

Effect of nitrogen and potassium on growth parameters and rhizomatic characters of mango-ginger (*Curcuma amada*)

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Received : January 2001

ABSTRACT

A field experiment was conducted in 1996–97 and 1997–98 on a lateritic soil, to study the performance of mango-ginger (*Curcuma amada* Roxb.) at 4 levels of nitrogen (N_0 , N_{50} , N_{100} and N_{150}) and 3 levels of potassium (K_0 , K_{50} and K_{100}). Significant differences were observed on single mother rhizome, number of secondary finger rhizome, number of tertiary fingers, total mother rhizome, root weight, weight of root tubers and weight of total fingers owing to the application of nitrogen and potassium. Mango-ginger recorded maximum rhizome yield (2,295 g), mother rhizome (616 g) and weight of total fingers (148.3 g) and highest plant height (62.3 cm). The application of nitrogen and potassium alone or combinedly increased the rhizome yield. Both nitrogen and potassium may be recommended @ 100 kg/ha for the better production of *amada* rhizome.

Key words : *Curcuma amada*, Rhizome, Fertilizers

Mango-ginger (*Curcuma amada* Roxb.) an important spice and aromatic commercial crops of India, is cultivated for its underground rhizome. It is extensively used in the preparation of chutneys, pickles and sweet meats (Guha, 1969). Besides the culinary use of rhizome, it also find application therapeutically as a carminative and stoma chic (Rao *et al.*, 1989) as well as a healing agent for sprains and bruises (Gholap and Bandyopathyay, 189). *Amada* requires humid climate and the soil should be well drained. Results of experiments conducted in different parts of the country may not be found suitable in the agro-

climatic conditions of Bhubaneshwar due to its lateritic soil and rainfall patterns. The present study was therefore made to find out the optimum dose of nitrogen and potassium to get maximum rhizome yield of *amada*.

MATERIALS AND METHODS

The present experiment was conducted during 1996–97 and 1997–98 at the Aromatic and Medicinal Plants Garden of Regional Research Laboratory at Bhubaneshwar, Orissa. The soil was sandy loam with pH 5-6 and organic carbon content of 0.68%. The soil-fertility status

indicated 0.055% total N and 23 and 140 kg/ha available P_2O_5 and K_2O respectively. The treatments consisted of 4 levels of nitrogen (0,50,100 and 150 kg/ha) and 3 levels of potassium (0,50 and 100 kg/ha) in an experiment was laid out in a factorial complete-randomized block design with 3 replications. Healthy and uniform mother rhizomes of *amada* were selected and treated with 0.3% Dithane M-45 and 0.5% Malathion for 30 min. before sowing.

Planting was done on 15 June, 1996 and 20 June 1997 in raised beds of 3 m × 1 m size. The dose of phosphorus as 60 kg/ha was kept constant. Nitrogen were applied in 2 equal splits at 40 days and 90 days after planting. Phosphorus and potassium were applied at the time of planting. Crops were harvested in January in both the years consecutively. Observations on plant height, vegetative growth and rhizomatic characters were recorded and statistical

Table 1. Effect of inorganic fertilizers on growth parameters

Treatment	Tiller number		Plant height		No. of leaves	
	I	II	I	II	I	II
N_0K_0	3.0	2.0	48.6	41.0	4.6	5.0
N_0K_{50}	1.6	3.3	48.6	43.0	4.3	5.0
N_0K_{100}	3.6	5.0	40.3	34.3	5.0	5.0
$N_{50}K_0$	4.0	3.3	41.6	49.0	4.6	4.6
$N_{50}K_{50}$	4.0	4.3	49.0	49.0	4.6	5.6
$N_{50}K_{100}$	2.0	2.6	55.6	38.0	5.0	5.3
$N_{100}K_0$	2.3	2.6	40.0	49.3	4.0	5.0
$N_{100}K_{50}$	2.3	3.6	50.0	49.3	4.6	5.0
$N_{100}K_{100}$	3.6	5.0	55.6	42.6	4.3	4.3
$N_{150}K_0$	1.6	5.3	53.0	53.3	5.0	4.6
$N_{150}K_{50}$	2.6	3.6	55.3	44.3	5.0	4.6
$N_{150}K_{100}$	5.3	4.0	60.6	62.3	5.0	4.6
F test Tr	S	S	S	S	S	S
CD ($P=0.05$)	2.17	1.82	7.8	19.1	0.95	1.09
N	NS	NS	S	S	S	NS
CD ($P=0.05$)	1.01	0.85	3.67	9.0	0.45	0.51
K	NS	NS	S	NS	NS	NS
CD ($P=0.05$)	0.89	0.74	3.17	7.79	0.39	0.43
Interaction	S	S	S	S	S	S
CD ($P=0.05$)	1.41	1.03	4.50	11.03	0.55	0.64

I, 1996-97; II, 1997-98

S, Significant

analysis was done.

RESULTS AND DISCUSSION

Vegetative characters

Application of nitrogen had significant effect on plant height and number of leaves (except in second year). All the nitrogen doses in both the years promoted the tillering in *C. amada* and the maximum number of tillers plant was recorded under the highest dose of nitrogen (N_{150}). The result supports the finding of Nair (1964). Effect of potassium was not significant on plant height, tiller number and number of leaves, whereas the combined fertilizer (N and K interaction) had significant effect on vegetative growth (Table 1).

Rhizomatic characters

The yield-attributing characters, viz. number of secondary and tertiary fingers, weight of fingers and mother rhizome significantly increased with various levels of nitrogen (Table 2). The yield differences were found significant, since this crop responded well to higher fertilizer doses for more fresh rhizome production. Raghava Rao (1973) reported similar results with turmeric. Weight of single mother rhizome, weight of total fingers and total mother rhizome showed a significant impact of nitrogen and potassium application.

Weight of single mother rhizome (29.3 g) and weight of total fingers (148.3 g) were recorded maximum in $N_{150}K_{100}$ and significantly higher than the fertilizer level at N_0N_{50} and N_{100} . Number of secondary fingers (13.6) was recorded maximum in $N_{150}K_{50}$ during both the years and significantly higher than fertilizer at N_0 and N_{50} ,

whereas the number of tertiary fingers were maximum in $N_{150}K_{50}$ (1996–97) and $N_{100}K_{100}$ (1997–98) and significantly higher than the control (N_0K_0). Maximum root weight was found at $N_{100}K_{50}$ during both the years, whereas maximum weight of root tubers were found at $N_{150}K_{100}$ (Table 2).

Though potassium has not any significant effect on plant height, tiller number, but it has significantly increased the number of secondary and tertiary fingers, root weight, root tubers, weight of mother rhizome, weight of total fingers and total mother rhizome. This result well corroborates with the finding of Rathinavel (1983). Potassium along with N and P plays a major role in growth and yield, as it is involved in assimilation, transport and storage time development (Tisdale *et al.*, 1985),

The nitrogen dose at 150–100 kg N/ha recorded more yield of mother rhizomes and finger rhizomes compared with other nitrogen doses. The yield differences were found highly significant, this might be due to the good response of this crop towards the higher fertilizer and response to nitrogen varies from place to place with the soil type. The total rhizome yield increased with the application of nitrogen and potassium. The maximum yield (765 g) were recorded in $N_{150}N_{100}$. Observations of vegetative characters showed that though maximum tiller number, more plant height and maximum number of leaves are recorded in $N_{150}K_{100}$, but there was no significant change in the observations from $N_{100}K_{100}$ to $N_{150}K_{100}$, i.e. the differences were at par. Hence $N_{100}K_{100}$ can be economically recommended for the cultivation of *C. amada*.

Table 2. Effect of inorganic fertilizers on rhizomatic characters

Treatment	No. of secondary fingers		No. of tertiary fingers		Root weight/plant (g)		Weight of root tubers/plant		Weight of single mother rhizome (g)		Weight of total fingers/plant (g)		Total mother rhizome (g)		Total rhizome yield (g)	
	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II
N ₀ K ₀	6.3	7.6	17.6	21.6	5.0	5.0	4.6	4.0	15.0	15.6	80.0	75.0	426.3	420.0	506.3	495.0
N ₀ K ₅₀	7.6	8.0	22.6	28.6	5.0	4.6	2.6	3.6	15.6	20.0	101.6	86.6	430.0	430.0	531.6	516.6
N ₀ K ₁₀₀	10.0	10.3	22.0	21.3	5.0	5.0	2.3	2.6	15.6	22.3	86.0	85.0	450.0	423.3	536.0	511.6
N ₅₀ K ₀	8.3	8.3	22.6	20.6	10.3	7.3	5.3	5.3	19.6	13.3	59.3	68.6	521.6	510.0	581.0	578.6
N ₅₀ K ₅₀	7.6	7.6	22.6	21.3	11.0	6.3	3.3	4.3	22.3	13.3	58.3	60.0	520.0	520.0	578.3	580.6
N ₅₀ K ₁₀₀	9.0	9.0	25.6	25.0	10.3	10.0	4.3	4.0	22.3	16.0	79.6	80.3	558.3	555.0	638.0	635.5
N ₁₀₀ K ₀	5.0	5.0	15.0	18.3	8.3	8.6	2.0	2.3	24.0	18.0	56.6	58.6	436.6	416.6	493.3	475.3
N ₁₀₀ K ₅₀	8.3	8.3	23.6	25.0	13.0	10.3	2.0	2.3	26.3	20.6	78.3	78.0	450.0	430.0	528.3	508.0
N ₁₀₀ K ₁₀₀	9.6	9.6	28.3	21.6	9.6	9.0	6.0	5.6	26.6	25.0	83.3	81.6	558.3	566.6	641.6	648.3
N ₁₅₀ K ₀	8.0	8.0	20.3	21.6	7.3	10.0	5.6	6.3	25.0	25.0	67.6	67.0	453.3	443.3	521.0	510.3
N ₁₅₀ K ₅₀	13.6	13.0	26.3	24.3	9.6	7.3	4.6	6.6	27.0	27.3	118.6	113.3	566.6	563.3	685.3	676.6
N ₁₅₀ K ₁₀₀	11.0	10.0	24.6	23.3	10.0	9.6	6.6	7.0	29.3	28.3	148.3	148.3	610.0	616.6	760.0	765.0
F test Tr	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CD (P=0.05)	2.8	2.6	5.22	5.72	1.2	2.17	2.4	2.49	3.56	5.37	9.08	8.59	22.4	13.8	21.96	6.01
N	S	S	NS	NS	S	S	S	S	S	S	S	S	S	S	S	S
CD (P=0.05)	1.32	1.24	2.46	2.69	0.55	1.01	1.11	1.16	1.67	2.53	4.27	4.04	10.59	6.53	12.67	3.46
K	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CD (P=0.05)	1.14	1.0	2.13	2.32	0.47	0.89	0.97	1.01	1.45	2.19	3.69	3.48	9.16	5.64	10.97	3.0
N x K	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
CD (P=0.05)	1.61	1.51	3.09	3.29	0.68	1.24	1.38	1.43	2.05	3.11	5.22	4.93	12.96	7.98	15.51	4.25

I, 1996-97; II, 1997-98

ACKNOWLEDGEMENT

I am thankful to the Director, Regional Research Laboratory and Head, Aromatic and Medicinal Plants Division for their encouragement in conducting the study. The CSIR Research Associateship is gratefully acknowledged.

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