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Effect of nitrogen and plant growth regulator on yield and economis of sesame (*Sesamum indicum* L.)

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Abstract
A field experiment was conducted at the Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P.), during the month of *Kharif* 2024 to study treatments consisting of three levels of Nitrogen *viz.* N 45 kg, 60 kg and 75 kg/ha and three levels of Plant Growth Regulators *viz* IAA at flowering stage, GA_3 at capsule formation stage and NAA at flowering and capsule formation stage The soil on the experimental plot was sandy loam in texture, had a pH of 7.8, contained 0.72 per cent organic carbon, and had 178.48 kg of nitrogen, 27 kg of phosphorus, and 233 kg of potassium available per hectare. There were 10 treatments, each reproduced three times, and they were organised using a random block design and was randomly allotted to different plots. It is concluded that T_5 (Nitrogen 60kg/ha+GA_3 100ppm) recorded significantly higher capsules per plant, seeds per capsule, seed yield, stover yield, gross return, net return and benefit cost ratio.

Keywords: Sesame, nitrogen, plant growth regulator, seed yield, economics

1. Introduction
The oil seed crop plays the second important role in the Indian agricultural economy next of the food grain in term of area and production. As Indian climate is suitable for the cultivation of oilseeds crop; large variety of oil seed crops are cultivated here. The government of India has been pursuing several development programs to meet the requirement of increasing demand of oilseeds in the country owing to increase in population, improvement in standard of living increasing industrial requirements. Sesame, celebrated as the "Queen of Oilseeds" due to its superior oil content and quality, is deeply embedded in the culinary and health traditions of China, Japan, and other Asian nations, where it is revered for its nutritional and medicinal attributes (Dossa *et al*., 2017) [6]. Beyond its rich supply of edible oil and protein, sesame seeds boast antioxidants like sesamolin and sesamin, which not only extend the shelf life of sesame oil by preventing rancidity but also contribute valuable lignans with significant physiological benefits for both human and animals.
Nitrogen (N) fertilizer application profoundly impacts sesame growth and yield, with optimal seed yields typically achieved within a range of 46 to 100 kg N/ha across major sesame-producing regions. Sufficient nitrogen availability not only bolsters overall productivity but also enhances the uptake of essential nutrients like phosphorus and potassium, alongside certain micronutrients crucial for sesame development. However, the efficiency of pre-emergence nitrogen application, particularly with mobile nitrogen forms, is often compromised due to potential nutrient losses, necessitating careful consideration of application strategies. The rapid availability of mobile nitrogen fertilizers, typically within two days of application, underscores the importance of timing in aligning nutrient availability with crop demand.
Plant growth regulators orchestrate a symphony of physiological activities, enhancing photosynthetic efficiency and regulating the source to sink relationship within field crops. Foliar applications of these regulators, particularly during the flowering stage, boosts physiological processes, leading to substantial gains in crop productivity (Singh *et al*., 2018). Compounds like amino acids and phenolics are applied through foliar sprays has demonstrated a remarkable ability to stimulate growth parameters, contributing in increased shoot height, augmented fresh and dry biomass, a greater number of branches, and a

proliferation of ear heads per plant. Gibberellic acid, also a very well-known endogenous regulator of plant metabolism, plays vital role in mitigating both biotic and abiotic stresses, acting as a hormonal messenger that governs plant growth. Its influence extends to stimulating rapid stem and root growth, accelerating germination processes, and ultimately bolstering crop productivity under challenging environmental conditions

2. Materials and Methods

In the 2024 *Kharif* season, a field experiment was conducted, employing a Randomized Block Design with three replications to study the effect of ten distinct treatment combinations. These treatments were strategically randomized within 10 plots of each replication to mitigate bias and ensure statistical validity. The experimental site was characterized by sandy loam soil which was slightly high in pH, combined with a deficiency in organic carbon and readily available nitrogen and phosphorus, while potassium levels were comparatively higher. The VIBHUTI-999 variety was rolled out for the study, and a consistent plant spacing of 40 cm × 10 cm was thoroughly maintained to ensure uniformity across the experimental units. Control plot was treated with RDF (N:P:K 60:40:20 kg/ha) and was used for comparison with other plots treated with factors with were Nitrogen(45kg/ha,60kg/ha and 75 kg/ha) and Plant growth regulator(IAA 100ppm at flowering stage, GA_3 100ppm at capsule formation stage and NAA 100ppm at both flowering and capsule formation stage). The observations recorded were seeds/capsule, capsule/plant, test weight, seed yield, stover yield, gross return, net return, benefit cost ratio.

3. Results and Discussion

3.1 Yield

The application of nitrogen at 60 kg/ha in conjunction with GA3 at 100 ppm (Treatment 5) resulted in a significantly greater number of capsules per plant (32.333), demonstrating the synergistic effects of combined nutrient and hormonal treatments on plant reproductive capacity.

Nitrogen (45 kg/ha) + GA3 100 ppm (Treatment 2), Nitrogen (45 kg/ha) + NAA 100 ppm (Treatment3), Nitrogen (75 kg/ha) + GA3 100 ppm (Treatment 8), Nitrogen (75 kg/ha) + NAA 100 ppm (Treatment 9) was statistically at par to Treatment 5. Nitrogen 60 kg/ha along with GA_3(Treatment 5) also recorded highest number seeds per capsule and Treatment 3 and Treatment 9 was statistically at par to highest recorded treatment. The significantly higher number of seed per capsules (71.2) was recorded in Nitrogen60kg/ha+GA_3 100ppm. Treatment 3 and Treatment 9 was statistically at par. The significantly highest, seed yield (923.6 kg/ha), stover yield (2.9t/ha) was observed in Nitrogen 60kg/ha+ GA3 100ppm (Treatment 5). In test weight, there was no significant difference among treatment.

3.2 Economics

The maximum cost of cultivation was found in with the application of Nitrogen75kg/ha + GA3at100ppm (INR29,055/ha) The maximum gross return, net return and benefit cost ratio was found in with the application of Nitrogen 60 kg/ha + GA3at 100 ppm (Treatment 5). INR 87,096.40/ha, INR 58,371.40/ha, 2.03 was gross return, net return and benefit cost ratio of Treatment 5 which was Nitrogen 60kg/ha along with GA_3 100ppm at capsule formation stag.

Table 1: Effect of Nitrogen and Plant growth regulator on sesame

Si no.	Treatment combination	Capsules/ Plant	Seeds/ Capsule	Test weight (g)	Seed Yield (Kg/ha)	Stover Yield(t/ha)	Harvest Index (%)
1	Nitrogen(45 kg/ha)+IAA 100 ppm	30.267	68.5	2.42	759.5	2.17	26.18
2	Nitrogen(45 kg/ha)+GA3 100 ppm	31.067	68.9	2.49	730.0	2.32	24.17
3	Nitrogen(45 kg/ha)+NAA 100 ppm	31.533	69.4	2.41	778.3	2.50	23.85
4	Nitrogen(60 kg/ha)+IAA 100 ppm	29.733	69.1	2.48	855.0	2.73	23.84
5	Nitrogen(60 kg/ha)+GA3 100 ppm	32.333	71.2	2.49	923.6	2.90	24.15
6	Nitrogen(60 kg/ha)+NAA 100 ppm	30.267	70.1	2.47	716.7	2.80	20.44
7	Nitrogen(75 kg/ha)+IAA 100 ppm	29.933	69.9	2.48	810.1	2.39	25.30
8	Nitrogen(75 kg/ha)+GA3 100 ppm	31.067	69.5	2.47	791.7	2.59	23.42
9	Nitrogen(75 kg/ha)+NAA 100 ppm	31.667	70.0	2.44	771.1	2.50	25.84
10	Control N:P:K(60:40:20) kg/ha	26.133	65.3	2.39	695.2	2.57	24.37
	F Test	S	S	NS	S	S	S
	SEm(±)	0.72	0.47	0.04	35.94	0.13	1.01
	CD	2.14	1.40	0.13	106.79	0.39	3.00

Table 2: Effect of Nitrogen and Plant growth regulator on economics of sesame

Si no.	Treatment combination	Cost of Cultivation (INR/ha)	Gross Return (INR/ha)	Net Return (INR/ha)	B:C ratio
1	Nitrogen(45 kg/ha)+IAA 100 ppm	28,353.00	71,002.50	42,649.50	1.50
2	Nitrogen(45 kg/ha)+GA3 100 ppm	28,403.00	69,109.10	40,706.10	1.43
3	Nitrogen(45 kg/ha)+NAA 100 ppm	28,303.00	72,895.90	44,592.90	1.58
4	Nitrogen(60 kg/ha)+IAA 100 ppm	28,675.00	80,469.50	51,794.50	1.81
5	Nitrogen(60 kg/ha)+GA3 100 ppm	28,725.00	87,096.40	58,371.40	2.03
6	Nitrogen(60 kg/ha)+NAA 100 ppm	28,625.00	67,215.70	38,590.70	1.35
7	Nitrogen(75kg/ha)+IAA 100 ppm	29,005.00	76,682.70	47,677.70	1.64
8	Nitrogen(75kg/ha)+GA3 100 ppm	29,055.00	74,789.30	45,734.30	1.57
9	Nitrogen(75kg/ha)+NAA 100 ppm	28,955.00	72,895.90	43,940.90	1.52
10	Control N:P:K(60:40:20) kg/ha	28,050.00	65,322.30	37,272.30	1.33

4. Conclusion

It is concluded from the experiment that application of Nitrogen 60kg/h coupled with GA3 100ppm (Treatment5) recorded maximum number of capsule per plant (32.333), seeds per capsule (71.2), seed yield (923.6 kg/ha), stover yield (2.9t/ha), highest gross return(87,096.40/ha), net return(58,371.40/ha) and benefit cost ratio (2.03).

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