~~*Per se a*~~Assessment of ginger genotypes under coconut ecosystem for Quantitative and ~~q~~Qualitative traits

Abstract

An experiment was conducted to evaluate the performance of fourteen ginger genotypes under coconut ecosystem at Coconut Research Station, Aliyar Nagar, Tamil Nadu Agricultural University, Coimbatore during 2018-19. The results showed that the highest Number of primary fingers (4.8), Length of primary fingers (4.4 cm), Diameter of primary finger (2.5 cm), No. of secondary finger (5.7)~~.~~, ~~Lowest~~ minimum days to maturity (248), TSS (10.4^0 Brix), lowest acidity (0.41%), Dry matter content (18.9%), fibre content (9.6%), Essential oil content (11.2 mg/g of dry ginger), Gingerolcontent (19.6 mg/g of dry ginger) and lowest incidence of soft rot (11.4 %) was registered in Athira~~,~~. On the basis of good performance Athira is adjudged as the suitable ginger genotype under coconut shade condition.

Key words: ginger genotypes, coconut ecosystem, quality parameters

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. 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 ~~7.45 lakh tonnes of the spice from an area of 15.78 hectares.~~ (NHB, 2014). Growing of ginger in coconut plantation proves profitable without hampering the performance of the main crop (Roy and Hore, 2007). 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 (Meerabai et al., 2001). Similar results was also obtained by Amin et al.

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(2010) 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 Karnataka, Orissa, Assam, 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 (Hawkes, 1981). Therefore, collection, conservation and evaluation of germplasm are essential at present as well as future crop improvement programmes. With this background in consideration, 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.

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Materials and Methods

The present investigation was carried out under coconut shade at Coconut Research Station, Aliyar Nagar during 2017-18 and 2018-19. which 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.

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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 was treated with fungicide Copper oxychloride 3 g/lit or 200 ppm Streptocycline for 30 minutes as a safeguard against 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

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genotype were sown and irrigation was done at weekly interval as per requirement. The crop was fertilized with 50: 25 kg of P and K per ha as basal and 37.5: 12.5 kg of N and K per ha applied on 45th and 90th day after planting as top dressing. N, P_2O_5 and K_2O were supplied by urea, single super phosphate and muriate of potash, respectively. In order to make the field free from weeds, three manual weedings 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 and replication. ~~-wise~~ ~~mean~~ Mean data was used for statistical analysis for thirteen diverse traits *viz*. ~~No.~~Number of primary fingers, Length of primary fingers ~~(~~ cm), Diameter of primary finger (cm), ~~No.~~Number of secondary finger, Lowest days to maturity, TSS (^{0}Brix), lowest acidity (%), Dry matter content (%), fibre content (%), Essential oil content (mg/g of dry ginger), Gingerol content (mg/g of dry ginger) and ~~lowest incidence of~~ soft rot incidence (%). The data were statistically analyzed following the procedure of Panse ~~&~~and Sukhatme (1985).

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Result and Discussion

The results showed that the highest Number of primary fingers (4.8), Length of primary fingers (4.4 cm), Diameter of primary finger (2.5 cm), No. of secondary finger (5.7) , Lowest days to maturity (248), TSS (10.4 ~~°~~^{0}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 %) was recorded in Athira during 2018-19 (Table 1). ~~.~~Leaf area influences the photosynthetic efficiency of plants and the leaf area in ginger genotypes under Aliyarnagar condition varied significantly. The highest 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 4.4 to 5.7. The maximum length (4.4) and~~,~~ diameter of primary rhizome (2.5cm) was recorded in Athira ~~(4.4 & 2.5 cm)~~ and the same genotype recorded the highest secondary rhizome (5.7) also. Dry recovery percentage varied significantly varied from genotypes. The genotype, Athira had recorded higher dry matter content of ~~(~~18.9 %~~)~~, fibre content (9.6%). Chongtham et al. (2013) stated that agro-climatic condition 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. 1995~~)~~ in turmeric and ~~(~~Sangeetha & Subramanian 2015~~)~~ in ginger. Essential oil content and Gingerol content of ginger genotypes ranged between 8.3 to 11.2%

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and (15.6 to 19.6 %), the maximum essential oil content and Gingerol content of 11.2% and 19.6% respectively was observed in the genotype Athira. In the present study the genotypes varied significantly for oleoresin content. 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 (Menon 2007). Such type of variation with respect to lower crude fibre content was also reported (Kale ~~U.B.~~ 2003) ~~[9]~~ in genotype Basavakalyan up to 3.28 per cent under Ghataprabha left bank command area of north Karnataka. This indicated that agro-climatic condition and cultural practices have a profound influence on determining the quality characters of ginger.

Conclusion

Higher yield and quality components contribute positively for the higher yield in crop plants. On evaluation of fourteen genotypes for yield and quality characters, the genotype Athira has excelled for cultivation under the coconut ecosystems of Coimbatore district.

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1.Environmental Considerations for Assessing ginger genotypes under a coconut ecosystem 2. Adaptation of ginger to Specific Ecosystems. 3. Crop Diversity and Genetic improvement

References

Comment [RN15]: Correct it as per the journals guidelines

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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