Yield and quality of ginger *(Zingiber officinale* Rosc.) varieties grown in Assam

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ABSTRACT

Twenty indigenous and exotic varieties of ginger were evaluated for yield and quality. Significant variations in yield were observed among the varieties. Nadia yielded the highest (67.0 q/ha-fresh ginger) followed by Chekerella (57.0 q/ha). Growth attributes like leaves per clump, tillers per clump and shoot height were positively correlated with yield. Moran, Jorhat hard, Thinladium and Wynad were fibrous. Moran and Jorhat hard yielded higher volatile oil and acetone extract. The fibrous varieties Moran and Jorhat hard were suitable for extraction of oleoresin and volatile oil.

Key words: ginger, *Zingiber officinale*, varieties, yield, quality.

Introduction

Ginger (*Zingiber officinale* Rosc.), a herbeceous perennial, usually grown as an annual crop, is a major spice grown in India. Plant population is one of the major factors affecting yield of ginger (Aiyadurai 1966; Paulose 1970; Randhawa & Nandpuri 1970; Roy & Wamanan 1988). There are many cultivated varieties of ginger in India whose yield and chemical composition varies with varieties and agroclimatic conditions (Natarajan *et al.* 1972). Ginger is valued for its organoleptic properties of aroma and pungency and therefore oleoresin content extracted from dried ginger which posses the organoleptic properties determines the quality of ginger. Dried and ground ginger is also used as a spice. Preserved ginger is prepared in certain ginger-growing countries. Quality of ginger oil is an important factor which depends on composition of ginger oil. A considerable amount of work has been done on this aspect (Sakamura 1987; Chen & Ho 1986; Miyazawa & Kameoka 1988; Eriev *et al.* 1988; Ekundaya, Laakaro & Hilturnew 1988; Narayanan & Mathew 1985). Though a number of ginger varieties are grown in Assam, information pertaining to yield and quality of these varieties is meagre and therefore the present investigation was carried out to evaluate the yield potential and quality of 20 ginger varieties.

Materials and methods

The experiment was laid out at Horticultural Research Station, Gauhati, Assam (Assam Agricultural University). This region has a subtropical climate with an average rainfall of 2500 mm and clay loam soil with a pH of 4.0. Twenty exotic and indigenous varieties of ginger were tested in a Randomised Block Design with three replications during 1989 and 1990. Rhizome bits weighing 15 to 20 g each were planted in a spacing of 25 x 20 cm at a depth of 10 cm in a plot size of 2.5 x 1.6 m. The varieties were grown as per recommended cultural practices. Six clumps from each plot were selected at random and were studied for growth characters. The data on shoot height, leaves per clump, tillers per clump and yield of fresh (green) ginger were recorded and statistically analysed.

For biochemical studies, raw samples were washed, dried in a through flow drier at 60°C for about 8 h and powdered in a Willy Mill. The analyses were carried out for moisture, crude protein, starch, crude fibre, total ash, volatile oil (AOAC 1965), acetone and water extract (ASTA 1960) with modification.

Results and discussion

Growth characteristics and yield

There were significant differences in growth characters and yield among the 20 varieties evaluated (Table 1). Nadia yielded the highest (67.0 q/ha - fresh ginger) followed by Chekerella (57.0 q/ha), Moran (54.58 q/ha) and Rio-de-Janerio (49.08 q/ha). The high potential of Nadia was also reported by Nair, Sasidhar & Sadanandan (1976), Singh (1982) and Roy & Wamanan (1990). However, the present yield of 49.8 to 67.0 q/ha was lower than the yield of 116.24 to 248.0 q/ha reported by Roy & Wamanan (1990) from Guwahati University campus of Assam. This may be due to variation in type and acidity of soil. Roy & Wamanan (1990) and Purseglove *et al.* 1981 also stated that location and type greatly affect yield of ginger. The maximum yield of green ginger obtained is reported to be 40 t/ha at Central Horticultural Research Station, Bangalore and yields higher than 59 t/ha were also reported from late harvested crop (Purseglove *et al.* 1981).

Though higher yields of varieties were significant and positively correlatedwith leaves per clump, tillers per clump and shoot height as reported earlier (Anonymous 1974), the highest yielder Nadia did not have highest number of leaves per clump and shoot height as reported by Roy & Wamanan (1990). In general, yield attributes were highly and positively correlated with yield. Plant height and leaf number were reported to be associated with yield of ginger (Anonymous 1974; Roy & Wamanan 1988 & 1990).

Biochemical composition

The oleoresin obtained from ginger has notable differences in yield, aroma, flavour and pungency due to geographical variations, age at which it is harvested, the choice of solvent and method of extraction followed (Purseglove *et al.* 1981). Significant variations in moisture content, crude protein, starch, crude fibre, total ash, volatile oil, acetone and water extract were found among the varieties tested (Table 2). A similar study for 26 varieties of ginger was also reported by Natarajan *et al.* (1972). Crude fibre was highest in Moran (8.05%) followed by

Table 1. Yield and growth characters of ginger varieties

Cultivar	Leaves per clump	Tillers per clump	Shoot height (cm)	Yield (q/ha)
Bahrein	30	5.00	55.1	29.50
Burdwan	28	5.21	61.0	32.92
Chekerella	59	6.13	55.0	57.00
China	35	6.38	62.0	44.83
Diphu	20	4.25	56.0	27.58
Ernad	42	4.89	55.0	39.83
Jorhat hard	30	4.00	58.0	25.67
Jugijan	48	6.10	59.6	34.58
Kahikuchi	35	4.81	52.5	28.08
Karakkal	28	4.81	64.0	31.50
Mizo	26	5.80	53.8	36.08
Moran	71	6.30	56.6	54.58
Nadia	58	6.80	63.8	67.00
Poona	31	4.30	59.3	25.92
Rio-de-Janerio	57	6.25	56.3	49.08
Singmakhir	33	4.30	61.0	30.58
Thingpuri	35	4.00	57.0	32.58
Thinladium	28	4.38	49.8	25.33
Tura	49	5.30	57.8	33.08
Wynad	56	6.00	49.9	44.63
SE	0.785	0.045	0.560	0.265
CD at 5%	1.321	0.070	0.940	0.440
CD at 1%	1.900	0.109	1.350	0.640

Jorhat hard (7.86%). Other fibrous varieties were Wynad, Thinladium, Rio-de-Janerio, Ernad and Singmakhir (6.00 to 7.21%). The fibrous varieties Moran and Jorhat hard had higher content of volatile oil (2.85 and 2.56%, respectively) along with Mizo (2.56%). Moran and Jorhat hard also recorded higher yield for acetone extract (9.7 and 9.5%, respectively). Natarajan *et al.* (1972) also found a higher content of volatile oil and acetone extract in these two varieties. However, water extract was highest in Nadia (24.8%) which was a prolific green rhizome yielder (Roy & Wamanan 1990). Ginger was also fairly rich in crude protein (8.0 to 13.0%) and starch (39.8 to 52.3%). Though Moran

Table 2. Biochemical composition of ginger varieties

Variety	Moisture (%)	Crude protein (%)	Starch (%)	Crude fibre (%)	Total ash (%)	Volatile oil (%)	Acetone extract	Water extract
Bahrein	12.0	10.8	45.3	5.35	6.05	1.13	5.9	19.8
Burdwan	11.0	13.0	39.8	5.92	5.26	2.00	6.9	19.0
Chekerella	13.0	11.0	48.4	4.89	4.89	1.50	6.0	20.3
China	11.0	10.3	50.0	6.33	8.25	1.45	7.0	17.0
Diphu	11.8	9.6	50.0	5.71	5.86	1.50	5.6	22.5
Ernad	15.0	12.5	49.8	6.05	6.63	1.48	6.0	17.8
Jorhat hard	12.0	12.6	50.2	7.86	7.20	2.56	9.5	26.3
Jugijan	12.5	13.0	49.0	4.56	6.25	2.25	8.0	17.9
Kahikuchi	12.0	9.9	48.0	5.82	6.00	2.05	6.9	21.8
Karakkal	14.0	11.6	50.5	4.36	6.95	2.15	7.2	24.5
Mizo	13.0	10.0	48.9	5.83	5.21	2.56	6.5	19.6
Moran	9.5	10.0	40.2	8.05	7.58	2.85	9.7	23.8
Nadia	12.5	9.0	53.0	4.35	7.65	1.35	4.0	24.8
Poona	13.0	11.8	51.2	5.38	5.36	1.40	5.5	23.1
Rio-de-Janerio	12.5	11.0	50.1	6.33	5.81	2.07	9.0	20.2
Singmakhir	10.8	9.0	49.0	6.00	5.05	2.10	5.8	17.6
Thingpuri	12.5	8.6	48.8	5.93	5.03	1.62	5.0	21.8
Thinladium	14.5	8.0	52.3	7.03	4.86	1.85	6.5	20.8
Tura	12.8	12.8	45.0	5.25	4.03	1.98	4.3	22.9
Wynad	12.0	13.0	48.0	7.21	5.86	2.03	7.5	22.1
SE	0.60	0.58	0.53	0.18	0.39	0.18	0.44	0.27
CD at 5%	1.01	0.97	0.89	0.30	0.65	0.30	0.74	0.45
CD at 1%	1.45	1.40	1.28	0.436	0.94	0.436	1.06	0.65

and Jorhat hard were fibrous and not satisfactory for use as raw spices and for making candies, it is useful as raw material for processing into ginger oils and oleoresin.

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