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Major nutrient requirement of mango-ginger (*Curcuma amada* Roxb.)

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Abstract

Field trials conducted at Vellayani (Kerala, India) with factorial combinations of three levels each of nitrogen (15, 30 and 45 kg N ha^{-1}), phosphorus (15, 30 and 45 kg P_2O_5 ha^{-1}) and potassium (30, 60 and 90 kg K_2O ha^{-1}) revealed that N, P_2O_5 and K_2O @ 30 : 30 : 60 kg ha^{-1} was optimum for obtaining maximum net returns and benefit-cost ratio in mango-ginger (*Curcuma amada*).

Key words : *Curcuma amada*, major nutrients, mango-ginger, yield.

Mango-ginger (*Curcuma amada* Roxb., Zingiberaceae) is an under exploited and lesser known spice crop. It grows wild as a perennial and is also cultivated as an annual for its thick underground rhizome that is used as a condiment and vegetable and also in indigenous and Unani systems of medicine. However agronomic trials on this crop is very scanty. The present investigation was undertaken to standardize the major nutrient requirements of mango-ginger.

The field experiment was conducted at College of Agriculture, Vellayani (Kerala, India) from June to December 1995. The soil of the experimental area was lateritic red loam containing 158.8, 16.4 and 128.6 kg ha^{-1} of available N, P_2O_5 and K_2O respectively, with a pH of 5.2. The experiment was laid out in 3^3 + 1 Factorial Randomised Block Design with 3 replications. The treatments consisted of factorial combinations of three levels each of N (15, 30 and 45 kg ha^{-1}), P_2O_5 (15, 30 and 45 kg ha^{-1}) and K_2O (30, 60 and 90 kg ha^{-1}) plus absolute control (no fertilizers). Farm yard manure (0.3% N, 0.3% P_2O_5 and 0.2% K_2O) @ 40 t ha^{-1} was uniformly applied as basal dose, in small pits taken for planting seed rhizomes at a spacing of 30 cm x 30 cm, in beds of 1.2 m x 3.0 m size.

The fertilizers were applied in the form of urea (46% N), super phosphate (16% P_2O_5) and muriate of potash (60% K_2O). Full dose of P and half dose of K as basal dose, 2/3 N at 30 days after planting (DAP) and 1/3 N plus remainin K at 60 DAP were applied as per treatments.

The fertilizers were applied by broadcasting at the time of bed formation, 30 DAP and 60 DAP. Mulching was done with green leaves @ 15 t ha^{-1} immediately after planting and was repeated after 50 days with the same quantity. Hand weeding was done at 30, 60 and 120 DAP and earthing up at 60 DAP. The crop was raised as rainfed, which received 875 mm rainfall during the cropping period. After 180 days of planting, the crop was harvested and the projected yield per ha was calculated. Net return, benefit cost ratio and return per rupee invested on fertilizers were also calculated. Response function model, represented by the quadratic response function of the form $Y = b_0 + b_1N + b_2P + b_3K + b_4NP + b_5NK + b_6N^2 + b_7P^2 + b_8K^2$ where Y is the predicted yield and N, P and K are the nutrient doses, was used to predict the optimum response. The economic dose was estimated by equating the partial derivatives to the respective input/output price ratios.

The rhizome yield of mango-ginger increased by application of varying levels of nutrients (Table 1). N at 30 kg ha^{-1} gave maximum yield (28.95 t ha^{-1}) and the yield increase was 89.2% over control. Significant increase in yield with increasing levels of nitrogen was also reported in turmeric (Govind *et al.* 1990; Singh *et al.* 1992). Significant

Table 1. Effect of N, P_2O_5 and K_2O on yield and economics of mango-ginger

Nutrient level	Fresh rhizome yield (t ha^{-1})	Economics of cultivation		
		Net returns ('000 Rs ha^{-1})	Benefit cost ratio	Return per rupee invested on fertilizers (Rs.)
Nitrogen (N kg ha^{-1})				
15	25.93	55.17	1.55	44
30	28.95	73.17	1.73	50
45	27.47	64.15	1.64	41
F test	S	S	S	S
Phosphorus (P_2O_5 kg ha^{-1})				
15	27.19	62.94	1.63	53
30	28.59	71.07	1.70	47
45	26.56	58.49	1.58	34
F test	S	S	S	S
Potassium (K_2O kg ha^{-1})				
30	25.55	53.09	1.53	45
60	30.04	79.69	1.79	54
90	26.76	59.70	1.59	36
F test	S	S	S	S
SE	0.25	1.48	0.02	1.12
CD (P=0.05)	0.70	4.20	0.04	3.21
Control	15.30	7.18	0.93	-
Treatment vs Control	S	S	S	-

S=Significant

Table 2. Effect of N, P_2O_5 and K_2O combination on yield and economics of cultivation of mango-ginger

N : P_2O_5 : K_2O (kg ha^{-1})	Cost of cultivation (A) ('000 Rs ha^{-1})	Fresh rhizome yield (t ha^{-1})	Gross returns (B) ('000 Rs ha^{-1})	Net returns (B-A) ('000 Rs ha^{-1})	Benefit cost ratio B/A	Return per rupee invested on fertilizers (Rs.)
15:15:30	99.76	21.42	128.49	28.73	1.28	38
15:15:60	100.07	25.57	165.44	65.37	1.65	61
15:15:90	100.38	26.29	157.72	57.34	1.57	42
15:30:30	100.09	27.30	167.56	67.47	1.67	62
15:30:60	100.39	29.37	176.19	75.79	1.75	54
15:30:90	100.70	27.44	164.61	63.95	1.63	37
15:45:30	100.42	23.29	139.79	39.38	1.39	28
15:45:60	100.72	26.88	161.27	60.54	1.60	35
15:45:90	100.00	23.16	138.97	37.94	1.39	38
30:15:30	99.89	27.74	166.45	66.55	1.67	74
30:15:60	100.20	30.65	183.92	83.71	1.83	70
30:15:90	100.51	28.68	172.06	71.55	1.71	47
30:30:30	100.22	23.35	140.07	39.85	1.39	33
30:30:60	100.53	33.92	203.49	102.96	2.02	67
30:30:90	100.84	26.19	157.17	56.33	1.56	31
30:45:30	100.55	27.07	162.41	61.86	1.62	40
30:45:60	100.86	33.73	202.39	101.54	2.01	55
30:45:90	101.16	29.23	175.37	74.21	1.73	34
45:15:30	100.02	26.47	158.82	58.79	1.59	57
45:15:60	100.33	29.24	175.46	75.13	1.75	56
45:15:90	100.64	26.65	159.93	59.28	1.59	36
45:30:30	100.35	27.89	167.37	67.02	1.67	50
45:30:60	100.66	32.03	192.19	91.53	1.91	55
45:30:90	100.97	29.27	175.64	74.68	1.74	38
45:45:30	100.68	24.80	148.81	48.13	1.48	29
45:45:60	100.99	26.95	161.67	60.49	1.60	31
45:45:90	101.29	23.89	143.38	42.09	1.42	18
0:0:0	99.00	15.30	91.82	7.18	0.93	-
F test	-	S	-	S	S	S
SE	-	0.74	-	4.40	0.04	3.38
CD (P=0.05)	-	2.1	-	12.61	0.13	9.92

Cost of cultivation excluding treatments = Rs. 99,000

Cost of inputs:

Seed	- Rs. 8 kg^{-1}	Plant protection			
Nitrogen	- Rs. 7.38 kg^{-1}	chemicals	-	Rs. 3000 ha^{-1}	
Phosphorus	- Rs. 20.31 kg^{-1}	Labour charges	-	Rs. 84 per head	
Potassium	- Rs. 8.85 kg^{-1}	Price of fresh			
FYM	- Rs. 350 t^{-1}	mango-ginger	-	Rs. 6 kg^{-1}	

increase in yield over control was noted at all P levels and 30 kg P_2O_5 ha^{-1} recorded maximum yield (28.59 t ha^{-1}). Similar results were also reported by Gupta *et al.* (1990) in turmeric. Potassium application also increased the fresh rhizome yield and 60 kg K_2O ha^{-1} recorded maximum value (30.03 t ha^{-1}). The yield increase was 66.96% over control. In turmeric, Muthuvel *et al.* (1989) reported that 60 kg K_2O ha^{-1} as adequate to get good yield.

The NP, NK and NPK interaction effects significantly influenced the yield of mango-ginger. Combined application of 30 kg N with 45 kg P_2O_5 ha^{-1} and 30 kg N with 60 kg K_2O ha^{-1} produced maximum yield among the respective combinations. Among NPK treatment combinations, 30 : 30 : 60 kg N, P_2O_5 and K_2O ha^{-1} produced maximum fresh rhizome yield (33.91 t ha^{-1}) which was on par with 30:45:60 and 45:30:60 kg N, P_2O_5 and K_2O ha^{-1} (Table 2). This can be attributed to the favourable N/K ratio of 1:2 leading to better translocation of photosynthates to the rhizomes. This was in conformity with the findings of Sadanandan & Hamza (1996) in turmeric.

Considering the economics of cultivation, the application of 30 kg N, 30 kg P_2O_5 and 60 kg K_2O ha^{-1} alone and in combination produced maximum net returns and benefit cost ratio. The return per rupee invested on fertilizers was higher with individual application of 30 kg N, 15 kg P_2O_5 and 60 kg K_2O ha^{-1}. The combination 30:15:30 kg N, P_2O_5 and K_2O ha^{-1} recorded maximum return per rupee invested on fertilizers. The physical and economic optimum dose for high yields were worked out to be 33:28:63 kg N, P_2O_5 and K_2O ha^{-1} (Table 2).

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