

Productivity of Sesame (*Sesamum indicum* L.) as Influenced by Ratios and Levels of Nitrogen and Phosphorus During Summer

Udaykumar, Vishwajith, P. Sheik Peer, S. M. S. Suresh,
L. H. Malligaud, M. V. Kusuma

Received 7 July 2016 ; Accepted 11 August 2016 ; Published online 26 August 2016

Abstract Field experiment was conducted during summer season 2013 to know the productivity of sesame (*Sesamum indicum* L.) to ratios and levels of nitrogen and phosphorus during summer. The treatment receiving N/P fertilizer ratio of 1.60 with the split application of nitrogen resulted in significantly higher seed, stalk yield and harvest index (2037, 4339 kg ha⁻¹ and 32.04 respectively) over treatment receiving N/P fertilizer ratio of 1.60 without split application of nitrogen and other treatments. Further it was observed that the split application of nitrogen in the treatments which received other N/P fertilizer ratios (0.78, 2.80, 2.40 and 2.00) also increased the seed yield of sesame over the basal application only.

Keywords N/P fertilizer, Split application of nitrogen, Basal application, Sesame.

Introduction

Sesame (*Sesamum indicum* L.) is one of the oldest indigenous oilseed crops with longest history of cultivation in India. India is the major producer of sesame. In India, it is cultivated over an area of 16.67 lakh ha with annual production of 6.75 lakh tones with a productivity of 405 kg ha⁻¹ (Anonymous [1], where as in Karnataka sesame is mainly grown under rainfed situations over an area of 0.38 lakh ha with annual production of 0.21 lakh tones year⁻¹ with an average productivity of 553 kg ha⁻¹ Anonymous [1]. Sesame oil possesses excellent nutritional, medicinal, cosmetic, pharmaceutical, insecticidal and cooking qualities for which it is known as the Queen of oilseeds. Seeds have high quality poly-unsaturated stable fatty acids, which offer resistance to rancidity. Sesame seeds are rich source of edible oil (48 to 55%) and protein (20 to 28%) consisting of methionine, tryptophane, vitamin (niacine) and minerals.

Materials and Methods

A field experiment was conducted at MARS, Dharwad during summer 2013. The soil of experimental site was medium black clay soil. The experimental site was medium in nitrogen (298.20 kg ha⁻¹), medium in phosphorus (29.63 kg ha⁻¹) and high in potash (369.84 kg ha⁻¹). Experiment was laid out in a randomized block design replicated thrice with ratios and levels of nitrogen and phosphorus. The net plot size was 2.40 m × 2.40 m (05.76 m²) (8 rows). Crop was planted in

Udaykumar, Vishwajith, P. S. Peer*, S. M. S. Suresh,
L. H. Malligaud
Department of Agronomy, College of Agriculture, Dharwad,
University of Agricultural Sciences, Dharwad 580005,
Karnataka, India

M. V. Kusuma
Department of Plantation, Aromatic and Medicinal Plants,
KRCCH, Arabhavi, University of Horticultural Sciences,
Bagalakote 591307, Karnataka, India
e-mail: sheikpeer220@gmail.com

*Correspondence

Table 1. Threshing percent, harvest index (%), seed yield (kg ha⁻¹) and stalk yield (kg ha⁻¹) in sesame as influenced by ratios and levels of nitrogen and phosphorus fertilizers. # Top dressing of nitrogen in the form of urea (46% N) at 30 days after sowing as per the treatments. DAS : Days after sowing. NS : Non-Significant.

Sl. No.	N/P ₂ O ₅ Ratios	Levels of N, P and K fertilizers (kg ha ⁻¹)			Treatments Time of N, P and K fertilizers application (kg ha ⁻¹)			At 30 DAS# N	Threshing percent	Harvest index (HI) (%)	Seed yield (kg ha ⁻¹)	Stalk yield (kg ha ⁻¹)
		N	P	K	N	Basal P ₂ O ₅	K ₂ O					
T ₁	0.00	0	0	0	00	00	00	00	51.24	22.55	1018	3593
T ₂	0.00	0	0	25	00	00	25	00	50.49	27.73	1388	3627
T ₃	0.78	36	46	25	36	46	25	00	51.06	30.64	1709	3863
T ₄	0.78	36	46	25	18	46	25	18	50.98	30.37	2029	4673
T ₅	1.60	40	25	25	40	25	25	00	51.49	29.46	1770	4277
T ₆	1.60	40	25	25	20	25	25	20	51.22	32.04	2037	4339
T ₇	2.00	50	25	25	50	25	25	00	52.00	27.36	1569	4235
T ₈	2.00	50	25	25	25	25	25	25	51.77	26.53	1849	5142
T ₉	2.40	60	25	25	60	25	25	00	51.51	31.32	1542	3389
T ₁₀	2.40	60	25	25	30	25	25	30	51.05	28.57	1908	4770
T ₁₁	2.80	70	25	25	70	25	25	00	51.58	28.58	1680	4233
T ₁₂	2.80	70	25	25	35	25	25	35	51.10	29.48	1969	4762
		Mean							51.29	28.72	1706	4242
		SEm±							0.32	1.53	56	327
		LSD (<i>p</i> = 0.05)							NS	4.49	165	959

gross plot by below mentioned treatment details. For recording various bio-metric observations on sesame, from each net plot a sample of five plants were selected at random. For statistical analysis data were analyzed using analysis of variance and means were compared using critical difference at the 5% probability.

Results and Discussion

Effect of ratios and levels of nitrogen and phosphorus fertilization on growth and yield of sesame

In the present investigation, different ratios and levels of nitrogen and phosphorus fertilizers (basal + top dress of nitrogen) had significant effect on harvest index, seed and stalk yield of sesame. The treatment receiving N/P fertilizer ratio of 1.60 (40 kg N, 25 kg P₂O₅ and 25 kg K₂O ha⁻¹) with split application of nitrogen (50% of nitrogen at the time of sowing and remaining 50% at 30 DAS) recorded significantly higher harvest index, seed yield and stalk yield (32.04%, 2037 and 4339 kg ha⁻¹ respectively) over N/

P fertilizer ratio of 1.60 (40 kg N, 25 kg P₂O₅ and 25 kg K₂O ha⁻¹) without the split application of nitrogen (29.46%, 1770 and 4277 kg ha⁻¹). Split application of nitrogen at different N/P fertilizer ratios (0.78 to 2.80) resulted in 13.11 to 19.18% higher seed yield over basal application of nitrogen alone. Further it was observed that the split application of nitrogen in the treatments which received other N/P fertilizer ratios (0.78, 2.80, 2.40 and 2.00) also increased the seed yield of sesame over the basal application only. Similar results were obtained by Umar et al. [2].

Increase in seed yield of sesame due to different ratios and levels of nitrogen and phosphorus fertilizers (basal + top dress of nitrogen) was mainly through the improvement in the yield components such as number of capsules plant⁻¹, number of seeds capsules⁻¹, 1000 seeds weight (g) and seed weight plant⁻¹ (g). The treatment receiving N/P fertilizer ratio of 1.60 with the split application of nitrogen resulted in more number of capsules plant⁻¹ (70.7), more capsule weight (0.412 g), more number of seeds capsule⁻¹ (74.0), more seed weight capsule⁻¹ (0.213 g), more seed weight plant⁻¹ (12.223 g) and more 1000

Table 2. Yield parameters of sesame at harvest stage as influenced by ratios and levels of nitrogen and phosphorus fertilizers. # Top dressing of nitrogen in the form of urea (46% N) at 30 days after sowing as per the treatments. DAS : Days after sowing. NS : Non-Significant.

Sl. No.	N/P ₂ O ₅ ratios	Levels of N, P and K fertilizers (kg ha ⁻¹)			Treatments Time of N, P and K fertilizers application (kg ha ⁻¹)			At 30 DAS# N	Total number of capsules plant	Seed weight capsule ⁻¹ (g)	Seed weight plant ⁻¹ (g)	1000 Seed weight (g)
		N	P ₂ O ₅	K ₂ O	N	Basal P ₂ O ₅	K ₂ O					
T ₁	0.00	0	0	0	00	00	00	00	60.1	0.206	6.110	3.611
T ₂	0.00	0	0	25	00	00	25	00	65.5	0.207	8.330	3.788
T ₃	0.78	36	46	25	36	46	25	00	75.1	0.209	10.255	3.773
T ₄	0.78	36	46	25	18	46	25	18	79.9	0.210	12.175	3.882
T ₅	1.60	40	25	25	40	25	25	00	67.3	0.211	10.620	3.695
T ₆	1.60	40	25	25	20	25	25	20	70.7	0.213	12.223	3.731
T ₇	2.00	50	25	25	50	25	25	00	78.4	0.212	9.415	3.767
T ₈	2.00	50	25	25	25	25	25	25	83.2	0.214	11.093	3.820
T ₉	2.40	60	25	25	60	25	25	00	70.8	0.210	9.253	3.546
T ₁₀	2.40	60	25	25	30	25	25	30	75.2	0.211	11.450	3.879
T ₁₁	2.80	70	25	25	70	25	25	00	76.9	0.211	10.080	3.719
T ₁₂	2.80	70	25	25	35	25	25	35	78.1	0.212	11.815	3.900
Mean									73.4	0.211	10.235	3.759
SEm±									2.9	0.001	0.337	0.109
LSD (<i>p</i> = 0.05)									8.6	0.003	0.989	NS

seeds weight (3.731 g) over treatment receiving N/P fertilizer ratio of 1.60 without split application of nitrogen and other treatments. In addition, split application of nitrogen in the treatments which received

Table 3. Growth parameters of sesame at harvest stage as influenced by ratios and levels of nitrogen and phosphorus fertilizers. # : Top dressing of nitrogen in the form of urea (46% N) at 30 days after sowing as per the treatments. DAS : Days after sowing. NS : Non-Significant.

Sl. No.	N/P ₂ O ₅ Ratios	Treatments							Plant height (cm)	Plant spread (cm)	Total number of branches plant ⁻¹	Leaf area index (LAI) at 60 DAS	Total dry matter (g plant ⁻¹)
		Time of N, P and K fertilizers application (kg ha ⁻¹)											
		Levels of N, P and K fertilizers (kg ha ⁻¹)				At 30 DAS#							
		N	P ₂ O ₅	K ₂ O	N	Basal P ₂ O ₅	K ₂ O	N					
T ₁	0.00	0	0	0	00	00	00	00	96.87	41.27	7.46	2.01	24.079
T ₂	0.00	0	0	25	00	00	25	00	99.50	38.17	7.64	2.28	28.567
T ₃	0.78	36	46	25	36	46	25	00	100.90	38.93	8.11	2.84	23.761
T ₄	0.78	36	46	25	18	46	25	18	103.27	37.42	7.69	2.70	30.530
T ₅	1.60	40	25	25	40	25	25	00	106.93	41.06	7.77	2.98	25.552
T ₆	1.60	40	25	25	20	25	25	20	103.37	43.63	8.27	3.42	27.831
T ₇	2.00	50	25	25	50	25	25	00	104.67	38.59	8.58	3.07	22.702
T ₈	2.00	50	25	25	25	25	25	25	105.17	39.70	8.08	2.92	26.311
T ₉	2.40	60	25	25	60	25	25	00	105.69	37.53	7.27	3.04	22.921
T ₁₀	2.40	60	25	25	30	25	25	30	106.82	39.17	7.92	3.50	25.712
T ₁₁	2.80	70	25	25	70	25	25	00	107.03	40.07	8.19	3.03	22.088
T ₁₂	2.80	70	25	25	35	25	25	35	106.53	39.23	7.75	2.94	29.182
Mean									103.9	39.56	7.89	2.89	25.770
SEm±									1.46	3.09	0.40	0.87	1.345
LSD (<i>p</i> = 0.05)									4.29	NS	NS	NS	3.944

N/P fertilizer ratios of 0.78, 2.00, 2.40 and 2.80 found advantages in improving yield components of sesame (Table 1). The similar results were reported by Shilpi et al. [3], Saleem et al. [4] and Thenttu et al. [5].

Among the different yield components, number of capsules plant⁻¹ (83.2), weight of capsules (0.413 g), number of seeds capsules⁻¹ (74.3), test weight (3.820 g), seed weight plant⁻¹ (11.09 g), seed weight capsules⁻¹ (0.214 g) and threshing percent (51.77%) were greater with split application of nitrogen over basal application of nitrogen at all the ratios and levels of nitrogen (Table 2).

This increase in grain yield and yield components was in turn due to improvement in the growth in respect to plant height, plant spread and number of branches plant⁻¹ due to increased N/P fertilizer ratio with split application of nitrogen resulted in an increased dry matter accumulation. Similar observations were also made by Thenttu et al. [5] and Kashani et al. [6].

At harvest, the treatment receiving N/P fertilizer ratio of 1.60 with the split application of nitrogen produced taller plants (106.93 cm), more number of branches plant⁻¹ (3.87), greater plant spread (43.63 cm) and more leaf area index (LAI) (2.11) over rest of the treatment which received different N/P fertilizer ratios (Table 3). Similar observations were also made by Kashani et al. [6].

Based on the present investigations, carried out in medium black clay soil with medium available nitrogen, medium available phosphorus and high available potassium it may be concluded that higher seed yield of sesame can be obtained with the application of nitrogen and phosphorus in N/P fertilizer ratio of 1.60 (40 kg N, 25 kg P₂O₅ and 25 kg K₂O ha⁻¹) with the nitrogen fertilizer in two split doses.

References

1. Anonymous (2013) Area, production and average yield. Direct Econ and Stat, Dep Agric and Coop Rep, New Delhi, available on the website: <http://www.agricoop.nic.in>
2. Umar UA, Mahmud M, Abubakar IU, Babaji BA, Idris UD (2012) Effect of nitrogen fertilizer level and intra row spacing on growth and yield of sesame (*Sesamum indicum* L.) varieties. Tech J Engg App Sci 2 : 22—27.
3. Shilpi S, Islam MN, Sutradhar GNC, Husna A, Akter F (2012) Effect of nitrogen and sulfur on the growth and yield of sesame. Inter J Bio-Reso Stress Manag 3 : 177—182.
4. Saleem FM, Bilal FM, Khan HZ, Ismail M (2012) Comparative performance of sesame cultivars under different nitrogen levels. Crop Environ 13 : 13—18.
5. Thenttu TL, Nawlakhe SM, Mankar SM, Srinivasrao M, Bhonde GV (2014) Growth, yield and quality of summer sesame as influenced by the fertilizer and sulfur levels. J Soils Crops 24 : 143—147.
6. Kashani SD, Buriro M, Nadeem A, Ahmed N, Saeed Z, Mohammad F, Ahmed S (2015) Response of various sesame varieties under the influence of nitrogen and phosphorus doses. Am J Pl Sci 6 : 405—412.