

## Yield and quality of ginger (*Zingiber officinale* Rosc.) grown in Nagaland, India

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### Abstract

Multilocal trials conducted at Nagaland, India, in ginger (*Zingiber officinale*) indicated significant differences in growth characteristics and yield components among the cultivars at various locations. The yield was very low (4.8-9.3 t/ha) and fibre content high (6.7-9.6%) at all locations. Yield and quality of ginger grown in Wokha, Mon, Mokokchang and Tuensang districts were superior to the ginger from other districts of Nagaland.

**Key words:** cultivars, ginger, yield, *Zingiber officinale*.

### Introduction

Though considerable work on yield and quality of ginger (*Zingiber officinale* Rosc.) has been done in different states of India (Krishnamurthy *et al.* 1977; Mohanty & Sarma 1978; Narayanan & Mathew 1985; Saha 1989; Saikia & Shadeque 1992; Pandey & Donbhai 1993), information on these aspects of ginger grown in Nagaland, India is not available. Hence, a survey was undertaken to study the yield and quality of ginger grown by farmers at different locations under rainfed conditions in Nagaland. Nagaland has a sub tropical temperate climate with altitudes varying from 200 to 3840 m with an annual rainfall of 200 to 250 cm.

### Materials and methods

Three locations where considerable quantity of ginger is grown were selected from each of the seven districts of Nagaland, namely, Mokokchang, Tuensang, Zhunoboto, Phek, Kohima, Wokha and Mon. As the farmers used their own seed stock and could not specify the variety grown, the name of locality was designated as cultivar. The cultivars are Ungma, Yisimyong and Chanki in Mokokchang District; Yimpang, Shamtor and Longkhim in Tuensang District; Yezami, Satami and Lutsumi in Zhunoboto District; Phek village, Losami and Chizami in Phek District; Kedima, Tsemenyu and Jalukie in Kohima District; Longsa, Azuhuto and Longtsung in Wokha District and

Lapa, Wakching and Longting in Mon District. In each locality a plot of 3 m x 2 m was marked adopting a Randomised Block Design and from which five clumps of plants were selected at random for studying growth and yield characters at maturity during 1995-1996. Pseudostem height, leaves and tillers per clump, length of fingers, number of fingers and yield were recorded and the data statistically analysed. Qualitative analyses were done

for starch, crude fibre, total ash, volatile oil and oleoresin content following standard methods (AOAC 1980). The essential oil was extracted by Cleavenger apparatus and their oil constituents were analysed by GLC.

## Results and discussion

Significant differences were observed in growth characteristics and yield among the cultivars (Table 1). Longsa recorded the highest yield (9.3 t/ha) followed by

**Table 1.** Physical characteristics of ginger cultivars grown in Nagaland

District	Cultivar	Leaves per clump	Tillers per clump	Pseudo-stem height (cm)	Length of fingers (cm)		No. of fingers		Estimated yield (t/ha)
					Primary	Secondary	Primary	Secondary	
Mokok-chang	Ungma	42.3	4.4	56.8	8.2	10.7	3.3	2.1	7.6
	Yisim-yong	48.5	5.1	57.2	8.4	10.9	3.5	1.8	9.0
	Chanki	41.0	4.2	56.8	8.2	10.7	3.5	2.1	7.2
Tuen-sang	Yimpang	47.8	4.4	56.8	8.2	10.8	3.6	1.8	8.8
	Shamtor	48.1	4.4	57.1	8.3	10.8	3.4	2.0	8.9
	Long-khim	42.8	4.2	56.8	8.1	10.4	3.5	2.2	7.5
Zhuno-boto	Yezami	40.5	3.9	56.4	7.4	6.2	3.2	2.2	6.9
	Satami	42.1	4.0	56.4	7.5	6.5	3.4	2.2	7.0
	Lutsumi	36.0	3.6	55.9	6.6	6.2	2.2	1.5	5.8
Phek	Phek village	42.3	3.8	56.2	7.3	6.5	3.5	2.1	6.9
	Losami	49.8	3.9	56.8	8.1	10.4	3.4	2.3	7.5
	Chizami	40.1	3.8	56.8	7.7	6.8	3.4	2.2	7.1
Kohima	Kedima	36.1	3.5	55.2	6.4	3.3	2.2	1.4	5.1
	Tsemenyu	35.8	3.2	55.4	6.4	3.6	2.3	1.4	5.3
	Jalukie	34.2	3.6	54.3	6.1	3.4	2.1	1.4	5.3
Wokha	Longsa	47.6	5.3	57.5	8.5	11.4	3.3	1.5	9.3
	Azuhuto	40.6	3.8	56.7	8.0	9.4	3.3	2.0	7.2
	Long-sung	37.0	3.1	54.9	6.1	3.3	2.2	1.5	4.8
Mon	Lapa	36.7	3.2	55.6	6.5	3.7	2.3	1.3	5.6
	Wakching	48.0	5.0	57.2	8.4	11.1	3.7	1.8	9.1
	Longting	41.0	3.7	56.4	7.1	6.2	3.3	2.3	6.9
SEm±		2.24	0.28	0.33	0.37	0.35	0.20	0.20	0.18
CD (P=0.05)		4.38	0.55	0.65	0.73	0.68	0.39	0.39	0.38

Wakching (9.1 t/ha) and Yisimyong (9.0 t/ha); the lowest yield was observed in Kedima (5.1 t/ha). Lusami produced the highest number of leaves per clump (49.8) followed by Yisimyong (48.5) and Shamtor (48.1) and the lowest by Jalukie (34.2). The highest number of tillers per clump was produced by Longsa (5.3) and the lowest in Longtsung (3.1). Maximum height of pseudostem (57.5 cm) and length of primary and secondary

fingers (8.5 and 11.5 cm) were observed in Longsa. The increase in yield could be attributed to the height of pseudostem and as observed in turmeric (Govind *et al.* 1981).

Significant variations were observed in crude protein, starch, crude fibre, volatile and oleoresin content among the cultivars at different locations (Table 2). Oleoresin content varied from 7.9 to

**Table 2.** Biochemical characteristics of ginger cultivars grown in Nagaland

District	Cultivar	Total moisture (%)	Dry recovery	Crude protein (%)	Starch (%)	Crude fibre (%)	Total ash (%)	Volatile oil (%)	Oleoresin (%)
Mokok-chang	Ungma	91.1	11.8	8.8	46.2	6.9	5.8	2.5	8.4
	Yisimyong	89.0	13.2	10.8	46.0	6.7	5.8	2.6	8.5
	Chanki	91.0	11.5	8.8	46.3	8.7	5.6	2.4	8.3
Tuen-sang	Yimpang	89.1	13.2	10.4	46.2	6.9	5.4	2.5	8.4
	Shamtor	89.2	14.3	10.5	46.2	6.9	5.7	2.6	8.4
	Longkhim	90.8	12.5	8.7	46.3	8.8	5.9	2.5	8.3
Zhuno-boto	Yezami	91.3	11.5	8.7	46.5	9.1	5.4	2.3	8.2
	Satami	91.2	12.0	8.6	46.8	9.1	5.8	2.4	8.3
	Lutsumi	86.0	17.8	7.2	48.5	9.3	5.2	1.9	8.0
Phek	Phek village	91.0	11.5	8.5	48.1	9.2	5.9	2.3	8.1
	Losami	91.1	11.7	7.3	48.2	9.2	5.9	2.5	8.2
	Chizami	89.1	14.5	7.3	48.2	9.2	6.1	2.4	8.1
Kohima	Kedima	84.2	19.3	7.2	50.0	9.3	5.1	1.9	8.0
	Tsemenyu	86.2	17.6	7.2	50.1	9.4	5.3	1.8	8.0
	Jalukie	86.0	16.0	7.2	50.2	9.4	5.2	1.8	8.5
Wokha	Longsa	89.3	12.8	10.8	46.0	6.8	5.7	2.6	8.6
	Azuhuto	91.1	12.2	7.3	48.2	9.2	5.9	2.5	8.1
	Longtsung	86.3	17.0	7.2	50.3	9.5	5.1	1.7	7.7
Mon	Lapa	86.0	16.3	7.0	50.3	9.6	5.2	1.8	7.9
	Wakching	89.1	14.3	10.7	46.1	6.9	5.8	2.6	8.5
	Longting	91.2	12.0	7.3	48.3	9.3	6.0	2.4	8.1
SEM±		3.49	0.11	0.29	0.31	0.22	NS	0.18	0.18
CD (P=0.05)		6.83	0.23	0.58	0.60	0.42	NS	0.35	0.35

NS = Not significant

8.6%. The highest oleoresin was found in Longsa (8.6%) and the lowest in Longtsung (7.7%). More than 10.4% crude protein was observed in five cultivars, namely, Yimpang, Shamtor, Wakching, Yisimyong and Longsa. The starch content was above 50% in Kedima, Tsemenyu, Jalukie, Longtsung and Lapa. The lowest crude fibre was recorded in Yisimyong (6.7%) which was at par with other cultivars, namely, Ungma, Yimpang, Shamtor, Longsa and Wakching. The percentage of essential oil ranged from 1.7 to 2.6 % and the maximum was recorded in Yisimyong, Shamtor, Longsa and Wakching. The

**Table 3.** Essential oil composition of four high oil yielding ginger cultivars grown in Nagaland

Composition	Cultivar			
	Yisim- yong	Sham- tor	Lon- gsa	Wak- ching
$\alpha$ -Pinene	0.23	0.82	0.06	0.24
Camphene	2.05	5.86	0.70	2.02
$\beta$ -Pinene	0.71	1.15	0.73	0.93
Myrcene	0.74	0.66	0.65	0.29
1,8-Cineole	0.84	5.00	2.57	3.20
Limonene	0.08	0.48	0.24	0.54
Linalool	27.40	8.07	3.09	3.27
Neral	11.48	13.76	15.17	18.78
Geraniol	2.87	1.23	5.81	1.80
Geranial	21.98	30.89	27.88	29.51
Gr. acetate	21.98	30.89	27.88	29.51
$\alpha$ -Curcumene	3.41	4.28	4.99	4.72
$\alpha$ -Gingiberene	0.46	0.45	2.00	0.89
$\alpha$ -Farnelene +				
$\beta$ -Bisabolene	0.82	0.30	1.37	1.80
$\beta$ -Sesquiphe- llandrene	0.05	1.64	1.01	0.31

composition of oil of these four high oil yielding cultivars was also determined (Table 3). The study indicates that the yield of ginger cultivars was markedly low while fibre content was high. It further reveals that the yield and quality of ginger grower in Wokha, Mon, Mokokchang and Tuensang districts were superior to the ginger grown in other districts of Nagaland.

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