻¹), medium in available phosphorous (22.9 kg ha⁻¹) and available potassium (223.9 kg ha⁻¹). During the experimental period the average maximum and minimum temperatures were 35.8°C and 19.0°C, respectively. The experiment was evaluated under a randomized block design (RBD) and replicated thrice and comprised of nine treatments:- T₁: RDF (Soil application), T₂: RDF + 1 foliar spray of 2% Urea at flowering stage, T₃: RDF + 2 foliar sprays of 2% Urea at flowering stage and capsule formation stages, T₄: RDF + 1 foliar spray of 2% DAP at flowering stage, T₅: RDF + 2 foliar sprays of 2% DAP at flowering stage and capsule formation stages, T₆: RDF + 1 foliar spray of 1% KCl at flowering stage, T₇: RDF + 2 foliar sprays of 1% KCl at flowering stage and capsule formation stages, T₈: RDF + 1 foliar spray of 2% 19:19:19 at flowering stage and T₉: RDF + 2 foliar sprays of 2% 19:19:19 at flowering stage and capsule formation stages. The variety used was Jagtial Til-1 (JCS 1020), which has a duration of 90-95 days. Sowing was done with a spacing of 30 cm x 15 cm using a seed rate of 5 kg ha⁻¹ on 24th January 2026. The recommended dose of fertilizer (80:20:20 kg N, P₂O₅ and K₂O ha⁻¹) was supplied. The 50% N and full dose of P and K were applied as basal and remaining 50% of N was applied as top dressing on 30 DAS. Data was recorded from five plants selected randomly from each treatment in every replication. Data on growth parameters such as plant height, Dry matter production, leaf area and SPAD chlorophyll meter reading were analyzed statistically using ANOVA.

Table 1: Plant height (cm) of summer sesame as influenced by the foliar nutrition at different stages of crop growth

Tr. No.	Treatments	Plant height (cm)		
		30 DAS	60 DAS	Harvest
T ₁	RDF (soil application)	24.6	64.4	80.3
T ₂	RDF + 1 foliar spray of 2% Urea at flowering stage	23.4	72.6	91.6
T ₃	RDF + 2 foliar sprays of 2% Urea at flowering and capsule formation stages	25.3	77.8	101.0
T ₄	RDF + 1 foliar spray of 2% DAP at flowering stage	23.5	73.9	93.0
T ₅	RDF + 2 foliar sprays of 2% DAP at flowering and capsule formation stages	24.9	79.4	104.0
T ₆	RDF + 1 foliar spray of 1% KCl at flowering stage	25.3	66.3	84.3
T ₇	RDF + 2 foliar sprays of 1% KCl at flowering and capsule formation stages	23.2	68.0	86.4
T ₈	RDF + 1 foliar spray of 2% 19:19:19 at flowering stage	25.9	75.8	97.3
T ₉	RDF + 2 foliar sprays of 2% 19:19:19 at flowering and capsule formation stages	24.2	83.3	109.8
	SEm ±	1.1	2.5	3.5
	CD (P=0.05)	NS	7.7	10.7

2. Dry matter production (g m⁻²)

Dry matter production is the cumulative outcome of various physiological and biochemical processes occurring within the plant and increased progressively with crop growth up to harvest. At 30 DAS, dry matter accumulation did not differ significantly among the treatments, which may be attributed to the uniform application of RDF through soil and the absence of foliar nutrient sprays up to this stage. However, significant differences were observed at 60 DAS and at harvest. The treatment T₉ (100% RDF + two foliar sprays of 2% 19:19:19 at flowering and capsule formation stages) recorded the highest dry matter production (189.0 g m⁻² at 60 DAS and 331.2 g m⁻² at harvest), which was

3. Results and Discussion

3.1 Effect of foliar nutrition on growth parameters of summer sesame

1. Plant height (cm)

Plant height was significantly influenced by the application of foliar nutrient treatments at 60 DAS and at harvest. Among the different treatments tested, the application of 100% RDF along with two foliar sprays of 2% 19:19:19 (T₉) recorded the highest plant height of (83.3 cm) and (109.8 cm) at 60 DAS and at harvest, respectively and was statistically on par with T₅ and T₃. The increased plant height under T₉ might be attributed to adequate and balanced foliar supply of nitrogen, phosphorus and potassium during the critical reproductive stages. The combined effect of these nutrients stimulated cell division and cell enlargement which promoted vigorous vegetative growth and resulted in increased plant height.

However, at 30 DAS, no significant differences in plant height were observed due to the absence of foliar spray application up to that stage, as all the treatments receiving RDF had similar nutrient availability during the early growth period. The lowest plant height of 64.4 cm and 80.3 cm was recorded in T₁ (RDF) at 60 DAS and at harvest, respectively. The present findings are in agreement with those reported by Basu *et al.* (2019) ^[1] and Solanki *et al.* (2022) ^[13].

statistically on par with T₅ and T₃. The lowest dry matter production was recorded in T₁ (100% RDF) with 142.5 g m⁻² at 60 DAS and 243.9 g m⁻² at harvest. The higher dry matter accumulation under T₉ may be attributed to the complementation of NPK through foliar application of 19:19:19 during critical growth stages, which enhanced nutrient uptake, assimilate translocation, carbohydrate metabolism, resulted in efficient partitioning of photosynthates from source to sink. The combined effect of these nutrients increased photosynthetic efficiency and biomass production. These results are in conformity with those reported by Biradar *et al.* (2023) ^[3] and Singh *et al.* (2018) ^[12].

Table 2: Dry matter production (g m⁻²) of summer sesame as influenced by the foliar nutrition at different stages of crop growth

Tr. No.	Treatments	Dry matter production (g m ⁻²)		
		30 DAS	60 DAS	Harvest
T ₁	RDF (soil application)	51.2	142.5	243.9
T ₂	RDF + 1 foliar spray of 2% Urea at flowering stage	52.3	159.5	278.5
T ₃	RDF + 2 foliar sprays of 2% Urea at flowering and capsule formation stages	52.5	172.0	301.9
T ₄	RDF + 1 foliar spray of 2% DAP at flowering stage	51.7	161.0	281.3
T ₅	RDF + 2 foliar sprays of 2% DAP at flowering and capsule formation stages	52.1	174.0	305.3
T ₆	RDF + 1 foliar spray of 1% KCl at flowering stage	51.4	148.5	258.4
T ₇	RDF + 2 foliar sprays of 1% KCl at flowering and capsule formation stages	51.4	151.0	263.1
T ₈	RDF + 1 foliar spray of 2% 19:19:19 at flowering stage	52.4	169.0	296.2
T ₉	RDF + 2 foliar sprays of 2% 19:19:19 at flowering and capsule formation stages	52.0	189.0	331.2
	SEm ±	2.2	5.8	10.8
	CD (P=0.05)	NS	17.4	32.4

3. Leaf area (cm²)

Leaf area was not significantly influenced by the treatments at 30 DAS, as foliar nutrient sprays was not applied and all treatments received a uniform recommended dose of fertilizers through soil application. However, significant differences were observed at 60 DAS and at harvest. The treatment T₉ (100% RDF + two foliar sprays of 2% 19:19:19 at flowering and capsule formation stages) recorded the highest leaf area (534.7 cm² at 60 DAS and 468.9 cm² at harvest), which was statistically on par with T₅ and T₃. The

lowest leaf area was recorded in T₁ (100% RDF alone), with 415.0 cm² at 60 DAS and 363.5 cm² at harvest. The higher leaf area recorded under T₉ might be attributed to the balanced foliar supply of essential nutrients, which enhanced cell division, cell expansion, photosynthetic efficiency and delayed leaf senescence, thereby promoting greater leaf expansion and leaf retention. These findings corroborate the observations of Sarika *et al.* (2022) ^[10] and Gutte *et al.* (2018) ^[5].

Table 3: Leaf area (cm²) of summer sesame as influenced by the foliar nutrition at different stages of crop growth

Tr. No.	Treatments	Leaf area (cm ²)		
		30 DAS	60 DAS	Harvest
T ₁	RDF (soil application)	119.2	415.0	363.5
T ₂	RDF + 1 foliar spray of 2% Urea at flowering stage	121.0	465.3	407.1
T ₃	RDF + 2 foliar sprays of 2% Urea at flowering and capsule formation stages	120.9	500.2	438.7
T ₄	RDF + 1 foliar spray of 2% DAP at flowering stage	120.5	476.9	417.5
T ₅	RDF + 2 foliar sprays of 2% DAP at flowering and capsule formation stages	120.7	513.0	449.6
T ₆	RDF + 1 foliar spray of 1% KCl at flowering stage	120.0	425.2	375.2
T ₇	RDF + 2 foliar sprays of 1% KCl at flowering and capsule formation stages	120.1	432.9	380.4
T ₈	RDF + 1 foliar spray of 2% 19:19:19 at flowering stage	121.2	483.5	424.5
T ₉	RDF + 2 foliar sprays of 2% 19:19:19 at flowering and capsule formation stages	121.0	534.7	468.9
	SEm ±	5.2	16.7	14.5
	CD (P=0.05)	NS	50.0	43.6

4. SPAD chlorophyll meter reading

SPAD chlorophyll meter reading (SCMR) served as an indirect measure of leaf chlorophyll content and photosynthetic activity. At 30 DAS, SCMR did not differ significantly among the treatments because foliar nutrient sprays had not been applied and all treatments received a uniform recommended dose of fertilizers through soil application.

However, significant differences were observed at 60 DAS and at harvest. The treatment T₉ (100% RDF + two foliar sprays of 2% 19:19:19 at flowering and capsule formation stages) recorded the

maximum SCMR (48.9 at 60 DAS and 34.0 at harvest), which was statistically on par with T₅ and T₃. The minimum SCMR was recorded in T₁ (100% RDF alone), with 36.1 at 60 DAS and 26.6 at harvest. The beneficial effect of SCMR in T₉ was most likely brought about by the liberal supply of NPK through soil application together with foliar feeding of major macronutrients at the peak physiological demand of sesame, which enhanced chlorophyll synthesis, delayed leaf senescence and improved photosynthetic activity. Similar results were reported by Kumar *et al.* (2023) ^[6] and Bhayal *et al.* (2022) ^[2].

Table 4: SPAD chlorophyll meter readings of summer sesame as influenced by the foliar nutrition at different stages of crop growth

Tr. No.	Treatments	SPAD meter readings		
		30 DAS	60 DAS	Harvest
T ₁	RDF (soil application)	34.7	36.1	26.6
T ₂	RDF + 1 foliar spray of 2% Urea at flowering stage	35.6	42.7	29.9
T ₃	RDF + 2 foliar sprays of 2% Urea at flowering and capsule formation stages	35.1	45.4	32.5
T ₄	RDF + 1 foliar spray of 2% DAP at flowering stage	35.5	43.1	30.3
T ₅	RDF + 2 foliar sprays of 2% DAP at flowering and capsule formation stages	36.5	46.0	33.1
T ₆	RDF + 1 foliar spray of 1% KCl at flowering stage	35.5	38.0	27.2
T ₇	RDF + 2 foliar sprays of 1% KCl at flowering and capsule formation stages	34.8	39.6	27.6
T ₈	RDF + 1 foliar spray of 2% 19:19:19 at flowering stage	36.9	44.3	30.7
T ₉	RDF + 2 foliar sprays of 2% 19:19:19 at flowering and capsule formation stages	34.4	48.9	34.0
	SEm ±	1.3	1.5	1.0
	CD (P=0.05)	NS	4.5	3.2

4. Conclusion

The results evidently indicate that application of 80-20-20 kg NPK ha⁻¹ + foliar sprays of 2.0% 19:19:19 mixture at flowering and capsule formation stage proved to be most suitable agronomic practice for optimum growth in summer sesame.

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