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Evaluation of different mango (*Mangifera indica*) varieties for high density orchard in lateritic zone of eastern India

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ABSTRACT

The present experiment was conducted under the semi-arid subtropical red lateritic zone of eastern India in West Bengal with seven years old popular mango *(Mangifera indica* L.) varieties grown at Horticulture Research Farm of Department of Horticulture and Postharvest Technology, Institute of Agriculture, Visva-Bharati, Sriniketan, West Bengal, India during 2015 and 2016. The varieties were evaluated for various morphological characters, yield and physicochemical quality of fruits. The results revealed that Kohinoor exhibited maximum tree volume (41.99 m^3), fruit yield (21.03 kg/tree) and fruit weight (253.33 g/fruit). Whereas, Kohitoor exhibited maximum TSS (20.07 ^oB), TSS/acid ratio (100.35) and ascorbic acid (43.17 mg/100g) content of the fruits. Acidity content was found lowest (0.17%) in Gulab Khas. Regarding morphological characters, yield and physicochemical quality of fruits, the varieties Kohinoor, Kohitoor, Inayat Pasand are superior in quality and stand to promise for the small family farming orchard in the red lateritic zone of eastern India.

Key words: Eastern India, Family farming, Lateritic zone, Mango, Varieties

Mango (*Mangifera indica* L.) belongs to the dicotyledonous family Anacardiaceae has more than 40 species and are believed to be grown in the tropical and sub-tropical region of South Asia probably in India for over 4000 years (Ravi *et al*. 2002). Mango contains a large amount of fiber, carbohydrates, minerals and a little amount of protein. It has more carotenoids content than most the fruit crops and also has a good amount of vitamin B and C. Carotenoids help to reduce the risk of cancer and heart diseases. The composition, in general, differs with varieties and stage of maturity.

It is an important fruit crop of the eastern part of India which is known to be the place of its origin. In West Bengal, Malda, Murshidabad, Burdwan, Nadia and Hoogly are known to be major mango producing districts. It can be grown up to an altitude of 600 m from mean sea level. However, it cannot withstand severe cold and frost and it is limited to tropical or near tropical climate because of its susceptibility (tenderness) to cold. Hot winds also adversely affect the plant. Mango trees are grown on a wide range of soil types but best production comes from well drained sandy loam soil (about 150-180 cm deep) having subsoil free from hard sticky clay and water-logged conditions. The water requirements depend on the type of soil and climate, planting distance, variety, age of plants, developmental stages, fertilizers (N,P,K) applications and weather conditions (Malik and Mitra 2001, Reddy *et al.* 2001, Gawankar *et al*. 2010, Dhake *et al*. 2011). However, at the flowering time the irrigation interval should be reduced as its affects flowers drop. During summer, weekly irrigation is required but during winter, it is irrigated fortnightly. Since mango fruit needs a special type of soil, climate and has different irrigational and nutritional requirements, it would then be necessary to choose varieties which can be best grown in the dry lateritic zone of eastern India. This study is therefore designed for high-density planting to select suitable varieties for small family farmers who are interested in planting an orchard in their own farm in the red lateritic zone of eastern India.

MATERIALS AND METHODS

The present investigation was carried out in Horticulture Research Farm of Department of Horticulture and Postharvest Technology, Institute of Agriculture, Visva-Bharati, Sriniketan, West Bengal, India during 2015 and 2016. The experimental orchard is located at an elevation of 40 m above mean sea level at 23° 42' N latitude and 87° 47'30" E longitudes, representing humid semi-arid subtropical region under red lateritic region of eastern India with mean temperature varying from 34.59°C to 15.17°C.

The experiment was carried out in seven years old popular mango varieties of eastern India, viz. Amrapali, Kohitoor, Rani Pasand, Gulab Khas, Bombai, Kohinoor,

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Inayat Pasand and Safdar Pasand, which were planted at a distance of 5 × 5 m in square system. Uniform cultural operations were followed during the course of the investigation. Tree volume and yield per tree were the parameters recorded at the orchard. Fruits were weighed individually in semi-analytical balance and express in g/fruit. Fruit pulp and stone weight were individually obtained by weighing each party in semi-analytical balance and expressed in grams and from it pulp: stone ratio was also calculated. The titratable acidity of the fruits followed the procedures described by Adolfo Lutz Institute (2008); evaluation of total soluble solids (TSS) was carried out from direct reading in the digital refractometer with results expressed in °Brix. The sugar/acid ratio was also calculated. Ascorbic acid was estimated by the method described in AOAC (2010). Using randomized block design, the varieties were considered as the treatments. Each treatment was replicated three times and each tree represents a single replication. Analyses of variance were carried out using PROC GLM procedure of SAS software (SAS/STAT 2009).

RESULTS AND DISCUSSION

The critical examination of the data of tree volume (Table 1) clearly showed that significant variation was noticed among different varieties. The highest tree volume was recorded in Kohinoor (41.99 m^3) which is at par with Rani Pasand (41.27 m^3) followed by Kohitoor (38.45 m^3) and Bombai (37.57 m^3), whereas the lowest tree volume was observed in Amrapali (12.76 m^3) followed by Safdar Pasand (20.83 m^3). The differences in the morphological characteristics in different varieties of fruits are probably due to their genetic makeup as well as due to the influence of climatic factors (Khurshid *et al*. 2004). The above results are in accordance with Patel (2008); Das and Nath (2016), which characterized different mangoes varieties by their morphological features. Earlier Gangoli *et al*. (1957) categorized Rani Pasand, Kohinoor, Kohitoor and Bombai in large and vigorous varieties groups while Inayat Pasand, Gulab Khas and Safdar Pasand in medium and moderate vigorous varieties group which significantly supported the results of the present investigation.

Table 1 Tree characteristics and fruit attributes and yield of different varieties of mango

Varieties	Tree Vol. (m^3)	Yield (kg/tree)	Fruit weight (g/fruit)	Pulp/Stone ratio
Amrapali	12.76	13.99	187.20	5.00
Kohitoor	38.45	17.84	251.42	4.00
Rani Pasand	41.27	14.18	205.57	3.16
Gulab Khas	26.59	13.80	181.49	3.72
Bombai	37.57	16.07	196.01	7.14
Kohinoor	41.99	21.03	253.33	4.06
Inayat Pasand	30.43	12.64	251.24	4.00
Safdar Pasand	20.83	12.50	190.18	5.00
CD (P=0.05)	9.04	2.38	0.94	0.90

The scrutiny of the data in Table 1 clearly indicates that the treatments differ significantly with respect to the fruit yield (kg/tree). The maximum fruit yield was recorded in Kohinoor (21.03 kg/ tree) followed by Kohitoor (17.84 kg/tree) and Bombai (16.07 kg/ tree). The minimum fruit yield was recorded in Safdar Pasand (12.50 kg/tree) which is at par with Inayat Pasand (12.64 kg/tree). Highly significant differences in fruit weight were also noted among different mango varieties (Table 1). Maximum fruit weight was recorded in Kohinoor (253.33 g) against minimum that in Gulab Khas (181.49 g). The corresponding effects of the tree morphological characters on fruit physical characters are due to the phenomenon that the rate of photosynthesis is directly proportional to the size of the tree canopy. Higher photosynthesis in varieties resulted in higher production of photosynthetic materials which are translocated to the active sink including fruit and ultimately resulted in the increased of fruit size and higher fruit yield (Singh and Rajan 2009, Surendar *et al*. 2013).

A perusal of data in Table 1 significant difference was existed in the pulp/stone ratio among the different mango varieties. Maximum pulp/stone ratio was exhibited in Bombai (7.14), whereas the minimum pulp/stone ratio was exhibited in Rani Pasand (3.16). The above results are in accordance with that of Hassan *et al*. (2004) and Kudachikar *et al*. (2003) where they observed significant variation in the percentage of pulp, peel and seed of fruit in different mango varieties. This variation may be due to the genetic or the physiological factors.

A careful scrutiny of the data clearly in Table 2 clearly indicated that the different varieties of mango have significant variation in TSS content of the fruits. The maximum TSS content was recorded in Kohitoor (20.07 °B) followed by Inayat Pasand (19.28 °B), whereas the minimum TSS content was recorded in Gulab Khas (16.90 °B). This finding is in accordance with that of Bhuyan and Guha (1995) in Rajshahi climatic conditions and Mitra *et al*. (2001) in West Bengal condition which clearly exhibited variation in TSS content among the different mango varieties.

The maximum titratable acidity (0.23%) was recorded in Rani Pasand which was at par with Kohinoor and

Table 2 Fruit quality of different varieties of mango varieties

Treatment	TSS (°B)	Acidity (%)	TSS/Acid ratio	Ascorbic acid (mg/100g)
Amrapali	17.86	0.19	94.00	34.96
Kohitoor	20.07	0.20	100.35	43.17
Rani Pasand	18.54	0.23	80.61	23.80
Gulab Khas	16.90	0.17	99.41	41.49
Bombai	17.83	0.19	93.84	28.80
Kohinoor	18.41	0.22	83.68	37.06
Inayat Pasand	19.28	0.22	87.64	41.84
Safdar Pasand	17.70	0.18	98.33	21.96
CD (P=0.05)	0.19	0.02	4.95	1.46

Inayat Pasand (Table 2). The lowest titratable acidity was obtained in Gulab Khas (0.17%) which is on par with Safdar Pasand, Amrapali and Bombai. This result is in conformity with the finding of Kalra *et al*. (1994), which exhibits variation in acidity among various mango varieties with the lowest acidity in fruits of Gulab Khas in Lucknow conditions.

Maximum TSS/acid ratio was recorded in Kohitoor (100.35) which is at par with Gulab Khas followed by Safdar Pasand while, minimum TSS/acid ratio was recorded in Rani Pasand (80.61).

Different mango varieties showed significant variation among themselves with respect to ascorbic acid content which ranges from 21.96 mg/100g (Safdar Pasand) to 43.17 mg/100g (Kohitoor). Significant variation in the ascorbic acid content of the different mango varieties were also earlier reported by Mitra *et al*. (2000) and Sharma *et al*. (1999).

Conclusion

Based on plant height, physicochemical quality and yield of the different mango varieties it can be concluded that the mango variety Kohinoor, Kohitoor, and Inayat Pasand can be grown successfully in the small family farming orchard in lateritic zone of eastern India.

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