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Performance of exotic mango cultivars under south Gujarat agro-climatic conditions

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Abstract
The focus of this research was to see how exotic mango cultivars performed in the agro-climatic conditions of south Gujarat. For this investigation, nine exotic mango cultivars were evaluated. Entire nine exotic cultivars can be grown successfully under South Gujarat agro-climatic conditions. Among these cultivar Apple found superior with respect to plant spread, fruit weight, fruit size, and yield. Whereas, on the basis of maximum fruit set, fruit retention, pulp percent, number of fruits per tree and overall acceptability cultivar Maya was found the best.

Keywords: Apple, cultivars, Maya, overall acceptability

Introduction
Mango is one of the most important tropical fruits of the world. It belongs to the family Anacardiaceae. Due to its high nutritional value, delicacy, wide adaptability, flavor, attractive appearance and popularity it enjoys the status of "The King of fruits". Mango is a medium to large evergreen tree with an open or dense symmetrical canopy, long tap root system with open or dense fibrous roots.

A large number of mango varieties are grown in India but the detailed information regarding their morphological and physicochemical characteristics are not available. Dhillon *et al.* (2004) [2] used the more constant and important qualitative and quantitative characters like leaf, fruit and stone characters in the characterization of different mango cultivars. Morphological characterization allows for the study of plant variation using visual attributes. By using morphological characters, it is not only easy to identify any cultivars well before the attainment of bearing stage but also reduces the time period required for improvement programmers. Fruits have been the major descriptors for identification of different varieties of fruit crops. The quality of mango for export is judged on the basis of size, weight, maturity, 4 total soluble solids, acidity, specific gravity, firmness and attractive golden yellow colour on ripening (Badhe *et al.*, 2007) [1]. In order to select good quality fruits for export, there is a strong felt need to determine physico-chemical properties of various mango cultivars. The flowering and fruiting traits of a variety cannot be ignored because the yield is closely related to these parameters. Most of mango is consumed raw as a dessert fruit and the rest is being processed into diverse products (nectar, powder, canned mango slices in syrup, chutneys, pickles, etc.). Thus, considerable and quantitative data are needed to appraise the natural variations to select excellent mango genotypes with improved nutritional quality and processing characteristics (Liu *et al.*, 2013) [8].

The most important mango varieties in cultivation in India are Kesar, Alphonso, Amrapalli, Banganapalli, Bangalora, Bombay Green, Chausa, Dashehari, Fazli, Gulabkhas, Himsagar, Krishnabhog, Langra, Mallika, Mulgoa, Neelum, Pairi, Rajapuri, Ratna, and Vanraj, out of them Dashehari, Alphonso and Kesar are being exported to some extent in UK and USA. Hence, it is necessary to grab mango market of USA, we must have to understand the varietal preferences of these countries. The main varieties marketed in USA are Kent, Osteen, Keitt and Maya. Currently these are imported from Brazil, Mexico, Peru *etc.* With the view to assess the performance and fruit quality characters, present investigation is proposed to evaluate performance of different exotic mango cultivars under Indian conditions. The present investigation was conducted to assess the morphological, flowering and yield characters of different exotic mango cultivars.

Material and Methods

The present investigation entitled "Performance of exotic mango cultivars under South Gujarat agro-climatic conditions" was conducted during 2018-19 at Agriculture Experimental Station, NAU, Paria and Center of Excellence on Post Harvest Technology, Department of Post Harvest Technology, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari. The experiment was taken on 15 year old exotic mango cultivars planted at 8 m spacing in square system and laid out in a Completely Randomized Design (CRD) repeated thrice with nine treatments, Comprising T_1- Lily, T_2- Osteen, T_3- Palmer, T_4- Maya, T_5- Kent, T_6- Keitt, T_7- Kensington, T_8-Sensation and T_9- Apple. Liu *et al.* (2013) [8].

Results and Discussion

Morphological Parameters

The data on different vegetative characters are presented in Table 1. The data revealed that maximum plant height (6.27 m) is observed in cultivar Kensington Whereas, the lowest plant height was found in Lily (4.45 m). Similar findings were reported by Kanpure *et al.* (2009) [5] where the mango variety Langra showed maximum plant height (430 cm) closely followed by Dashehari, Mallika, Amrapali and Alphonso. The variation in plant height may be due to variation in the availability of different growing condition under varied agro-ecological region along with the genetic makeup of the particular mango variety. Highest stem girth (97.67 cm) is observed in Kensington while, minimum stem girth (55.67 cm) was recorded in Maya (55.67 cm). The variation in stem girth may be due to genetic makeup of cultivars and climatic condition of that region Kanpure *et al.* (2009) [5]. Apple had the greatest canopy spread in the East-West direction (8.80 m), whereas Lily had the smallest canopy spread (4.83 m). Apple had the greatest North-South canopy spread (8.63 m), while the Lily cultivar of mango had the smallest canopy spread (4.67 m). The variation in canopy spread may be due to genetic makeup of cultivars and also climatic condition and nutrient status of soil Kanpure *et al.* (2009) [5]. Maximum plant spread was recorded in Apple (8.73 m) while, minimum plant spread was recorded in Lily (4.77 cm). The variation in plant spread may be due to genetic makeup of cultivars and climatic condition where it is being grown and similar results were observed by Kanpure *et al.* (2009) [5]. The emergence of panicle varied from the first to third week of January. Early flowering was noticed in Osteen, Palmer and Maya (First week of January) and in most of the cultivars, flowering was noticed in Third week of January. The variation in flowering behaviour may be attributed to the genetic variation responding to climatic condition. Variation in flowering duration was reported by Kanpure *et al.* (2009) [5]. The full bloom stage varied from the first week of February to last week of February. Early flowering was noticed in Osteen, Palmer and Maya (Second week of February) while it was noticed in last week of February in rest of the cultivars under study. It may be due to genetic makeup of cultivars and climatic conditions in which they are grown. These results are in line with the findings of Jha *et al.* (2006) [4].

Table 1: Morphological parameters of different mango cultivars

Treatments	Plant height (m)	Stem girth (cm)	Canopy spread (m)		Plant spread (m)	Panicle emergence and initiation of flowering	Full bloom stage
			East-West	North-South			
T_1: Lily	4.45	57.33	4.83	4.67	4.77	Third week of January	Last week of February
T_2: Osteen	5.55	72.00	6.33	6.00	6.23	First week of January	Second week of February
T_3: Palmer	5.14	86.00	7.53	7.60	7.60	First week of January	Second week of February
T_4: Maya	5.35	55.67	5.00	4.90	4.97	First week of January	Second week of February
T_5: Kent	6.17	78.67	8.20	7.50	7.87	Third week of January	Last week of February
T_6: Keitt	5.30	70.67	7.10	7.30	7.20	Third week of January	Last week of February
T_7: Kensington	6.27	97.67	8.70	8.23	8.50	Third week of January	Last week of February
T_8: Sensation	6.03	77.33	7.50	7.00	7.30	Third week of January	Last week of February
T_9: Apple	6.18	94.67	8.80	8.63	8.73	Third week of January	Last week of February
S. Em. ±	0.22	4.07	0.36	0.42	0.36	-	-
C.D. at 5 %	0.64	12.11	1.08	1.24	1.06	-	-
C.V. %	6.70	9.21	8.87	10.48	8.77	-	-

Physical quality parameters

Table 2 shows the findings on distinct flowering characteristics. Higher fruit weight at the time of harvest was observed in Apple (824.67 g) and the lowest fruit weight was found in Maya (216.67 g). Genetic makeup may be accounted for the variation in fruit weight, Sharma and Rana (2007) [10]. The maximum specific gravity (1.41) was observed in Apple cultivar which was found at par with Kensington (1.32) while, minimum specific gravity (0.74) of fruit was recorded in Maya cultivar. The higher specific gravity in Apple fruit at later stages of maturation may be due to the additional inflow of photosynthates into the fruit, which might have resulting in an increase in dry matter content as result of accumulation of starch and organic acids with increase in the fruit dimensions in almost all the cultivars of mango Sharma and Rana (2007) [10]. Maximum length (15.97 cm) of fruit was recorded in Apple cultivar whereas, minimum length of fruit (8.49 cm) was recorded in Maya cultivar of mango. This might be due to genetic variability of different mango cultivar. Singh (2002) [11]. During the present study, peel colour of cultivars ranges from vivid reddish orange to brilliant yellow green during the ripening period, Jha *et al.* (2006) [4] also reported that change in fruit colour could be used as reliable index of maturity in mango. A good range of flesh colour was observed from vivid radish orange in Lily to brilliant yellow colour in Apple cultivar of mango. Similar variation in mango flesh colour was observed by Sharma and Rana (2007) [10] in mango fruits. Higher fruit set (0.45 %) was recorded in Maya whereas,

minimum fruit set (0.09 %) was noticed in Osteen. Variation in fruit set among different cultivars has been supported by the findings of Singh (2002) [11], where he has mentioned that the fruit set is a varietal character depending upon several factor such as sex ratio, time of flowering, efficient cross pollination and intensity of drop. Highest fruit retention was observed in Maya (7.32 %) which was found at par with Kent (6.87 %) and it was minimum (3.06 %) in Osteen cultivar of mango. This variation may be due to genetic makeup of plant and sex ratio. These results are in accordance with the results reported by Singh (2002) [11]. Maximum number of fruits per plant (184.33) was recorded in Maya and it was minimum (109.00) in Apple cultivar. Similar variation in the yield was recorded by Reddy *et al*. (2002) [9] and Kumar and Jaiswal (2003) [6] in mango. In the present study yield per tree were found significantly differed among the cultivars. Apple recorded maximum fruit yield per tree (89.96 kg/tree) and minimum fruit yield per tree was found in Kent (38.47 kg/tree). The findings of this study are supported by the idea that yield is highly variable factor depending upon the cultivars, climatic condition, age of plants and incidence of pest and diseases. Kundu *et al.* (2006) [7]. Maximum and minimum weight of pulp was recorded in Apple (670.67 g) and Kent (158.60 g), respectively. Similar variation was reported by Dhillon *et al.* (2004) [2] The variations in weight of pulp may be due to higher fruit weight and genetic difference among cultivars. Maximum pulp per cent was recorded in Maya (90.89 %) which was found at par with Apple (81.69 %) and minimum pulp per cent was recorded in Kensington (61.01 %). The variations in pulp per cent may be due to higher weight of pulp and fruit weight or genetic difference among cultivars. Dhillon *et al.* (2004) [2]. It was observed that the maximum overall acceptability was found in Maya (7.50) and lower overall acceptability was found in Apple (4.08). Mango peel colour is important for perception of overall appearance by the consumers (Gonzalez-Aguilar *et al*., 2001) [3] and skin colour development determines the quality of mangoes and depending upon the cultivar it may vary orange-yellow or yellowish hue appear from the base colour. Fruit textural changes are due to pectic substances in the cell wall of middle lamella of mango Dhillon *et al.* (2004) [2].

Conclusion

Result of present study revealed that among these exotic cultivars maximum canopy spread, plant spread, weight of fruit, specific gravity, fruit length, yield, and weight of pulp were recorded in Apple cultivar. Whereas, maximum fruit set, fruit retention, pulp percent, number of fruits and organoleptic evaluation were recorded in Maya cultivar. The research manifests that among these exotic cultivars Maya is the superior cultivar. So, farmers can grow exotic cultivars to cater the demand of these cultivars in European countries to earn good foreign exchange. Maya can be proved as an asset for the farmers who are interested in exotic mango cultivars and it can expand the horizons for international merchandise. Keeping these vegetative, physical and chemical parameters under consideration farmers of this region may choose Maya exotic mango cultivar for new plantation.

Table 2: Physical parameters of different mango cultivars

Treatments	Weight of fruit (g)	Specific gravity	Fruit length (cm)	External skin colour	Flesh skin colour	Fruit set (%)	Fruit retention (%)	Number of fruits per tree	Fruit yield (kg/tree)	Fruit yield (t/ha)	Weight of pulp	Pulp percent	Organoleptic Score
T_1: Lily	370.00	1.11	11.64	3A (Brilliant greenish yellow)	30B (Vivid reddish orange)	0.21	4.38	42.33	51.38	8.03	250.00	68.63	5.75
T_2: Osteen	306.67	0.85	10.79	3B (Brilliant greenish yellow)	24B (Strong orange yellow)	0.09	3.06	20.33	40.74	6.37	224.33	73.85	6.08
T_3: Palmer	368.33	1.01	12.95	3A (Brilliant greenish yellow)	12A (Vivid yellow)	0.19	3.76	39.00	55.11	8.61	228.33	63.01	5.17
T_4: Maya	216.67	0.74	8.49	23A (Yellow orange green)	9A (Vivid yellow)	0.45	7.32	88.67	40.04	6.26	188.67	87.92	7.50
T_5: Kent	220.00	0.80	12.21	2C (Greenish yellow light)	24A (Strong orange)	0.35	6.87	73.00	38.42	6.00	106.33	48.33	6.33
T_6: Keitt	370.00	1.05	11.57	2A (Vivid greenish yellow)	8B (Brilliant yellow)	0.26	4.76	51.33	53.92	8.43	239.33	65.73	5.00
T_7: Kensington	498.33	1.32	12.12	154A (Vivid yellow green)	8A (Brilliant yellow)	0.21	4.11	39.00	66.69	10.42	312.00	64.76	6.33
T_8: Sensation	400.00	1.13	10.88	9A (Vivid yellow)	7A (Brilliant yellow)	0.32	4.98	61.67	66.14	10.33	259.33	67.45	5.75
T_9: Apple	824.67	1.41	15.97	149B (Brilliant yellow green)	7A (Brilliant yellow)	0.32	5.43	65.00	90.05	14.07	349.33	42.25	4.08
S. Em. ±	36.67	0.04	0.42	-	-	0.01	0.28	2.48	4.12	0.64	3.19	5.94	-
C.D. at 5 %	108.95	0.12	1.24	-	-	0.04	0.85	7.36	12.25	1.91	9.49	17.66	-
C.V. %	15.99	6.83	6.10	-	-	9.13	9.94	8.04	12.79	12.79	2.31	15.92	-

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