

Original Research Article

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Effect of Polyamines and NAA Application on Quality and Shelf Life of Mango (*Mangifera indica* L.) cv. Kesar

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ABSTRACT

Keywords

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A study was conducted to investigate the effect of polyamines and NAA on quality and shelf life attributes like, TSS (Brix⁰), Ascorbic acid (%), Acidity (%), Reducing sugars (%), Total sugars% and physiological weight loss (%), Days to ripening, shelf life (%), Fruit spoilage (%) in 15 years old trees of mango cv. Kesar, under Junagadh Agricultural University, Junagadh, saurashtra region of Gujarat during 2015-16 and 2016-17. Results indicated that Putrescine 150 ppm reduced TSS (15.60 Brix⁰), Ascorbic acid (17.85%), Reducing sugars (5.15%), Total sugars (14.55 %) and maximum acidity (0.37 %), as well as reduced physiological weight loss (13.06 %), Days to ripening (16.68), shelf life (20.73%), fruit spoilage (8.71%) in treated trees over non-treated trees at full bloom stage after post-harvest. Our results suggested that effect of polyamines on mango cv. Kesar to increased quality and shelf life parameters.

Introduction

Mango (*Mangifera indica* L.) belongs to the family *Anacardiaceae*, originated from indo-burma region. Owing to excellent flavour, attractive colour, delicious taste and high nutritive value, this prized fruit has occupied premier position in our country and also in the international market.

The fruit is intimately associated with the history of Indian Agriculture and civilization and enjoys a royal status in country when compared to the other growing places. No one will have a difference of opinion about the status given to mango as 'King of Fruits' due to its captivating flavour, irresistible taste and

sweetness. Its production has been increasing since independence, contributing 20.7% of the total fruit production of India. Uttar Pradesh, Andhra Pradesh, Karnataka, Telangana, Maharashtra, Gujarat, Tamil Nadu and Bihar together contribute for about 82% of the total production in India (Anon., 2014). The important cultivars commercially grown under Gujarat are Kesar, Alphonso, rajapuri, Totapuri, jamadar, vashibadami, Dashehari, langra, Mulgoa, Pairi, and Neelum. Kesar variety grown commercially in Gujarat and it is generally regular bearer, high yielder, early mid-season and adaptable to wide range of soil and climatic conditions with attractive flesh colour, fruit size, excellent sugar: acid blend, good keeping quality and gained wide

spread among consumers in India as well as in abroad (Arogha, 1999).

Exogenous application of polyamines may improve fruit set, retention and extend the storage life of mango fruits by inhibiting ethylene production (Malik and Singh, 2006). Recent studies of Malik and Singh (2003) revealed that PAs applications generally improved fruit retention and yield in mango depending upon the type and concentration of PAs and phenological stage of application. Spray of SPM prior to anthesis and PUT at full bloom was found more effective in increasing final fruit retention in 'Dashehari' and 'Langra' mango respectively (Singh and Singh, 1995).

Increase in fruit size and levels of endogenous PAs in apples have been associated with exogenous application of PAs which indicated that lower level of these compounds could act as growth limiting factors (Biasi *et al.*, 1988). Exogenous application of polyamines have been demonstrated to influence yield, shelf life and quality of various fruit crops such as apple (Kramer *et al.*, 1989), strawberry (Ponappa *et al.*, 1993), plum (Ren *et al.*, 1995), peaches (Martinez- Romero *et al.*, 2000) and mango (Purwoko *et al.*, 1998).

The role of NAA in the control of vegetative and reproductive development has been the subject of studies of several workers. These substances appear to have different effect at different concentrations (Shinde *et al.*, 2002). The promotion of floral initiation and control of fruit drop are well established by these substances. They also improve size and quality of fruits in mango and other crops (Rani and Brahmachari, 2004).

Materials and Methods

The experiment was carried out at Fruit Research Station, Sakkarbaugh Farm and

Department of Horticulture, College of Agriculture, Junagadh Agricultural University, Junagadh during 2015-16 and 2016-17. Junagadh is situated at 21.5⁰ N latitude and 70.5⁰ E longitudes with an altitude of 60 meters above the mean sea level on the western side at the foot hills of the mount 'Girnar'. The present study was conducted on fifteen years old plants of mango cultivar 'Mango'. All the plants selected were uniform in growth and size which planted at the distance of 10m × 10m and were subjected to uniform application of cultural practices like weeding, irrigation, manures, fertilizers and plant protection measures *etc.*

The polyamines and NAA was used for the present investigation and supplied through Department of Horticulture, Junagadh Agricultural University. The experiment was laid out in Randomized Block Design with ten treatments and three replications. The experiment comprising of ten treatments involving: T₁ – Spermine 2 ppm; T₂ – spermine 3 ppm; T₃ – Spermine 4 ppm; T₄ – Putrescine 100 ppm; T₅ – Putrescine 150 ppm; T₆ – Putrescine 200 ppm; T₇ – NAA 20 ppm; T₈ – NAA 30 ppm; T₉ – NAA 40 ppm; T₁₀ – Control (No spray). One spray was done at the full bloom stage of mango cv. Kesar.

Results and Discussion

Physico-chemical parameters

Fruit quality characters like total soluble solids (⁰Brix), sugars (reducing and total sugars) (%), titrable acidity (%) and ascorbic acid (mg/100g) were significantly influenced by foliar spray of different polyamines on mango cv. Kesar. Putrescine 150 ppm was found to be minimum total soluble solids (⁰Brix), sugars (reducing and total sugars %) and maximum acidity (%). Whereas, highest ascorbic acid (mg/100g) were recorded in putrescine 150 ppm treatment (Table 1).

Table.1 Effect of polyamines and NAA application on quality of mango (*Mangifera indica* L.) cv. Kesar

Treatments	TSS (Brix ⁰)		Ascorbic acid%		Acidity%		Reducing sugars%		Total sugars%	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
T ₁	17.30	17.36	16.62	16.67	0.34	0.34	5.44	5.51	15.57	15.62
T ₂	16.75	16.80	17.27	17.31	0.35	0.36	5.63	5.69	15.26	15.31
T ₃	16.71	16.75	16.50	16.53	0.34	0.34	5.85	5.89	15.19	15.36
T ₄	17.60	17.66	17.10	17.13	0.35	0.35	5.25	5.30	14.86	15.25
T ₅	15.57	15.60	17.89	17.85	0.37	0.37	5.07	5.15	14.48	14.55
T ₆	17.44	17.49	16.79	16.82	0.36	0.36	5.38	5.41	14.85	14.89
T ₇	17.66	17.76	16.70	16.73	0.32	0.32	6.03	6.07	15.61	15.64
T ₈	18.22	18.29	16.62	16.44	0.31	0.32	6.07	6.11	16.14	16.21
T ₉	18.93	19.01	15.93	15.99	0.30	0.31	6.14	6.18	16.27	16.30
T ₁₀	19.53	19.71	15.57	15.60	0.29	0.30	6.23	6.26	16.33	16.38
S.Em.±	0.73	0.71	0.35	0.40	0.01	0.01	0.19	0.18	0.41	0.40

Table.2 Effect of polyamines and NAA application on shelf life of mango (*Mangifera indica* L.) cv. Kesar

Treatments	PWL%		Days to ripening		Shelf life%		Fruit spoilage (%)	
	2016	2017	2016	2017	2016	2017	2016	2017
T ₁	14.12	14.21	14.48	14.69	18.02	18.75	12.04	12.49
T ₂	13.16	13.25	15.69	15.90	19.60	19.94	10.21	10.54
T ₃	13.83	13.91	13.81	14.02	17.93	18.05	13.21	13.50
T ₄	13.63	13.73	15.28	15.48	19.03	19.26	14.57	14.69
T ₅	13.04	13.06	16.47	16.68	20.53	20.73	8.57	8.71
T ₆	13.45	13.50	14.52	14.73	18.32	18.57	13.31	13.55
T ₇	14.89	14.97	14.35	14.56	18.11	18.31	18.55	18.88
T ₈	15.08	15.15	13.34	13.55	17.07	17.37	20.12	20.46
T ₉	15.18	15.34	12.47	12.68	16.51	16.66	21.33	21.48
T ₁₀	15.90	16.01	11.39	11.61	15.14	15.42	23.04	23.63
S.Em.±	0.45	0.40	0.33	0.30	0.98	0.98	0.96	0.81

Regarding non-reducing sugars, no positive effect was observed with the spray of either of the polyamines.

Putrescine might retard chlorophyll destruction and/or increased their bio-synthesis.

Polyamine may retard senescence by altering the stability and permeability of membranes, by protecting and preventing chloroplasts from senescing and therefore retarding chlorophyll loss (Gonzalez-Aguilar *et al.*, 1997). Diamine aminotransferase transfers the

amino group of putrescine to α -oxoglutaric acid, the precursor of chlorophyll (Askar and Treptow, 1986). Promotive effects of polyamines on photosynthetic pigments were also observed in mulberry (Das *et al.*, 2002), cucumber (He *et al.*, 2002) and common bean (Nassar *et al.*, 2003). Thus, beneficial effect of foliar application of putrescine in enhancing fruit quality is notably due to the bio regulatory effect on enzymatic activity and translocation processes from leaves to fruits, linking or converting to other plant metabolites (Serafini-Fracassini and Del Duca, 2008).

The findings of Malik and Singh (2006) in mango, Marzouk and Kassem (2011) in grape, Kassem *et al.*, (2011) in ber, Abd El-Migeed *et al.*, (2013) in date palm and Ali *et al.*, (2010) in apricot are in agreement with the present investigation.

Physiological loss in weight (%)

The loss in weight of fruit increased with increasing storage period irrespective of any treatment. However, this increase was at reduced rate in all the treated fruits as compared to control.

The results of the present investigation indicated that physiological loss in weight was significantly influenced by the application of polyamines.

The minimum loss in weight starting from the day of storage up to the 16th day occurred consistently in fruits treated with putrescine 150 ppm. Similarly, the maximum loss in weight was observed in untreated fruits during the entire storage period.

The reduced loss in weight of fruit was more evident in fruit treated with putrescine, it might be due to comparatively lower rates of respiration and increased fruit firmness (Valero *et al.*, 2002). The findings of Mirdehghan *et al.*, (2013a) in pistachio nut, Malik *et al.*, (2006) in mango are in confirmation with the present investigation.

Days to ripening

The maximum days to ripening (16.47, 16.68 and 16.58 days) were recorded at treatment T₅ (putrescine 150 ppm.) as compared to other treatments and the minimum days to ripening (11.39, 11.61 and 11.50 days) were recorded in treatment T₁₀ (control) during the both years and in pooled respectively.

Application of putrescine 150 ppm could be due to delayed changes associated with the senescence such as ethylene production, browning, peroxide level and cell leakage (Jiang and Chen, 1995), preventing fungal infection (Mirdehghan *et al.*, 2013a) and retardation of fruit softening due to the inhibition of polygalacturonase activities, presumably through binding to pectic substances (Kramer *et al.*, 1989).

Shelf life (days)

The significant improvement was observed in shelf life of mango fruits by the application polyamines. The maximum shelf life was recorded in fruits treated with putrescine 150 ppm and the minimum shelf life was observed in fruits harvested from untreated trees (Table 2).

The probable reasons for increased shelf life by application of putrescine 150 ppm could be due to delayed changes associated with the senescence such as ethylene production, browning, peroxide level and cell leakage (Jiang and Chen, 1995), preventing fungal infection (Mirdehghan *et al.*, 2013a) and retardation of fruit softening due to the inhibition of polygalacturonase activities, presumably through binding to pectic substances (Kramer *et al.*, 1989).

Similar findings were also observed by Malik *et al.*, (2006) in mango, Khan and Singh (2008) in plum, Mirdehghan *et al.*, (2013a) in pistachio nut and Mirdehghan *et al.*, (2013b) in grape.

Spoilage (%)

Fruit spoilage was significantly influenced by the application polyamines. The minimum spoilage was reported in fruits receiving putrescine 150 ppm. Whereas, the maximum spoilage was observed in fruits from untreated trees.

Reduced spoilage can be attributed to a decrease in the microbial activity of fruits (Mirdehghan *et al.*, 2013a). Polyamines conjugated to phenolic compounds and hydroxycinnamic acid amides have been shown to accumulate in cells in interactions between plants and a variety of pathogens (Walters, 2003). Thus, putrescine treated fruits had less fungal infection than untreated ones.

Similar findings were also observed by Mirdehghan *et al.*, (2013a) in pistachio nut and Mirdehghan *et al.*, (2013b) in grape.

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