



Yield and quality evaluation of ginger (*Zingiber officinale* Rosc) genotypes under high rainfall zone of Tamil Nadu

R Balakumbahan* & J P Joshua¹

Horticultural College and Research institute, Periyakulam East- 625 604, Tamil Nadu.

*E-mail: hortibala@gmail.com

Received 25 July 2017; Revised 30 October 2017; Accepted 07 December 2017

Abstract

An experiment on ginger was undertaken with an objective to identify suitable ginger cultivar or accession with higher yield and quality attributes suitable for high rainfall zone of Tamil Nadu. Twenty four ginger genotypes, local strains and varieties were collected from different ginger growing tracts of India and evaluated for their performance in high rainfall region. Among the twenty four genotypes tested, the accession Z. O- 4 recorded higher fresh rhizome yield (22.16 ha⁻¹) than other genotypes whereas Z. O - 6 recorded highest dry recovery per cent (22.47%). Higher oleoresin and fibre content was recorded in genotypes Z. O-5 (9.56%) and Z . O-17 (11.20%) respectively.

Keywords: fibre, genotypes, ginger, high rainfall zone, oleoresin, yield

Among the major spices cultivated in India, ginger (*Zingiber officinale* Rosc.), is a Zingiberaceous spice cum condiment grown for its pungent rhizome. Since sexual reproduction is a constraint in crop plants like ginger which is reproduced vegetatively, it has less chance of crop improvement than other crops. In such species, collection and evaluation of genotypes from diverse agro climatic conditions can be an alternate method to select a suitable material for the specific agro - ecological condition. In Tamil Nadu, ginger is predominantly cultivated in southern parts especially warm humid tropical region like Kanyakumari which receives mean annual rainfall of more than 1700 mm. But the choice of cultivars and local types for the ginger growers is very limited in this

region. In this context, an experiment was conducted to evaluate ginger genotypes suitable for high rain fall zone of Tamil Nadu.

Experiment was conducted at Horticultural Research Station, Pechiparai, Kanyakumari district, Tamil Nadu for a period of three years from April 2012 to March 2015. Twenty four ginger accessions were collected from High Altitude Research Station, OUAT, Pottangi, Orissa (13 accessions), Horticultural Research Station, Chintapalli (3 accessions), Pechiparai (3 accessions), Sengottai (1 Accession), and Horticultural College & Research Institute, Coimbatore (4 Accessions) for evaluating their performance for yield and quality under Pechiparai region (High rainfall zone). The experiment was conducted for three years

¹Agricultural college & Research Institute, Killikulam, Thoothukudi, Tamil Nadu.

between May 2nd to December first week of 2012, 2013 and 2014. The collected seed rhizomes were treated with cow dung slurry and kept under shade for a week period to induce sprouts. Incorporation of farm yard manure @ 25 tones ha⁻¹, *Pseudomonas fluorescence* and *Trichoderma viride* @ 2 kg ha⁻¹, was done during the last ploughing. Besides 75: 50: 50 Kg N, P₂O₅ and K₂O as recommended dose of inorganic fertilizers were applied uniformly to all the experiment plots (Durgavathi 2011). The field was ploughed to fine tilth and 2 × 4 m sized raised beds (15 cm) were prepared with a spacing of 50 cm in between two beds. The experiment plot was designed and laid out as per Randomized Block design with three replications in each season. The sprouted uniform sized, 30-40 g ginger rhizomes were planted on the prepared raised beds at a spacing of 25 cm × 25 cm. Growth and yield was observed and the data presented in the tables are the observations recorded at harvest. Mean of three year data were statistically analyzed following the procedure of Panse & Sukhatme (1967). The quality parameters namely fiber content and oleoresin contents of collected ginger genotypes were analyzed at IISR, Marikunnu, Kozhikode.

Performance of ginger genotypes under high rainfall zone of Tamil Nadu showed significant variation in plant growth, yield and quality parameters. Plant height of ginger genotypes ranged between 55.70 cm to 82.50 cm. The maximum plant height of 82.50 cm was observed in Pechiparai local genotype (Z.O-3). The variation in plant height among ginger genotypes under coconut ecosystem at Coimbatore condition was already reported by Sangeetha & Subramanian (2015). Leaves are the primary centers for the production of photosynthates and number of leaves produced by plants shows direct significant contribution for better plant growth and yield (Sharatbabu *et al.* 2017). Among the ginger genotypes evaluated at Pechiparai condition more number of leaves were observed in the genotype Z.O - 4 i.e., Sengottai local which recorded 103.2 leaves plant⁻¹. With respect to number of tillers plant⁻¹, ginger genotypes showed significant variation

during the period of growth. The highest number of tillers (12.3) was recorded in Z.O - 4. This might be due to ability of particular genotype to translocate higher quantity of stored food in the rhizome to the new sprouts along with favourable climatic conditions during the growth period.

Leaf area influences the photosynthetic efficiency of plants and the leaf area in ginger genotypes under Pechiparai condition varied significantly. The highest total leaf area of 7732.76 cm² was recorded in the genotype Z.O-1 (IISR Varadha) which is on par with Z.O - 4 (7668.06 cm²). Primary and secondary rhizomes number are one of the major yield contributing characters in ginger. Among the ginger genotypes evaluated, the number of primary rhizomes ranged from 5.12 to 7.98. The maximum number of primary rhizome was recorded in Z.O-4 (7.98) and the same genotype recorded the highest secondary rhizome (12.20) also.

The yield characters *viz.*, fresh rhizome yield plant⁻¹, dry rhizome yield plant⁻¹ and estimated green ginger yield ha⁻¹ were significantly influenced by the ginger genotypes at heavy rainfall region of Tamil Nadu. Among the twenty four genotypes the Sengottai local (Z.O-4) recorded highest yield parameters of 227.47 g plant⁻¹ of fresh rhizome, 48.57 g plant⁻¹ of dry rhizome and 22.16 t ha⁻¹ of estimated rhizome yield and this was closely followed by the genotype Z.O-1 (IISR Varadha) which recorded 224.16 g plant⁻¹ fresh rhizome, 47.73g plant⁻¹ dry rhizome and 20.80 t ha⁻¹ estimated rhizome yield. The variations in the eco conditions and the cultural practices adopted in that region might be the reason for this as reported (Latha *et al.* 1995) in turmeric (Sangeetha & Subramanian 2015) in ginger. Dry recovery per cent of ginger genotypes ranged between 16.68% to 22.47%, the maximum dry recovery of 22.47% was observed in the genotype Z.O - 6 (Narasipatnam local collected from Chintapalli) followed by 22.33% in Sengottai local.

The performance of ginger genotypes under high rainfall region of Tamil Nadu had

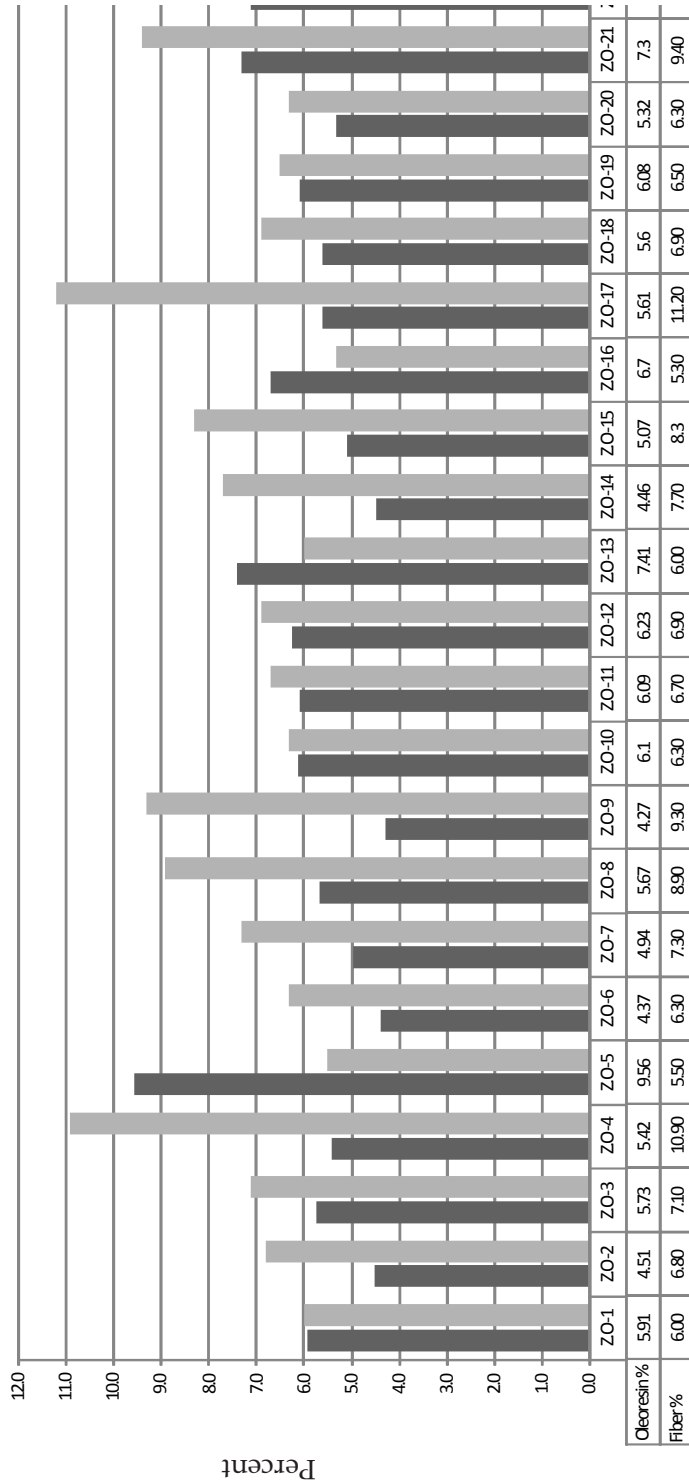


Fig. 1. Oleoresin and fiber content of ginger genotypes evaluated at high rainfall zone of Tamil Nadu

Table 1. Performance of ginger genotypes for morphological characters under high rainfall zone of Tamil Nadu

Cultivar/ Genotype name	Genotype	Plant height at harvest (cm)	Number of leaves plant ⁻¹ at harvest	Number of tillers plant ⁻¹ at harvest	Total leaf area plant ⁻¹ (cm ²)	No. of primary rhizome plant ⁻¹	No. of secondary rhizome plant ⁻¹
<i>IISR Varadha</i>	Z.O -1	80.30	97.4	12.1	7732.76	6.36	10.41
<i>Malai Inji</i>	Z.O -2	80.80	83.5	8.9	5644.31	6.40	7.60
<i>Pechiparai local</i>	Z.O -3	82.50	76.8	10.1	4971.81	7.01	10.20
<i>Sengottai local</i>	Z.O -4	81.10	103.2	12.3	7668.06	7.98	12.20
<i>Suprabha</i>	Z.O -5	78.20	76.4	9.1	4046.80	6.56	9.92
<i>Narasipatnam local</i>	Z.O -6	79.30	94.3	9.3	5375.00	6.96	9.96
V1S1 - 2	Z.O -7	76.10	71.6	8.4	3498.94	5.19	10.98
V1E8- 2	Z.O -8	77.20	71.2	9.0	3488.93	5.12	8.60
PGS - 8	Z.O -9	72.20	80.5	9.1	4496.31	5.96	8.47
V1K1- 1	Z.O -10	74.60	84.2	9.8	4350.88	5.43	10.08
<i>Muktha</i>	Z.O -11	70.40	80.2	9.9	5040.60	5.16	8.29
V1C - 8	Z.O -12	70.90	97.6	9.3	5460.84	6.26	8.31
V1S1 - 8	Z.O -13	69.80	83.8	8.8	4042.39	5.51	8.99
PGS -7	Z.O -14	71.40	83.9	9.5	4312.68	5.53	8.40
S 666	Z.O -15	67.70	73.3	9.2	3773.01	5.40	9.25
<i>Ranga</i>	Z.O -16	69.30	78.4	10.3	4578.58	4.91	7.58
PGS - 24	Z.O -17	71.70	78.1	10.4	4759.91	5.10	8.60
<i>Nadia</i>	Z.O -18	69.80	87.6	11.0	4352.38	5.39	7.31
<i>Suruchi</i>	Z.O -19	73.50	81.4	10.5	4314.42	6.21	7.98
<i>Suravi</i>	Z.O -20	75.70	97.7	10.2	6703.60	6.42	8.90
<i>Maran</i>	Z.O -21	66.30	90.2	9.2	5246.26	6.01	7.24
<i>Idukki local - 1</i>	Z.O -22	65.80	90.5	9.5	5334.60	5.80	7.18
<i>Idukki local - 2</i>	Z.O -23	55.70	90.9	10.0	4436.49	5.74	7.28
<i>Idukki local - 3</i>	Z.O -24	66.20	88.7	9.3	4022.93	5.24	7.63
	SEd _±	0.24	0.73	0.20	64.85	0.04	0.08
	CD (P<0.05)	0.49	1.52	0.36	130.55	0.09	0.15

Table 2. Performance of ginger genotypes for yield parameters under high rainfall zone of Tamil Nadu

Genotype	Fresh rhizome yield (g plant ⁻¹)	Dry rhizome yield (g plant ⁻¹)	Estimated green ginger yield (t ha ⁻¹)	Dry recovery (%)	Oleoresin content (%)	Fibre content (%)
Z.O -1	224.16	47.73	20.80	21.29	5.91	6.00
Z.O -2	171.48	34.17	14.08	19.93	4.51	6.80
Z.O -3	187.47	38.12	20.81	20.33	5.73	7.10
Z.O -4	227.47	48.57	22.16	22.33	5.42	10.90
Z.O -5	183.92	37.32	19.58	20.29	9.56	5.50
Z.O -6	183.75	41.28	18.65	22.47	4.37	6.30
Z.O -7	187.42	33.69	13.20	17.98	4.94	7.30
Z.O -8	201.56	33.62	13.64	16.68	5.67	8.90
Z.O -9	173.09	37.36	14.08	21.58	4.27	9.30
Z.O -10	179.15	28.65	12.32	15.99	6.10	6.30
Z.O -11	169.05	28.31	12.76	16.75	6.09	6.70
Z.O -12	167.60	34.45	18.00	20.55	6.23	6.90
Z.O -13	172.36	36.62	14.08	21.25	7.41	6.00
Z.O -14	185.12	36.59	17.60	19.77	4.46	7.70
Z.O -15	189.04	40.15	16.72	21.24	5.07	8.30
Z.O -16	169.27	31.05	17.07	18.34	6.70	5.30
Z.O -17	168.88	30.38	17.60	17.99	5.61	11.20
Z.O -18	187.61	32.71	18.48	17.44	5.60	6.90
Z.O -19	191.42	34.70	17.97	18.13	6.08	6.50
Z.O -20	207.18	38.00	19.17	18.34	5.32	6.30
Z.O -21	156.05	31.60	19.07	20.25	7.30	9.40
Z.O -22	152.65	29.58	17.60	19.38	7.11	7.60
Z.O -23	144.05	29.20	17.60	20.27	5.48	7.80
Z.O -24	142.36	28.10	16.13	19.74	4.12	6.10
SEd _±	1.23	0.32	0.16	0.10	0.03	0.08
CD (P<0.05)	2.47	0.63	0.31	0.21	0.56	0.17

significant variation in quality contents (Fig. 1). Fiber content is one of the most important criteria for assessing the suitability of ginger rhizome for its value addition like ginger paste, salted ginger, ginger powder etc. (Kizhakkayil & Sasikumar 2009). Fiber content estimated in the 24 genotypes revealed that, highest fiber content of 9.56% was recorded in the genotype Z.O - 5 (Suprabha) followed by 7.41% in Z.O - 13 (V1S1 - 8 from Pottangi). The best fresh rhizome yielder Sengottai local recorded only 5.42% of fiber content. Flavour and pungency of ginger is valued by the quantum of oleoresin present in the rhizomes (Menon 2007). Among the 24 genotypes Z.O - 17 (PGS - 24 from Pottangi) recorded the highest oleoresin content of 11.20% followed by the genotype Sengottai local which recorded 10.90% of oleoresin.

Acknowledgement

The authors are highly grateful to Dr. T. John Zachariah, Principal Scientist, ICAR-Indian Institute of Spices Research, Kozhikode for the estimation of oleoresin and fiber content in ginger rhizome accessions used for this study.

References

- Chongtham T, Chatterjee R, Hnamte V, Chattopadhyay P K & Khan S A 2013 Ginger (*Zingiber officinale* Rosc.) germplasm evaluation for yield and quality in southern West Bengal. J. Spices Arom. Crops 22: 88–90.
- Durgavathi V 2011 Evaluation of ginger (*Zingiber officinale* Rosc.) genotypes for growth, yield and quality under coconut ecosystem. M.Sc., (Hort.) Thesis TNAU Coimbatore Tamil Nadu, India.
- Kizhakkayil J & Sasikumar B 2009 Variability for quality traits in a global germplasm collection of ginger (*Zingiber officinale* R.). Curr. Trends Biotechnol. Pharm. 3: 254–259.
- Latha P, Giridharan M P & Naik B J 1995 Performance of turmeric (*Curcuma longa* L.) cultivars in open and partially shaded conditions under coconut. J. Spices Arom. Crops 4: 139–144.
- Menon A N 2007 Chemical composition of the essential oil from leaves and roots of ginger (*Zingiber officinale*) from Kerala. J. Med Arom. Plant Sci. 29: 78–80.
- Panase V G & Sukhatme P V 1985 Statistical methods for agricultural workers ICAR Publications, New Delhi.
- Sangeetha K S & Subramanian S 2015 Evaluation of ginger (*Zingiber officinale* Rosc.) genotypes under coconut ecosystem. Bioscan 10: 1925–1928.
- Sharatbabu A, Goudar P M, Gangadharappa Shashidhar M, Dodamani Cherukupalli Lokesh & Vittal Uddappa Dharamatti 2017 Evaluation of ginger (*Zingiber officinale* Rosc.) genotypes for growth and yield attributes. Int. J. Pure App. Biosci. 5: 994–999.