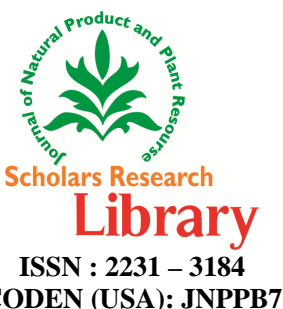




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J. Nat. Prod. Plant Resour., 2013, 3 (1):24-29
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Study on the Indigenous Varieties of Ginger of Golaghat District (Assam), and its Economic Viability as Aroma Ingredients

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ABSTRACT

Ginger is a tropical perennial herb, rhizome is considered as important spice in the world. In India 70% of the total ginger production is from the North-East. Ginger rhizome contains many important volatile and non-volatile oils along with other compounds such as pungent compounds, resins, proteins, cellulose, pentosans, starch, gingerol, shogaols, etc. Three varieties of ginger are cultivated in different areas of Golaghat district of Assam, locally called as Zeng Ada, Bhola Ada and Moran Ada (Ada = ginger). Bhola Ada plants were found to have more height and rhizome size. Moran Ada was found to have more economic importance than other two varieties due to higher amount of oil content. This variety has less quantity of edible part due the presence of more fibers, roots and bulks. But still it has more economic value because of great taste and medicinal demand. Extraction of oil was done by using Clevenger's apparatus. Oil content extracted from dry ginger rhizome was 1.2% in Zeng Ada, 1.1% in Bhola Ada and 1.5% in Moran Ada.

Key word: Ginger, Volatile oil, Aroma, Oil extraction, Stream distillation

INTRODUCTION

Ginger (*Zingiber officinale* Roscoe) is a herbaceous tropical perennial, the rhizomes of which are used as a spice, and it belongs to the family Zingiberaceae [1],[3]. Ginger is cultivated in several regions of the world such as Ginger is cultivated in India, China, Japan, Indonesia, Australia, Nigeria and West Indies islands [2],[4]. Among them India and China are the dominant suppliers to the world market. In India ginger is cultivated mostly in Kerala, Karnataka, Mizoram, Arunachal Pradesh, Assam, Meghalaya, Nagaland, Manipur, Tripura, Sikkim, Orissa and Madhya Pradesh [1],[4],[5]. In Northeast region, Assam ranks first in ginger acreage as well as production, but productivity was the highest in Mizoram, followed by Arunachal Pradesh, Assam and Nagaland [5]. A few varieties of ginger are found in different districts of Assam such as Nagaon, Golaghat, Sibsagar, Jorhat, Dibrugarh, Barpeta, Kamrup, Darrang, Sonitpur, Karbi-Anglong and N.C. Hills.

The ginger rhizome contains many useful oils such as steam volatile oil, fixed fatty oil and also other compounds such as pungent compounds, resins, proteins, cellulose, pentosans, starch, gingerol, shogaols, fiber, amino acids and minerals. The pleasant aroma of ginger is due to the presence of more than 70 constituents present in the volatile oil of rhizome. Some of the volatile oils lost by evaporation during drying, therefore, the aroma and flavour of fresh ginger will be different from dry ginger [6].

Ginger is one of the useful rhizomatous species because of their spicy as well as medicinal nature. Ginger is one of the useful rhizomatous species because of their spicy as well as medicinal nature. It is an indispensable component of curry powder, sauces, ginger bread and ginger flavoured carbonated drinks, and it is also used in some products like biscuits, pickles and confectionaries [7]. Gingerol, one of the important pungent of ginger, helps counter liver toxicity by increasing bile secretion. It has potent anti-microbial and anti-oxidant activity [8]. Ginger is also found to

be useful for stimulating digestion, absorption, relieve constipation and flatulence by increasing muscular activity in the digestive tract [7].

MATERIALS AND METHODS

Agronomy:

Ginger grows well in warm and humid climate and is cultivated from sea level to an altitude of 1500 meters above sea level. Ginger can be grown both under rain fed and irrigated conditions. For successful cultivation of the crop, a moderate rainfall at sowing time till the rhizomes sprout, fairly heavy and well distributed showers during the growing period and dry weather for about a month before harvesting are necessary. Ginger thrives best in well drained soils like sandy loam, clay loam, red loam or lateritic loam. A friable loam rich in humus is ideal. However, being an exhausting crop it is not desirable to grow ginger in the same soil year after year.

Selection of Germplasm:

Many village area of Golaghat district, where ginger cultivation is well were selected for the study. Most parts of this district are favourable for agriculture. The people of these areas are engaged in agriculture. These areas are quite fertile; hence different types of crops are cultivated. The major crops of this district are rice, mustard, sugarcane and different types of vegetables, fruits like banana, orange, papaya etc.

For the study, three different varieties of Ginger found in the locality, were collected from some farmers of Missamora, Dhekial and Numaligarh (some of the major ginger cultivating areas of Golaghat). The vernacular name of the varieties were Moran Ada, Bholada and Zeng Ada (Ginger).

Ten plants of each variety were selected for the observation of their growth and development. Growth is being observed time by time at the site of cultivation. Other observation such as size and shape of ginger rhizome, weight of rhizome, colours etc. were also being observed time to time using different laboratory methods.

Physical properties:

Physical properties of ginger were analyzed by selecting 10 rhizomes randomly. Mass is calculated using analytical weight balance of 0.1 gram sensitivity by following the standard procedure and thus, mean mass is calculated.

Colour of the rhizome is determined redness to greenness and yellowness to blueness by physical observation.

The spatial dimensions (length, breadth and thickness) of ginger rhizome are determined using scale having least count of 0.1 cm. Size is the geometric mean of the above three dimensions and calculated using the following expression:

$$\text{Size} = [\text{length (L)} \times \text{breadth (W)} \times \text{thickness (T)}]^{1/3}$$

Edible Index is determined by taking ratio of edible part of rhizome to total weight of rhizome multiplied by 100.

$$\text{Edible Index} = \frac{\text{Edible part of rhizome}}{\text{Total weight of rhizome}} \times 100$$

Harvesting:

Harvest management is one of the key factors to ascertain the quantitative and qualitative yield of herbage and oil content of ginger.

The most important work of the project was to study the production of oil from the different varieties found in locality. At first, the rhizomes were collected separately from different farmer's fields during the month of January. The aerial parts were removed and the rhizomes were washed thoroughly to remove entangled soil particles and cut the adventitious roots. They were dried in open and weighted to record the fresh weight of the rhizomes, which is the economic production of the crop.

The Rhizomes were cut into slices and dried in Hot air oven at 50°C for 24 hours. They were turned periodically to ensure proper drying. Moisture content of the dry herbage was reduced to 10-12% during the curing process at 2-3 days in shade after removing from Hot Air Oven. Dry weights were measured separately with the help of electronic balance. Properly dried rhizomes developed characteristic ginger note.

Extraction of oil:

Dried rhizomes were crushed separately and were hydro distilled in Clevenger's apparatus for each samples separately. The distillation processes were continued for 3-4 hours at 95°C for each sample.

After distillation the extracted oil samples were measured on dry weight basis (Volume/Weight) of rhizomes. Each oil samples recovered were treated with anhydrous Sodium Sulfate to remove entrapped water molecules in the oil immediately after extraction. Analyzed oil samples were preserved in sample bottle for further chemical analysis.



Fig. 1 Extracted oil from Moran Ada by steam distillation method

RESULTS

The first observation was done during the maturation stage of the Ginger plants. The readings were taken on October 2012 and on January 2013 just before harvesting. The data are as follows:

Table 1: Morphological Study of Ginger Varieties on October 2012:

Characters	Zeng Ada		Bhola Ada		Moran Ada	
Height of the plant	39 cm	Average: 42.3 cm	52 cm	Average: 50.7 cm	47 cm	Average: 45 cm
	46 cm		46 cm		43 cm	
	42 cm		54 cm		45 cm	
Size of the Rhizome (Big ones)	Length: 4.5 cm		Length: 3.4 cm		Length: 3 cm	
	Breadth: 2.4 cm		Breadth: 2.7 cm		Breadth: 2 cm	
	Thickness: 1.6 cm		Thickness: 1.7 cm		Thickness: 1.6 cm	
Size of the Rhizome (Small ones)	Length: 2.8 cm		Length: 2 cm		Length: 2.7 cm	
	Breadth: 1.8 cm		Breadth: 1.8 cm		Breadth: 1.8 cm	
	Thickness: 1.4 cm		Thickness: 1.4 cm		Thickness: 1.6 cm	
Weight of Rhizome with Adventitious roots	54 gm		39 gm		45.4 gm	
Weight of Rhizome without Adventitious roots	51 gm		38.8 gm		38.5 gm	
Weight without Balk	50.8 gm		38.5 gm		38.2 gm	
Number & Types of Adventitious roots per Rhizome	12(Thick / Short)		9(Thin / Short)		15(Thick / Long)	

Table 2: Morphological Study of Ginger Varieties on January 2013:

Characters	Zeng Ada		Bhola Ada		Moran Ada	
Height of the plant	46 cm	Average: 51.7 cm	68 cm	Average: 64.3 cm	61 cm	Average: 56.7 cm
	51 cm		66 cm		58 cm	
	48 cm		59 cm		51 cm	
Size of the Rhizome (Big ones)	Length: 4.9 cm		Length: 5.6 cm		Length: 3.6 cm	
	Breadth: 2.4 cm		Breadth: 3.1 cm		Breadth: 2.1 cm	
	Thickness: 1.7 cm		Thickness: 2.2 cm		Thickness: 1.9 cm	
Size of the Rhizome (Big ones)	Length: 3.1 cm		Length: 3.2 cm		Length: 3.1 cm	
	Breadth: 1.9 cm		Breadth: 1.9 cm		Breadth: 1.8 cm	
	Thickness: 1.6 cm		Thickness: 1.8 cm		Thickness: 1.7 cm	
Weight of Rhizome with Adventitious Roots	58 gm		62 gm		53 gm	
Weight of Rhizome without Adventitious Roots	54.2 gm		60.9 gm		45.7 gm	
Weight without Balk	53.9 gm		60.5 gm		45.4 gm	
Number & Types of Adventitious Roots per Rhizome	13(Thick / Short)		12(Thin / Short)		17(Thick / Long)	

Applying the formula, $Size = [length (L) \times breadth (W) \times thickness (T)]^{1/3}$ size was determined as follows:

A. October, 2012:

- 1) Zeng Ada:
 - a) Big one: 2.6 cm
 - b) Small one: 1.9 cm
- 2) Bhola Ada:
 - a) Big one: 2.5 cm
 - b) Small one: 1.7 cm
- 3) Moran Ada:
 - a) Big one: 2.1 cm
 - b) Small one: 1.9 cm

A. January, 2013:

- 1) Zeng Ada:
 - a) Big one: 2.7 cm
 - b) Small one: 2.1 cm
- 2) Bhola Ada:
 - a) Big one: 3.3 cm
 - b) Small one: 2.2 cm
- 3) Moran Ada:
 - a) Big one: 2.4 cm
 - b) Small one: 2.1 cm

Table 3: Other Physicochemical Properties:

Sl. No.	Characters	Zeng Ada	Bhola Ada	Moran Ada
1	Fresh Weight	500 gm	500 gm	500 gm
2	Dry Weight	122	104	89
3	Edible Index	92.9%	97.6%	85.7%
4	Percentage of Oil Content	1.2%	1.1%	1.5%
5	Colour of Cross Section of Rhizome	Light Yellow	Very Light Yellow	Dark Brownish Yellow

The graphical representations of some of the data from the above observations are given below:

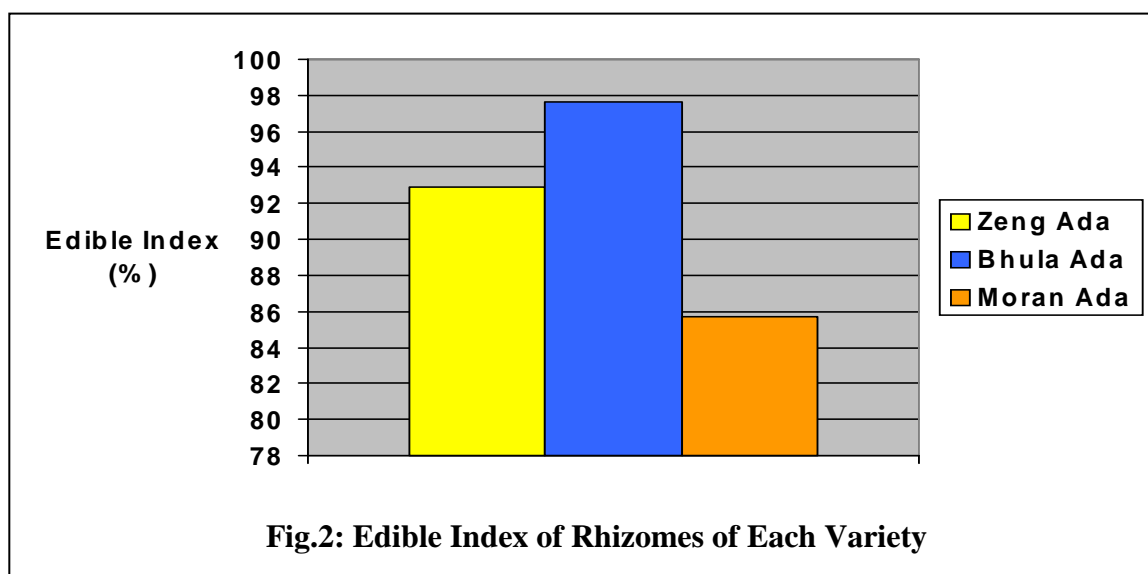
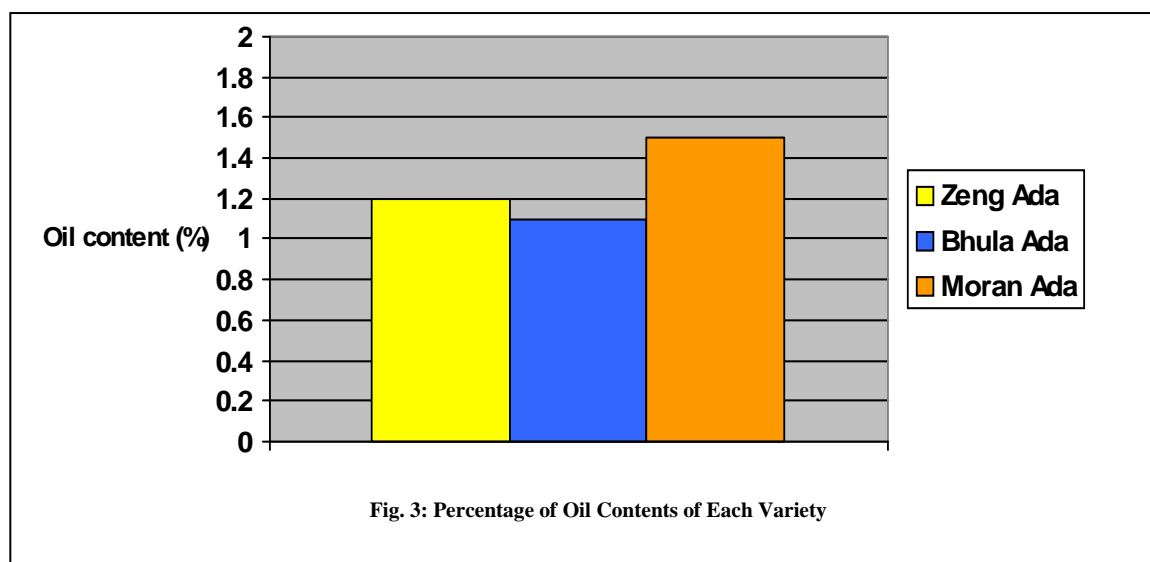


Fig.2: Edible Index of Rhizomes of Each Variety



DISCUSSION

From the experimental observation it was found that the size of Bhola Ada was maximum (3.3 cm) than the Zeng Ada (2.7 cm) and Moran Ada (2.4 cm).

The highest plant was observed in Bhola Ada (68 cm) compared to other Moran Ada (61 cm) and Zeng Ada (51 cm). More adventitious roots were observed in Moran Ada than the other two varieties- Zeng Ada and Bhola Ada. The adventitious roots were thick & long in Moran Ada, thick & short in Zeng Ada and thin & short in Bhola Ada.

Edible index was found to be more in Bhola Ada (97.6%) than the Zeng Ada (92.9%) and Moran Ada (85.7%). Colour of the edible part of the rhizome is yellow. But it slightly varies in different varieties. In Moran Ada it is much darker and in Bhola Ada it is very light.

The percentage of oil content calculated from the fresh weight was found 1.5% in Moran Ada, 1.2% in Zeng Ada and 1.1% in Bhola Ada. Although Moran Ada has smaller edible index but it has higher oil content than the other two varieties. Also, the aroma of the oil of Moran Ada is stronger than the other two varieties. The oils from three varieties contain volatile substances therefore smell strongly.

Depending upon the soil and quality of ginger, the size, height or other values may greater or smaller than these experimental data. The values mentioned here are considered under random selection.

CONCLUSION

The growth and development of ginger rhizome largely depends upon soil and quality of ginger. Rhizome size varies with respect to proper development and use of natural resources and fertilizer. Many rhizome diseases of ginger were reported which affect the production of the crop. The Assamese local variety 'Moran Ada' is very rich in oil. So, the variety has 3x more market value than the other local ones. Assam can develop in the agricultural sector by cultivating this variety in larger amount using better cultivation methods, investing more grounds of cultivation and increasing production capacity with the help of advanced agricultural protocols.

Acknowledgement

The authors would like to thank the Department of Botany of D.K.D. College and their faculties for providing laboratory facilities during the course of study.

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