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INFLUENCE OF VARIED INTEGRATED NUTRIENT MANAGEMENT STRATEGIES ON THE YIELD AND ECONOMICS OF SESAME (*SESAMUM INDICUM* L.)

K. Kaviya*, K. Suseendran, G. Murugan and S. Jawahar

Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalainagar - 608 002, Tamil Nadu, India.

*Corresponding author E-mail : kaviyakm2000@gmail.com

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ABSTRACT

Therefore, a field experiment was conducted at the Faculty of Agriculture, Annamalai University during the Summer of 2022 for yield maximization in sesame through nutrient management practices (NPK, FYM, PMC, Urea, KCl, GA₃). The field experiment comprised of 13 treatments laid out in a Randomized Block Design (RBD) replicated thrice. Sesame test variety VRI(SV)2 was sown at a distance of 30 cm × 30 cm in clayey loam soil. The result revealed that T₁₃ - 100% RDN+ 25 % N on equivalent basis of PMC + Two foliar spray of GA₃ 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages recorded the highest yield attributes viz., number of flowers/plant (110.23), number of capsules/plant (135.39), number of seeds/capsules (66.47), 1000 seeds weight (3.13 g), grain yield (773 kg/ha) and stover yield (2640 kg/ha) and economics B:C ratio 2.35.

Key words : Growth attributes, Integrated nutrient management, Sesamum, Yield attributes.

Introduction

Sesame (*Sesamum indicum* L.) is an ancient oilseed crop of the world which belongs to the family pedaliaceae and it was originated in Africa. It had earned a poetic label "Queen of Oilseeds". India contributes 23.2 percent of the world acreage and 13.1 per cent of world production. In the year 2018-19 in India, the production was 7.46 lakh tons from 17.3 lakh hectares with average productivity of 431 kg/ha (FAOSTAT, 2020). The productivity of sesamum in India is low compared to world level (512 kg/ha). Heavy flower drop, delayed dry matter accumulation, and poor assimilate partitioning from source to sink restrict sesamum cultivation (Alex *et al.*, 2017). To improve upon the productivity on sustainable basis, integrated nutrient management approach needs to be emphasized wherein combined use of organic and inorganic fertilizers (Afe *et al.*, 2020).

Materials and Methods

A field experiment was carried out at the Experimental Farm, Department of Agronomy, Faculty

of Agriculture, Annamalai University May 2022 - August 2022 to study the agronomic strategies for yield maximization in sesame through nutrient management. The Experimental farm is geographically situated at 11°38' North Latitude and 79°72' East Longitude and at an altitude of ± 5.79 m above mean sea level. The texture of the experimental field soil was clayey loam with a pH of 7.2 and levels of accessible nitrogen, phosphorus, and potassium that were low, high and high, respectively. The weather in Annamalai Nagar is moderately warm, with a hot summer. The weekly mean maximum and minimum temperatures prevailed during the cropping period were 35.4°C and 24.8°C, respectively. The relative humidity is 68.3 per cent. The rainfall received during the cropping season was 194.1 mm in 16 rainy days.

The treatment details are-T₁ - 100% RDF, T₂ - 50% RDN + 50% of N on equivalent basis of FYM, T₃ - 50% RDN + 50% of N on equivalent basis of PMC, T₄ - T₂ + Two foliar spray of GA₃ 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages, T₅ - T₃ + Two foliar spray of GA₃ 100 ppm + Urea (0.4%) +

KCl (1.0%) at flowering and capsule formation stages, T_6 - 75% RDN + 25% N on equivalent basis of FYM, T_7 - 75% RDN + 50% of N on equivalent basis of PMC, T_8 - T_6 + Two foliar spray of GA₃ 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages, T_9 - T_7 + Two foliar spray of GA₃ 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages, T_{10} - 100% RDN + 25% N on equivalent basis of FYM, T_{11} - 100% RDN + 25% N on equivalent basis of PMC, T_{12} - T_{10} + Two foliar spray of GA₃ 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages, T_{13} - T_{11} + Two foliar spray of GA₃ 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stage.

The experiment was laid out in randomized block design with three replications. The sesame variety VRI (SV)₂ was used in this study. The seeds were sown at the rate of 5 kg/ha with a spacing of 30 cm × 30 cm. The foliar nutrition were applied on flowering and capsule formation stages as per the treatment schedule.

Observations

Number of flowers plant⁻¹ : The flower numbers of five sample plants were counted on 55 DAS and the mean value was calculated and recorded.

Number of capsules plant⁻¹ : The total number of seed bearing, mature capsules was counted in the main stem as well as primary, secondary and tertiary branches from the five tagged plants in each treatment plot on 65 DAS and at the harvest stage and the mean value was calculated and expressed in numbers.

Number of seeds capsule⁻¹ : Five capsules in each sample plant were selected at random from each treatment plot and dehisced after sun drying. The total number of seeds was counted at the harvest stage and the mean seed number per capsules were calculated and recorded and expressed in numbers.

Test weight : Sample seeds were drawn from the bulk and seeds obtained as a whole from each treatment plot. One thousand seeds were counted and the seed weight was weighed and recorded in grams.

Seed yield : After complete threshing and cleaning. The seeds were sundried plot wise until a constant weight was obtained. Then the seed yield was weighed, recorded separately and expressed in kg ha⁻¹.

Stover yield : The stover yield from each plot area was recorded after drying and expressed in kg ha⁻¹.

Economics

Cost of cultivation : The cost of cultivation was

calculated by considering the hire charges of labour and the market value of the inputs (fertilizers, insecticides and pesticides etc.)

Gross income (₹. ha⁻¹) : Gross income was computed from the seed and stover yield of irrigated sesame and worked out based on the prevailing market price.

Net income (₹. ha⁻¹) : Net income was calculated by deducting the total cost of cultivation from gross income.

Benefit cost ratio (BCR) : The benefit cost ratio (BCR) was calculated by using the following formula.

$$\text{Benefit Cost Ratio} = \frac{\text{Gross income (₹. ha}^{-1}\text{)}}{\text{Cost of cultivation (₹. ha}^{-1}\text{)}}$$

Statistical analysis

The data on various biometrics were statistically analysed by adopting the procedure of Panse and Sukhatme (1978). Wherever the results were significant, the critical differences were worked out at a 5 per cent probability level to draw statistical conclusions.

Results and Discussion

Yield attributes

The effect of various integrated nutrient management practices on sesame growth stages was shown in Table 1. Among the different treatments tried the highest yield attributes viz., number of flowers/plant (110.23), number of capsules/plant (135.39), number of seeds/capsules (66.47), 1000 seeds weight (3.13 g) was recorded with the treatment T_{13} - 100% RDN + 25 % N on equivalent basis of PMC + Two foliar spray of GA₃ 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages. This might be due to the role of nitrogen on dry matter accumulation which might have led to enhanced translocation of assimilates into the sink. It also may be due to increased availability of nitrogen at critical stages of growth viz., flowering and capsule formation, which would have played a vital role in cell division. The enhanced meristematic activity and consequent vertical extension of growth due to consistent availability of nutrients would have led to more branches. This would have definitely influenced positively the yield attributes of sesame. Foliar application of gibberellic acid improved the chlorophyll and carbohydrates in the plants, and ultimately improved the yield attributes of the sesame. Improved tissue differentiation from the somatic stage to the reproductive stage increases the number of flowers and capsules on the plant. Foliar fertilization at the start of reproductive growth stage promises to increase yield

Table 1 : Effect of integrated nutrient management practices on yield attributes of sesame.

Treatments		Number of flowers/ plant	Number of capsules/ plant	Number of seeds/ capsule	Test weight (g)
T ₁	100% Recommended Dose of Fertilizer	83.12	98.48	50.14	2.27
T ₂	50% Recommended Dose of Nitrogen + 50% N on equivalent basis of Farmyard Manure	85.80	102.16	52.59	2.28
T ₃	50% Recommended Dose of Nitrogen + 50% N on equivalent basis of Pressmud Compost	86.94	104.28	52.74	2.32
T ₄	T ₂ + Two foliar spray of GA ₃ 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages	97.31	117.29	58.48	2.74
T ₅	T ₃ + Two foliar spray of GA ₃ 100 ppm + Urea (0.4%) + KCl(1.0%) at flowering and capsule formation stages	99.88	121.24	60.09	2.81
T ₆	75% Recommended Dose of Nitrogen + 25% of Non equivalent basis of Farmyard manure	89.75	107.93	54.42	2.39
T ₇	75% Recommended Dose of Nitrogen + 25% of N on equivalent basis of Pressmud Compost	90.95	109.14	54.71	2.47
T ₈	T ₆ + Two foliar spray of GA ₃ 100 ppm Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages	102.36	124.92	61.71	2.85
T ₉	T ₇ + Two foliar spray of GA ₃ 100 ppm Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages	104.97	128.46	63.29	3.01
T ₁₀	100% Recommended Dose of Nitrogen+25% of N on equivalent basis of Farmyard manure	93.54	112.62	56.33	2.60
T ₁₁	100% Recommended Dose of Nitrogen + 25% of N on equivalent basis of Pressmud compost	94.74	113.64	56.87	2.69
T ₁₂	T ₁₀ + Two foliar spray of GA ₃ 100 ppm+Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages	107.65	131.97	64.89	3.08
T ₁₃	T ₁₁ + Two foliar spray of GA ₃ 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages	110.23	135.39	66.47	3.13
SEm±		0.82	1.13	0.53	0.03
CD(p=0.05)		2.40	3.30	1.54	NS

by preventing the depletion of nutrients in the soil. Similar results were found by Kumar and Uthayakumar (2006), Deshmukh (2014), Kashani *et al.*, (2015), Krishnaprabu (2015), Saleem *et al.* (2015), Gabhane *et al.* (2018), Harisudan and Sapre (2019), Swain *et al.*, (2021), Badshah (2017), Parmar (2020), Aslam *et al.*, (2021).

Yield

Among the different treatments tried the highest yield was recorded with the treatment T₁₃ - 100% RDN+ 25% N on equivalent basis of PMC + Two foliar spray of GA₃ 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages. Higher Sesamum yield is due to increased and more balanced nutrient intake through both inorganic and organic sources throughout the lifecycle of the plant. Foliage application has significantly increased sesame seed yield. Higher seed yield is due to the influence

of enhanced yield attribute characteristics. However, the increase in stover yield may be due to an increase in dry matter at harvest. Similar results were found by Omer and Abd-Elnaby (2017), Tripathy *et al.*, (2012), Martin Stanley and Basavarajappa (2014), Mahajan *et al.* (2016), Behera *et al.*, (2017), Ramesh *et al.* (2017), Kulkarni *et al.* (2018), Veeral and kalaimathi (2021).

Economics

The economics of sesame were higher with the application of various nutrition was presented in Table 3. Among the treatments, T₁₃ - 100% Recommended Dose of Nitrogen + 25% of N on equivalent basis of Pressmud compost + Two foliar sprays of GA₃ 100 ppm + Urea (0.4%) + KCl (1.0%) during the flowering and capsule formation stages recorded higher gross return, net return and B:C ratio invested over rest of the treatments. The

Table 2 : Effect of integrated nutrient management practices on yield of sesame.

Treatments		Grain yield (kg ha ⁻¹)	Stover yield (kg ha ⁻¹)
T ₁	100% Recommended Dose of Fertilizer	1794	534
T ₂	50% Recommended Dose of Nitrogen + 50% N on equivalent basis of Farmyard manure	1885	581
T ₃	50% Recommended Dose of Nitrogen +50% N on equivalent basis of Pressmud compost	1936	590
T ₄	T ₂ + Two foliar spray of GA ₃ 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages	2285	678
T ₅	T ₃ + Two foliar spray of GA ₃ 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages	2360	697
T ₆	75% Recommended Dose of Nitrogen + 25% of N on equivalent basis of Farmyard manure	2015	615
T ₇	75% Recommended Dose of Nitrogen+25% of N on equivalent basis of Pressmud compost	2066	626
T ₈	T ₆ + Two foliar spray of GA ₃ 100 ppm Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages	2432	716
T ₉	T ₇ + Two foliar spray of GA ₃ 100 ppm Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages	2500	736
T ₁₀	100% Recommended Dose of Nitrogen + 25% of N on equivalent basis of Farmyard manure	2145	645
T ₁₁	100% Recommended Dose of Nitrogen+25% of N on equivalent basis of Pressmud compost	2206	657
T ₁₂	T ₁₀ + Two foliar spray of GA ₃ 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages	2571	755
T ₁₃	T ₁₁ + Two foliar spray of GA ₃ 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages	2640	773
SEm ±		22.95	5.99
CD (p=0.05)		66.98	17.49

Table 3 : Effect of integrated nutrient management practices on economics of sesame.

Treatments		Cost of cultivation (Rs/ha)	Gross income (Rs/ha)	Net income (Rs/ha)	B:C ratio
T ₁	100% Recommended Dose of Fertilizer	31946	54297	22351	1.69
T ₂	50% Recommended Dose of Nitrogen + 50% N on equivalent basis of Farmyard manure	33912	59043	25131	1.74
T ₃	50% Recommended Dose of Nitrogen + 50% N on equivalent basis of Pressmud compost	32799	59968	27169	1.82
T ₄	T ₂ + Two foliar spray of GA ₃ 100 ppm + Urea (0.4%)+ KCl (1.0%) at flowering and capsule formation stages	35512	68943	33431	1.94
T ₅	T ₃ + Two foliar spray of GA ₃ 100 ppm + Urea (0.4%)+ KCl (1.0%) at flowering and capsule formation stages	34399	70880	36481	2.06
T ₆	75% Recommended Dose of Nitrogen + 25% of N on equivalent basis of Farmyard manure	32248	62508	30260	1.93
T ₇	75% Recommended Dose of Nitrogen +25% of N on equivalent basis of Pressmud compost	31691	63633	31942	2.00
T ₈	T ₆ + Two foliar spray of GA ₃ 100 ppm Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages	33848	72816	38968	2.15

Table 3 continued...

Table 3 continued...

Treatments		Cost of cultivation (Rs/ha)	Gross income (Rs/ha)	Net income (Rs/ha)	B:C ratio
T ₉	T ₇ + Two foliar spray of GA ₃ 100 ppm Urea (0.4%) +KCl (1.0%) at flowering and capsule formation stages	33291	74850	41559	2.24
T ₁₀	100% Recommended Dose of Nitrogen+25% of N on equivalent basis of Farmyard manure	32336	65573	33237	2.02
T ₁₁	100% Recommended Dose of Nitrogen+25% of N on equivalent basis of Pressmud compost	31779	66803	31779	2.10
T ₁₂	T ₁₀ + Two foliar spray of GA ₃ 100 ppm + Urea (0.4%)+KCl (1.0%) at flowering and capsule formation stages	33936	76786	42850	2.26
T ₁₃	T ₁₁ + Two foliar spray of GA ₃ 100 ppm +Urea (0.4%)+KCl (1.0%) at flowering and capsule formation stages	33379	78620	45241	2.35

application of 100% Recommended Dose of Nitrogen + 25% of N on equivalent basis of Pressmud compost + Two foliar sprays of GA₃ 100 ppm + Urea (0.4%) + KCl (1.0%) during the flowering and capsule formation stages resulted in a higher net return ha⁻¹ and B:C ratio invested, which could be attributed to higher grain yield and stover yield increments obtained with this treatment combination. These findings are in line with those of Selvamurugan *et al.* (2013), Harisudan and Sapre (2019), Arunkumar *et al.* (2020), Swain *et al.* (2020).

Conclusion

Based on the aforementioned experimental data, it can be concluded that T₁₃ - 100% RDN + 25% N on equivalent basis of PMC + Two foliar spray of GA₃ 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages is an effective practice for enhancing the yield and nutrient uptake of irrigated sesame. Furthermore, as an agronomically sound, environmentally safe and cost-effective strategy, this practice has potential for sesame farmers.

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