Plant Archives Vol. 26, Supplement 2, 2026 pp. 654-658 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2026.v26.supplement-2.074

INFLUENCE OF DRIP IRRIGATION REGIMES ON FRUIT QUALITY AND SHELF LIFE OF MANGO VARIETIES UNDER ULTRA HIGH DENSITY PLANTING SYSTEM

T. Manvitha[1]*, A. Bhagwan[2], A. Kiran Kumar[3], Md. Latheef Pasha[4] and G. Sathish[5]
[1]Department of Fruit Science, College of Horticulture, Rajendranagar, Hyderabad, Telangana, India.
[2]Registrar and Comptroller (I/c), SKL Telangana Horticultural University, Mulugu, Siddipet, Telangana, India.
[3]Director, Telangana Seed and Organic Certification Authority, Hyderabad, Telangana, India.
[4]Principal Scientist (Agronomy) & Head, AICRP on Integrated Farming System Unit, C-NARE, PJTAU, Hyderabad, Telangana, India.
[5] Department of Agricultural Statistics, PGIHS, SKLTGHU, Mulugu, Siddipet, Telangana, India.
*Corresponding author E-mail: thatipellymanvitha@gmail.com
(Date of Receiving : 25-03-2026; Date of Revision : 18-05-2026; Date of Acceptance : 01-06-2026)

ABSTRACT

A field experiment was conducted during 2022–23 and 2023–24 at the Centre of Excellence for Fruits, Mulugu, Siddipet district, Telangana to study the influence of drip irrigation regimes on fruit quality and shelf life of mango varieties under ultra-high density planting system. The experiment was laid out in factorial randomized block design with four mango varieties viz., Banganpalli, Dashehari, Himayath and Kesar, and four irrigation levels viz., 125% ETc, 100% ETc, 75% ETc and 50% ETc. Significant differences were observed among varieties and irrigation treatments with respect to fruit quality parameters. Among the varieties, Himayath recorded superior fruit quality with higher total soluble solids, total sugars and ascorbic acid content along with lower titratable acidity. Irrigation at 100% ETc significantly improved fruit quality and shelf life by maintaining optimum soil moisture during critical fruit developmental stages. Deficit irrigation at 50% ETc adversely affected fruit weight, firmness and shelf life, whereas excessive irrigation at 125% ETc reduced certain quality parameters because of dilution effects. The results indicated that irrigation scheduling at 100% ETc through drip irrigation was optimum for improving fruit quality and shelf life of mango under ultra-high density planting system.
Keywords **:** Mango, drip irrigation, ETc, fruit quality, shelf life, UHDP, TSS.

Introduction

Mango (*Mangifera indica* L.) is one of the most important tropical fruit crops belonging to the family Anacardiaceae and is popularly known as the “King of Fruits”. India occupies a leading position in global mango production and cultivation. In Telangana, mango occupies a prime position among fruit crops, but productivity remains comparatively low because of improper irrigation management and inefficient utilization of water resources.

Water is one of the most important factors influencing growth, yield and quality of mango. Although mango trees are comparatively drought tolerant, moisture stress during flowering, fruit set and fruit development stages adversely affects fruit retention, fruit size and quality parameters. Efficient irrigation management is therefore essential for sustainable mango production.

Drip irrigation is considered one of the most efficient irrigation methods because it supplies water directly to the root zone with minimal losses through evaporation and percolation. It helps in maintaining optimum soil moisture conditions, thereby improving nutrient uptake, photosynthetic efficiency and fruit quality. Under ultra-high density planting (UHDP) systems, precise irrigation management becomes more important because of increased competition among plants for moisture and nutrients.

Fruit quality parameters such as total soluble solids, sugars, acidity, firmness and shelf life are

highly influenced by irrigation regimes. Appropriate irrigation scheduling improves market acceptability and storage potential of mango fruits. However, information regarding the influence of different drip irrigation regimes on fruit quality and shelf life of mango varieties under UHDP conditions in Telangana is limited.

Therefore, the present investigation was undertaken to study the effect of different drip irrigation regimes on fruit quality and shelf life of mango varieties under ultra-high density planting system.

Materials and Methods

The present investigation was carried out at the Centre of Excellence for Fruits, Mulugu, Siddipet district, Telangana during 2022–23 and 2023–24. The statistical design adopted was factorial randomized block design with two factors comprising four mango varieties and four irrigation levels.

Treatments

Factor I : Varieties

- V_1 : Banganpalli
- V_2 : Dashehari
- V_3 : Himayath
- V_4 : Kesar

Factor II : Irrigation levels

- I_1 : 125% ETc
- I_2 : 100% ETc
- I_3 : 75% ETc
- I_4 : 50% ETc

Irrigation was applied through drip irrigation system according to crop evapotranspiration requirement during different phenophases.

Observations on fruit quality parameters such as physiological loss in weight, average fruit weight, fruit firmness, DA meter reading, fruit length, fruit breadth, fruit volume, specific gravity, pulp weight, peel thickness, pulp to peel ratio, pulp to stone ratio and shelf life were recorded. Biochemical quality parameters including total soluble solids, reducing sugars, non-reducing sugars, total sugars, titratable acidity, brix acid ratio and ascorbic acid content were also analyzed using standard procedures.

The experimental data were statistically analyzed using analysis of variance (ANOVA) appropriate for factorial randomized block design. Significance of treatment differences was tested at 5 per cent probability level.

Results and Discussion

Effect of irrigation regimes on fruit physical parameters

Significant variation was observed among varieties and irrigation levels with respect to fruit physical parameters. Irrigation at 125% ETc recorded higher fruit weight, fruit volume and pulp weight because of increased moisture availability during fruit development stages. However, excessive irrigation resulted in reduction of certain quality attributes due to dilution effect.

Among the varieties, Himayath recorded superior fruit physical characteristics with higher pulp recovery and improved fruit firmness. Deficit irrigation at 50% ETc significantly reduced fruit size and fruit weight because of inadequate moisture availability during critical fruit developmental stages.

Fruit firmness was significantly higher under 100% ETc irrigation level indicating better maintenance of cellular structure and delayed ripening. Similar findings were reported by Panigrahi *et al.* (2010).

Shelf life

Shelf life was significantly influenced by irrigation levels and varieties. Fruits harvested from trees irrigated at 100% ETc exhibited maximum shelf life due to balanced moisture availability and improved physiological stability.

Among the varieties, Himayath recorded comparatively longer shelf life than Banganpalli and Dashehari. Severe moisture stress under 50% ETc reduced shelf life because of increased physiological deterioration and lower fruit firmness.

Total soluble solids (TSS)

Total soluble solids differed significantly among irrigation levels and varieties. Irrigation at 100% ETc recorded higher TSS values compared to other treatments. Excessive irrigation at 125% ETc diluted soluble solids whereas severe moisture stress at 50% ETc reduced assimilate accumulation and photosynthetic activity.

Among the varieties, Himayath recorded maximum TSS followed by Kesar, indicating superior fruit quality under optimum irrigation conditions.

Sugars

Reducing sugars, non-reducing sugars and total sugars were significantly influenced by irrigation

scheduling. Irrigation at 100% ETc recorded higher sugar accumulation due to efficient translocation of assimilates and better metabolic activity.

Deficit irrigation at 50% ETc reduced sugar accumulation because of restricted photosynthesis and impaired carbohydrate metabolism.

Titratable acidity

Titratable acidity was comparatively lower under 100% ETc irrigation level. Increased acidity under moisture stress conditions may be due to incomplete conversion of organic acids into sugars during ripening.

Among the varieties, Himayath recorded lower acidity and superior fruit palatability.

Ascorbic acid content

Ascorbic acid content was significantly influenced by irrigation levels and varieties. Fruits harvested from trees irrigated at 100% ETc recorded higher vitamin C content due to optimum soil moisture conditions during fruit development.

Among the varieties, Himayath recorded maximum ascorbic acid content.

The present findings are in conformity with earlier reports indicating that optimum irrigation improves fruit quality and shelf life in mango and other fruit crops.

Conclusion

The present investigation revealed that drip irrigation regimes significantly influence fruit quality and shelf life of mango varieties under ultra-high density planting system. Among the varieties evaluated, Himayath exhibited superior quality parameters with higher TSS, sugars and ascorbic acid content along with lower acidity and improved shelf life. Irrigation at 100% ETc was found optimum for improving fruit quality and maintaining better shelf life. Excessive irrigation at 125% ETc increased fruit size but reduced certain quality parameters due to dilution effects, whereas severe moisture stress at 50% ETc adversely affected fruit quality and shelf life. Therefore, drip irrigation scheduling at 100% ETc may be recommended for sustainable mango production under UHDP systems.

Table 1 : Effect of irrigation regimes on average fruit weight (g)

Irrigation level	Banganpalli	Dashehari	Himayath	Kesar	Mean
125% ETc	301.22	298.54	309.33	296.42	301.38
100% ETc	295.44	292.12	304.11	291.63	295.83
75% ETc	286.15	281.42	293.33	284.71	286.40
50% ETc	279.44	275.32	286.16	278.10	279.75

SE(m) ± = 2.14 CD (P=0.05) = 6.32

Table 2 : Effect of irrigation regimes on shelf life (days)

Irrigation level	Banganpalli	Dashehari	Himayath	Kesar	Mean
125% ETc	8.20	8.11	9.12	8.45	8.47
100% ETc	9.10	8.95	10.21	9.32	9.39
75% ETc	7.95	7.82	8.64	8.02	8.10
50% ETc	6.84	6.71	7.42	6.93	6.98

SE(m) ± = 0.18 CD (P=0.05) = 0.54

Table 3 : Effect of irrigation regimes on total soluble solids (°Brix)

Irrigation level	Banganpalli	Dashehari	Himayath	Kesar	Mean
125% ETc	19.12	18.84	20.42	19.36	19.43
100% ETc	20.41	20.12	21.86	20.94	20.83
75% ETc	18.90	18.72	20.11	19.02	19.19
50% ETc	17.82	17.51	18.94	18.06	18.08

SE(m) ± = 0.21 CD (P=0.05) = 0.63

Table 4 : Effect of irrigation regimes on reducing sugars (%)

Irrigation level	Banganpalli	Dashehari	Himayath	Kesar	Mean
125% ETc	4.86	4.72	5.14	4.95	4.92
100% ETc	5.22	5.11	5.48	5.30	5.28
75% ETc	4.65	4.52	4.96	4.74	4.72
50% ETc	4.22	4.10	4.54	4.31	4.29

SE(m) ± = 0.08 CD (P=0.05) = 0.24

Table 5 : Effect of irrigation regimes on non-reducing sugars (%)

Irrigation level	Banganpalli	Dashehari	Himayath	Kesar	Mean
125% ETc	11.38	11.16	11.88	11.47	11.47
100% ETc	11.89	11.71	12.42	11.96	12.00
75% ETc	11.27	11.12	11.92	11.37	11.42
50% ETc	10.58	10.44	11.18	10.60	10.70

SE(m) ± = 0.12 CD (P=0.05) = 0.36

Table 6 : Effect of irrigation regimes on total sugars (%)

Irrigation level	Banganpalli	Dashehari	Himayath	Kesar	Mean
125% ETc	16.24	15.88	17.02	16.42	16.39
100% ETc	17.11	16.82	18.34	17.26	17.38
75% ETc	15.92	15.64	16.88	16.11	16.14
50% ETc	14.80	14.54	15.72	14.91	14.99

SE(m) ± = 0.16 CD (P=0.05) = 0.48

Table 7 : Effect of irrigation regimes on titratable acidity (%)

Irrigation level	Banganpalli	Dashehari	Himayath	Kesar	Mean
125% ETc	0.34	0.36	0.28	0.31	0.32
100% ETc	0.28	0.30	0.22	0.26	0.27
75% ETc	0.39	0.41	0.33	0.36	0.37
50% ETc	0.48	0.50	0.40	0.44	0.46

SE(m) ± = 0.01 CD (P=0.05) = 0.03

Table 8 : Effect of irrigation regimes on ascorbic acid content (mg 100 g^{-1} pulp)

Irrigation level	Banganpalli	Dashehari	Himayath	Kesar	Mean
125% ETc	36.22	35.84	39.16	37.24	37.11
100% ETc	40.18	39.64	43.22	41.08	41.03
75% ETc	35.44	34.82	38.11	36.20	36.14
50% ETc	31.52	30.94	34.26	32.18	32.22

SE(m) ± = 0.42 CD (P=0.05) = 1.24

Table 9 : Effect of irrigation regimes on brix acid ratio

Irrigation level	Banganpalli	Dashehari	Himayath	Kesar	Mean
125% ETc	56.23	52.33	72.92	62.45	60.98
100% ETc	72.89	67.06	99.36	80.53	79.96
75% ETc	48.46	45.66	60.94	52.83	51.97
50% ETc	37.12	35.02	47.35	41.05	40.14

SE(m) ± = 1.08 CD (P=0.05) = 3.18

References

Adak, T., Kumar, K. and Singh, V.K. (2012). Effect of water stress on mango productivity and fruit quality. *Journal of Horticultural Sciences*, **7**(2), 101–106.

Agrawal, N. and Agrawal, S. (2007). Effect of trickle irrigation on growth and quality of pomegranate. *Indian Journal of Horticulture*, **64**(3), 312–315.

Bhriguvanshi, S.R., Srivastava, P.K. and Singh, H.P. (2012). Impact of fertigation on yield and water use efficiency of mango. *Indian Journal of Agricultural Sciences*, **82**(7), 620–624.

Cotrim, C.E., Coelho, E.F. and Santos, M.R. (2008). Soil water balance in micro irrigated mango orchard. *Agricultural Water Management*, **95**, 1347–1354.

Deshmukh, S. and Hardaha, M.K. (2014). Effect of drip irrigation on growth and yield of papaya. *Journal of Agricultural Engineering*, **51**(2), 23–29.

Dukes, M.D. (2012). Advances in irrigation scheduling technologies. *Agricultural Water Management*, **108**, 1–2.

Ghosh, S.N. and Pal, P.P. (2010). Effect of drip irrigation on fruit quality in citrus. *Indian Journal of Horticulture*, **67**(1), 25–29.

Joshi, G.D., Shinde, B.N. and Patil, V.K. (2011). Integrated nutrient and water management in litchi. *Indian Journal of Horticulture*, **68**(2), 185–190.

Kumar, P., Mishra, D.S. and Singh, A.K. (2008). Drip irrigation effects on mango cv. Arka Anmol. *Scientia Horticulturae*, **115**, 290–295.

Mathew, B. and Ghosh, S.N. (2004). Influence of irrigation and mulching on sweet orange. *Indian Journal of Horticulture*, **61**(2), 123–126.

Morgan, K.T., Wheaton, T.A. and Parsons, L.R. (2006). Irrigation scheduling tools using weather data. *Irrigation Science*, **24**, 123–132.

Panigrahi, P., Srivastava, A.K. and Huchche, A.D. (2010). Drip irrigation and mulch effects on mango yield and quality. *Agricultural Water Management*, **97**, 1441–1448.

Pradhan, S., Sehgal, V.K. and Das, D.K. (2010). Influence of irrigation levels on mango productivity and quality. *Indian Journal of Agricultural Sciences*, **80**(8), 725–729.

Singh, V.K., Tiwari, K.N. and Santosh, D.T. (2015). High density planting and irrigation management in fruit crops. *Scientia Horticulturae*, **192**, 237–245.

Sun, Y., Li, H. and Zhao, J. (2022). Phenophase-based irrigation scheduling in perennial fruit crops. *Irrigation Science*, **40**, 567–579.

Tiwari, K.N., Singh, A. and Mal, P.K. (2014). Response of sapota under drip irrigation and mulch. *Agricultural Water Management*, **132**, 90–98.

Viswanatha, G.B., Ramachandrappa, B.K. and Nanjappa, H.V. (2002). Drip irrigation and water use efficiency in fruit crops. *Journal of Water Management*, **10**(1), 23–27.