

Optimum dose of nitrogen and potassium for ginger in Wynad, Kerala

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Abstract

Study on nutrient requirement of ginger in Wynad, Kerala showed the positive effect of higher doses of N and K on the yield. Among the 16 levels of N and K, 3 combinations viz., 150 kg N, 50 kg K; 150 kg N, 100 kg K and 75 kg N, 150 kg K ha⁻¹ were found to be significantly superior with respect to yield. Among the vegetative characters, plant height was found to be significantly influenced by nitrogen. The optimum dose of N and K derived from the quadratic equation was 144 kg and 109 kg ha⁻¹, respectively.

Key words: ginger, nutrients, nitrogen, potassium.

Introduction

Ginger, grown in Wynad, Kerala is popular across the globe for its characteristic aroma and quality. Ginger is cultivated both as a rainfed crop (April to December) and irrigated crop, mainly in the rice fields (January to August). It is a nutrient exhaustive crop and shows good response to applied nutrients. The present fertilizer recommendation for ginger crop in Kerala is 75 : 50 : 50 kg NPK ha⁻¹ (KAU 1989). Over the years, farmers in Wynad are applying 2-3 times the recommended dose of N and K to boost up the yield in ginger. But in earlier studies on the fertilizer requirements of ginger showed no significant response to fertilizers and application of N above 50 kg ha⁻¹ reduced the yield (Muralidharan 1973; Muralidharan *et al.* 1973). Hence, a study was undertaken at the Regional Agricultural Research Station, Ambalavayal, for determining the optimum

nitrogen and potassium requirement of ginger crop in Wynad.

Materials and methods

The experiments were conducted in a 4² factorial in Randomized Block Design with three replications for 3 years (1990, 1991 and 1992). The soil of the experimental farm was acidic clay loam (typic sulphaquint) with an initial fertility status of 1.65% organic carbon, 10.14 ppm available P and 333.84 ppm exchangeable K. Nitrogen and potassium at four levels each viz, 0, 75, 150 and 225 and 0, 50, 100 and 150 kg ha⁻¹ respectively, were applied in combination with phosphorous (50 kg P₂O₅ ha⁻¹). The crop was planted during the first fortnight of May and harvested during the first fortnight of December. There was not much variation in weather parameters like temperature (17.4 – 25.7°C) and rainfall (192.3 – 291.40 mm) during the experimental period, except for a low

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rainfall in 1990. Rhizomes of the popular variety, Rio-de-Janeiro were planted on raised beds (4 m x 1 m) with a spacing of 20 cm x 25 cm. Full dose of P and half dose K were applied as basal dose and half dose of N was applied at 60 days after planting. Remaining half dose of N and K were applied at 120 days after planting. The beds were mulched with green leaves @ 5 kg per bed immediately after planting. Observations were recorded on height of plant, number of tillers per plant and yield of rhizomes. Pooled analysis of data was done to find out the main effects of N, K and their interaction with season/year. Optimum requirement of N and K was worked out from the quadratic response curve using the equation

$$X = 1/2c (q/p - b)$$

where X is the optimum dose of N or K kg ha⁻¹, b and c are the coefficients of quadratic response curve i.e.

$y = a + bx + cx^2$, p the unit price of ginger and q the unit cost of N or K.

Results and discussion

The pooled analysis of data revealed that error mean sum of squares were heterogeneous and treatment x year interaction was highly significant by weighted analysis for plant height and yield. Therefore unweighted analysis was done to compare the different treatment effects and their interactions. The mean data for three years along with the result of pooled analysis are given in Table 1.

Pooled analysis revealed the positive influence of nitrogen on plant height and the increase was significant up to 75 kg N ha⁻¹ (Table 1). Muralidharan *et al.* (1973) observed no significant response to plant height with increased application of N, P and K in a pooled analysis of three year data, but response was significant in the first year. Analysis of individual year data showed that N application increased the plant height significantly up to 150 kg N ha⁻¹ in first year and up to 75 kg ha⁻¹ in the second and third year (Table 2). However, K had no significant effect on plant height,

though the interaction between N and K was significant in the first year. Plant height is reported to have positive correlation with rhizome weight of ginger among the various contributing factors (Pandey & Dobhal 1993) and the increased height with higher dose of N was found to improve the yield of ginger.

Though there was an increase in tiller production in response to the increasing levels of N and K, the difference was non significant. However, Muralidharan *et al.* (1973) observed significant increase in the number of tillers in response to higher dose of N, P and K. The tiller number is reported to be positively correlated with the yield of ginger (Ray & Wamanan 1990). Present study also indicated the positive influence of N and K on the vegetative characters like plant height and tiller number, which might have contributed to the increased yield of ginger.

Pooled analysis of the yield data revealed the existence of significant interaction between N and K on yield (Table 1). The main effects of N and K were found to be highly significant in pooled analysis for yield of ginger. The interaction between N and K was also significant for rhizome yield. Combinations of 150 kg N with 50 or 100 kg K₂O and 75 kg N with 150 kg K₂O were found to be significantly superior to other combinations with respect to yield. Higher yield was obtained in the second year compared to that of first and third year. This can be attributed to the well distributed and high rainfall in June and July, the critical period for tiller production in ginger in second year. Analysis of the individual year data showed that N application increased the yield significantly up to 75 kg N ha⁻¹ and increasing trend continued up to 150 kg N ha⁻¹ and then declined in all the three years (Table 3). However, the increase/decrease was not significant beyond 75 kg N ha⁻¹. Muralidharan *et al.* (1974) reported an increased rhizome yield by the application of 70 kg ha⁻¹ N, unaffected by P and decreased level of K (140 kg ha⁻¹). The present study indicated a positive response to higher dose of N for rhizome yield, which

Table 1. Effect of different levels of nitrogen and potassium on growth and yield of ginger (pooled data for three years)

N/K level (kg ha ⁻¹)	0	50	100	150	Mean N
a) Height (cm)					
0	56.06	58.10	58.44	55.96	57.14
75	63.20	62.23	63.44	62.70	62.89
150	62.30	66.80	66.35	63.77	64.80
225	63.58	62.24	62.20	63.04	62.77
Mean K	61.28	62.34	62.61	61.37	
F test	N - **	K - NS	N x K - NS		
CD N	4.64				
b) Number of tillers					
0	5.91	7.07	6.95	7.08	6.75
75	6.23	7.00	6.99	7.49	6.93
150	7.09	8.48	7.74	6.92	7.56
225	7.43	7.61	7.59	7.74	7.59
Mean K	6.66	7.54	7.32	7.31	
F test	N - NS	K - NS	N x K - NS		
c) Yield (t ha ⁻¹)					
0	27.109	25.819	28.952	28.372	27.563
75	33.270	35.878	37.321	39.870	36.585
150	33.267	41.548	42.916	38.230	38.990
225	31.664	38.673	36.329	35.892	35.640
Mean K	31.328	35.479	36.380	35.591	
F test	N - **	K - **	NxK - *		
CD	N - 5.463	K - 3.3351	NxK - 3.529		

might be due to its indirect effect on increased plant height and tiller number.

Aiyadurai (1996) reported that N @ 50 to 100 kg ha⁻¹ increased the yield of ginger by 18 to 32 per cent and improved the dry matter content of rhizome. However, Sadanandan & Sasidharan (1979) got the highest yield with 50 kg N ha⁻¹ in the main crop of ginger. They observed a reduction in yield with increased levels of nitrogen. Though potassium application also followed the same trend, the yield increased up to 100 kg K₂O ha⁻¹, significant

increase was observed only in the second year up to 50 kg K₂O ha⁻¹ and its effect was non significant during the first and third year. The interaction effect of N x K was non significant in all the three years.

Quadratic equation was applied for arriving at the optimum dose of N and K from the above study. The unit price of ginger, N and K were taken as Rs 26.63, 10.33 and 6.31 kg⁻¹, respectively. The optimum dose of N and K were found to be 144 kg and 109 kg, respectively which was close to the combined application

Table 2. Influence of N and K on plant height (cm) in ginger

N/K level	1990					1991					1992				
	0	50	100	150	Mean N	0	50	100	150	Mean N	0	50	100	150	Mean N
N															
0	39.66	39.85	41.75	41.56	40.71	63.72	67.38	67.33	63.16	65.40	64.80	67.07	66.26	63.15	65.32
75	49.83	45.16	48.93	44.63	47.14	70.16	70.99	70.55	71.16	70.72	69.61	70.53	70.85	72.31	70.82
150	45.15	56.90	57.40	48.08	51.88	71.99	72.33	70.55	72.11	71.75	69.76	71.16	71.11	71.13	70.79
225	50.70	49.35	48.96	48.66	49.42	68.44	69.16	68.33	70.99	69.23	71.61	68.20	69.31	69.48	69.65
Mean K	46.33	47.81	49.26	45.73		68.58	69.97	69.19	69.36		69.94	69.24	69.38	69.02	
F test N	(1990) **					(1991) **					(1992) **				
K	(1990) NS					(1991) NS					(1992) NS				
N x K	(1990) **					(1991) NS					(1992) NS				
CD N	(1990) 3.9					(1991) 3.64					(1992) 2.82				
K	(1990) 7.8					-					-				

Table 3. Influence of N and K on the yield (t ha⁻¹) of ginger

N/K Level	1990					1991					1992				
	0	50	100	150	Mean N	0	50	100	150	Mean N	0	50	100	150	MeanN
0	15.886	15.318	20.016	21.162	18.096	41.150	39.979	42.808	43.746	41.921	24.292	22.152	24.030	20.208	22.672
75	22.838	24.505	24.650	25.572	24.391	47.596	51.654	53.332	57.454	52.506	29.375	31.475	33.992	36.580	32.856
150	22.272	25.493	27.015	24.838	24.904	48.029	62.083	63.592	55.077	57.195	29.500	37.067	38.142	34.775	34.871
225	21.017	25.016	26.259	24.883	24.294	45.900	56.693	51.263	50.147	51.135	28.075	34.042	31.467	32.375	31.490
Mean K	20.503	22.583	24.485	24.114		45.669	52.670	52.146	51.674		27.810	31.185	31.907	30.985	
F test N	(1990)**					(1991) **					(1992) **				
K	(1990) NS					(1991) **					(1992) NS				
N x K	(1990) NS					(1991) NS					(1992) NS				
CD N	(1990) 4.80					(1991) 5.45					(1992) 9.04				
K	(1990) 5.45					-					-				

of 150 kg N and 100 kg K. Present study established the beneficial effect of higher levels of N and K on the yield of ginger and can be recommended for realising better yield in high ranges of Kerala.

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