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

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; SP3: 479-481

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

Quality of ginger (*Zingiber officinale* Rosc.) genotypes grown under soppinabetta ecosystem of Karnataka

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Abstract
Ginger (*Zingiber officinale* Rosc.) has been used by traditional Chinese and Indian medicine for over 25 centuries. The active components of ginger are reported to stimulate digestion, absorption, relieve constipation and flatulence by increasing muscular activity in the digestive system. The experiment was conducted to assess the quality of ginger genotypes under Soppinabetta ecosystem in Karnataka. The genotype Rio-de-Janeiro recorded maximum oleoresin and essential oil content (2.55% and 8.04% respectively) which was on par with Hummnabad Local (7.10% and 2.33%). Maximum dry ginger recovery percentage was recorded in Hummnabad Local (27.35%). The genotype Himagiri recorded maximum crude fiber content (4.87%). The study indicated that the local genotype also have the potential to perform better following standard package of practices. It indicated that local cultivar Humnabad Local is well acclimatized with the soil and climatic conditions of the state.

Keywords: *Zingiber officinale*, *quality*, essential oil, oleoresin, crude fibre

Introduction
Ginger (*Zingiber officinale* Rosc.) has been used by traditional Chinese and Indian medicine for over 25 centuries [1]. It is an herbaceous perennial, rhizomatous spice crop containing volatile oil, fixed oil, pungent compounds, resins, starch, protein and minerals. Among the many components, 'alpha zingiberene' is the predominant component of essential oil. 'Gingerol' and 'Shagoal' are responsible for the characteristic pungency of the ginger rhizome. The active components of ginger are reported to stimulate digestion, absorption, relieve constipation and flatulence by increasing muscular activity in the digestive system. In traditional Chinese medicine, ginger is used to improve the flow of body fluids. It stimulates blood circulation throughout the body by powerful stimulatory effect on the heart muscle and by diluting blood. It is one of the major spice cultivated in India. Quality of ginger is mainly determined by its essential oil, non-volatile ether extract (oleoresin) and crude fibre content. India is the leading producer and exporter of ginger in the world. There is a need for genetically superior strains containing high essential oil and oleoresin content. Besides obtaining higher yields, superior quality of the produce is also important for export to fetch premium price in the international market quality of the produce is largely determined by the minimum fibre content and good aroma. Oleoresin content is important attribute to decide the quality of ginger rhizomes. Apart from having tangy flavour, fresh rhizome has appreciable quantities of proteins (2.3%), carbohydrates (12%), fats (1%), minerals (1.2%) and moisture (81%) of fresh rhizome [2]. In India, it is grown in an area of 1, 65,000 hectares with an annual production of 10, 81,000 MT with productivity of 6.57 MT per hectare [3].

Material and methods
Definite quantity of rhizome samples in each replication of each entry were labeled and used for determining the quality parameters including essential oil content (on F/W basis), oleoresin content and crude fibre in percentage were recorded after harvesting of rhizomes. Essential oil content was determined by hydro distillation of freshly harvested rhizomes using Clevenger type apparatus (Fig-1). Fresh rhizomes were boiled for about 2 to 4 hours crop heat exchange unit and oil content was noted. For extraction of oleoresin, pre-weighed finely ground ginger

powder was extracted for 18 hours in Soxhlets apparatus (Fig-2) with anhydrous petroleum either. The extract was transferred to a capsule and kept for extraction at room temperature. Then it was dried in hot air oven at 110 ^{0}C till the loss in weight between successive weighing was less than 2 mg. The oleoresin (Nonvolatile Ether Extract, i.e. NVEE) was calculated by using the formula [4].

$$\text{NVEE \% by weight on dry weight basis} = \frac{\text{Loss in wt. of sample (g)}}{\text{Weight of sample taken (g)}} \times 100$$

Fig 1: Clevenger's apparatus for Essential oil distillation

Fig 2: Soxhlet apparatus for Oleoresin extraction

For determining the crude fibre content in rhizomes, 2 g of dry ginger powder was extracted in Soxhlets apparatus for 18 hours with petroleum either. The dried material was boiled in 200 ml of H_2SO_4 (1.25%) for 30 minutes before filtering through muslin cloth and washed with boiling water. The residue was boiled with 200 ml of sodium hydroxide (1.25%) for 30 minutes and filtered through muslin cloth. It was further washed in 2.5 ml of boiling H_2SO_4 (1.25%) and water. The residue was transferred to weighing ash dish (W_1), First, the residue was dried for two hours at 130+2 ^{0}C and weight was taken (W_2). After that it was ignited for 30 minutes at 600± 15 ^{0}C and pre weighed (W_3). The crude fibre content in ginger rhizome was estimated by using formula [5].

$$\text{Crudefibre (\%)} = \frac{(W_2 - W_1) - (W_3 - W_1)}{\text{Weight of the sample (g)}} \times 100$$

The data collected were subjected to statistical analysis (Panse and Sukhatme 1967) [6] was referred for determination of standard error of mean (S.Em.±) and critical difference (C.D).

Results and discussion

The present study indicated that the genotype Rio-de-Janeiro recorded higher essential oil content of 2.52%, which was on par with Humnabad Local (2.33%), IISR Rajatha (2.25 %), Suruchi (2.11 %) and Jorhat-1 (2.08%). The lower essential oil content was recorded in Karkala Local (1.52 %) [Table-1]. Similarly, the genotype Rio-de-Janeiro had the maximum essential oil content (2.40% and 2.35%) under open and coconut shade respectively in Gokak, Karnataka condition reported (Hegde *et al*., 2006) [7].

Oleoresin is an important quality parameter in deciding quality of ginger. In the present study the genotypes varied significantly for oleoresin content. The genotype Rio-de-Janeiro recorded highest oleoresin content (8.04%) which was on par with Humnabad Local (7.10%). The genotype Jorhat-1 recorded the lowest oleoresin content (3.93%) [Table-1]. It could be attributed to the influence of environmental condition on the inherent genetic constitution resulting in better accumulation of photosynthates.

Table 1: Quality attributes of different ginger genotypes under Soppinabetta ecosystem

S. No.	Genotypes	Essential oil content (%)	Oleoresin content (%)	Dry Ginger recovery (%)	Fiber content (%)
1	Suprabha	1.62	5.91	20.88	4.08
2	IISR-Mahima	1.92	4.71	25.10	4.04
3	Karkala Local	1.52	5.10	24.03	4.78
4	Humnabad Local	2.33	7.10	27.35	3.91
5	Himagiri	1.85	4.15	20.40	4.87
6	IISR-Varada	1.82	4.77	22.09	3.20
7	Suravi	1.95	5.17	22.51	3.90
8	Shikaripura Local	1.64	4.55	22.59	3.64
9	Suruchi	2.11	5.10	19.15	3.79
10	Jorhat-1	2.08	3.93	17.17	3.89
11	Himachal	1.69	4.69	21.32	4.01
12	Rio-de-Janeiro	2.52	8.04	24.80	4.50
13	IISR-Rajatha	2.25	5.99	20.07	4.18
14	Bidar-1	1.83	4.41	18.54	4.00
15	Jorhat-2	1.80	4.23	20.46	3.88
16	Bidar-2	1.79	4.32	20.35	4.05
	CD (0.05)	0.54	1.12	4.56	0.78
	CV (%)	13.13	10.22	11.13	9.03

%- per cent, CD- Critical difference @ 5 % level of significance.

The analysis revealed that some amount of variation existed with respect to the locations, the Cv. Suravi recorded highest oleoresin content (10.25 %) and lowest was recorded in Sambuk local (3.00 %) in southern West Bengal condition [8] (Chongtham *et al.*, 2013). Such variation with respect to oleoresin content in ginger under different agro-climatic condition was also reported by (Hegde *et al.*, 2006) [7] under open and shaded condition.

The genotype Humnabad Local recorded the maximum dry ginger recovery (27.35%) which was on par with the genotype IISR- Mahima (25.10%), Rio-de-Janeiro (24.80%) and Karkala Local (24.03%). The lowest dry ginger recovery

percentage was recorded in the genotype Jorhat-1 (17.17%). Under west Bengal condition difference in dry ginger recovery varied from 26.90% to 33.48% (Chongtham *et al.*, 2013) [8]. The genotype IISR-Varada recorded lower crude fibre content (3.20%) followed by Suruchi (3.79%). Higher crude fibre content was recorded in the genotype Himagiri (4.87%). 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

The study revealed that the local genotype also has the potential to perform better by following standard package of practices. It indicated that local cultivar Humnabad Local is well acclimatized with the soil and climatic conditions of the state. The other improved cultivars possibly could not exhibit their full potential due to variation in soil and climatic conditions from the area of collection.

Acknowledgement

The authors are grateful to Dr. Gangadharappa P.M. Head, Division of PSMA, K. R. C. C. H. Arabhavi for facilitating the research and Lab Asst. Hanmanth Jalli for support.

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