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Pooja Yaddanapudi
Ph.D. Scholar, Department of
Fruit Science, SKLTSHU,
College of Horticulture-
Rajendranagar, Hyderabad,
Telangana, India

A Kiran Kumar
Professor Horticulture,
Dean of Horticulture,
SKLTSHU, Administrative
Office, Mulugu, Telangana, India

M Raj Kumarbb
Retd. Principal Scientist and
Head, Fruit Research Station
Sangareddy, Telangana, India

K Aparna
Senior Scientist & Head, MFPI,
Quality Control Laboratory,
PJTSAU, Rajendranagar,
Hyderabad, Telangana, India

G Sathish
Assistant Professor, CoH,
Agriculture Statistics, Mojerla,
Telangana, India

B Naveen Kumar
Assistant Professor, CoH,
GRS, Soil Science,
Rajendranagar, Hyderabad,
Telangana, India

Corresponding Author:
Pooja Yaddanapudi
Ph.D. Scholar, Department of
Fruit Science, SKLTSHU,
College of Horticulture-
Rajendranagar, Hyderabad,
Telangana, India

Evaluation of mango (*Mangifera indica* L.) varieties under ultra-high density planting system in Telangana state

Pooja Yaddanapudi, A Kiran Kumar, M Raj Kumar, K Aparna, G Sathish and B Naveen Kumar

Abstract

In the current research seventeen mango varieties (*viz.*, Alphonso, Amrapali, Baneshan, Dasher, Dasher-35, Himayat, Kesar, Mahamooda vikarabad, Sindhu, Suvarnarekha, Totapuri, Ratna, Swarna sindhura, Amini, Hydershab, Jalal and Royal special) were evaluated under ultra-high density planting system (3×2 m) with simple RBD design in Telangana state (two seasons *viz.*, 2020-21 & 2021-2022). The analysis of variance (ANOVA) of RBD on fruit quantitative and qualitative characteristics revealed significant differences among seventeen varieties of mango. Among seventeen mango varieties Amini recorded lowest weight loss (%) and highest fruit firmness, shelf life; Baneshan variety recorded maximum total, reducing and non-reducing sugar percent.

Keywords: Seventeen mango varieties, ultra high density planting, Baneshan

Introduction

Accommodation of the maximum possible number of the plants per unit area to get the maximum possible profit per unit of the tree volume in a short period without impairing the soil fertility status is called the high-density planting. Recently Ultra High-Density Planting (UHDP) or meadow orchard system of planting which was developed in guava for the first time in India at CISH. This system occupies still more number of plants than HDP. The major benefits of UHDP from traditional methods of planting is to make the best use of vertical and horizontal space per unit time and to get maximum possible return per unit of inputs. Evaluation of such commercial and popular mango varieties of Telangana under UHDP revealed great information regarding qualitative and quantitative characteristics of mango varieties under UHDP in Telangana state.

Materials and Methods

Seventeen mango varieties *viz.*, Alphonso, Amrapali, Baneshan, Dasher, Dasher-35, Himayat, Kesar, Mahamooda vikarabad, Sindhu, Suvarnarekha, Totapuri, Ratna, Swarna sindhura, Amini, Hydershab, Jalal and Royal special; were evaluated under UHDP in Telangana state.

All qualitative and quantitative characters of seventeen mango varieties were analysed through standard procedures and were recorded in the laboratory at College of Horticulture, Rajendranagar. All chemicals used in the investigation were of analytical grade.

For the current experiment, randomized completely block design was applied with 17 treatments and four replications. The collected data was analyzed using SPSS software 20 version and applied post-hoc test as LSD at level of significance at 5 percent.

In current research studied various quantitative parameters *viz.*, Physiological loss in weight (%), Fruit firmness (kg/cm²) (by penetrometer), Fruit length (cm) (by Vernier Calipers), Fruit width (cm) (by Vernier Calipers), Fruit weight (g), Fruit volume (ml), Shelf life (days); Qualitative parameters *viz.*, TSS (°Brix) (by Digital refractometer), Titrable acidity (%), Total sugars (%) (Lane and Eynon AOAC, 1997), Reducing sugars (%) (Lane and Eynon AOAC, 1997), Non-reducing sugars (%) (Lane and Eynon AOAC, 1997).

Result and Discussion

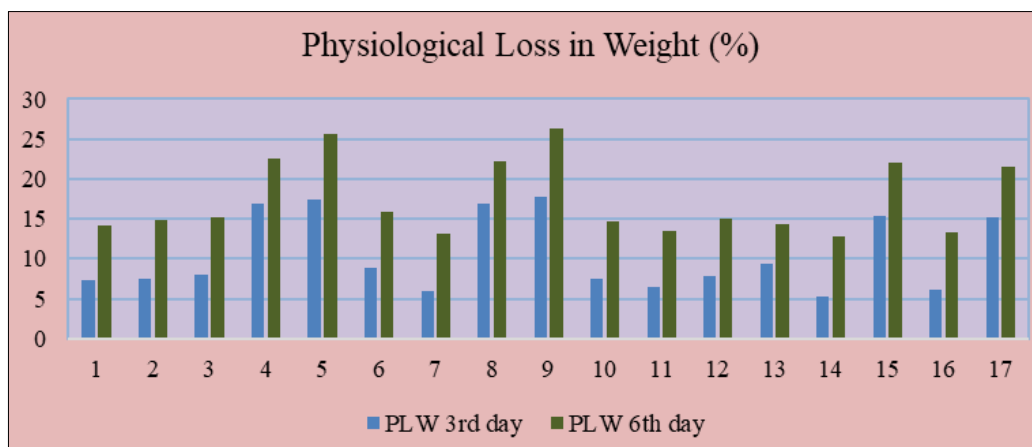
Physiological Loss in Weight (%)

On 3rd day the results significantly differed among the seventeen mango varieties and the PLW

was ranged from 5.34% to 17.73%. As per the pooled results, minimum PLW was noticed in Amini (5.34%) followed by Kesar (5.97%) and Jalal (6.13%), while maximum PLW was noticed in Sindhu (17.73%) followed by Dasher-35 (17.42%) and Dasher (16.94%).

On 6th day results significantly differed among the seventeen mango varieties and it could be ranged from 12.82% to 26.27%. According to the interpretation of experimentation results, minimum PLW was recorded in Amini (12.82%) followed by Kesar (13.13%) and Jalal (13.32%), while maximum PLW was recorded in Sindhu (26.27%) followed by Dasher-35 (25.57%) and Dasher (22.62%).

Similar results are previously reported by Zeweter (2008) [12] who stated that in all fruit crops there is a steady increase in physiological loss in weight from harvest to ripening and during storage period, particularly in climacteric fruits. The minimum weight losses were recorded at the beginning of storage period, while the maximum weight loss was noticed at the end of ripening period, because after harvest, the fruits undergo a series of metabolic process, the tissues continue to respire, transpire and undergo evaporation and loss of moisture and other chemical components which ultimately result in the loss of weight (Eskin *et al.*, 1971) [5].



Physiological Loss in Weight (%)

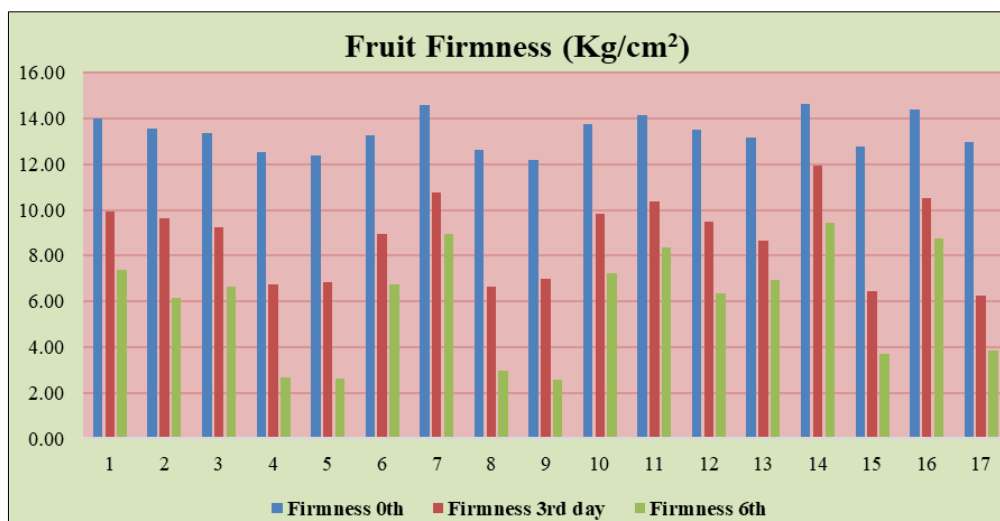
Firmness (kg/cm²)

On 1st day (immediately after harvest) the interpretation of data revealed that there was a significant difference in fruit firmness among the seventeen mango varieties and it was ranged from 12.18 to 14.64 kg/cm². Highest fruit firmness was noticed in Amini (14.64 kg/cm²) was found to be on par with Kesar (14.58 kg/cm²) followed by Jalal (14.38 kg/cm²), while lowest fruit firmness was noticed in Sindhu (12.18 kg/cm²) followed by Dasher-35 (12.37 kg/cm²) and Dasher (12.54 kg/cm²).

On 3rd day, there was a significant difference in fruit firmness among the seventeen mango varieties and it was ranged from 6.27 to 11.96 kg/cm². Maximum fruit firmness was noticed in

Amini (11.96 kg/cm²) followed by Kesar (10.77 kg/cm²) and Jalal (10.54 kg/cm²), while minimum fruit firmness was recorded in Royal special (6.27 kg/cm²) followed by Hydersaheb (6.46 kg/cm²) and Mahammoda vikarabad (6.65 kg/cm²).

On 6th day there was a significant difference in fruit firmness among the seventeen mango varieties and it was ranged from 2.55 to 9.44 kg/cm². Highest fruit firmness was noticed in Amini (9.44 kg/cm²) followed by Kesar (8.95 kg/cm²) and Jalal (8.73 kg/cm²), while lowest fruit firmness was recorded in Sindhu (2.55 kg/cm²) and was found to be on par with Dasher-35 (2.64 kg/cm²) and Dasher (2.65 kg/cm²).



Fruit Firmness (Kg/cm²)

Fruit length (cm)

Significant difference was observed among the seventeen mango varieties with respect to fruit length and it could be ranged from 8.03 cm to 14.71 cm. Kesar variety recorded maximum fruit length (14.71 cm) which was found to be on par with Dasheri (14.70 cm) followed by Totapuri (14.00 cm), while Royal special variety recorded minimum fruit length (8.03 cm) followed by Alphonso (9.08 cm).

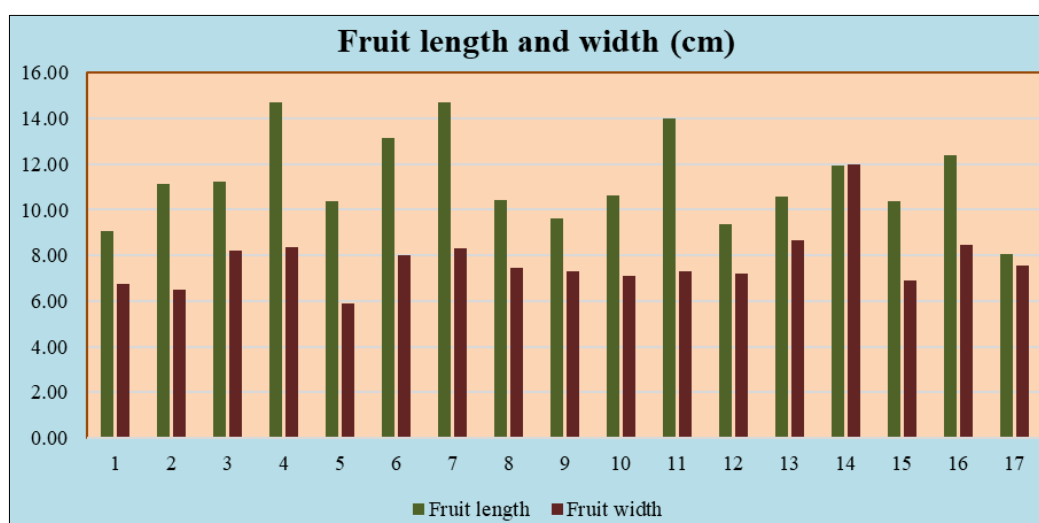
Similar pattern of results previously reported by Bibi *et al.* (2006) [3] reported that, the fruit size (length, width and weight) was a major trait that plays a main role for the success of any fruit variety. The variations among the varieties for fruit length, fruit width and weight might be due to their different genetic makeup of individual variety, location and environmental conditions prevailing during the year of production (Mannan *et al.*, 2003 and Jilani *et al.*, 2010) [10, 7].

Fruit width (cm)

According to the pooled data, fruit width of seventeen mango

varieties significantly differed and could be ranged from 5.91 to 11.99 cm. The present investigation observed that Amini variety recorded maximum fruit width (11.99 cm) followed by Suvarna sindhura (8.68 cm) and Jalal (8.48 cm), while Dasheri-35 variety recorded minimum fruit width (5.91 cm) followed by Amrapali (6.50 cm).

Our results are in agreement with Bibi *et al.* 2006, Mannan *et al.* 2003 and Jilani *et al.* [3, 10, 7] who evaluated mango varieties for morphological characters of fruit. Mango fruits showed significant differences in size, weight and circumferences depending on the cultivar. Fruit size (length, width and weight) is a major trait and plays a main role for the success of any fruit varieties. The variations among the fruits for fruit length and fruit width and weight might be due to their different genetic makeup of individual variety, location and environmental conditions prevailing during the year of production.



Fruit length and width (cm)

Fruit weight (g)

The interpretation of data with respect to fruit weight revealed that, there was a significant variation among the mango varieties and it was increased from harvest to ripening and during storage and it is ranged from 157.66 to 835.92 g.

As per the results obtained from present investigation, maximum fruit weight was reported in Amini (835.92 g) followed by Jalal (402.65 g), while minimum fruit weight was reported in Dasheri-35 (157.66 g) followed by Dasheri (185.49 g) and Amrapali (196.94 g).

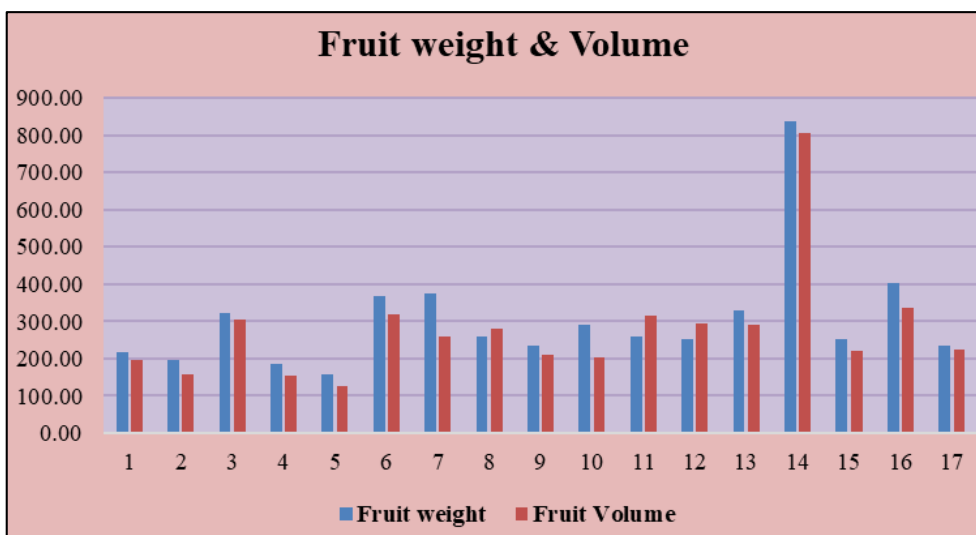
Similar results were also observed by Ahmed *et al.* (2016) [1] who evaluated five mango cultivars *viz.*, Kent, Keitt, Tommy Atkins, Heidi and Naomi for their yield parameters and they identified that mango Cv. Kent recorded maximum fruit weight followed by Naomi, while minimum fruit weight was recorded in Heidi. This variation is due to their genetic makeup of individual variety, location and environmental conditions prevailing during the year of production.

Fruit volume (ml)

The interpretation of data revealed that, there was a significant difference in values of fruit volume among the seventeen mango varieties and it showed an increasing trend from harvest to ripening and during the storage and it could be ranged from 125.50 ml to 805.29 ml.

According to the data significantly maximum fruit volume was noticed in Amini (805.29 ml) followed by Jalal (335.38 ml) and Himayat (320.08 ml), while minimum fruit volume was noticed Dasheri-35 (125.50 ml) followed in Dasheri (155.30 ml) and Amrapali (157.73 ml).

Similar findings have previously reported by Anil and Radha (2003) [2]. They evaluated some mango varieties and concluded that Ratna variety recorded maximum fruit volume, whereas H-151 recorded minimum value. The variation in fruit volume might be depending on the fruit weight per unit area of fruit and genetic makeup of the variety.

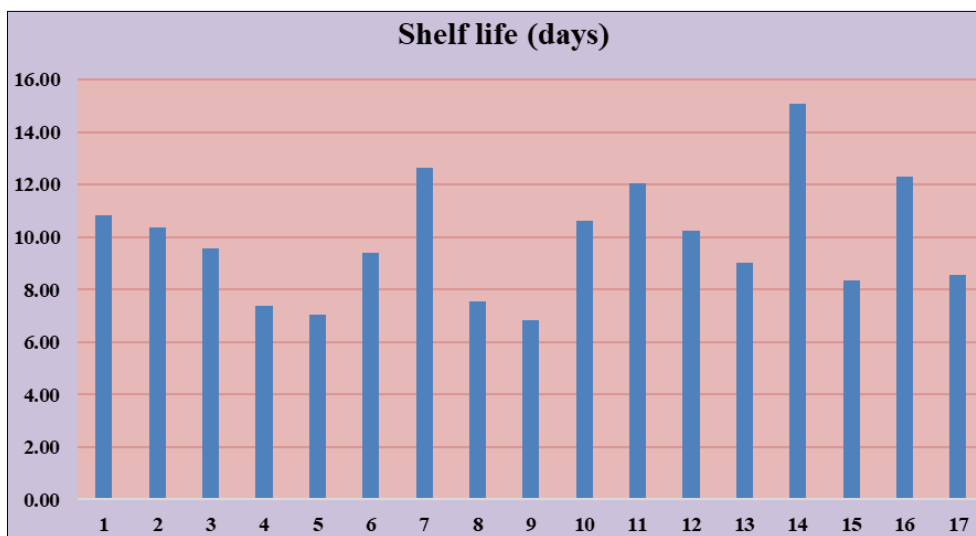


Fruit weight & Volume

Shelf life (days)

It was observed from the data that, there was a considerable variation among seventeen mango varieties with respect to shelf life. The shelf life of seventeen varieties was ranged from 6.84 to 15.10 days. According to interpretation of pooled data, maximum shelf life was reported in Amini (15.10 days) followed by Kesar (12.65 days) and Jalal (12.30 days), while minimum shelf life was reported in Sindhu (6.84 days) followed by Dasher-35 (7.06 days).

The shelf life of fruit is varietal specific character and reliant on textural softness which is due to cell wall alteration ensuing in structural changes in starch and non-starch polysaccharide (Yashoda *et al.*, 2006)^[11]. Similar results have also been viewed by Himabindu *et al.* (2018)^[6] and reported that mango Cv. Langra had lowest softness values and showed better shelf life as compared to other tested varieties in their study.



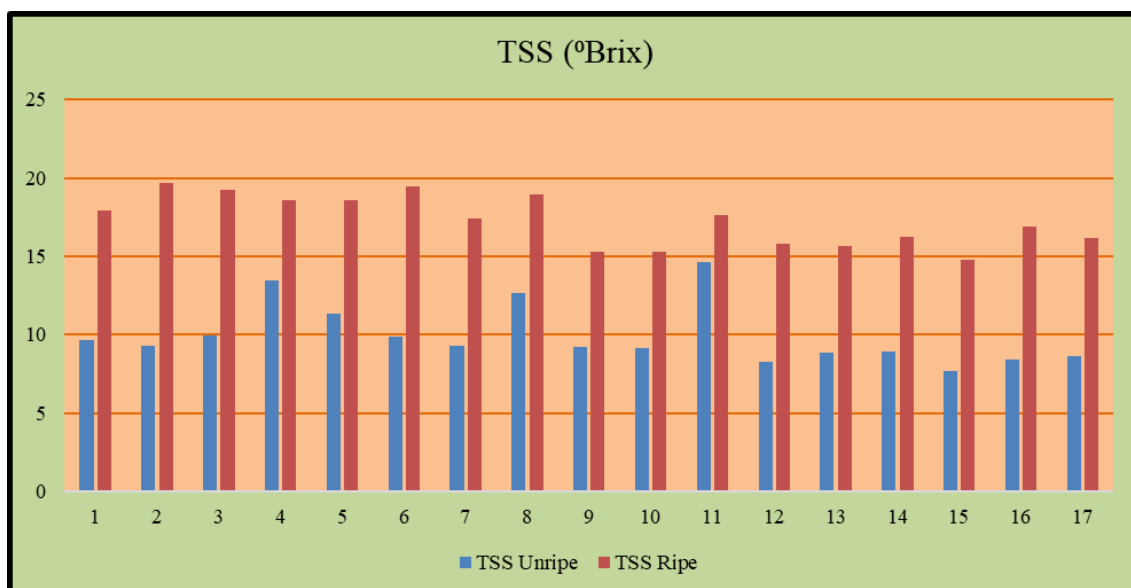
Shelf life (days)

TSS (°Brix)

As per the pooled data among the unripe fruits, maximum amount of TSS was noticed in Totapuri (14.66 °Brix), followed by Dasher-35 (13.44 °Brix) and Mahammoda vikarabad (12.64 °Brix), while minimum amount of TSS was noticed in Hydersaheb (7.67 °Brix) followed by Ratna (8.27

°Brix) and Jalal (8.39 °Brix).

Among the ripe fruits, maximum amount of TSS was noticed in Amrapali (19.64 °Brix) followed by Himayat (19.42 °Brix) and Baneshan (19.21 °Brix), while minimum amount of TSS was noticed in Hydersaheb (14.79 °Brix) followed by Suvarnarekha (15.28 °Brix) and Sindhu (15.31 °Brix).



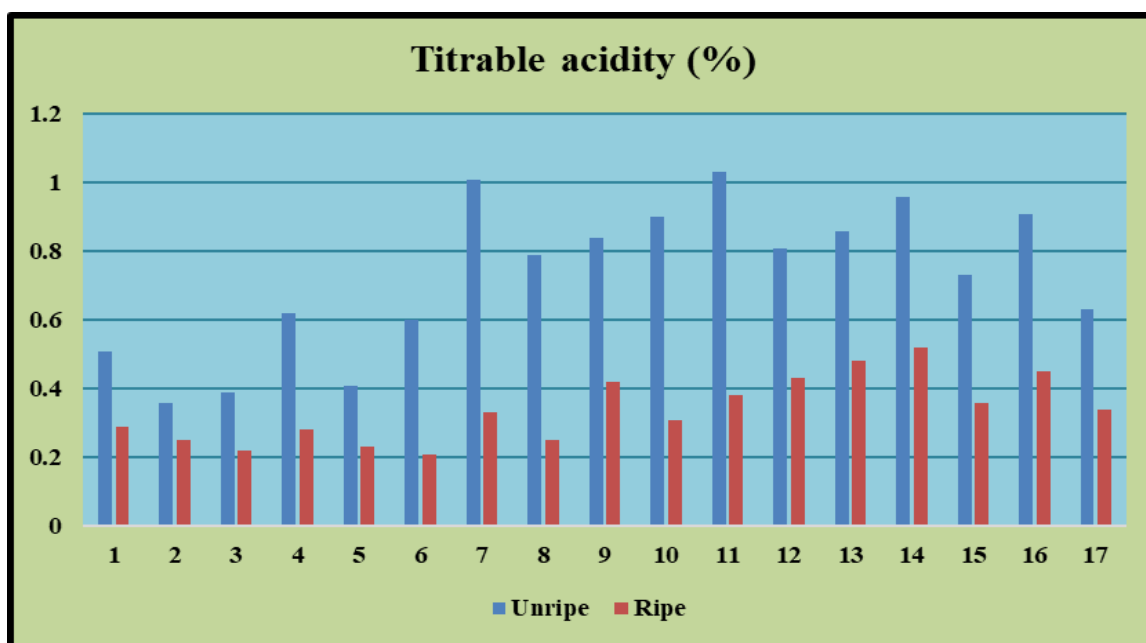
TSS (°Brix)

Titration acidity (%)

The varietal differences in terms of titration acidity were found to be statistically significant. The variation among the seventeen mango varieties ranged from 0.36 to 1.03% in unripe fruits, while it ranged from 0.21 to 0.52% in ripe fruits. The results depict that titration acidity decreased from harvesting to ripening. Among the unripe fruits lowest titration acidity was noticed in Amrapali (0.36%) which was found to be on par with Baneshan (0.39%) and Dasher-35 (0.41%), while highest titration acidity was noticed in Totapuri (1.03%) which was found to be on par with Kesari (1.01%).

It is evident from the data that, among the ripen fruits lowest acidity was reported in Himayat (0.21%) was found to be on par with Baneshan (0.22%) and Dasher-35 (0.23%), while highest acidity was reported in Amini (0.52%) followed by Suvarna sindhura (0.48%) and Jalal (0.45%).

Mandal and Thokchom (2018)^[1] stated that sugars in mango fruits first increased rapidly and then decreased which is due to conversion of starch into sugars during ripening and after the completion of ripening process, the sugars reduced, because then the senescence stage started in which stage sugars are utilized for further respiration.



Titration acidity (%)

Total Sugar (%)

As per the pooled data among the unripe fruits maximum content of total sugars was recorded in Baneshan (5.97) which was on par with Suvarnarekha (5.90) followed by Totapuri (5.87), while minimum was found in Amini (4.02%) followed by Jalal (4.47%).

As per the pooled data among the ripe fruits, significantly maximum content of total sugars observed in Baneshan (10.89%) followed by Mahammoda vikarabad (10.79%) and Suvarnarekha (10.58%), while minimum was found in Amini (8.65%) which was found to be on par with Jalal (8.66%) followed by Sindhu (8.80%).

Reducing Sugar (%)

Among the unripe fruits significantly maximum reducing sugars was noticed in Baneshan (3.45%) followed by Dasheri-35 (3.08%) and Totapuri (3.04%), while significantly minimum reducing sugar percent was noticed in Amini (1.83%) followed by Suvarna sindhura (1.94%) and Royal special (1.98%).

As per the pooled results among the ripen fruits, significantly maximum reducing sugar per cent was noticed in Mahammoda vikarabad (5.36%), Baneshan (5.33%) and Ratna (5.30%), while significantly minimum reducing sugars per cent was noticed in Jalal (4.39%) followed by Hydersaheb (4.43%) and Sindhu (4.53%).

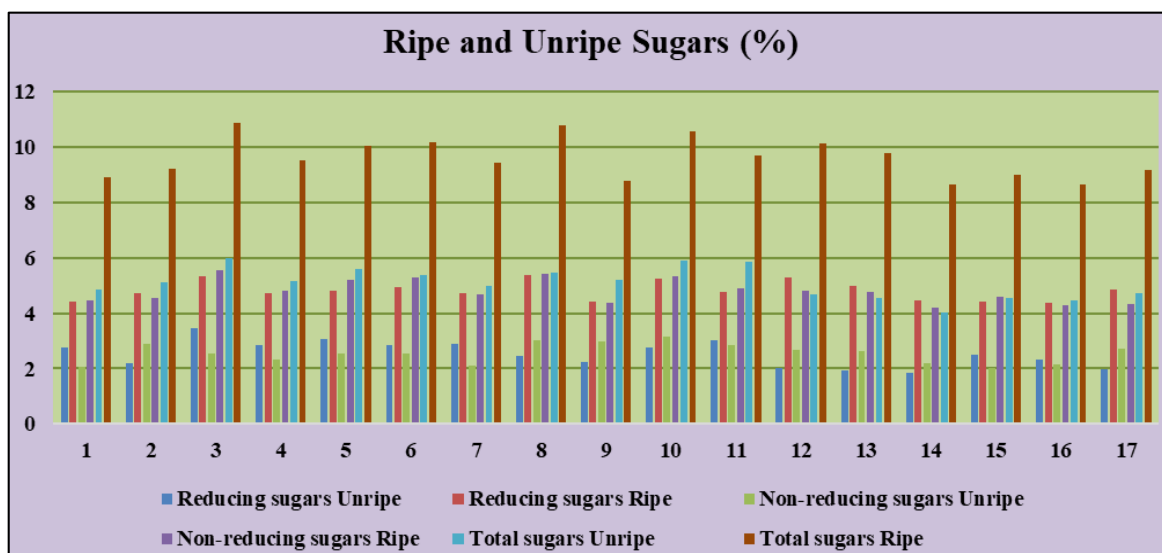
Non reducing sugar (%)

Among the unripe fruits significantly maximum non-reducing sugar percent was found in Suvarnarekha (3.14%) followed by Mahammoda vikarabad (3.03%) and Sindhu (2.96%), while minimum non-reducing sugar percent was found in

Hydersaheb (2.03%) followed by Alphonso (2.08%) and Kesar (2.12%).

Among the ripe fruits significantly maximum non-reducing sugar percent was found in Baneshan (5.56%) followed by Mahammoda vikarabad (5.43%) and Suvarnarekha (5.33%), while minimum non-reducing sugar percent was found in Amini (4.21) followed by Jalal (4.27%).

It is indicated from the data that a significant variation was revealed among the varieties in terms of sugars (*viz.*, total sugars, reducing and non-reducing sugars) and exhibited an increasing trend as the ripening process progressed and during the storage and then slightly decreased at the last edible stage. Subsequently acidity of fruits decreased on progress of ripening. This could be due to the varying activity of hydrolytic enzymes during the ripening process of different varieties, which in turn have influenced the hydrolysis of complex sugars into simpler ones (Elshestawy *et al.*, 2016) [4].



Ripe and Unripe Sugars (%)

Conclusion

Amini recorded minimum post-harvest weight loss, maximum fruit firmness, highest fruit weight and longest shelf life when compared with other seventeen mango varieties under Ultra high-density planting system in Telangana state. Baneshan followed by Himayat and Dasheri recorded maximum TSS ($^{\circ}$ Brix), sugars (reducing, non-reducing and total %) and minimum titrable acidity (%) when compared with other seventeen mango varieties under Ultra high-density planting system in Telangana state.

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