P-ISSN: 2349-8528

E-ISSN: 2321-4902

www.chemijournal.com

IJCS 2020; 8(5): 1922-1925

© 2020 IJCS

Received: 24-07-2020

Accepted: 27-08-2020

Saloza BertilaDepartment of Horticulture,
SASRD, Nagaland University,
Lumami, Nagaland, India**MM Shulee Ariina**Department of Horticulture,
SASRD, Nagaland University,
Lumami, Nagaland, India**CS Maiti**Department of Horticulture,
SASRD, Nagaland University,
Lumami, Nagaland, India**Yabi Gadi**Department of Horticulture,
SASRD, Nagaland University,
Lumami, Nagaland, India**L Daiho**Department of Horticulture,
SASRD, Nagaland University,
Lumami, Nagaland, India

Effect of planting time and harvest on yield and quality of ginger (*Zingiber officinale* Rosc.) cv. Nadia

Saloza Bertila, MM Shulee Ariina, CS Maiti, Yabi Gadi and L Daiho

DOI: <https://doi.org/10.22271/chemi.2020.v8.i5z.10585>

Abstract

In the present study, the effect of different planting time and harvest on yield and quality of ginger (*Zingiber officinale* Rosc.) cv. Nadia were evaluated. The experiment was laid out in Split Plot Design with dates of planting as main treatment (30th March, 30th April and 30th May) and five harvesting time as sub-treatments (6 MAP, 7 MAP, 8 MAP, 9 MAP and 10 MAP) with three replications. The study revealed that harvesting time effectively influenced on the quality of ginger. Planting time showed significant effect on almost all the characters except for fibre content. The quality of ginger rhizome such as oil content, dry recovery and oleoresin content had significant influence on both the planting time and the harvesting time. Planting of rhizomes on 30th April resulted better yield and yield attributing characters. Among different harvesting time, harvesting at 8 MAP recorded significantly higher fresh weight of ginger and quality characters. The treatment (M₂H₃) i.e. April planting time and harvesting at 8 MAP exhibited higher yield and yield attributing characters viz. length of finger (8.69 cm), girth of finger (8.09 cm), fresh weight of rhizome plant⁻¹ (1310.03 g), yield plot⁻¹ (11.98 kg), and yield ha⁻¹ (31.53 t). Planting in the month of April and harvesting at 9 MAP (M₂H₄) recorded better quality rhizome with high oil (2.83%), oleoresin (15.74%) and dry recovery (23.83%) with less fibre content (4.9%) followed by planting in April and harvest at 8 MAP (M₂H₃).

Keywords: Ginger, date of planting, date of harvest, yield and quality, Nadia

Introduction

Ginger (*Zingiber officinale* Rosc.) belongs to the family Zingiberaceae. The somatic chromosome no. is 2n=22 and is native to tropical region of Southeast Asia. India is the top producing country accounting for 33% of the world's total ginger production with 0.683 million tonnes. (Anon, 2017) [2]. In India ginger is cultivated in most of the states where Karnataka occupies the maximum area (20,489 ha) and production (1,98,180 t). However, Assam, West Bengal, Maharashtra, Karnataka, Gujarat, Meghalaya and Mizoram together contribute 75% of the country's total ginger production (Spice Board of India, 2018). Ginger is sensitive to water logging, frost, salinity and tolerant to wind and drought. The crop being a shade loving plant, partial shade increases the rhizome yield of ginger (Jayachandran *et al.*, 1991). It was also reported that the rhizome size and plant spacing have significant influence on the growth and yield of ginger (Monnaf *et al.*, 2010) [5]. Ginger produced of North Eastern Region was reported to have higher oil content (1.6-2.5%) and oleoresin content (5.9-8.56%) than ginger grown from other parts of India, so it have vast scope for dry ginger production, export and where bulk quantities of green ginger are not available in nearby market. Thus to make the crop remunerative, essential oil or ginger oil which is derived from the rhizome of the ginger has earned the nickname 'The Oil of Empowerment' for the feeling of confidence that it is known to inspire for its high value, high cost with low volume produce. In NER, Assam ranks first in area as well as production of ginger but productivity was the highest in Mizoram (8.40 t ha⁻¹) followed by Arunachal Pradesh (7.39 t ha⁻¹), Assam and Nagaland (6.99 t ha⁻¹). Among the ginger varieties, improved cultivar such as Nadia which is very fleshy, juicy, lemon flavoured and yield high quantities of dry rhizome, oleoresin and oil, also with less fiber content (4.5%) are in great demand among domestic buyers, exporters and in the market. Rhizomes of this variety are suitable for conversion into candy, cube preserve, ginger powder, drinks, powder makings etc., thereby increasing its potential for export especially to

Corresponding Author:**Saloza Bertila**Department of Horticulture,
SASRD, Nagaland University,
Lumami, Nagaland, India

the neighboring countries. The main objective of this investigation was to find out the interaction effect on yield and yield attributes at different time of planting, harvest and interaction effect on quality parameters at different time of planting and harvest.

Materials and Methods

The experiment was conducted at the Research farm of SASRD, Nagaland University located at Medziphema, under foot hill condition of Nagaland at an altitude of 310m above msl and geographically located at 25°45'43"N latitude and 95°53'45"E longitude. The climate is sub-humid tropical with high humidity and moderate temperature (12°C to 32°C) having medium to high rainfall (2000-3000 mm) and R.H of 70% to 80%. The soil of the experimental plot was categorized as sandy loam and well drained. The experiment was layout in Split Plot Design (SPD) with three replications. Each block was divided into 15 equal size- plots. The treatments were randomized by standard procedures as per the design given by (Panse and Sukhatme, 1997) [6]. Healthy rhizome of Nadia variety weighing 25g were treated with hot water at 51°C constant for 10 minutes and then dried and the treated rhizome were soaked with *Trichoderma viride* @10 g per litre of water for 30 minutes. FYM @20 tonnes per hectare was incorporated and mixed thoroughly with the soil. NPK @100:90:90 kg per ha was applied as per recommended dose. The healthy and treated rhizomes were planted on raised bed of size 1.8 m × 2 m with a spacing of 30 cm × 25 cm at depth of 5-7 cm. The treated rhizome was planted on 30th march, 30th April, 30th May, 2018 respectively. Data were recorded for all the treatments including 4 quality traits from five randomly selected plants of each plant for recording the data related to plant traits viz. Length of finger (cm), Girth of finger (cm), Number of fingers per rhizome, Fresh weight of rhizome per plant (g), Yield per plot (kg), Yield (t ha⁻¹), Fibre content (%), Oleoresin content (%), Oil content (%) and Dry recovery (%) respectively.

Fibre content of rhizome was estimated as per the procedure describe by J. S. Purthi on Quality assurance in spice and spice product, 1998.

$$\text{Fibrecontent \%} = \frac{A \times 100}{B}$$

Where

A- Denotes fiber content (g) on fresh weight

B- Denotes weight of sample used (g)

The oleoresin content in ginger was estimated as per the procedure suggested by the AOAC (Horwitz, 1980) [3]

$$\text{Oleoresin \% (W/W)} = \frac{\text{Wt. of oleoresin (g)} \times 100}{\text{Wt. of the sample (g)}}$$

Oil Content (%) was determined by the formula

$$X = \frac{A \times 100}{B}$$

Where

X- Denotes volatile oil percentage

A- Denotes volume of volatile oil extracted (ml)

B- Denotes weight of sample used (g)

Treatment details

Treatments were designated as main plot and sub-plot treatments. In the experiment, effect of planting time was the main plot and the harvesting time was the sub-plot treatments.

Time of planting (M)

M₁: 30th March

M₂: 30th April

M₃: 30th May

Time of harvesting (H)

H₁: Harvest at 6 Month

H₂: Harvest at 7 Month

H₃: Harvest at 8 Month

H₄: Harvest at 9 Month

H₅: Harvest at 10 Month

Results and Discussion

From the observation (Table-1) it was observed that planting time and harvesting time (H) have effective significant on all the yield and yield attributing characters. The maximum mean length of finger, girth of finger, highest number of finger per rhizome, highest fresh weight of rhizomes per plant, yield per plot and maximum yield (t ha⁻¹) was recorded in M₂ with 8.47 cm, 7.53 cm, 15.64, 1072.39 g, 9.95 kg and 26.89 t ha⁻¹ the lowest was recorded in M₃ with 7.69cm, 6.83 cm, 12.75, 909.76 g, 7.59 kg and 20.95 t ha⁻¹. The maximum mean length of finger was observed where harvesting was done at 9 MAP (H₄) with 8.33 cm while lowest finger length was recorded in 10 MAP (H₅) i.e. 7.69 cm. Maximum girth of finger was recorded where harvesting was done at 8 MAP (H₃) with 7.64 cm. The lowest was recorded where harvesting was done at 10 MAP (H₅) with 6.70 cm. The highest mean number of fingers recorded with effect of harvesting time was 15.57 with H₃ (8 MAP) treatment and minimum number of fingers were recorded in the treatment H₅ (10 MAP) with 13.26. Fresh weight of rhizomes per plant with respect to harvesting time was recorded highest in H₃ (8 MAP) with 1076.24 g, 10.01 kg and 26.52 t ha⁻¹. The lowest was recorded in H₅ (10 MAP) with 909.94 g. The findings were in conformity with Aggarwal *et al.* (2002). Effect of harvesting on yield per plot was from H₃ (8 MAP) with 10.01 kg and the lowest was observed in H₁ (6 MAP) with 7.82 kg. The lowest yield(t ha⁻¹) was observed when harvesting was done from 10 MAP (H₅) with 21.24 t ha⁻¹. This is in conformity with the findings of Sangwal *et al.* (2012) [8].

The interaction between effect of planting time and harvest showed significant for all the yield and yield attributing characters except for the number of fingers per rhizome. The maximum mean length of fingers obtained from M₂H₄ and M₂H₃ resulted maximum for mean girth of fingers, highest fresh weight of rhizome per plant and highest yield. The number of fingers per rhizome was non-significant for the treatment combination. This may be due to the use of same variety which is genetically similar.

Quality attributes: Data presented in Table-2 showed that planting time and harvesting time have effective significant on all the quality attributes except for the fibre content (%) with planting time. However the highest mean fibre content was recorded from (M₃) with 6.11% and the lowest was observed in (M₁) with 5.89%. The maximum mean fibre content was observed where harvesting was done from H₅ (10 MAP) with 6.70% and the lowest was observed where harvesting was done from H₁ (6 MAP) with 5.25%. The findings were in conformity with Sharma (2004). The maximum oleoresin was recorded highest during the planting time of April (M₂) with 13.71% and the minimum was recorded in planting time of M₃ with 11.79%. The maximum

oleoresin was recorded highest when the harvesting was done from H₄ (9MAP) with 15.15% and the lowest was recorded when harvesting was done from H₁ (6 MAP) with 10.44%. The oil content was recorded maximum in M₂ with 2.23% while in M₃ it was 1.93%. The effect of harvesting time on oil content showed when harvesting was done from H₄ (9 MAP) with 2.28% and the lowest were observed from H₁ (6 MAP) with 1.72%. Dry recovery where the highest dry recovery (%) was observed in M₂ with 22.11% and the least was observed in M₁ with 20.34%. Dry recovery (%) was recorded maximum when harvesting was done from H₄ (9 MAP) with 23.59% and minimum dry recovery was recorded when harvesting was done from H₁ (6 MAP) with 19.18%. The

interaction between effect of planting time and harvest showed effective significant on all the quality attributes. The maximum mean fibre content obtained was from M₂H₅ with 7.17% and lowest was observed from M₁H₁ with 4.90%. The highest oleoresin content was recorded from M₂H₄ with 15.74% while the least oleoresin content was recorded in M₁H₁ with 8.61%. The present findings were in accordance with the findings of (Kumar and Gill, 2009) [4]. The highest oil content (2.83%) was observed in M₂H₄ and the lowest oil content (1.50%) was observed in M₃H₁. The highest dry recovery was recorded in M₂H₄ with 23.83% and the lowest was recorded in M₁H₁ with 15.13%.

Table 1: Effect of planting time (M) and harvest (H) on length of finger (cm), girth of finger (cm), number of fingers per rhizome, fresh weight of rhizome per plant (g), yield per plot (kg), yield (t ha⁻¹), on fibre content (%), oleoresin content (%), oil content (%) and dry recovery (%)

Treatment	Length of finger (cm)	Girth of finger (cm)	Number of fingers per rhizome	Fresh weight of rhizome per plant (g)	Yield per plot (kg)	Yield (t ha ⁻¹)	Fibre content (%)	Fibre content (t (%))	Oil content (t (%))	Dry recovery (%)
M ₁	7.95	7.33	13.91	927.32	8.15	22.42	5.89	5.89	2.03	20.34
M ₂	8.47	7.53	15.64	1072.39	9.95	26.89	6.09	6.09	2.23	22.11
M ₃	7.66	6.83	12.75	909.76	7.52	20.95	6.11	6.11	1.93	20.75
SEm±	0.15	0.13	0.26	16.56	0.12	0.34	0.10	0.10	0.06	0.27
CD (P=0.05)	0.76	0.63	1.27	81.87	0.58	1.68	NS	NS	0.29	1.33
H ₁	7.92	7.06	13.42	915.00	7.82	21.98	5.25	5.25	1.72	19.18
H ₂	7.94	7.31	14.64	978.91	8.82	24.22	5.5	5.5	2.17	20.09
H ₃	8.25	7.64	15.67	1076.24	10.01	26.74	6.22	6.22	2.22	21.31
H ₄	8.33	7.44	13.49	965.69	8.29	22.93	6.49	6.49	2.28	23.59
H ₅	7.69	6.7	13.27	913.28	7.76	21.24	6.7	6.7	1.94	21.15
SEm±	0.15	0.09	0.42	27.71	0.18	0.54	0.14	0.14	0.14	0.72
CD (P=0.05)	0.5	0.3	1.43	93.69	0.60	1.83	0.47	0.47	0.46	2.44

Table 2: Interaction effect on planting time (M) and harvest (H) on length of finger (cm), girth of finger (cm), number of fingers per rhizome, fresh weight of rhizome per plant (g), yield per plot (kg), yield (t ha⁻¹), on fibre content (%), oleoresin content (%), oil content (%) and dry recovery (%)

Treatment	Length of finger (cm)	Girth of finger (cm)	Number of fingers per rhizome	Fresh weight of rhizome per plant (g)	Yield per plot (kg)	Yield (t ha ⁻¹)	Fibre content (%)	Oleoresin content (%)	Oil content (%)	Dry recovery (%)
M ₁ H ₁	7.19	6.77	12.8	912.2	7.48	21.26	4.9	8.61	1.67	15.13
M ₁ H ₂	8.01	7.36	13.93	916.8	7.78	21.61	5.5	12.24	2	19.85
M ₁ H ₃	8.53	7.65	15.4	980.7	9.51	25.81	5.87	14.38	1.83	21.56
M ₁ H ₄	8.15	7.53	13.13	917.1	7.7	21.38	6.36	14.97	2.17	23.57
M ₁ H ₅	7.87	7.33	14.27	909.8	8.27	22.05	6.83	14.12	2.5	21.57
M ₂ H ₁	8.21	7.08	14.8	925.03	8.61	24.23	5.42	13.59	2	22.23
M ₂ H ₂	8.45	7.94	16.27	1105.13	10.97	29.35	5.09	13.54	2.17	20.63
M ₂ H ₃	8.51	8.09	17.2	1310.03	11.98	31.53	6.01	13.1	2.5	23.44
M ₂ H ₄	8.69	7.67	15.6	1074.96	9.9	27.24	6.78	15.74	2.83	23.83
M ₂ H ₅	8.49	6.88	14.33	946.8	8.3	22.13	7.17	12.57	1.67	20.41
M ₃ H ₁	8.36	7.34	12.67	907.77	7.36	20.46	5.43	9.13	1.5	20.17
M ₃ H ₂	7.37	6.62	13.73	914.8	7.71	21.68	5.9	12.1	2.33	19.8
M ₃ H ₃	7.71	7.17	14.4	938	8.55	22.88	6.78	10.68	2.33	18.91
M ₃ H ₄	8.14	7.14	11.73	905	7.26	20.18	6.32	14.74	1.83	23.38
M ₃ H ₅	6.71	5.87	11.2	883.23	6.7	19.55	6.11	12.32	1.67	21.48
SEm±	0.26	0.15	0.73	47.99	0.31	0.94	0.24	0.90	0.24	1.25
CD (P=0.05)	0.86	0.52	NS	162.28	1.03	3.16	0.81	3.04	0.79	4.22

Fig 1: Harvested rhizome of ginger cv. Nadia under different treatments

From the result of the investigation, it was concluded that planting during April and harvesting at 8 MAP (*i.e.*, December) recorded the highest yield however, in respect to the quality characters *viz.*, essential oil, oleoresin content and dry recovery showed better value during April planting and harvested at 9 MAP for ginger cv. Nadia.

Reference

- Aggarwal S, Korla BN, Sharma V. Effect of date of planting and mulch material on growth and yield of ginger (*Zingiber officinale* Rosc.) Haryana Journal of Horticulture Science. 2002; 31(1/2):108-110.
- Anonymous. The leading ginger producing countries in the world, 2017. <https://www.worldatlas.com>
- Horwitz K. Evaluation of oleoresin content from black pepper berries using actone. Journal of Intr. Academy. 1980; 9:341-344.
- Kumar B, Gill BS. Effect of method of planting and harvesting time on growth, yield and quality of turmeric (*Curcuma longa* L.). Journal of Spices and Aromatic Crops. 2009; 18(1):22-27.
- Monnaf MA., Rahim MA., Hossain MMA, Alam MS. Effect of planting method and rhizome size on the growth and yield of ginger. Journal of Agroforestry Environment. 2010; 4(2):73-76.
- Panse VG, Shukhatme PV. Statistical methods for Agricultural workers. Indian Council of Agricultural Research, New Delhi, 1997.
- Purthi JS. Quality assurance in spice and spice products: Modern Method of Analysis. Publications and Information Division. Indian Council of Agriculture Research Khrishi Anusandhan Bhavan, Pusa, New Delhi 110012, 1998, 244-283p.
- Sanwal SK, Singh SK, Yadav RK, Singh PK, Misra AK. Yield and quality assessment of ginger (*Zingiber officinale* Rosc.) genotypes. Indian Journal of Plant Genetic Resource. 2012; 25(3):281-286.
- Sharma A. Effect of harvesting dates on growth, yield and quality of ginger (*Zingiber officinale* Rosc.).M.Sc thesis, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, 2004.