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Qualitative analysis of various ginger (*Zingiber officinale* Rosc.) genotypes suitable in Nagaland

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ABSTRACT

Ginger is a perennial tropical herb, the economic part being the rhizome used mostly as a spice all over the world. In Nagaland, ginger is cultivated under rainfed condition and it is the main cash crop supporting the livelihood and improving the economic level among the ginger growers. The investigation was done to assess the performance of different ginger genotypes for qualitative parameters at experimental farm of School of Agricultural Sciences and Rural Development, Medziphema campus, Nagaland University during the year 2021-2022. Seventeen genotypes were collected from different districts of Nagaland, namely Jalukie, Pherema, Medziphema, Chumoukedima and planted for the evaluation and qualitative performance of genotypes suitable in Nagaland condition. The genotype 'BGG-8' performed better for qualitative parameters such as oil content (2.83%), oleoresin content (6.59%) followed by 'CBG-1' having oil content (2.57%), oleoresin content (5.21%), fibre content (4.77%) and 'CBG-4' having oil content (2.47%), oleoresin content (4.83%).

***Keywords*:** Genotypes, ginger, performance**,** qualitative

INTRODUCTION

Ginger is valued as a medicinal crop and has been used as a spice for over 2000 years (Bartley and Jacobs, 2000). It has a significant role in our national economy. The scientific name of ginger is *Zingiber officinale* Roscoe belonging to the family Zingiberaceae under the order Zingiberales. Ginger possesses a refreshing aroma along with strong taste which makes it an important ingredient in the world food processing industry (Sarwar and Butt, 2016). Dry gingers are used in the manufacturing of non-alcoholic beverages and food products (Afzal *et al.*, 2001). The ginger rhizome is one of the most common constituents of diets worldwide and is reported to possess antioxidants, anti-inflammatory, antiseptic and carminative properties. (Sekiwa *et al*., 2000). The aroma of ginger is due to the presence of more than 70 constituents present in the volatile oil of rhizome. The aroma and flavor of fresh ginger will be different from dry ginger because some of the volatile oils are lost by evaporation during drying (Hazarika and Kakoti, 2013). India accounts for 30% production of ginger in the global market (Sial and Tarai, 2017).

Many ginger cultivars are grown in North Eastern region. In India 70% of the total ginger production is from the North-East. Ginger cultivars grown in North-East Region vary from each other in quality, quantity and productivity. In India, the North Eastern hills (NEH) region accounts for 49% of the area for ginger and 72% for production (Rahman *et al.*, 2009). Nagaland falls under sub-tropical and temperate climate where farmers cultivate ginger and use their own seed stock and as such they were not able to specify the variety they have grown and they named their cultivar according to their locality. The cultivars are Ungma, Yisimyong, Chanki from Mokokchang District; Longkhim, Shamtor from Tuensang District; Kedima, Tsemenyu, Jalukie from Kohima District (Kanjilal *et al.*, 1997). The objective of this experiment was to analyse the quality of ginger genotypes grown suitably in Nagaland.

MATERIALS AND METHODS

The field experiment was carried out at the Horticultural Farm of School of Agricultural Sciences and Rural Development (SASRD), Medziphema, Nagaland University during April 2021 to March 2022. The site is located at an altitude of 310 m above mean sea level with 20°45'43"N latitude and 95°53'04"East longitude. The climatic condition of the experimental site is sub-tropical, high humid and moderate temperature about 12 ° C to 32° C. The area receive medium to high rainfall (2000-3000mm) with relative humidity of 70% to 80%. The experimental plot soil was sandy loam and well drained. A total of seventeen ginger genotypes were collected from Nagaland and assessed for its qualitative traits**.** The experiment was laid out in Randomized Block Design (RBD) with seventeen treatments of ginger genotypes replicated three times. The healthy seed rhizomes weighing around 25-30 g were planted on a raised bed of size 1 m x 2 m at a spacing of 30 cm x 25 cm between rows and in between plants at a depth of 5-7 cm with the bud facing upward in the first week of April, 2021. Five plants in each plot were selected randomly and they were tagged for taking data on the qualitative traits viz. oil content, fibre content, oleoresin content and dry recovery. The rhizomes were carefully harvested with the help of khurpi and spade to minimize injury. The harvested rhizomes were kept separately for all plots and the tagged rhizomes were also kept separately for taking further observations**.** Fresh ginger oil was extracted by using modified Clevenger's method as mentioned in Official Methods of Analysis, Association of Official Analytical Chemists (A.O.A.C, 1976). 200 g of fresh ginger was ground using mortar and pestle. Then it was transferred to the apparatus and 500 ml of distilled water was added. It took 6 hours to extract the fresh ginger oil for each sample. Percentage of extracted oil was measured in the form of volatile oil (ml) per weight of sample used (g). The oil content percentage was calculated by volume of oil extracted in (ml) divided by the weight of sample used in (g) multiplied by 100. For determining the fibre content in rhizomes, Leibig's digestion apparatus was used. 2g of fine powdered ginger were put into a beaker and 200 ml of 1.25% H_2SO_4 was added. Then it was boiled for 30 minutes in the digestion bench. The contents of the beaker were then filtered using muslin cloth and the residue were washed thoroughly using distilled water till the pH neutralizes. After washing, the residue was transferred into the beaker and 200 ml of 1.25% NaOH was added. Again it was boiled for 30 minutes in the digestion bench and the contents were again filtered and washed. The residue was then transferred to the Gooch crucible which was already weighed and it was oven dried for 1 hour. Weight was taken after it was oven dried and the sample was kept in muffle furnace for 20 minutes to obtain the ash content. The crucible is cooled and the weight was taken. The fibre content was calculated by the loss in weight of sample divided by weight of sample taken multipled by 100 (George, 1961). Dry ginger oleoresin was extracted using "Soxhlet extraction" method. 10 g finely ground powdered ginger was put into titration pipette. 50 ml acetone was added and kept overnight. The extract was drained in the beaker which was already weighed after which 30 ml acetone was added and kept for 1hour. After that it was kept into the oven for 2 hours for the acetone to evaporate. The weighed was immediately taken after it was taken out of the oven. Percentage of non-volatile ether extract was calculated by the weight of non volatile extract (g) divided by the weight of sample taken for extraction (g) multiplied by 100 (Jensen, 2007). For estimating dry matter content in ginger, 100 g of freshly harvested cleaned ginger were weighed and were cut out into small slices and dried in the oven at 60° C for 24 hours. After drying the weighed was taken in weighing machine. The value was converted in percent dry recovery. Mean, range of variation, standard error of mean and critical difference for each qualitative characters were worked out by the method of analysis of variance using Randomized Block Design (Panse and Sukhatme,1967).

RESULTS AND DISCUSSION

The data in Table 1 and Figure 1 shows significant variations for oil content among the genotypes. The fresh ginger oil content varied between 1.33% to 2.83%. The highest percentage of oil content was recorded in BGG-8 (2.83%) followed by CBG-1 (2.57%) and CBG-4 (2.47%).The lowest oil content was recorded in

Table 1: Variability in quality attributes of different ginger genotypes

Genotypes	Oil content (%)	Fibre content (%)	Oleoresin content (%)	Dry recovery (%)
BGG-1	1.77	3.66	3.26	23.33
BGG-2	1.50	3.36	4.16	16.33
BGG-3	2.17	3.62	3.80	19.67
BGG-4	2.10	4.23	3.63	22.00
BGG-5	1.83	4.77	4.26	21.33
BGG-6	1.77	3.60	3.60	14.33
BGG-7	1.53	3.47	4.11	22.33
BGG-8	2.83	4.03	6.59	23.00
BGG-9	1.33	4.42	3.50	21.00
BGG-10	1.33	3.67	3.58	11.67
CBG-1	2.57	4.46	5.21	20.00
CBG-2	2.07	6.04	4.83	22.67
CBG-3	2.17	4.49	3.83	24.00
CBG-4	2.47	3.43	4.30	20.33
CBG-5	2.13	4.66	4.20	25.33
CBG-6	0.27	4.61	3.53	31.33
CBG-7	1.93	4.52	4.53	28.00
SEm±	**0.09**	**0.24**	**0.22**	**2.38**
CD(P=0.05)	**0.26**	**0.70**	**0.63**	**6.85**

BGG-9 (1.33%), BGG-10 (1.33%). The general mean for the oil content was 1.99±0.09. According to the findings of Gopalam and Ratnambal (1989) where they conducted a study to evaluate 9 ginger cultivars using gas chromatography for essential oil and found that the total essential oil yield ranged from 1.5 to 2.2%.

Table 1 and Figure 2 shows that there was a significant variation in the fibre content among the genotypes. The fibre content ranged between 3.36% - 6.04%. The highest fibre content was recorded in CBG-2 (6.04%) followed by BGG-5 (4.77%), CBG-5 (4.66%) and CBG-6 (4.61%). The lowest fibre content was recorded in BGG-2 (3.36%). The general mean for fibre content was 4.18±0.24. The findings were in conformity with Mohanty and Panda (1991) where they assessed high yielding mutant V1K1-3 ginger and observed that the fibre content ranged between 3.8% to 4.4% in the genotypes evaluated. Chandra and Govind (1999) also conducted a study on twenty-one indigenous and exotic genotypes under mid-hills of Meghalaya and recorded maximum fibre content in the genotype Khasi Local (7.6%).

Table 1 and Figure 3 shows that there was a notable difference in the oleoresin content among the seventeen ginger genotypes. The oleoresin content varied between 3.26% - 6.59%. The highest percentage of oleoresin content was recorded in BGG-8 (6.59%) followed by CBG-1 (5.21%), CBG-2 (4.83%). The lowest percentage was recorded in BGG-1 (3.26%). The general mean for the oleoresin content was 4.17±0.22. This was evident from the earlier results of Mohanty *et al.* (1990) where they conducted a study on ginger in with special reference to its varietal and cultural improvement and observe that the maximum oleoresin content was in the cultivar Suprabha was 8.9%. Sanwal *et al*. (2009) also conducted a study on eighteen ginger genotypes and found that the genotype Meghalaya Local contained the highest concentration of total gingerol.

Table 1 and Figure 4 shows that there was a significant difference in the dry recovery percentage among the ginger genotypes. The dry recovery percentage varied between 11.67% to 31.33%. The highest dry recovery rate was recorded in CBG-6 (31.33%) followed by CBG-7 (28.00%) and CBG-5 (25.33%). The lowest dry recovery percentage

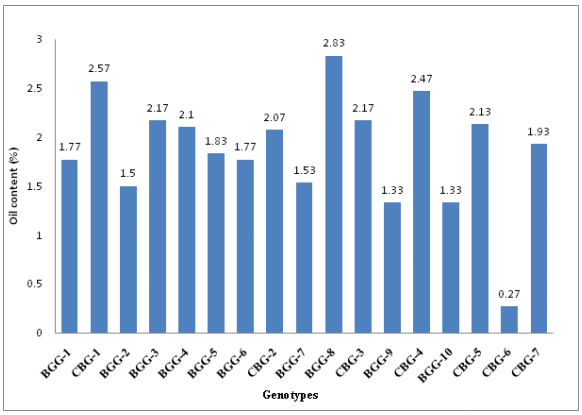

Fig. 1: Variability studies on ginger genotypes and landraces on oil content (%)

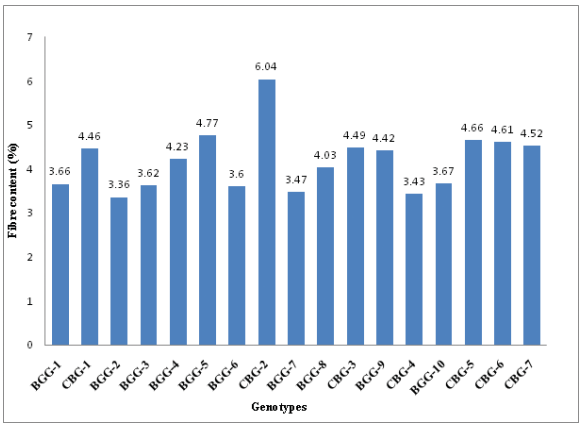

Fig. 2: Variability studies on ginger genotypes and landraces on fibre content (%)

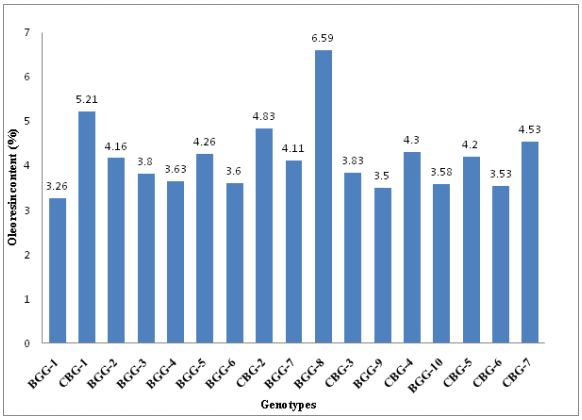

Fig. 3: Variability studies on ginger genotypes and landraces on oleoresin content (%)

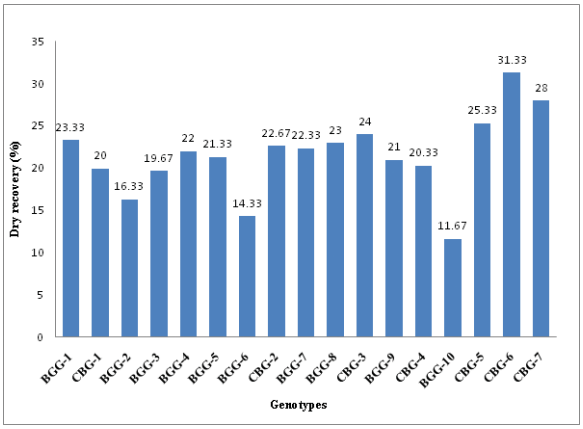

Fig. 4: Variability studies on ginger genotypes and landraces on dry recovery (%)

was recorded in BGG-10 (11.67%). The general mean for the dry recovery percentage was 21.57±2.38. The findings was at par with Bertila (2019) who observed that the dry recovery percentage ranged between 15.13% to 23.44% in the genotypes evaluated.

CONCLUSION

Among the seventeen ginger genotypes used for the evaluation, it was found that the genotype BGG-8 performed better for qualitative parameters such as oil content (2.83%), oleoresin content (9.50%) followed by CBG-1 having oil content (2.57%), oleoresin content (7.2%), fibre content (4.72%) and CBG-4 having oil content (2.47%), oleoresin content(6.50%). Genotypes BGG-8, CBG-1 and CBG-4 are suitable in Nagaland and can be recommended for growing for oil and oleoresin purpose.

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