Effect of De-blossoming Treatments on Physical Characteristics of Different Mango Varieties during Off-season Fruit Production under South Gujarat Conditions

A. D. Chaudhary¹, T. R. Ahlawat*, D. R. Bhandari² and Dharmishtha Patel³

¹Department of Fruit Science, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari – 396 450, Gujarat, India.
²Department of Horticulture, N. M. College of Agriculture, Navsari Agricultural University, Navsari – 396 450, Gujarat, India.
³Krishi Vigyan Kendra, Tapi, Vyara, Navsari Agricultural University, Gujarat, India.

Authors’ contributions

This work was carried out in collaboration among all authors. Authors TRA and DRB designed the study. Author ADC conducted the trial, recorded the observations, performed the statistical analysis and wrote the first draft of the manuscript. Author DP managed the literature searches and assisted. Author ADC in writing the manuscript. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/CJAST/2020/v39i830585

Original Research Article

ABSTRACT

An investigation was conducted during 2013-14 and 2014-15 seasons under South Gujarat conditions to study the impact of de-blossoming in six mango varieties during regular flowering season on off season fruiting characters. The investigation consisted of four de-blossoming treatments i.e. foliar sprays of Naphthalene Acetic Acid at 400 and 800 ppm, hand de-blossoming and untreated trees which were imposed on six mango varieties i.e. Amrapali, Baramasi, Neelphanso, Neelum, Ratna and Totapuri. The trial was evaluated in a Randomized Block Design with factorial concept. De-blossoming was done at full bloom stage for induction of off season flowering. Results indicated that in regular season cultivar ‘Totapuri’ recorded significantly higher
2. MATERIALS AND METHODS

The present study was carried out at Agriculture Experimental Station, Paria NAU, Gujarat, India during the fruiting season of 2013-14 and 2014-15. Paria is located 18 m above mean sea level; at a latitude and longitude of 20°26'32"N and 72°56'17"E. Ten year old healthy mango trees spaced at 10 × 10 m were selected for this study. The experiment was evaluated in a Randomized Block Design with factorial concept. The investigation comprised of four de-blossoming treatments i.e. foliar sprays of Naphthalene Acetic Acid (NAA) at 400 and 800 ppm, hand de-blossoming and untreated trees which served as control along with six varieties i.e. Amrapali, Baramasi, Neelphanso, Neelum, Ratna and Totapuri. Thus in all there were 24 treatment combinations which were replicated thrice. Varieties were selected according to their flowering behavior, late flowering habit and parentage of selected varieties. De-blossoming was done at full bloom stage for induction of off season flowering. Plants were maintained under uniform conditions as per the recommended package of practices of Navsari Agricultural University. Fully mature mango fruits were harvested and collected randomly (as and when the fruits matured on the tree). For the estimation of physical parameters during each season, five fruits were randomly selected from the harvested lot of each treatment, they were brought to the laboratory and utilized for observational study as per standard procedure and protocols. Average fruit weight was calculated using an electronic weighing machine whereas, fruit length and width were recorded using Vernier calipers. Fruit volume was estimated by water displacement method using a measuring cylinder. Significance differences among treatments were compared using the Fisher’s analysis of variance at the 95% probability level [5]. All differences reported were significant at $p \geq 0.05$ unless otherwise stated.

3. RESULTS AND DISCUSSION

3.1 Regular Season Fruiting

Fruits are used as major descriptors in the identification of different varieties in fruit crops [6]. Data indicated a significant variation amongst the selected six varieties for fruit weight, length, width and volume in regular fruiting season.
During 2013-14 and 2014-15 (Table 1). Totapuri (V₆) recorded the maximum fruit weight (406.93 and 412.40 g), fruit length (13.23 and 13.26 cm), fruit width (8.56 and 8.42 cm) and fruit volume (401.59 and 407.85 ml) during 2013-14 and 2014-15, respectively. While the lowest fruit weight (237.92 and 240.31 cm), fruit width (5.93 and 6.02 cm) and fruit volume (232.55 and 235.00 cm) were noticed in Neelum (V₃). Whereas, the smallest fruit in term of fruit length (9.47 and 9.51 cm) was observed in Neelphonso (V₄) variety (Fig. 1). This variation can be attributed to the absorption and translocation pattern of photosynthates, genetic composition and environmental factors. Varietal differences for fruit weight and fruit volume has earlier been reported by Roshan et al. [7]; Rymbai et al. [8]; Patel et al. [9] and Hada and Singh [10]. While results on fruit length and fruit width find support from Bora et al. [11] and Kumar et al. [12].

3.2 Off Season Fruiting

There was a significant impact of hand de-blossoming on weight and volume of fruits during the off-season in 2013-14 and 2014-15. Higher fruit weight (305.04 and 306.29 g) and fruit volume (299.81 and 301.02 ml) were recorded in fruits harvested from hand de-blossoming trees as compared to fruits from untreated trees during both years (Fig. 2). This improvement was mainly due to greater shifting of soluble assimilates to developing and active sink (i.e. fruit) in off-season. While, untreated trees showed lower fruit weight and fruit volume as compared to hand de-blossoming treatment. This may be due to scarcity of photosynthates or higher utilization of soluble assimilates in regular season. Oosthuyse and Jacobs [13] and Yeshitela et al. [14] found marginally higher fruit weight in hand de-blossomed treatments over untreated trees (control).

Significant differences were noticed in off season fruiting parameters of selected varieties during 2013-14 and 2014-15. Maximum fruit weight (334.90 and 338.73 g), fruit length (10.60 and 10.78 cm), fruit width (8.21 and 8.28 cm) and fruit volume (329.44 and 333.47 ml) was observed in Ratna (V₅). Whereas, lowest fruit weight (269.87 and 271.94 g), fruit length (8.46 and 8.49), fruit width (5.86 and 5.87 cm) and fruit volume (264.67 and 266.47 ml) was recorded in variety Neelphonso (V₃) during 2013-14 and 2014-15, respectively (Table 2).

![Fig. 1. Varietal and seasonal variation in selected mango varieties for fruit length and fruit width](image-url)
### Table 1. Fruiting traits of selected mango cultivars during the regular flowering season

| Varieties | Fruit weight (g) | Fruit length (cm) | Fruit width (cm) | Fruit volume (ml) |
|-----------|------------------|-------------------|------------------|------------------|
|           | 2013-14 | 2014-15 | 2013-14 | 2014-15 | 2013-14 | 2014-15 | 2013-14 | 2014-15 |
| V₁: Amrapali | 248.77 | 264.84 | 10.72 | 10.70 | 6.72 | 6.80 | 243.20 | 259.87 |
| V₂: Baramasi | 270.90 | 278.21 | 10.53 | 10.59 | 6.39 | 6.42 | 266.19 | 273.25 |
| V₃: Neelphonso | 237.92 | 240.31 | 9.81 | 10.07 | 5.93 | 6.02 | 232.55 | 235.00 |
| V₄: Neelum | 265.49 | 275.26 | 9.47 | 9.51 | 6.80 | 7.49 | 260.42 | 270.14 |
| V₅: Ratna | 327.33 | 335.95 | 10.59 | 10.61 | 8.15 | 8.25 | 322.61 | 330.89 |
| V₆: Totapuri | 406.93 | 412.40 | 13.23 | 13.26 | 8.65 | 8.42 | 401.59 | 407.85 |
| S. Em.± | 7.503 | 10.197 | 0.268 | 0.287 | 0.324 | 0.249 | 7.540 | 10.217 |
| C.D. at 5% | 23.64 | 32.13 | 0.84 | 0.90 | 1.02 | 0.78 | 23.76 | 32.20 |

### Table 2. Effect of de-blossoming on off season fruiting traits in selected mango varieties

| Treatments | Fruit weight (g) | Fruit length (cm) | Fruit width (cm) | Fruit volume (ml) |
|------------|------------------|-------------------|------------------|------------------|
|            | 2013-14 | 2014-15 | 2013-14 | 2014-15 | 2013-14 | 2014-15 | 2013-14 | 2014-15 |
| De-blossoming #|        |        |        |        |        |        |        |        |
| T₁: Manually (hand de-blossoming) | 305.04 | 306.29 | 9.76 | 9.80 | 7.07 | 7.10 | 299.81 | 301.02 |
| T₂: Control | 286.63 | 293.12 | 9.59 | 9.68 | 6.88 | 6.89 | 281.46 | 287.92 |
| S. Em.± | 4.10 | 4.23 | 0.11 | 0.11 | 0.11 | 0.12 | 4.10 | 4.22 |
| C.D. at 5% | 12.43 | 12.82 | NS | NS | NS | NS | 12.44 | 12.79 |

### Varieties (V)#

| V₂: Baramasi | 280.94 | 277.76 | 10.52 | 10.45 | 6.33 | 6.43 | 276.01 | 272.57 |
| V₃: Neelphonso | 269.87 | 271.94 | 8.48 | 8.49 | 5.86 | 5.87 | 264.67 | 266.47 |
| V₄: Neelum | 297.62 | 310.40 | 9.12 | 9.25 | 7.51 | 7.40 | 292.42 | 305.37 |
| V₅: Ratna | 334.90 | 338.73 | 10.60 | 10.76 | 8.21 | 8.28 | 329.44 | 333.47 |
| S. Em.± | 5.79 | 5.98 | 0.15 | 0.15 | 0.15 | 0.16 | 5.80 | 5.96 |
| C.D. at 5% | 17.57 | 18.14 | 0.46 | 0.47 | 0.45 | 0.49 | 17.59 | 18.09 |

### Interaction effect (T×V)

| S. Em± | 8.19 | 8.46 | 0.21 | 0.22 | 0.21 | 0.23 | 8.20 | 8.43 |
| C.D. at 5% | NS | NS | NS | NS | NS | NS | NS | NS |

(##) denotes removal of selected treatment and its combination from statistical analysis and data were analysed using remaining treatment combinations. # Amrapali (V₁) and Totapuri (V₆) did not flower in the off season after imposition of de-blossoming treatments. ## Trees subjected to treatment T₁ (NAA-400 ppm) and T₂ (NAA-800 ppm) did not carry their fruits to maturity.
With regard to fruit length variety Baramasi (V₂) was at par with Ratna cultivar (V₅). The reported variation in physical parameters may probably be due to the absorption and translocation pattern of photosynthates, environmental factors and inherent genetic variation among varieties. Varietal variation in fruit weight during off-season was observed by Kaviarasu and Vanilarasu [15] and Kaviarasu et al. [16]. Several workers have reported that mango cultivars differ in fruit length and width, according to their genetic make-up [17]. This finding on fruit length is in accordance with Kaviarasu et al. [16].

4. CONCLUSION

Based on the above investigation, it can be concluded that in the regular fruiting season, cultivar Totapuri showed the maximum fruit weight and fruit size. However, on de-blossoming at full bloom stage, cultivar Ratna recorded the highest fruit weight and size. Between the different de-blossoming techniques employed, hand-deblossoming proved best. This trial highlights the possibility of employing hand de-blossoming to regulate the fruiting time and physical traits in mango cultivars exhibiting off-season flowering in coastal climate of South Gujarat. These varieties can be further evaluated and used in mango breeding programmes, to meet the demand of mango fruits during the off season.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Tharanathan RN, Yashoda HM, Prabha TN. Mango (Mangifera indica L.). The King of fruits: An overview. Food Rev. Int. 2006;22:95-123. DOI: 10.1080/87559120600574493
2. Mehrotra RC, Dilcher DL, Awasthi NA. Paleocene Mangifera-Like leaf fossil from India, Phytomorphology. 1998;48:91-100.
3. Mitra SK, Mango production in the world-Present situation and future prospect. Acta Hortic. 2016;1111:287-296. DOI: 10.17660/ActaHortic.2016.1111.41
4. Yadav IS, Rajan S. Genetic resources of Mangifera. In: Chadha KL, Pareek OP. editors, Advances in Horticulture. New Delhi: Malhotra Publishing House. 1993; 1(1).
5. Panse VG, Sukhatme PV. In: Statistical methods for agricultural workers. 2nd Edition. ICAR, New Delhi; 1967.
6. Toili MEM, Rimeria FK, Nyende AB, Mutwiwa U, Kaluli J, Sila D. Assessing morphological diversity of mango germplasm from the upper Athi river (UAR) region of eastern Kenya. In: Scientific Conference Proceedings. 2013;602-12. Available:https://pdfs.semanticscholar.org/e753/203bfe6d40cfae79695ea30769328f216eec.pdf

7. Roshan RK, Pebam N, Singh DB. Physico-chemical analysis of polyembryonic mango cultivars under North Indian conditions. Acta Hort. 2013;975:351-354. DOI: 10.17660/ActaHortic.2013.975.44

8. Rymbai H, Patel CR, Ahlawat TR, Patel NL. Studies on fruit and yield traits in indigenous coloured varieties of mango (Mangifera indica L.) in South Gujarat, India. J. Hortic. Sci. 2015;10(1):94-98. ISSN: 0973-354x Available:https://sph.iihr.res.in/index.php/jhs/article/view/43

9. Patel MC, Satodiya BN, Barot HR, Patel DA. Evaluation of mango (Mangifera indica L.) genotypes for fruit characters and quality attributes. Int. J. Chem. Stud. 2017;5(4):1843-1845.

10. Hada TS, Singh AK. Evaluation of mango (Mangifera indica L.) cultivars for physical characteristics and quality parameters of fruit under Indo-Gangetic Plains. Int. J. Chem. Stud. 2018;6(2):2560-2563. DOI: https://dx.doi.org/10.22271/chemi

11. Bora L, Singh AK, and Singh CP. Characterization of mango (Mangifera indica L.) genotypes based on physio-chemical quality attributes. J. of Appl. Nat. Sci. 2017;9(4):2199-2204. Available:https://doi.org/10.31018/jans.v9i4.1510

12. Kumar A, Malik S, Chaudhary Pallavi, Kumar N. Studies on the growth and flowering of different mango (Mangifera indica L.) cultivars under Western Uttar Pradesh conditions. J. Pharmacogn. Phytochem. 2017;SP1:439-42. DOI: http://dx.doi.org/10.22271/phyto

13. Oosthuysen SA, Jacobs G. Flowering synchronization of sensation mango trees by chemical inflorescence removal. Yearb. S. Afr. Mango Growers’ Assoc. 1997;17:53-56.

14. Yeshitela T, Robbertse PJ, Stassen PJC. The impact of panicle and shoot pruning on inflorescence and yield related developments in some mango cultivars. J. Appl. Hort. 2003;5(2): 69-75.

15. Kaviarasu A, Vanilarasu, K. Off-season flowering and fruiting behaviour in mango (Mangifera indica L.) cultivars in Kanyakumari. In: Chadha KL, Singh SK, Srivastav M, Behera TK, editors. Book of Abstracts (Poster Papers), 6th Indian Horticulture Congress: An International Event on Horticulture for Inclusive Growth, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu. 2014;215-16.

16. Kaviarasu A, Balakrishnan S, Indirakumar K. Environmental influence under off-season production on yield and quality attributes of mango. Int. J. Curr. Microbiol. App. Sci. 2017;6(2):494-502. DOI:http://dx.doi.org/10.20546/ijcmas.2017.602.056

17. Jilani MS, Bibi F, Waseem K, Khan MA. Evaluation of physico-chemical characteristics of mango (Mangifera indica L.) cultivars grown in D.I. Khan. J. Agril. Res. 2010;48(2):201-07.

© 2020 Chaudhary et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/55330