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Screening and Selection of Superior Plant Types in Comparison to Alphonso Mango

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A B S T R A C T

An experiment was conducted during (2002 to 2017) to select regular bearing spongy tissue free half sibs from seedling population of mango cv. Alphonso. Elite Alphonso trees having a history of regular bearing were selected at Agriculture Experimental Station, Navsari Agricultural University, Paria, Gujarat and in adjoining areas at fields of progressive farmers. Mature fruits were collected from these trees, ripened at room temperature and 228 extracted stones were planted at 5x2.5m spacing in 2002. Alternate Bearing Index (ABI) was used to select thirty regular bearing seedlings (ABI < 0.25) on the basis of yield/tree of 148 surviving seedlings during 2012 to 2017. Based on the yield and fruit characteristics of these trees, three selections (25, 29 and 30) had regular bearing tendencies with promising shape of fruit, colour of pulp, taste and other biochemical parameters and were recommended for further evaluation in block plantations. Incidence of spongy tissue was not recorded in the fruits and there was no major incidence of pest and diseases on these selected plants.

Introduction

The mango (*Mangifera indica* L.), commonly called as the 'King of fruits' in India is acclaimed an important tropical and sub-tropical fruit in the world due to its excellent flavour, delicious taste, attractive colour and nutraceutical properties (Nayak *et al.*, 2013). The king of mangoes, Alphonso, better known as 'Hapus' in Gujarat and Maharashtra, is in great demand in domestic and international markets for its taste, pleasant fragrance and vibrant colour. In spite of the economic importance and increasing demand, the spread of Alphonso cultivation, is handicapped by certain problems, among which the development of spongy tissue in its fruits has received general attention of the scientists for the last 90 years. Although, the incidence of spongy tissue was reported as early as 1932, not much is known regarding its exact causes and control. The spongy tissue develops as yellowish white corky patches with or without air pockets in the breakdown tissues. Spongy tissue is caused by various factors and hence it is difficult to

attribute an exact and specific reason for its cause. Singh, (1990) has pointed out that convective heat acts as a causal agent and vegetation or mulch over the soil helps in protecting the fruits from the spongy tissue disorder. The peculiarity of this malady is that the external symptoms of spongy tissue affected fruits are not apparent either at the time of picking or at the ripe stage. The affected tissue is visible only when the ripe fruit is cut into two halves. It renders the fruit unfit for human consumption and fetches low value in the market. Alphonso also has a tendency of alternate bearing which is considered as one of the long standing unresolved problems, directly and substantially contributing to poor production. It was observed that unbalanced fertilization, micronutrients deficiencies, poor tree management and inadequate cultural practices are mainly responsible for orchard related quality issues (Ahmad and Rashid, 2003). These bottlenecks have limited the expansion of Alphonso cultivation in Maharashtra, Karnataka, Andhra Pradesh and Gujarat States where it is grown commercially.Mango is a cross-pollinated crop and pollination is essential for fruit set which is primarily accomplished by insects; housefly (*Musca domestica* L.) being the chief agent. Hence, this study was designed to screen regular bearing, spongy tissue free half sibs from the segregating seedling polulation raised from Alphonso stones.

Materials and Methods

Studies were conducted from (2002-2017) at the Agriculture Experimental Station, Navsari Agricultural University, Paria (Elevation: 16 m amsl; Latitude: 22° 35' N; Longitude: 72° 35' E). The site is located in the western coastal region of India, which is characterized by sub-tropical, hot and humid climate. The monsoonal rains commence from the second week of June and most of the precipitation is received during mid-June to end of September. The seasonal rainfall ranges from 1500 -2000 mm. Minimum temperature varies from 18.0 ^{0}C to 22.0^{0}C, while May is the hottest month when the maximum temperature varies from 35.0 ^{0}C to 41.0 ^{0}C. Soil of the experimental plot was medium to deep with high clay content, belonging to vertisols, medium in nitrogen, high in phosphorus and sufficient in potash.Elite Alphonso trees having a history of regular bearing were selected at Agriculture Experimental Station, Navsari Agricultural University, Paria, Gujarat and in adjoining areas at fields of progressive farmers. Mature fruits collected from these trees were ripened at room temperature and 228 extracted stones were planted at 5 x 2.5 m spacing in 2002.All the trees were provided with standard orchard management practices including insect and pest management. Out of the total 228 stones planted in the field, due to mortality 148 plants were available in the experiment in 2012 which had come to bearing. The yield per plant, fruit characters were recorded during the successive years from 2012 to 2017. The severity of alternate bearing was calculated by Alternate Bearing Index (ABI) as given by (Monselise and Goldschmidt, 1982).

$$ABI=1/(n-1) \quad X \quad \{|(a_2-a_1)|/(a_2+a_1)+|(a_3-a_2)|/(a_3+a_2) \ldots + |(a_n)-a_{(n-1)})|/(a_{(n)}+a_{(n-1)})\}$$

where n = number of years, and a_1, a_2, …, $a_{(n-1)}$, a_n = yield of corresponding years. The calculation within brackets is done ignoring signs of terms

Where ABI = 0 is no alternate bearing and ABI = 1.0 is complete alternate bearing.

Out of the total 148 trees screened, 30 regular bearing trees (ABI< 0.25) were evaluated for sensory and biochemical analysis of fruits as per fruit descriptors for mango. Twenty

mature fruits were collected from each tree and all physical properties of fruits *viz*. fruit weight (g), fruit length (cm) and fruit width (cm)were evaluated at fully ripestage. Then the same fruits were peeled for weighing pulp, peel and seeds to express them as percentage of total fruit weight. Total Soluble Solids (TSS) were measured by digital refractometer (0–32 °Brix), total and reducing sugars were estimated by methods suggested by Ranganna (1986) and titratable acidity was estimated by 0.1N NaOH method (AOAC, 2005). The sensory test was carried out with ten volunteers recruited from the faculty of Agriculture Experimental Station, Paria. Panelists were trained on descriptive analysis, using the Spectrum method (Meilgaard *et al.*, 1991). Introductory sessions to discuss flavor and aroma concepts, as well as training sessions to test their ability to detect the basic tastes and to describe and discriminate aromas, were performed. A vocabulary for basic tastes, texture, aroma, aromatics, chemical feeling factors, and aftertaste attributes for mangoes was developed. A hedonic scale from 0 (lowest) to 9 (highest) was used, following the universal intensity scale for common aromatics. Shelf life was also studied and incidence of spongy tissue, insect/pest was recorded. Statistical analysis was carried out by following the standard methods as given by Panse and Sukhatme (1967).

Results and Discussion

The results presented in this study are particularly important because they represent morpho-physico-chemical traits, which are highly heritable. Morphotaxonomic parameters like fruit weight, fruit length, fruit width, seed weight, skin weight, pulp weight, percent edible portion and total soluble solids of 148 half sibs of Alphonsowere analyzed and presented in Table 1. A large variation was observed for all the physico-chemical fruit characteristics studied. The fruit weight ranged from 166 g to 425 g while the pulp percentage ranged from 48.74 to 79 %. It was concluded by Gill and Navprem (2015) that fruit weight, fruit breadth and peel weight are the major yield contributing characters and hence during selection, weightage should be given to these characters for the development of high yielding cultivars of mango. Higher pulp percentage can be used for selection of varieties that have potentiality for exploitation for juice and canning industry (Navprem *et al.*, 2011). Other important characteristics viz; TSS, seed weight and peel weight also exhibited large variation as is evident from the range and coefficient of variation values amongst these seedlings (Table 1). Sugar and acids are the primary taste compounds which enhance human perception of specific flavours including aroma but acidity and TSS are also related well to sourness and astringency (Malundo *et al.*, 2001). ABI ranged from 0.11 to 0.70 suggesting the variability and tendencies towards regular and alternate bearing in segregating population. All these observations clearly exhibited the existence of large variation in the half sib population, which offers a chance for the selection of superior clones. In the past also, most of the mango cultivars have originated as openpollinated seedlings in nature (Pandey, 2015).

Thirty regular bearing half sibs (ABI < 0.25) were evaluated and compared with Alphonso fruits for physico-chemical traits and sensory attributes. After careful analysis of data three half sibs were selected for further evaluation in block plantation (Table 2). The shape of fruit which is characteristic obovoid in case of Alphonso was taken into consideration during sensory evaluation. Higher pulp percentage (72 %) and TSS (20.2 ^{0}Brix) was recorded in Selection 29 than Alphonso where the corresponding values were 71 % and 19.8 ^{0}Brix, respectively.

Table.1 Variability for physicochemical and sensory attributes in 148half-sib Alphonso seedlings

Fruit Character	Range	Mean	Standard deviation	Coefficient of Variability (%)
Fruit weight (g)	166 - 425	296.57	77.77	26.22
Fruit length (cm)	7.5-18.50	12.34	2.44	19.77
Fruit width (cm)	5.30-11.20	7.15	1.06	14.82
Fruit length: width	1.04-2.95	1.76	0.44	24.71
T.S.S. (^{0}Brix)	12.00-20.20	16.19	2.51	15.50
Stone weight(g)	19.36-87.15	49.23	17.16	34.87
Stone percentage	10.81-21.96	16.42	3.27	19.92
Peel weight (g)	16.60-146.85	65.36	29.60	45.29
Peel percentage (%)	7.66-38.90	21.93	7.45	33.97
Pulp weight (g)	89.84-307.00	183.89	53.83	29.27
Pulp (%)	48.74-79.00	61.70	7.28	11.81
ABI (Alternate Bearing Index)	0.11-0.70	0.38	0.14	36.74

Table.2 Comparison of selected half sibs with Alphonso

Fruit character	Alphonso	Selection 25	Selection 29	Selection 30
Fruit weight (g)	293.0	218.0	216.0	260.0
Fruit length (cm)	10.5	10.2	10.4	10.4
Fruit width (cm)	8.4	8.1	7.5	7.3
Fruit length: width	1.3	1.3	1.4	1.4
T.S.S. (^{0}Brix)	19.8	19.5	20.2	19.4
Stone weight(g)	38.2	39.2	34.6	36.4
Stone percentage	13.0	18.0	16.0	14.0
Peel weight (g)	46.8	24.0	25.9	44.2
Peel percentage (%)	16.0	11.0	12.0	17.0
Pulp weight (g)	208.0	154.8	155.5	179.4
Pulp (%)	71.0	71.0	72.0	69.0
Total Sugars (%)	16.1	14.2	14.0	14.2
Reducing Sugars (%)	3.5	3.8	4.1	3.8
Acidity (%)	0.33	0.26	0.34	0.27
TSS: Acidity	61.9	75.0	59.4	71.9
Shelf life (days)	15	14	15	14
Overall acceptability	8.2	8.1	8	8.1
Pest and disease incidence	Medium	low	Medium	Medium
Incidence of spongy tissue	Medium	Nil	Nil	Nil

Degree of ripeness at which a fruit is tested, plays a major role in the assessment of its sensory qualities and acceptability (Mtebe *et al.*, 2006). A number of biochemical reactions or metabolic activities are involved in the ripening process of mango fruit such as

increased respiration, ethylene production, change in structural polysaccharides causing softening, degradation of chlorophyll and synthesis of carotenoids, changes in carbohydrates or starch conversion into sugars, organic acids, lipids, phenolics and a number of volatile compounds. All these changes lead to ripening of fruit with softening of texture to acceptable quality. These factors predominantly contribute towards developing a total sensory profile of the mango fruit (Herianus *et al.*, 2003).

This study explored the potential of variability in the half sib population of Alphonso mango seedlings and demonstrated the utility of physicochemical and sensory traits to select superior and comparable types of Alphonso which are regular bearers and free from spongy tissue disorder. Finally, three seedlings, having the majority of desirable fruit characteristics in relation to Alphonso were selected for further multiplication and detailed evaluation.

References

Ahmad, N. and Rashid, M. 2003. Fertilizers and their use in Pakistan. Extension Bulletin (3rd ed.). NFDC, Islamabad. Pp. 3-4.

AOAC. 2005. Official Methods of Analysis. 18th Edition, Association Official Analytical Chemists, Gaitherburg, Washington DC.

Gill, Mandeep Singh and Navprem, S. 2015. Genetic Parameters, Character Association and Path Analysis for Fruit Yield and its Component Characters in Mango (*Mangifera indica* L.). Indian J. Plant Genet. Resour. 28(3): 292-295.

Herianus, J.D., Singh, L.Z. and Tan,S.C. 2003. Aroma volatiles production during fruit ripening of 'Kensington Pride' mango. Post Harvest Biol. Tec. 27: 323-336.

Malundo, T.M.M., Shewfelt, R.L., Ware, G.O. and Baldwin, E.A. 2001. Sugars and acids influence flavour properties of mango (*Mangifera indica*). Journal of American Society of Horticultural Sciences. 126: 115-121.

Meilgaard, D., Civille, B.S. and Carr, M.S. 1991. Sensory Evaluation techniques. 2nd Ed., CRC Press, Boca Raton, FL.

Monselise, S.P. and Goldschmidt, E.E. 1982. Alternate bearing in fruit trees. In: J. Janik, ed. Horticultural Rev. 4:128-173.

Mtebe, K., Mamiro, P. and Fweja, L. 2006. Sensory attributes, microbial quality and aroma profiles of off vine ripened mango (*Mangifera indica* L.) fruit. African Journal of Biotechnology, 5: 201-205.

Navprem, S., Jerath, N. and Singh, G. 2011. In situ conservation of seedling mango biodiversity in sub mountane region of Punjab. In Sandhu, S.K., Pathak, D., Sidhu, N., Bhardwaj, R. and Rang, A. (eds). Proceedings of International Conference on Preparing Agriculture for Climate Change. February 6-8th 2011, Ludhiana, India. Crop Improvement 38(Spl. Issue):89-90.

Nayak, D., Singh, A. K. and Srivastav, M. 2013. Estimation of genetic parameters of fruit quality traits in mango hybrid population. Indian J. Hort. 70: 13-17

Pandey, S.N. 2015. Diversity in genus *Mangifera* L. and varietal variation and improvement in mango (*Mangifera indica* L.): A review. Progressive Horticulture 47(1):20-38.

Panse, V.G. and Sukhatme, P.V. 1967. Statistical Methods for Agricultural Workers 2nd Edition. Indian Council of Agricultural Research, New Delhi. 381pp.

Ranganna, S. 1986. Hand Book of Analysis and Quality Con- trol for Fruit and Vegetable Products. Tata McGraw-Hill Pub- lishing Company Limited New Delhi.

Singh, R. N. 1990. Mango. Indian Council of Agricultural Research, News Delhi. 119pp.

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