International Journal of Plant & Soil Science

Volume 35, Issue 22, Page 605-610, 2023; Article no.IJPSS.109783
ISSN: 2320-7035

Assessment of Ginger Genotypes under Coconut Ecosystem for Quantitative and Qualitative Traits

V. Sivakumar [a*], M. Kumar [a], R. Balakumbahan [b], K. Vanitha [a], D. Vidhya [a], S. Karthikeyan [a] and R. Sudha [c]

[a] Horticultural College & Research Institute, Tamil Nadu Agricultural University, Coimbatore, India.
[b] Horticulture Research Station, Tamil Nadu Agricultural University, Thadiyankudisai, India.
[c] ICAR-Central Plantation Crops Research Institute, Kasaragod, Kerala, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2023/v35i224170

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/109783

Original Research Article

Received: 23/09/2023
Accepted: 28/11/2023
Published: 04/12/2023

ABSTRACT

Ginger is one of the major spice grown in subtropical hilly regions and ultivation of ginger under coconut ecosystem is gaining popular among the farmers. Coimbatore district, Pollachi region is one of the major coconut growing belt in Tamilandu. With this view an experiment was conducted to evaluate the performance of ginger genotypes under coconut ecosystem at Coconut Research Station, Aliyar Nagar, Tamil Nadu Agricultural University, Coimbatore during 2018- 2020. . Fourteen ginger genotypes/ varieties were collected for this study. The ginger rhizomes were sown in the prepared land all cultural operations as per the TNAU recommendations were followed uniformly. Growth and yield parameters of ginger genotypes were recorded for three seasons. The date collected were pooled and analysed for statistical significance. Among the fourteen varieties of ginger, var. Athira excelled with respect to number of primary fingers (4.8), length of primary fingers (4.4 cm), diameter of primary finger (2.5 cm), number of secondary finger (5.7), days to maturity (248), TSS (10.4^0 Brix), acidity (0.41%), Dry matter content (18.9%), fibre content (9.6%),

**Corresponding author: E-mail: sivakumarv@tnau.ac.in;*

Essential oil content (11.2 mg/g of dry ginger), Gingerol content (19.6 mg/g of dry ginger) and lowest incidence of soft rot (11.4 %). On the basis of good performance Athira is adjudged as the suitable ginger genotype under coconut shade condition of this region.

Keywords: Ginger genotypes; coconut ecosystem; quality parameters.

1. INTRODUCTION

"Ginger (*Zingiber officinale* Rosc.) is an herbaceous perennial belonging to the family Zingiberaceae and is one of the important commercial spice crops of the tropical and subtropical regions valued all over the world from ancient period for its aroma, flavour and also medicinal properties" [1]. "The economic part is the underground rhizome, which is pungent and aromatic and is largely used in the manufacture of ginger pill, ginger oil, ginger essence, soft drink, non-alcoholic, ginger oleoresin or gingerin. South East Asia is a major ginger producing region and, in this region, leading ginger producing countries are China, India, Nepal and Vietnam. India is a leading producer of ginger in the world and the country produces" [2]. "Growing of ginger in coconut plantation proves profitable without hampering the performance of the main crop" [3]. "These coconut gardens offer similar climatic conditions that exist in the sub tropical areas where the ginger is a regular crop. Hence, there is an ample opportunity for the remaining shaded area of coconut gardens to grow intercrops such as ginger and turmeric, which are shade loving / tolerant and highly profitable crops" [4]. Similar results was also obtained by Amin et al. [5] in ginger with agroforestry model and proved ginger is a scicophytic crop performing remarkably well under partial shade (50±5%) than the open field. Ginger is cultivated in most of the states in India. However, states namely Madhya Pradesh, Karnataka, Orissa, Assam, Maharashtra, Meghalaya, Arunachal Pradesh and Gujarat together contribute 65 per cent to the country's total production. It grows well in warm and humid climate and is cultivated from sea level to an altitude of 1500 m above sea level. Ginger can be grown both under rainfed and irrigated conditions. For successful cultivation of the crop, a moderate rainfall at sowing time till the rhizome sprout, fairly heavy and well distributed showers during the growing period and dry weather for about a month before harvesting are necessary. Ginger thrives in well-drained soil like sandy loam, clay loam, red loam or lateritic loam. For any breeding program, the available germplasm serves as most valuable natural reservoir for proving donor parent to improve the particular traits by genetic reconstruction of plant [6]. Therefore, collection, conservation and evaluation of germplasm are essential at present as well as future crop improvement programmes. In Tamil Nadu, Coimbatore occupies top position in area under coconut with 88,467 ha. With this background in consideration of augmenting the additional income to the coconut planters, the present study was undertaken with fourteen ginger genotypes collected from different sources and evaluated their performance under coconut ecosystems at Coconut Research Station, Aliyarnagar, Pollachi region of Tamil Nadu.

2. MATERIALS AND METHODS

The present investigation was carried at Coconut Research Station, Aliyar Nagar during 2018-19 and 2019-20 under the 40 years coconut plantation with 50% shade. The research plot is located in between $10^0$29 N latitude and 76.58^0 E longitude having elevation of 288 m above the mean sea level in the western zone of Tamil Nadu which falls under humid tropical climate. Fourteen ginger genotypes *viz.,* Rejetha, Ashwathy, Maran, Karthika, GCP 49, IISR 1 (GB), Mahima, ACC 578, Athira, ACC 581, Rio de Janeiro, Varadha, Thadimaram and Gudalore local were collected from different parts of India. The experiment was laid out in Randomized Block Design (RBD) with three replications.

The experimental field was prepared by ploughing with cultivator followed by leveling where well decomposed manure F.Y.M @ 25 tonnes per hectare were applied at 30 days before sowing. Selected rhizomes of large shiny, free from spots or marks bud or eye injury were cut into bits of 3-5 cm in the length, 15- 20 g in weight and at least one sound bud. The prepared rhizomes were treated with Copper oxy chloride 3 g/lit as a prophylactic measure to escape from soft rot and to induce early sprouting. Single row of 1.30 m plot with the spacing of 30 cm row to row and 30 cm plant to plant was maintained. The bits of each genotype were sown and irrigation was done at weekly interval as per requirement. 50: 25 kg/ha of Phosphorous and potassium fertilizers were applied as basal and 37.5: 12.5 kg of N and K per ha were applied on 45th and 90th day after planting as top dressing. In order to make the field free from weeds, three

manual weeding were done at 30, 45 and 60 days, respectively. The recommended cultural practices and plant protection measures were adopted to raise a healthy crop. The data were recorded from five randomly selected plants from each treatment in each replication. Mean data was used for statistical analysis for thirteen diverse traits *viz*. Number of primary fingers, Length of primary fingers (cm), Diameter of primary finger (cm), Number of secondary finger, Lowest days to maturity, TSS (^{0}Brix – refractometer method), acidity (%), Dry matter content (%), fibre content (%), Essential oil content (mg/g of dry ginger), Gingerol content (mg/g of dry ginger) and Percent Disease Incidence (%). The data were statistically analyzed following the procedure of Panse and Sukhatme [7].

3. RESULTS AND DISCUSSION

Significance performance variations were exhibited by the tested varieties of ginger under the shade of coconut plantations of Alayar Nagar. More number of primary fingers (4.8) were observed in the variety Athira. The parallel results were also observed by Balakumbahan and Joshua [8] and Karthikeyan et al. [9] in ginger. Length of primary fingers (4.4 cm), Diameter of primary finger (2.5 cm), No. of secondary finger (5.7) also found hiher in the same variety. The genetic characters of this variety had adopted well to the ecology of the tested region might be the reason for the superior performance. Earliness in maturity is one of the important charater of ginger mainly influenced majorly by genetically as well as by the environmental factors to the some extent. Among the ginger varieties examined, minimum days taken for maturity (248) was observed in variety Athira, The same trend was also noticed in terms of TSS (10.4˚ Brix), lowest acidity (0.41%), Dry matter content (18.9%), fibre content (9.6%), Essential oil content (11.2 mg/g of dry ginger), Gingerol content (19.6 mg/g of dry ginger) and lowest incidence of soft rot (11.4 %) (Table 1). Number of primary and secondary rhizomes are directly contributing for ginger yield. The number of primary rhizomes ranged from 3.1 to 4.8 and the maximum was recorded in the variety Athira in which the length (4.4) and diameter of primary rhizome (2.5cm) was also found higher. The same trend was also observed for highest secondary rhizome (5.7), dry recovery percentage dry matter content of 18.9 %, fibre content (9.6%). Chongtham et al. [10] stated that suitable agro-climatic conditions and cultural practices have a profound influence on determining the quality characters of ginger. The variations in the eco conditions and the cultural practices adopted in that region might be the reason for this as reported by Latha et al. [11] in turmeric and Sangeetha & Subramanian [12] in ginger. Essential oil content and Gingerol content of ginger genotypes ranged between 8.3 to 11.2% and (15.6 to 19.6 %). The maximum was observed in the genotype Athira. The genotype Athira recorded lowest incidence of soft rot (11.4%). It could be attributed to the influence of environmental condition. Flavour and pungency of ginger is valued by the quantum of oleoresin present in the rhizomes [13]. Such type of variation with respect to lower crude fibre content was also reported Kale [14] in genotype Basavakalyan up to 3.28 per cent under Ghataprabha left bank command area of north Karnataka. The genetic character coupled with suitable agro climatic conditions prevailed in the study area helped the ginger variety Athira for bette performance with respect to growth yield and quality.

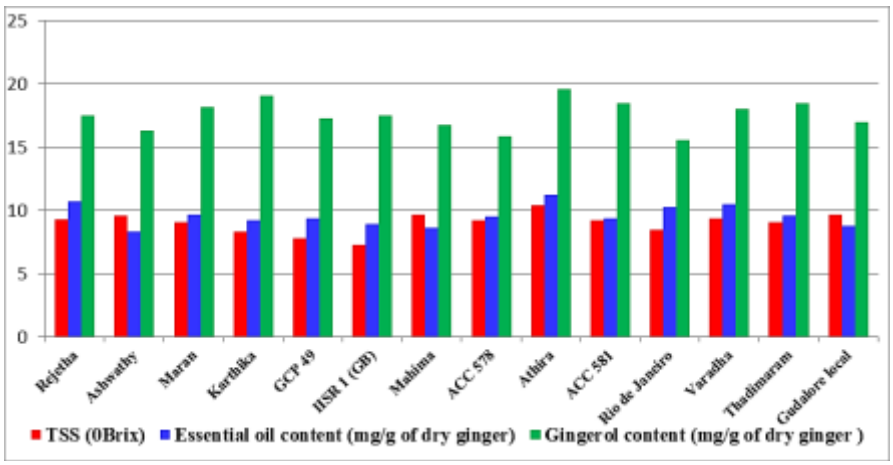

Fig. 1. Quality attributes of ginger genotypes under coconut ecosystem

Table 1. Quality attributes of ginger genotypes under coconut ecosystem

Genotypes	No. of primary fingers	Length of primary fingers (cm)	Diameter of primary finger (cm)	No. of secondary finger	Days to maturity	TSS (^{0}Brix)
Rejetha	3.8	3.9	1.9	4.6	242	9.3
Ashwathy	3.5	3.2	2.1	4.1	258	9.6
Maran	3.3	2.9	1.9	3.9	261	9.1
Karthika	3.2	3.4	2.1	3.5	259	8.3
GCP 49	4.3	2.8	2.3	4.6	249	7.8
IISR 1 (GB)	4.2	2.4	1.9	4.0	276	7.3
Mahima	3.8	2.6	1.8	4.3	279	9.7
ACC 578	4.4	3.2	1.9	4.4	265	9.2
Athira	4.8	4.4	2.5	5.7	248	10.4
ACC 581	3.5	2.3	2.1	4.6	267	9.2
Rio de Janeiro	3.2	3.8	2.0	4.8	255	8.5
Varadha	3.7	3.3	2.3	4.9	261	9.4
Thadimaram	3.1	3.6	1.7	5.1	259	9.1
Gudalore local	4.2	3.4	1.9	5.0	267	9.7
Mean	3.8	3.2	2.0	4.5	260.4	9.0
S.Ed	0.22	0.27	0.05	0.16	8.81	0.17
CD (p=0.05)	0.46	0.55	0.11	0.32	18.10	0.35

Table 2. Quality attributes of ginger genotypes under coconut ecosystem

Genotypes	Acidity (%)	Dry matter content (%)	Fibre content (%)	Essential oil content (mg/g of dry ginger)	Gingerol content (mg/g of dry ginger)	Incidence of soft rot (%)
Rejetha	0.56	17.8	9.1	10.7	17.5	15.2
Ashwathy	0.49	17.4	7.3	8.3	16.3	12.5
Maran	0.53	15.6	5.7	9.7	18.2	14.6
Karthika	0.57	15.7	6.4	9.2	19.1	17.5
GCP 49	0.48	14.5	7.8	9.4	17.3	18.4
IISR 1 (GB)	0.50	15.2	5.5	8.9	17.5	16.5
Mahima	0.57	16.8	5.8	8.6	16.8	17.0
ACC 578	0.54	16.3	6.9	9.5	15.9	18.5
Athira	0.41	18.9	9.6	11.2	19.6	11.4
ACC 581	0.53	16.5	8.1	9.4	18.5	19.2
Rio de Janeiro	0.55	18.0	7.4	10.3	15.6	18.9
Varadha	0.58	18.2	5.2	10.5	18.0	21.4
Thadimaram	0.49	15.7	8.4	9.6	18.5	16.5
Gudalore local	0.48	16.6	8.1	8.8	17.0	19.4
Mean	0.5	16.7	7.2	9.6	17.6	16.9
S.Ed	0.03	0.76	0.36	0.40	0.32	1.23
CD (p=0.05)	0.06	1.56	0.73	0.81	0.67	2.52

4. CONCLUSION

Based on the study conducted with fourteen genotypes/varieties of ginger under the shade of 40 year old coconut plantation in Aliyar Nagar region, it is concluded that the ginger variety Athira is best suitable for commercial cultivation than other ginger.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Sivakumar V, Kumar M, Balakumbahan R, Vanitha K, Vidhya D, Karthikeyan S, Sudha R. Evaluation of Ginger (*Zingiber officinale* Rosc) Genotypes under Coconut Ecosystem. International Journal of Environment and Climate Change. 2023; 13(10):3438–3443.
2. FAO; 2021. World Food and Agriculture - Statistical Yearbook 2021. Rome. Available:https://doi.org/10.4060/cb4477en
3. Roy SS, Hore JK. Influence of organic manures on growth and yield of ginger. J. Plantn. Crops. 2007;35(1):52-55.
4. Meerabai M, Jayachandran BK, Asha KR, Geetha V. Boosting spice production under coconut gardens of Kerala: yield maximization of ginger with balanced fertilization. Better Crops International. 2001;15(1):25-17
5. Amin MR, Ikbal TMT, Miah MMU, Hakim MA, Amanullah ASM. Performance of ginger under agroforestry system. Bangladesh Research Publications J; 2010;4(3):208-217.
6. Hawkes JG. Germplasm collection, preservation, and use. In Plant Breeding II. K.J. Frey, ed. Ames, Iowa: The Iowa State University Press. 1981;57-83
7. Panse VG, Sukhatme PV. Statistical methods for agricultural workers ICAR Publications, New Delhi; 1985.
8. Balakumbahan R, Joshua JP. Yield and quality evaluation of ginger (*Zingiber officinale* Rosc) genotypes under high rainfall zone of Tamil Nadu. Journal of Spices and Aromatic Crops. 2017;26(2): 95-99.
9. Karthikeyan S, Anand M, Malathi S, Manonmani S. Evaluation of ginger (*Zingiber officinale*) Genotypes for High Yield and Resistance to Soft Rot Suitable for Gudalur Regions in Nilgiris Distric. Int. J. Curr. Microbiol. App. Sci. 2018;7(7): 2979-2985.
10. Chongtham T, Chatterjee R, Hnamte V, Chattopadhyay PK, Khan SA. Ginger (*Zingiber officinale* Rosc.) germplasm evaluation for yield and quality in southern West Bengal. J. Spices Arom. Crops. 2013;22:88–90
11. Latha P, Giridharan MP, Naik BJ. Performance of turmeric (*Curcuma longa* L.) cultivars in open and partially shaded conditions under coconut. J. Spices Arom. Crops. 1995;4:139–144.
12. Sangeetha KS, Subramanian S. Evaluation of ginger (*Zingiber officinale* Rosc.) genotypes under coconut ecosystem, The Bioscan. 2015;10(4):1925-1928
13. Menon AN. Chemical composition of the essential oil from leaves and roots of ginger (*Zingiber officinale*) from Kerala. J. Med Arom. Plant Sci. 2007;29:78–80.
14. Kale UB. Quality of ginger genotypes in the Ghataprabha left bank command area of Northern Karnataka. Karnataka Journal of Agriculture Sciences. 2003;16(4):633-635.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/109783