

Influence of nitrogen, phosphours and potassium on growth and yield of black cumin (*Nigella sativa* L.)

A Nataraja, A A Farooqi, B S Sreeramu & K N Srinivasappa

Division of Horticulture

University of Agricultural Sciences, GKVK

Bangalore - 560 065, India

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Abstract

A field experiment was conducted to study the influence of nitrogen, phosphorus and potassium on growth and seed yield of black cumin at Sanjivini Vatika, University of Agricultural Sciences, Bangalore during 2000-2001. The experiment consisted of twenty seven treatment combinations with three levels each of nitrogen (0, 50 and 100 kg ha⁻¹), phosphorus (0, 20 and 40 kg ha⁻¹) and potassium (0, 30 and 60 kg ha⁻¹), and was laid out in factorial randomized block design with three replications. The results revealed significant differences in growth and yield parameters among the treatments. Application of nitrogen at 100 kg ha⁻¹ recorded the maximum values for plant spread (427.75 cm²) and number of seeds (57.52) per pod. Significant differences were also observed with the interaction of NPK at 50:40:30 kg ha⁻¹ producing pods of good size (3.84 cm²), higher test weight of 1000 seeds (2.38 g) and seed yield (17.45 q ha⁻¹).

Key words: black cumin, *Nigella sativa*, nitrogen, phosphorus, potassium

Black cumin (*Nigella sativa* L.) commonly called 'kolongi' belongs to the family Ramunculaceae. The crop is being cultivated in states of Himachal Pradesh, Uttar Pradesh, Bihar, Assam, Punjab and West Bengal over small areas. Black cumin seeds are popular both as a spice and a medicine. The seeds are aromatic, carminative and possess diuretic, diaphoretic, antibilious, stomachic, stimulant, carminative, digestive, anthelmintic, galactagogue and emmenagogue properties (Nadakarni 1976). Due to the diversified uses it is becoming more popular and there is an increase in demand for the seeds. An investigation was carried out in order to workout the nutritional requirements of this crop for cultivation in Karnataka.

The experiment was carried out in red sandy

loam soil with uniform fertility, during third week of November 2000 to second week of March 2001 at Sanjeevini Vatika, Medicinal and Aromatic Crops Section, Department of Horticulture, University of Agricultural Sciences, GKVK, Bangalore. The effects of three levels of nitrogen (N₀, N₁ and N₂ at 0, 50 and 100 kg ha⁻¹, respectively), phosphorus (P₀, P₁ and P₂ at 0, 20 and 40 kg ha⁻¹, respectively) and potassium (K₀, K₁ and K₂ at 0, 30 and 60 kg ha⁻¹, respectively) were studied. The experiment was laid out in a factorial randomized block design with three replications and there were 27 treatment combinations. The individual plot size was 1 m x 1m with 20 cm row and 10 cm plant to plant spacing amounting to 50 plants per square meter area. The soil was red sandy loam with a pH of 5.6 and

0.72 per cent organic carbon and 266.35, 27.34 and 131.20 kg ha⁻¹ of available N, P₂O₅ and K₂O, respectively. Observations were recorded on growth parameters like plant height, plant spread, number of branches and number of leaves per plant and on yield parameters like number of pods per plant, size of the pod, number of seeds per pod, 1000 seed weight and seed yield per plant. The plant spread was recorded by measuring the spread along North - South and East - West directions and the size of the pod was calculated by taking the length and breadth of the pod using Vernier calipers.

The data are presented in Tables 1 & 2. Application of nitrogen 100 kg ha⁻¹ (N₂) significantly influenced the plant spread (427.76 cm²). But the maximum plant height (41.84 cm), number of branches (13.77) and number

of leaves (58.05) per plant were recorded at 50 kg N ha⁻¹ (N₁). Among the yield attributes 100 kg N ha⁻¹ recorded maximum number of pods (25.66) per plant, size of pod (3.34 cm²), number of seeds per pod (57.52), 1000 seed weight (2.30 g) seed yield (15.31 q ha⁻¹).

Plants grown at 40 kg phosphorus per hectare (P₂) recorded maximum plant height (41.04 cm), plant spread (350.61 cm²), number of branches (13.56), number of leaves (54.89) and number of pods (23.37) per plant, size of the pod (2.82 cm²), number of seeds per pod (54.67), 1000 seed weight (2.21g) and seed yield (13.12 q ha⁻¹). Potassium application at 60 kg ha⁻¹ (K₂) also significantly influenced various growth and yield attributes recording maximum plant spread (346.47 cm²), number of branches (12.47), number of leaves (52.10) and number of pods (22.46) per plant,

Table 1. Effect of nitrogen, phosphorus and potassium on growth and yield of black cumin

Nutrient level (kg ha ⁻¹)	Plant height (cm)	Plant spread (cm ²)	No. of branches plant ⁻¹	No. of leaves plant ⁻¹	No. of pods plant ⁻¹	Size of the pod (cm ²)	No. of seeds pod ⁻¹	1000 seed weight (g)	Seed yield (g plant ⁻¹)	Seed yield (q ha ⁻¹)
Nitrogen										
0 (N ₀)	35.15	231.87	8.73	37.38	16.33	1.54	43.66	1.96	1.41	6.37
50 (N ₁)	41.84	342.33	13.77	58.05	24.33	2.66	53.99	2.21	2.91	13.12
100 (N ₂)	39.97	427.76	13.38	56.36	25.66	3.34	57.52	2.30	3.40	15.31
F-test	*	*	*	*	*	*	*	*	*	*
S.Em±	0.245	2.397	0.166	0.326	0.258	0.038	0.300	0.007	0.038	0.172
CD at 5%	0.694	6.792	0.469	0.924	0.730	0.109	0.850	0.021	0.108	0.487
Phosphorus										
0 (P ₀)	36.42	308.10	9.98	44.39	20.58	2.23	47.96	2.09	2.17	9.77
20 (P ₁)	39.50	343.25	12.34	52.51	22.37	2.49	52.54	2.17	2.65	11.90
40 (P ₂)	41.04	350.61	13.56	54.89	23.37	2.82	54.67	2.21	2.92	13.12
F-test	*	*	*	*	*	*	*	*	*	*
S.Em±	0.245	2.397	0.166	0.326	0.258	0.038	0.300	0.007	0.038	0.172
CD at 5%	0.694	6.792	0.469	0.924	0.730	0.109	0.850	0.021	0.108	0.487
Potassium										
0 (K ₀)	37.96	320.79	11.18	48.31	21.59	2.47	49.43	2.13	2.38	10.72
30 (K ₁)	39.72	334.69	12.24	51.38	22.27	2.58	52.78	2.17	2.67	12.04
60 (K ₂)	39.28	346.47	12.47	52.10	22.46	2.50	52.96	2.18	2.67	12.04
F-test	*	*	*	*	*	*	*	*	*	*
S.Em±	0.245	2.397	0.166	0.326	0.258	0.038	0.300	0.007	0.038	0.172
CD at 5%	0.694	6.792	0.469	0.924	0.730	0.109	0.850	0.021	0.108	0.487

* Significant at 5% level

Table 2. Interaction effects of nitrogen, phosphorus and potassium on growth and yield attributing characters in black cumin

Interaction	Plant height (cm)			Plant spread (cm ²)			No. of branches plant ⁻¹			No. of leaves plant ⁻¹			No. of pods plant ⁻¹		
	K ₀	K ₁	K ₂	K ₀	K ₁	K ₂	K ₀	K ₁	K ₂	K ₀	K ₁	K ₂	K ₀	K ₁	K ₂
N ₀ P ₀	35.47	35.54	36.46	167.55	198.31	218.40	7.33	7.60	7.93	31.07	32.67	35.60	12.87	13.73	14.47
N ₀ P ₁	34.68	34.69	34.78	247.75	251.88	269.52	7.80	9.27	9.00	36.93	38.73	38.40	16.93	18.27	17.53
N ₀ P ₂	34.81	34.86	35.02	234.57	223.77	275.10	10.47	9.33	9.80	40.20	40.33	42.47	16.67	17.93	18.53
N ₁ P ₀	35.29	37.14	36.86	324.32	282.17	293.30	9.20	10.87	11.93	44.13	51.60	54.00	26.13	23.60	25.13
N ₁ P ₁	39.21	45.69	44.30	338.09	346.44	345.64	12.20	16.80	16.33	57.33	60.53	63.07	23.00	23.33	23.20
N ₁ P ₂	44.36	47.27	46.49	310.40	437.47	403.11	15.40	15.27	15.93	62.67	65.13	64.40	22.27	26.27	26.03
N ₂ P ₀	36.55	36.41	38.03	457.07	399.37	432.40	10.87	12.33	11.80	47.47	49.87	53.13	23.00	23.00	23.27
N ₂ P ₁	38.96	42.88	40.35	416.26	429.26	444.22	12.93	13.67	13.07	56.40	61.33	59.87	26.73	25.93	26.40
N ₂ P ₂	42.31	43.03	41.24	391.12	391.12	436.56	14.40	15.00	16.40	59.00	62.20	58.00	26.67	28.33	27.60
F-test	NS			*			*			NS			NS		
S.Em±	-			12.460			0.860			-			-		
CD at 5%	-			20.380			1.410			-			-		

* Significant at 5% level; NS - Non significant

Interaction	Size of the pod (cm ²)			No. of seeds pod ⁻¹			1000 seed weight (g)			Seed yield plant ⁻¹			Seed yield ha ⁻¹		
	K ₀	K ₁	K ₂	K ₀	K ₁	K ₂	K ₀	K ₁	K ₂	K ₀	K ₁	K ₂	K ₀	K ₁	K ₂
N ₀ P ₀	1.45	1.49	1.39	39.03	41.92	42.01	1.94	1.94	1.96	0.98	1.14	1.19	4.41	5.11	5.36
N ₀ P ₁	1.55	1.48	1.62	42.83	46.11	44.25	1.97	1.96	1.97	1.43	1.65	1.53	6.43	7.43	6.88
N ₀ P ₂	1.64	1.65	1.63	42.07	47.04	47.71	1.98	1.98	1.99	1.39	2.38	1.76	6.25	7.51	7.92
N ₁ P ₀	1.84	2.11	1.86	44.80	47.05	46.08	2.11	2.08	2.13	2.47	2.95	2.46	11.20	10.74	11.09
N ₁ P ₁	2.37	2.39	2.87	48.37	56.44	60.62	2.15	2.24	2.28	2.39	3.88	3.21	10.76	13.28	14.44
N ₁ P ₂	3.29	3.84	3.35	58.20	62.17	62.22	2.22	2.38	2.34	2.88	3.03	3.59	12.95	17.45	16.05
N ₂ P ₀	3.35	3.29	3.28	54.80	57.85	58.11	2.19	2.27	2.23	2.84	3.03	3.02	12.78	13.65	13.57
N ₂ P ₁	3.41	3.59	3.16	56.00	59.42	58.86	2.31	2.32	2.35	3.45	3.57	3.62	15.54	16.08	16.29
N ₂ P ₂	3.31	3.39	3.39	58.81	57.02	56.77	2.31	2.35	2.36	3.60	3.80	3.69	16.18	17.09	16.61
F-test	*			*			*			*			*		
S.Em±	0.200			1.560			0.040			0.200			0.890		
CD at 5%	0.330			2.550			0.060			0.320			1.460		

* Significant at 5% level; NS - Non significant

number of seeds per pod (52.96) and 1000 seed weight (2.18 g). Among the interaction effects the nutrient combination of $N_1P_2K_1$ ($N_{50}P_{40}K_{30}$ kg ha⁻¹) recorded maximum values for plant height (47.27 cm), number of leaves (64.40) per plant, size of the pod (3.82 cm²), 1000 seed weight (2.38 g) and seed yield per plant (3.88 g) and per hectare (17.45 kg).

The seed yield is governed by a number of factors, which have direct or indirect impact. The main factors, which have the direct bearing on the seed yield are number of pods per plant, number of seeds per pod and 1000 seed weight. The nutrient level $N_1P_2K_1$ at 50 : 40 : 30 kg ha⁻¹ of NPK has recorded maximum seed yield. Thus, an over all effect of NPK in improving growth and yield attributes of black cumin lead to better seed yield at higher NPK levels. Beneficial effects of N fertilization in increasing yield of black cumin have been reported by Ghosh *et al.* (1981). The yield trends of phosphorus are in agreement with the findings of El deen & Ahmed (1997) in black cumin. A positive correlation

was observed between nutrient level and seed yield indicating the enhanced fertilizer use by the crop. The results of nutrient interactions are in conformity with Khan & Chatterjee (1982) in black cumin.

The present study has shown that NPK dose at 50 : 40 : 30 kg ha⁻¹ ($N_1P_2K_1$) as the optimum dose for obtaining maximum growth and seed yield from kalongi under Bangalore conditions.

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