Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; SP3: 308-310

Priyanka BM
M.Sc. (Horticulture) Department of Plantation, Spice, Medicinal and Aromatic Crops, College of Horticulture, Mudigere, Chikkamagaluru, Karnataka, India

Bhoomika HR
Assistant Professor, Department of Plantation, Spice, Medicinal and Aromatic Crops, College of Horticulture, Mudigere. Chikkamagaluru, Karnataka, India

Correspondence
Priyanka BM
M.Sc. (Horticulture) Department of Plantation, Spice, Medicinal and Aromatic Crops, College of Horticulture, Mudigere, Chikkamagaluru, Karnataka, India

National conference on "Conservation, Cultivation and Utilization of medicinal and Aromatic plants"
(College of Horticulture, Mudigere Karnataka, 2018)

Effect of rhizome weight and nutrition on plant growth and yield in mango ginger (*Curcuma amada* Roxb.) under arecanut cropping system

Priyanka BM and Bhoomika HR

Abstract
Mango ginger (*Curcuma amada* Roxb. F: Zingiberaceae) an herbaceous perennial spice crop is a reservoir of several medicinal benefits. It is mainly grown in Southern parts of India like Karnataka, Kerala, Tamil Nadu and Andhra Pradesh. A field experiment was conducted at College of Horticulture, Mudigere to standardize the nutrition and seed rhizome weight for getting higher yields. The treatments consisted of two factors viz., rhizome weight (W_1-20, W_2-40, W_3-60g) and nutrition levels (N_1-Control, N_2-90:75:150 kg/ha NPK, N_3-60:50:100kg/ha NPK, N_4-30:25:50kg/ha NPK, N_5-150:125:250kg/ha NPK, N_6-180:150:300 kg/ha NPK). Among 18 treatment combinations, W_3N_6 (rhizomes weighing 60g with 180:150:300 kg/ha) recorded highest plant height (56.56cm), number of leaves/clump (13.63), number of tillers/clump (3.56), rhizome yield per plant (358.70g) and yield per hectare (35.86 t/ha).

Keywords: Mango ginger, Rhizome, Growth, Yield, Nutrition.

Introduction
Mango ginger (*Curcuma amada*Roxb.) a sterile triploid is a unique spice that resembles ginger (*Zingiber officinale* Rosc), and is the second most widely cultivated *Curcuma* species after turmeric (*Curcuma longa* L.) (Syamkumar and Sasikumar. 2007) [1]. The raw mango-like flavour is due to presence of car-3-ene and cis-ocimene compounds (Gholap and Bandyopadhyay., 1984) [2]. Henceit is used in pickling industry. The pale yellow color of mango ginger is due to curcumin ranging from 0.1-0.25% (Chatterjee *et al*., 2012) [3].
The rhizomes are rich in fibre and starch and promote digestion. They alsoreported to have antimicrobial, antioxidant, anticancer, anti-inflammatory, antidepressant, antitubercular and platelet aggregation inhibitory activities (Policegoudra *et al*., 2010) [4].
It is a perennial herb but cultivated as an annual crop mostly in India and Malaysia. In India, mainly grown in southern states like Karnataka, Kerala, Tamil Nadu and Andhra Pradesh. But clear statistics regarding its area and production are lacking. Since rhizomes are both planting material and economic part, it is necessary to consider the size of the planting material which is economically feasible to the grower and standardize a proper fertilizer management schedule for maximized yield. Considering these facts, the present investigation was undertaken to standardize the major nutrient requirements and seed rhizome weight of mango ginger for commercial cultivation.

Materials and methods
The present experiment was conducted at College of Horticulture, Mudigere, during 2017-18. Healthy rhizomes were procured from local farmer's field. Raised beds of 3m X 1m size were prepared in between existing 10 years old arecanut plants spaced at 2.7m X 2.7m in hexagonal system. The experiment was laid out in a factorial RCBD with Factor I being Rhizome weight at Three levels i.e. W_1-20g, W_2-40g, W_3-60g and Factor II being Nutrient levels at Six levels i.e. N_1-control, N_2-90:75:150 Kg/ha, N_3-60:50:100Kg/ha, N_4-30:25:50Kg/ha, N_5-150:125:250 Kg/ha, N_6-180:150:300 Kg/ha. Totally there were eighteen treatment combinations which were replicated thrice.
During land preparation farm yard manure at 45t/ha was mixed well with soil and the seed rhizomes were planted at a spacing of 30 cm X 30 cm on raised beds. Urea, SSP and MOP

were used as sources of N, P and K respectively. 50% of N and full dose of P and K were given at the time of planting and the remaining 50% of N was given after 45 days of planting as per the treatments.

Growth parameters like plant height, number leaves and number of tillers per clump were recorded at monthly intervals. Rhizomes were harvested after complete yellowing and drying of aerial plant parts and the yield parameters were recorded.

The data obtained were statistically analyzed as per the procedure and design given by Panse and Sukhatme (1985) [5]. The statistical significance was tested by applying 'F' test at 0.05 level of probability and critical differences were calculated for those parameters which turned significant ($P < 0.05$) to compare the effects of different treatments.

Table 1: Effect of seed rhizome weight and major nutrients on growth parameters of mango ginger (*Curcuma amada* Roxb.)

	Plant height (cm)							Number of leaves							Number of tillers						
Treatment	**N1**	**N2**	**N3**	**N4**	**N5**	**N6**	**M**	**N1**	**N2**	**N3**	**N4**	**N5**	**N6**	**M**	**N1**	**N2**	**N3**	**N4**	**N5**	**N6**	**M**
W1	28.50	34.80	32.80	39.40	38.70	40.83	35.83	7.53	8.33	8.30	10.23	10.00	10.50	9.15	1.71	1.87	1.82	2.48	2.46	2.58	2.15
W2	30.00	37.83	35.13	45.60	46.13	44.63	39.88	7.96	9.13	8.83	10.66	11.46	11.36	9.90	1.74	2.01	2.12	2.73	2.89	2.86	2.39
W3	30.26	35.20	46.53	46.20	51.56	56.56	44.38	8.10	9.33	9.86	12.80	12.66	13.63	11.00	1.77	2.25	2.22	3.27	3.17	3.56	2.70
M	29.58	35.94	38.15	43.73	45.46	47.34		7.86	8.93	9.00	11.23	11.37	11.83		1.74	2.03	2.05	2.82	2.85	3.00	
	SEm±				CD (5%)			SEm±				CD(5%)			SEm±				CD (5%)		
W	0.50				1.44			0.13				0.38			0.04				0.12		
N	0.71				2.04			0.18				0.54			0.06				0.17		
W×N	1.23				3.54			0.32				0.93			0.10				0.30		

NOTE-(RDF for Turmeric is 150:125:250 kg/ha)

Factor 1:Rhizome weight **Factor 2:Nutrition**

W_1-Rhizomes weighing 20g N_1-Control N_4-30:25:50 Kg/ha

W_2- Rhizomes weighing 40g N_2-90:75:150 Kg/ha N_5-150:125:250 kg/ha

W_3- Rhizomes weighing 60g N_3-60:50:100 Kg/ha N_6-180:150:300 Kg/ha

Results and Discussion

The effect of major nutrients and seed rhizome weight on growth of mango ginger is presented in Table 1. All growth parameters such as plant height, number of leaves and number of tillers were significantly influenced by NPK levels and seed rhizome weight. Maximum plant height (47.34 cm), number of leaves per clump (11.83) and number of tillers per clump (3.00) were recorded at higher NPK level 180:150:300 kg/ha (N_6). This might be due to the role of major essential nutrients (N, P and K) in plant metabolism, particularly in cell division, multiplication and speeded up the assimilation of photosynthates which in turn boosted the growth parameters (Pradeep kumar *et al*., 2001, Ajithkumar and Jayachandran., 2002) [6-7]. The results are in close confirmity with results of Dayankatti and Sulikeri (2000) [8], Hikaru *et al.*, (2007) [9].

The seed rhizome weighing 60g recorded the highest plant height (44.38 cm), number of leaves (11.00) and number of tillers/clump (2.70). This might be due to availability of sufficient food reserves which encouraged vigorous plant growth (Kumar. 2005) [10]. This is in agreement with the findings of Girma and Kindie (2008) [11], Padma devi *et al*., (2012) [12]. Variationin number of tillers per plant and number of leaves per plant might be due to the fact that the plants produced from the largest seed rhizome emerge earlier, showed vigorous and rapid growth using the initial reserve food materials than the smallest rhizome size (Mahender *et al.*, 2015) [13]. These results are in conformity with the findings of Sengupta and Dasgupta (2011) [14], Girma and Kindie (2008).

Interaction effect of rhizome size and major nutrients was found to be significant. Among the treatments, the combination of 60g rhizome size and NPK levels at 180:150:300 Kg/ha (W_3N_6) recorded highest values for growth parameters.

Table 2: Effect of seed rhizome weight and major nutrients on yield parameters of mango ginger (*Curcuma amada* Roxb.)

	Yield per plant (g)							Yield per hectare (t)						
T	**N1**	**N2**	**N3**	**N4**	**N5**	**N6**	**M**	**N1**	**N2**	**N3**	**N4**	**N5**	**N6**	**M**
W1	152.7	179.4	189.4	252.2	260.7	282.3	219.4	15.27	17.93	18.94	25.21	26.07	28.43	21.97
W2	167.7	208.5	215.1	292.5	301.4	296.4	246.9	16.76	20.85	21.51	29.25	30.13	29.64	24.69
W3	169.3	238.2	260.7	317.9	333.3	358.7	279.7	16.93	23.82	26.07	31.79	33.33	35.86	27.96
M	163.2	208.7	221.73	287.5	298.4	313.1		16.32	20.87	22.17	28.75	29.84	31.31	
	SEm±				CD (5%)			SEm±				CD (5%)		
W	2.98				8.57			0.30				0.88		
N	4.21				12.12			0.43				1.24		
W×N	7.30				21.00			0.75				2.16		

NOTE-(RDF for Turmeric is 150:125:250 kg/ha)

Factor 1: Rhizome weight **Factor 2: Nutrition**

W_1-Rhizomes weighing 20g N_1-Control N_4-30:25:50 Kg/ha

W_2- Rhizomes weighing 40g N_2-90:75:150 Kg/ha N_5-150:125:250 kg/ha

W_3- Rhizomes weighing 60g N_3-60:50:100 Kg/ha N_6-180:150:300 Kg/ha

The effect of major nutrients and seed rhizome weight on yield of mango ginger is presented in Table 2. Yield parameters such as yield per clump and yield per hectare were significantly influenced by NPK levels and seed rhizome weight. Maximum yield per clump (313.1 g) and yield per hectare (31.31t/ha) were recorded at higher NPK level 180:150:300 Kg/ha (N_6). Increase in yield with the application of higher levels of N, P and K might be due to exhaustive nature of the crop (Haque *et al*., 2007) [15]. This is in close conformity with results of Tripathi and Singh (2010) [16].

Seed rhizome weighing 60g (W_3) produced significantly highest rhizome yield per plant (279.7g) and rhizome per

hectare (27.96 t/ha). Seed rhizome yield is reported to be positively correlated with plant height, number of leaves per clump and number of tillers per clump (Girma and Kindie.2008). The results are in conformity with the findings of Monnaf *et al.* (2010) [17], Sengupta and Dasgupta (2011) and Datta *et al*., (2017) [18].

The interaction effect of seed rhizome weight and plant nutrition showed significant effect on mango ginger yield. Significantly highest mango ginger yield per plant (358.7 g) and yield per hectare (35.86 t) was observed from combination of 60g seed rhizome weight with plant nutrition 180:150:300 Kg/ha (W_3N_6).

Conclusion

The experimental results revealed that the seed rhizomes weighing 60g with plant nutrition at 180:150:300 Kg/ha has significantly increased the plant growth and rhizome yield in mango ginger. Further research on aspects like INM is proposedin mango ginger.

Reference

1. Syamkumar S, Sasikumar B. Molecular marker based genetic diversity analysis of *Curcuma* species from India. *Sci Hort.* 2007; 112:235-241.
2. Gholap AS, Bandyopadhyay C. Characterization of mango ginger like aroma in *Curcuma amada* Roxb. J Agric Food Chem. 1984; 32:57-59.
3. Chatterjee R, Chattopadhyay PK, Hnamte V, Chongtham T, Dattaray SK. Assessment of quality characteristics of mango ginger (*Curcuma amada* Roxb.) germplasm. Int J Bio resource stress manag. 2012; 3(3):380-382.
4. Policegoudra RS, Rehna K, Rao LJ, Aradhya SM. Antimicrobial, antioxidant, cytotoxicity and platelet aggregation inhibitory activity of a novel molecule isolated and characterized from mango ginger (*Curcuma amada* Roxb.) rhizome. J Biosci. 2010; 35:231-240.
5. Panse VG, Sukhatme PV. Statistical Methods for Agriculture Workers. 1985; 14-33.
6. Pradeepkumar T, Mayadevi P, Aipe KC, Manomohandas TP, Giridharan MP, Satheesan KN *et al*. Optimum dose of nitrogen and potassium for ginger in Wynad, Kerala. J Spices Aromatic Crop. 2001; 10(1):7-11.
7. Ajithkumar K, Jayachandran BK. Effect of major nutrients on growth and rhizome yield of ginger (*Zingiber officinale* Rosc.) intercropped in coconut garden. South Indian Hort. 2002; 50(4-6):702-707.
8. Dayankatti BS, Sulikeri GS. Effect of plant population and nitrogen levels of growth, yield and quality of ginger – yield and yield attributes. Karnataka J Agric Sci. 2000; 13(4):933-936.
9. Hikaru A, Hossain A, Ishimine Y, Yogi K, Hokama Y, Iraha Y, Yoko A. Effects of application of N, P and K alone or in combination on growth, yield and curcumin content of turmeric (*Curcuma longa* L.). Pl Production Sci., 2007; 10(1):151-154.
10. Kumar B. Growth and yield of turmeric (*Curcuma longa* L.) as affected by different agronomic practices. *Ph.D. (Agri.) Thesis* submitted to Punjab Agriculture University, Ludhiana (Punjab), 2005.
11. Hailemichael G, Tesfaye K. The effects of seed rhizome size on growth, yield and economic return of ginger (*Zingiber officinale* Rosc). Asian J Pl Sci. 2008; 7(2):213-217.
12. Padmadevi K, Jeeva Jothi L, Ponnuswami V, Durgavathi V, Rijwana Parveen I. Effect of different grades of rhizomes on growth and yield of turmeric (*Curcuma longa* L.). The Asian J Hort. 2012; 7(2):465-67.
13. Mahender P, Syam Sunder Reddy P, Thanuja G, Balakrishna, Pratap. Effect of seed rhizome size and plant spacing on growth, yield and quality of ginger (*Zingiberofficinale* Rosc.) under coconut cropping system. *Pl Archs* 2015; 15(2):769-774.
14. Sengupta DK, Dasgupta B. Effect of weight of planting material on growth and yield of ginger (*Zingerofficinale* Rosc.) in the hilly region of Darjeeling district. *Envir Ecol.* 2011; 29(2):666-669.
15. Haque MM, Rahman AKMM, Ahmed M, Masud MM, Sarker MMR. Effect of nitrogen and potassium on the yield and quality of turmeric in hill slope. Int J Sustainable Crop Production. 2007; 2(6):10-14.
16. Tripathi S, Singh DK. Effects of dates of planting, fertility levels and varieties on growth and yield of turmeric. Int J Pl Sci. 2010; 5(1):266-268.
17. Monnaf MA, Rahim MA, Hossain MA, Alam MS. Effect of planting method and rhizome size on the growth and yield of ginger. J Agroforestry Envir Sci. 2010; 4(2):73-76.
18. Datta N, Ghosh DK, Sarkar T. Effect of different seed rate and spacing on yield and economics of ginger (*Zingiber officinale* Rosc). Int J Curr microbial Applied sci. 2017; 6(9):1120-1125.