Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5034

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (3):** 844-848 (2017)

Review Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Evaluation of Ginger (*Zingiber officinale* Rosc.) Genotypes for growth, Yield and Quality

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Received: 20.06.2017 | Revised: 28.06.2017 | Accepted: 29.06.2017

ABSTRACT

India occupies an unique position of being the largest producer and exporter of ginger in the world. The average productivity of the crop at present is very low (4.9 MT per ha). There is tremendous scope to increase the yield per unit area and there by the total production. It is basic need to develop high yielding varieties with better quality to increase the production and productivity of ginger in India. The available germplasm serves as most valuable natural reservoir for providing donor parent to improve the particular traits by genetic reconstruction of plant[5]. Therefore, collection, conservation and evaluation of germplasm are essential for present as well as future crop improvement programmes.

Key words: *Germplasm, Crop, Ginger, Varieties.*

INTRODUCTION

Ginger (*Zingiber officinale* Rosc.) is one of the oldest known spices valued for its aroma and pungency. It is both spice cum medicinal plant originated from South East Asia. It has been in use for more than 5000 years ago by ancient Chinese and Indians and it finds a place in Bible, Kuran, Mahabharata and Ramayana.

Ginger belongs to the family Zingiberaceae under the natural order Scitamineae. It is a herbaceous perennial but cultivated as an annual. Ginger of commerce is the rhizome which is the modified stem for storage of food material. Aroma and flavour in ginger are imparted by essential oil, which mainly constitute zingiberene and phellandrene. The full taste of ginger including pungency is present in the oleoresin and the constituents responsible for pungency are gingerol and shogaol.

Ginger is used both in fresh and dried form. It is utilised widely as spice, for pickles, candies and as a medicinal herb for the treatment of gastrointestinal diseases, including dyspepsia, nausea and diarrhea. The anti-inflammatory and anti nausea properties of ginger have applications in the pharmaceutical industry.

Cite this article: Goudar, S.A., Shashidhar M.D., Hadapada, B., Mahantesh, P.S. and Dharamatti, V.U., Evaluation of Ginger (*Zingiber officinale* Rosc.) Genotypes for growth, Yield and Quality, *Int. J. Pure App. Biosci.* **5(3):** 844-848 (2017). doi: http://dx.doi.org/10.18782/2320-7051.5034

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As a component of traditional health products, ginger is known to be effective as appetite enhancer, anti-cold and a potent antioxidant. The application of ginger to treat rheumatism, toothache and malaria is also well documented. Ginger oil is used in food, beverage and fragrance industry.

Ginger production is mainly distributed over India, China, Nigeria, Indonesia, Bangladesh, Thailand, Philippines, Nepal and Jamaica. India ranks first with respect to ginger production contributing to about 34.6 percent, followed by China, Nepal, Nigeria, Thailand and Bangladesh[1]. Indian ginger popularly known as cochin ginger, mainly comes from kerala is known for its quality in the world market. In India, it is grown in an area of 1,32,620 ha spread over Kerala, Assam, Gujarat, Sikkim, Arunachal Pradesh, Meghalaya, Orissa, West Bengal, Mizoram, Andhra Pradesh and Karnataka with an annual production of 6,55,060 MT and productivity of 4.9 MT/ha. Among the states, Orissa occupies 11.94 percent of total area and Assam is the largest producer with 18.67 percent of total production of the country. In Karnataka, it is grown in an area of about 15,710 hectares with an annual production of 50,050 MT[2]. It is mainly grown in the districts of Coorg, Shivamogga, Bidar, Dakshina Kannada, Udupi, Bengaluru, Uttar Kannada and Belagavi.

The average productivity of the crop at present is very low (4.9 MT per ha). There is tremendous scope to increase the yield per unit area and there by the total production. A good amount of genetic variability has been reported among different varieties with regard to growth, yield and quality parameters under different agro-climatic conditions. Several cultivars of ginger are grown in different ginger growing areas in India. They are generally named after the localities or place where they are grown. These local cultivars are selected, domesticated and planted for a long time under local natural conditions. They generally have greater adaptability, higher yield, better quality and unique use value. The available germplasm serves as most valuable natural reservoir for providing donor parent to improve the particular trait[5]. Therefore, collection, conservation and evaluation of germplasm are essential for present as well as future crop improvement programmes.

Evaluation of Ginger genotypes for Growth and Yield attributes

Manomohandas *et al*[12]., evaluated ten genotypes of ginger for 6 years and observed significant differences for number of tillers, leaf number and yield. The range of variations for number of tillers (7.73 – 10.84), plant height (66.87-72.37 cm) and number of leaves (60.76-88.84) were recorded. The fresh yield per hectare was maximum in V2E5-2 (40.38 t/ha) and minimum was recorded in Rio- de-Janeiro (27.59 t/ha).

Maximum plant height (87.67 cm) and number of tillers per plant (9.9) was recorded in cv. Nadia while minimum (70.84 cm and 5.36, respectively) was recorded in cv. Karkal. Again, the highest fresh yield per plant (316.83 g) was recorded in cv. Nadia and lowest (184.66) was in cv. HP-666[21]. Kale[9] observed maximum plant height (54.50 cm), number of tillers per plant (27.98), leaf area index (18.70), fresh yield per plant (258.92 g) and fresh yield per hectare (28.45 t) in Humnabad Local.

Yadav[23] reported that, maximum plant height (50.2 cm) and fresh rhizome yield (175.3 q/ha) in Varada. Number of leaves was maximum in V_1S_1 8 (110), while minimum was recorded in SG 554 (81.2). Number of primary rhizomes was high in SG 554 (8) and lowest was recorded in V_3S_1 8 (5).

Kale *et al*[10]., recorded, the highest essential oil content in Rio-de-Janeiro (2.38 %) which was followed by Suravi (2.10 %). The oleoresin content was maximum in Humnabad (8.94 %) which was on par with Rio-de-Janeiro (8.73 %) and the minimum was recorded in Haveri (3.69 %). The crude fibre content was lowest in Basavakalyan (3.28 %) which was followed by Suruchi (3.51 %) and the highest was found in Haveri (6 %).

Kurubar[11] evaluated fifteen ginger genotypes and found maximum plant height (45.20 cm), number of tillers per plant (16.80),

fresh yield per plant (24.42 t/ha), harvest index (63.23%) and highest curing percentage (24.00 %) in cv. Humnabad. Number of days taken from planting to harvesting varied significantly from 200 days in Maran to 241 days in Kundapur.

Sasikumar *et al*[19]., reported that, two high yielding varieties IISR Mahima (Acc. 117) and IISR Rejatha (Acc. 35) had maximum plant height (67.63 and 65.30 cm respectively), number of tillers (8.26 and 12.80, respectively), fresh rhizome yield (23.20 and 22.40 t/ha respectively) and dry ginger yield (5.30 and 4.35 t/ha respectively). Among the accessions, the dry recovery varied from 18.67 - 21.33 percent. IISR Mahima recorded dry recovery of 21.12 percent, while it was 20.81percent in IISR Rejatha.

Neerja and Korla[13] evaluated twenty nine ginger genotypes and found significantly high yield per plot ($3m^2$) in genotypes 51/04 (7.5 kg) and SG 707 (7.0 kg) compared to check Himgiri (6.00 kg). Jyotsana *et al*[8]., observed highest plant height (69.2 cm), number of tillers per plant (7.4), leaf area index (3.03), fresh rhizome yield (20.46 t/ha) and dry matter percent (20.31 %) in Bhaisey, while the lowest was recorded in Manipur Local. Crop growth rate was highest in Manipur Local (1.86) and the lowest was recorded in Gorubathan (1.64).

Chongatham *et al.*, recorded maximum fresh rhizome yield per plant (201.00 g) and per hectare (18.27 t/ha) in cv. Gorubathan. The curing percentage was maximum in Sambuk (33.48 %) and lowest was recorded in Suprabha (26.90 %). IISR Varadha (3.53 cm) was found to have highest length of primary rhizome and lowest was recorded in Suruchi (3.01 cm). The length of secondary rhizome was highest in cv. V_3S_1-8 (3.73 cm), while the lowest was recorded in IISR Varada (2.74 cm). Shakeel and Kazuo[20] evaluated land races of ginger under Japan conditions and found variations for different characters like number of leaves per plant, plant height, number of tillers per plant and weight of the rhizome.

Rajyalakshmi and Umajyothi[15] recorded highest plant height (50.60 cm), number of tillers per plant (10.07), number of leaves per plant (18.87), number of mother rhizomes (14.90), finger rhizomes (13.37) and fresh rhizome yield (21.71t/ha) in Suprabha. Positive significant correlation of rhizome yield with number of finger rhizomes/plant, number of mother rhizomes/plant and number of tillers/plant was observed. Ravishankar *et al*., evaluated 25 ginger genotypes and observed significant variation for different characters like plant height, girth of the plant, days taken to harvest, number, length and diameter of the primary rhizome and yield per plant.

Sangeetha and Subramanian[17] evaluated thirty ginger genotypes and observed variation for different characters like plant height (43.5 cm in ZO-12 to 60 cm in ZO-26), number of leaves per plant (60.15 in ZO-12 to 148.16 in ZO-26), number of tillers per plant (2.8 in ZO-12 to 7.3 in ZO-28), leaf area (1249.17 cm^2 in ZO-26 to 2378.72 cm^2 in ZO-26), yield per plant (42.07 g in ZO-12 to 179.42 g in ZO-26), yield per hectare (5.33 t/ha in ZO-12 to 28.62 t/ha in ZO-26) and dry recovery (18.28 % in ZO-19 to 25.16 % in ZO-12).

Evalution of Ginger genotypes for Quality attributes

Under the Himachal Pradesh condition, maximum oleoresin content was recorded in the cv. Thinglaidum (5.44 %), followed by Rio-de-Janeiro (5.25 %), Khasi Local (5.08 %) and the minimum was recorded in the cv. Ernad (4.14%). Crude fibre content was lowest in the cv. HP-666 (4.33 %) and was highest (9.37 %) in the cv. Nadia[21].

Kurubar[11] reported highest essential oil content in cv. Rio-de-Janeiro (2.40%) while it was lowest in cv. Mahima (1.00 %). Oleoresin content ranged between 3.20 percent in cv. Mahima to 8.70 percent in cv. Humanabad. Highest crude fibre content was recorded in Mahima (5.18 %) followed by Bhaisa (4.58 %) and lowest was in Basavakalyana (3.10 %).

Tiwari[22] evaluated twenty four genotypes of ginger for quality attributes under rain fed and irrigated conditions. BDJR and 1054B gave highest oleoresin content under rain fed and irrigated conditions (5.31 and 5.27%, respectively). Whereas, higher essential oil content was found in SG 61 (2.28%) and SG 687 (2.18%) under rain fed and irrigated conditions, respectively. Sasikumar *et al*[19]., found highest essential oil (2.36%) and oleoresin content (6.34 %) in Acc.35 (IISR Rejatha). The crude fibre was minimum in Acc. 294 (2.32 %) and maximum (4.00 %) was found in Acc. 35 (IISR Rajatha).

Hegde *et al*[6]., evaluated performance of 15 ginger genotypes under open and coconut shade in Arabhavi, Karnataka, and observed that Rio-de-Janeiro had the maximum essential oil content (2.40% in open and 2.35% under coconut shade). The oleoresin content was highest in Humnabad (8.70 under open and 8.60% under shaded condition) followed by Rio-de-Janeiro (8.35 under open and 8.01% under shaded condition).

Neerja and Korla[13] evaluated twenty nine ginger genotypes and observed significantly higher essential oil and oleoresin content. Essential oil content was maximum in SG-716, SG-827, SG-995 and SG-12/04 (2.0%) compared to the check Himgiri (1.4%) and lowest was recorded in SG-1085 (1.3 %). The oleoresin content was highest in SG-682 (6.9%) and SG-716 (6.6%) compared to check Himgiri (4.8%) and least was in SG-1085 (4%). The fibre content ranged from 3 percent in SG-716 to 6.3 percent in SG-1071.

Jaleel and Sasikumar[7] evaluated fourty six ginger genotypes for quality and revealed that the essential oil ranged from 0.9 percent in Mananthodi to 4 percent in pink ginger. The oleoresin content was high in Kozhikode (8.2 %) and lowest was in Karakkal (2.7 %). Fibre content was minimum in Kintoki (1.3 %) and maximum was recorded in Kottayam (8 %). From this study it was found that the primitive types/land races were rich in oleoresin and essential oil and low in crude fiber content compared to the improved varieties.

Eleazu and Eleazu[4] observed that the oleoresin content was ranging from 2.93 percent in UGII7GY25 to 3.97 percent in UGII7GY5. The crude fibre content was lowest in UGII7GY25 (1.2 %), while the highest was recorded in UGII11GY11 (1.9 %). Jyotsna *et al*[8]., observed the highest oleoresin content in Bhaisey (5.12 %), Gorubathan (4.88 %), Nadia (4.6%) and the lowest was recorded in Manipur Local (4.28 %). The fibre content ranged from 5.17 % in Nadia to 6.17 % in Gorubathan.

Sanwal *et al*[18]., evaluated thirty three ginger genotypes and observed variation for essential oil content (1.10 % in Khasi Local to 1.90 %) and crude fibre content (5.16 % in China to 8.03 % in Burdwan). Chongtham *et al*[3]., recorded the highest oleoresin content (10.25 %) in cv.Suravi followed by Suruchi (6.25 %), V_3S_1-8 (5.78 %) and the least was observed in Sambuk Local (3.00 %).

Nileema *et al*[14]., observed the highest oleoresin content in Mahima (3.94 %) followed by Varada (3.79 %) and the lowest was recorded in Rejatha (3.58 %). There was no significant difference for oil content among the varieties (Varada - 1.38 %, Mahima -1.36 % and Rejatha - 1.36 %). Ravishanker *et al*[16]., observed variation for oleoresin content among the twenty five ginger genotypes with an average of 5.48 percent.

REFERENCES

1. Anonymous, Food and Agricultural organisation, United Nation, Statistics division, Faostat3.fao.org (2013).
2. Anonymous, Indian Horticulture Database, National Horticulture Board, 2013-2014. Ministry of Agriculture, Government of India, Gurgaon, P. 14 (2014).
3. Chongtham, T., Chatterjee, R., Hnamte, V., Chattopadhyay, P.K. and Khan, S.A., Ginger germplasm evaluation for yield and quality in Southern West Bengal. *J. Spices and Arom. Crops*, **22 (1):** 88-90 (2013).
4. Eleauz, C.O. and Eleauz, K.C., Physico - chemical properties and antioxidant potentials of 6 new varieties of ginger (*Zingiber officinale* Rosc.). *Am. J. Food Technol.,* 1-8 (2012).

5. Hawkes, J.G. and Frey, K.J., Germplasm collection, preservation, and use in Plant Breeding II. The Iowa State University Press, 57-83 (1981).
6. Hegde, N.K., Kurabar, A.R., Hanamashetti, S.I. and Kulkarni, M., Quality of ginger genotypes grown under open and coconut shade. *Biomed,* **1(2):** 120-124 (2006).
7. Jaleel, K. and Sasikumar, B., Variabilty for quality traits in a global germplasm collection of ginger (*Zingiber officinale* R.). *Current Trends in Biotechnology and Pharmacy*, **3(3)**: 254 – 259 (2009).
8. Jyotsna, N., Ghosh, D.C. and Meitei, W.I., Study of growth, yield and quality of organically grown ginger varieties under rainfed condition of Manipur. *J. of Crop and Weed,* **8(1):** 17-21(2012).
9. Kale, A.R., Evaluation of ginger (*Zingiber officinale* Rosc.) genotypes under open and shaded situation. *M. Sc. (Hort.) Thesis*, Univ. Agric. Sci., Dharwad (2001).
10. Kale, U.B., Hegde, N.K., Hanamashetti, S.I. and Patil, P.L., Quality of ginger genotypes in the Ghataprabha left bank command area of Northern Karnataka. *Karnataka J. Agric. Sci.*, **16(4):** 633-635 (2003).
11. Kurubar, A.R., Evaluation of ginger (*Zingiber officinale* Rosc.) genotypes under open and shaded situation. *M. Sc. (Hort.) Thesis*, Univ. Agric. Sci., Dharwad (2003).
12. Manomohandas, T.P., Pradeepkumar, T., Mayadevi, P., Aipe, K.C. and Kumaran, K., Stability analysis of ginger (*Zingiber officinale* Rose.) genotypes. *J. Spices and Arom. Crops.,* **9(2):** 165-167 (2000).
13. Neerja, R. and Korla, B.N., Evaluation of ginger germplasm for yield and quality under mid hill conditions of Himachal Pradesh. *Haryana J. of Hort. Sci.,* **36(3/4):** pp.393-394 (2007).
14. Nileema, C.R., Srinivasan, V., Hamza, S., Leela, N.K. and Thankamani, C.K., Quality profile of ginger under different management systems. *J. Spices and Arom. Crops.,* **23(1):** 125-129 (2014).
15. Rajyalakshmi, R. and Umajyothi, K., Evaluation of Ginger (*Zingiber officinale* Rosc.) varieties in high altitude and tribal zone of Srikakulam district of Andhra Pradesh. *J. Spices Arom. Crops*, **23(2):** 258–261 (2014).
16. Ravishanker, Santosh Kumar, Chatterjee, A., Baranwal, D.K. and Solankey, S.S., Genetic variability for yield and quality traits in ginger (*Zingiber officinale* Rosc.). *The Bioscan,* **8(4):** 1383-1386 (2014).
17. Sangeetha, K.S. and Subramanian, S., Evaluation of ginger (*Zingiber officinale* Rosc.) genotypes under coconut ecosystem. *The Bioscan,* **10(4):** 1925-1928 (2015).
18. Sanwal, S.K., Singh, S.K., Yadav, R.K., Singh, P.K. and Misra, A.K., Yield and Quality Assessment of Ginger (*Zingiber officinale* Rosc.) Genotypes. *Indian J. Pl. Gen. Res.,* **25(3):** 281–286 (2012).
19. Sasikumar, B., Saji, K.V., Alice Antony, Johnson, K. G., John, Z. T. and Eapen, S. J., IISR Mahima and IISR Rejatha - two high yielding and high quality ginger *(Zingiber officinale* Rose.) varieties. *J. Spices and Arom. Crops*, **12(1):** 34-37 (2003).
20. Shakeel, A. and Kazuo, N.W., Diversity analysis and relationships among ginger landraces. *Pak. J. Bot.,* **45(4):** 1203-1214 (2013).
21. Singh, P.P., Singh, V.B., Singh, H.P. and Rajan, S., Genetic diversity in ginger (*Zingiber officinale* Rosc.) with reference to essential oil content. *J. Spices and Arom. Crops,* **9(2)**: 161-164 (2000).
22. Tiwari, S.K., Evaluation of ginger genotypes for yield and quality attributes under rainfed and irrigated conditions. *Annals of Agril. Res*., **24(3):** 512-515 (2003).
23. Yadav, R.K., Performance of ginger and turmeric genotypes in Raigarh District of Chattisgarh. *J. Spices and Arom. Crops*, **11(1):** 62-63 (2002).