The Bioscan 11(1): 211-213, 2016
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.in

EFFECT OF POLYAMINES ON FRUIT RETENTION AND YIELD OF MANGO (*MANGIFERA INDICA* L.) CV. KESAR

M. RAVI VENKANNA BABU[1], T. R. AHLAWAT*[1], ALKA SINGH[2], J. RAVI KANTH[1] AND G. NARAYANA SAWAMY[3]
[1]Department of Fruit Science, ASPEE College of Horticulture and Forestry,
N.A.U., Navsari - 396 450, Gujarat, INDIA
[2]Department of Floriculture and Landscape Architecture,
ASPEE College of Horticulture and Forestry, NAU, Navsari - 396 450, Gujarat, INDIA
[3]Department of Vegetable Science, Dr. Y. S. R. Horticultural University,
Anantharajupet - 516 105, Andhra Pradesh, INDIA
e-mail: tahlawat4@gmail.com

KEYWORDS
Mango
Spermine
Spermidine
Putrescine

Received on :
18.10.2015

Accepted on :
12.01.2016

***Corresponding author**

ABSTRACT
Putresine, spermine and spermidine at three different concentrations (0.1, 0.01 and 0.05 mM) were applied as foliar spray on mango panicles cv. Kesar at pea stage and 20 days thereafter to study their effect on fruit retention and fruit yield at Navsari Agricultural University, Navsari during 2012-13. Exogenous application of polyamines had a positive and significant impact on all parameters included in the study except fruit breadth. Between the three polyamines, foliar application of spermine at 0.01mM resulted in the highest fruit retention (20.70%), number of fruits per panicle (1.37), number of fruits per tree (272.67) and fruit yield per tree (73.22 kg/tree). The maximum fruit weight (284.17 g), fruit length (12.15 cm), fruit volume (280.89 ml) and pulp weight (153.60 g) was recorded in spermine 0.1mM treatment. Foliar sprays of spermine at 0.01mM can thus be employed for improving fruit retention and increasing production in mango cv. Kesar.

INTRODUCTION

Mango (*Mangifera indica* L.), the choicest fruit of Hindustan is one the most widely cultivated fruits of the country. The estimated area under mango in India is about 25.16 lakh hectares with a production of 184.31 lakh MT and a productivity of 7.2 MT/ha. India is the largest producer of mango in the world contributing about 45.1% to the overall global production (NHB, 2014). Kesar is the most popular mango variety in Gujarat and has good export potential. It accounts for ninety per cent of the mangoes exported from Gujarat (Srivastav, 2007). The area under this variety has increased not only in Gujarat but also in neighbouring states like Maharashtra, Madhya Pradesh and Rajasthan because of its higher productivity, regularity in bearing, superior fruit quality, rich flavor and pleasant aroma. It is widely appreciated by the consumers for its attractive shape, size and colour.

Polyamines (PAs) are biological compounds of low molecular weight with aliphatic nitrogen groups that are ubiquitous in plants. The most common PAs are putrescine (PUT), spermidine (SPD) and spermine (SPM). The universal occurrence of PUT, SPD and SPM in plant organs suggests that they fulfill important functions in plant growth regulation. Research work indicates the involvement of phytohormones (Bains *et al.*, 1999) and endogenous PAs (Malik and Singh, 2003) in fruit drop of mango. Malik and Singh (2003) revealed that exogenous application of PAs generally improved fruit retention and yield in mango depending upon the type and concentration of PAs and phonological stage of application. Increase in fruit size has been associated with exogenous application of PAs in apple, which indicated that lower level of these compounds could act as growth limiting factors (Biasi *et al.* 1988). Previous investigations in the country have shown that exogenous applications of polyamines can prolong the shelf life of mango (Bhat *et al.*, 2014) and improve fruit quality in peach (Ullah and Jawandha, 2014).

Productivity of mango in India is much lower than that of countries like Brazil, Pakistan and Kenya. Low fruit set and poor fruit yield are some of the reasons associated with low productivity in mango. At times only 0.1% of set fruits reach maturity (Chadha, 1993). Various chemicals and plant growth regulators have been employed for increasing productivity in mango. However, polyamines are yet to be evaluated for this purpose, particularly in India. The present investigation was therefore designed with the twin objectives of improving fruit retention and boosting fruit yield in mango cv. Kesar using three different polyamines *i.e.* Spermine, Spermidine and Putrescine.

MATERIALS AND METHODS

Experimental material

This investigation was carried out during the year 2012-13 at

Navinchandra Mafatlal College of Agriculture (NMCA) Farm, Navsari Agricultural University, Navsari which is situated on the coast of Arabian Sea at 20^0-57′N latitude and 72^0-54′E longitude at an altitude of about 10 meters above the mean sea level. The experimental material consisted of 7 years old uniform mango trees of cultivar 'Kesar' planted at a distance of 5 × 5 m. Trees of uniform shape, size and growth were selected for experimentation. Selected trees of mango cv. Kesar were subjected to two foliar sprays of spermine, spermidine and putrescine at three different concentrations i.e. 0.1, 0.01 and 0.05 mM. The first spray was done at pea stage and the second spray 20 days thereafter. The freshly prepared solutions were sprayed on panicles by using battery operated knapsack sprayer, till the panicles and its surrounded leaves were thoroughly wet. At the pea stage, eight panicles were randomly selected from all four sides of the tree canopy and labeled. The numbers of fruits on each labeled panicle were counted at marble stage. The number of fruits retained on these labeled panicles was once again recorded at harvesting. Fruit drop per panicle was calculated by subtracting the number of fruits at harvest from the number of fruits at marble stage. Fruits retention at harvesting was estimated using the following formula.

$$\text{Fruit retention (\%)} \quad \frac{\text{No. of fruits at marble stage} \quad \text{No. of fruit dropped}}{\text{No. of fruits at marble stage}} \quad 100$$

The number of fruits per panicle and the number of fruits per tree was counted treatment wise for each experimental tree at the time of harvest. Five fruits from each treatment were drawn randomly to calculate fruit weight (g), fruit length (cm), fruit breadth (cm) and pulp weight (g). Fruit volume (ml) was measured by water displacement method using a measuring cylinder of 3 litre capacity.

Statistical analysis

The data obtained in the present investigation were statistically analyzed using the method suggested by Panse and Sukhatme (1967) for Randomized Block Design (RBD). Treatment means were compared by means of critical differences at 5 per cent level of probability. Statistical analysis was done under the supervision of Department of Agricultural Statistics, NMCA, NAU, Navsari.

RESULTS AND DISCUSSION

Effect on fruit retention

Fruit retention in mango cv. Kesar was significantly influenced by various polyamines during the investigation (Table 1). Treated trees had higher values of fruit retention as compared to control. Application of spermine 0.01mM resulted in the highest fruit retention (20.70%). While, minimum fruit retention (14.38) was noted in unsprayed trees. The increase in fruit retention with exogenous application of polyamines may be ascribed to the increased levels of endogenous polyamines in fruitlets and pedicels, which were less prone to abscise (Malik and Singh, 2003). It may also be argued that exogenous application of polyamines improved fruit retention, possibly by inhibiting ACC synthase (Kakkar and Ray, 1993) and endogenous ethylene bio-synthesis which is known to trigger abscission (Brown, 1997). Higher fruit retention by the application of spermine was earlier reported by Singh and James (2000) and Malik and Singh (2006) in mango cv. 'Kensington Pride'.

Effect on fruit yield and associated traits

Polyamines exerted a significant influence on fruit yield and its associated traits in mango cv. Kesar as reflected in Table 1. Among the different polyamines, spermine 0.01mM was found to be the most effective and resulted in significantly maximum number of fruits per panicle (1.37), maximum number of fruits per tree (272.67) and yield per tree (73.22 kg/tree). Whereas, average fruit weight (284.17g) was the highest under spermine 0.1mM. Polyamines have been suggested to be associated with cell division. Highest concentrations of endogenous polyamines were found in both pericarp and mesocarp at the time of fruit set and initial fruit development stage. These endogenous levels of polyamines progressively decreased towards maturity of the fruit and this was scientifically reported in pear fruit by Toumadje and Richardson (1988).

The positive effects observed on yield and fruit characteristics of mango fruits could also be attributed to the effect of polyamines on cell metabolism. The polyamine stimulated cellular metabolism in sink tissues may change the phloem transport, cell enlargement and reduce fruitlet abscission which resulted in an overall improvement in fruit yield. According to Harhash and Abdel-Nasser (2010) higher fruit weight could

Table 1: Effect of polyamines on fruit retention, fruit yield and associated traits in mango cv. Kesar

Treatments	No. of fruits at marble stage	No. of fruits at harvest	Fruit retention (%)	No. of fruits per panicle	No. of fruits per tree	Fruit yield/tree (kg/tree)	Average fruit weight (g)
Spermine 0.1mM	48.33	9.00	18.58	1.12	247.67	70.57	284.17
Spermine 0.01mM	53.33	11.00	20.70	1.37	272.67	73.22	268.28
Spermine 0.05mM	50.00	9.67	20.36	1.21	257.00	72.70	282.19
Putrescine 0.1mM	45.33	8.33	18.33	1.04	239.33	63.75	268.77
Putrescine 0.01mM	44.33	7.67	17.18	0.96	239.00	59.80	249.01
Putrescine 0.05mM	48.67	9.33	19.25	1.16	254.33	64.44	253.87
Spermidine 0.1mM	43.67	7.33	16.96	0.92	221.33	56.52	257.79
Spermidine 0.01mM	36.33	5.67	15.43	0.71	213.00	50.51	242.79
Spermidine 0.05mM	40.00	6.67	16.97	0.83	216.33	52.45	244.75
Control (No spray)	30.67	4.33	14.38	0.54	183.67	37.95	212.33
S. Em. ±	3.61	0.63	1.28	0.08	16.52	4.48	13.49
C. D. at 5 %	10.74	1.86	3.79	0.23	49.08	13.31	40.09
C. V. %	14.20	13.72	12.41	13.69	12.20	12.89	9.11

Table 2: Effect of polyamines on physical parameters of mango fruits cv. Kesar

Treatments	Fruit length (cm)	Fruit breadth (cm)	Fruit volume (ml)	Pulp weight (g)
Spermine 0.1mM	12.15	7.43	280.89	153.60
Spermine 0.01mM	11.08	6.87	266.39	147.52
Spermine 0.05mM	11.71	7.38	278.01	131.44
Putrescine 0.1mM	11.30	7.16	267.64	139.11
Putrescine 0.01mM	10.35	6.74	249.93	132.87
Putrescine 0.05mM	10.47	6.85	253.34	131.13
Spermidine 0.1mM	10.94	6.86	256.49	132.69
Spermidine 0.01mM	10.07	6.67	240.62	128.36
Spermidine 0.05mM	10.26	6.73	241.77	122.89
Control (No spray)	9.85	6.64	208.99	122.30
S. Em. ±	0.45	0.31	13.40	6.32
C. D. at 5 %	1.35	NS	39.81	18.78
C. V. %	7.25	7.62	9.12	8.16

be due to an increase cell size or cell number or to the improvement in fruit growth and uptake of nutrient elements that accelerate metabolic processes. Similar observations were made by Malik and Singh (2006) in mango 'Kensington Pride', Ali *et al*. (2010) in apricot cv. 'Canino' and Kamiab *et al*. (2015) in pistachio nut cvs. (Ohadi, Akbari and Kalehghoochi). Unsprayed trees had the lowest fruit yield.

Effect of physical parameters of mango fruits

There was a significant impact of polyamines on fruit length, fruit volume and pulp weight in mango cv. Kesar (Table 2). Fruit length (12.15 cm), fruit volume (280.09 ml) and pulp weight (150.63 g) were found maximum with the application of spermine 0.1mM. Polyamines as a growth regulator are known to increase the source sink relationship, stimulate the translocation of photoassimilates and accumulation of sugars thereby inducing better development in fruit length and pulp weight (Kassem *et al*., 2011). An increased in fruit weight under foliar application of spermine was earlier demonstrated by Ali *et al*. (2010) in apricot cv. 'Canino'. Minimum values for the above mentioned traits were observed in water sprayed trees.

Based on the above investigation, it can thus be inferred that for better fruit retention, improved fruit size and higher fruit yield mango growers of South Gujarat should spray cv. Kesar with spermine 0.01mM twice, once at the pea stage and again 20 days after the first spray.

REFERENCES

Ali, E. A. M., Sarrwy, S. M. A. and Hassan, H. S. A. 2010. Improving 'Canino' apricot trees productivity by foliar spraying with polyamines. *J. Appl. Sci. Res.* **6(9):** 1359-1365.

Bains, K. S., Bajwa, G.S. and Singh, Z. 1999. Effect of indole-3-acetic acid, gibberelic acid and abscissic acid on abscission of mango fruitlets. *Trop. Agric.* **76:** 88-92.

Bhat, A., Raj Kumari Kaul, Monica Reshi and Gupta, N. 2014. Effect of polyamines on shelf life and chilling injury of mango cv. Dashehari. *The Bioscan*. **9(3):** 1097-1100.

Biasi, R., Bagni. N. and Costa, G. 1988. Endogenous polyamines in apple and their relationship to fruit set and fruit growth. *Physiol. Plantarum*. **73:** 201-205.

Brown, K. M. 1997. Ethylene and abscission. *Physiol. Plantarum*. **100:** 567-576.

Chadha, K. L. 1993. Fruit drop in mango. In: *Advances in Horticulture*. Ed: Chadha K. L. and Pareek, O. P. Maharastra Publishing House, New Delhi, pp. 1131-1166.

Harhash, M. M. and Abdel-Nasser, G. 2010. Improving of fruit set, yield and fruit quality of Khalas tissue culture derived date palm through bunches spraying potassium and/or putrescine. *Aust. J. Basic Appl. Sci.* **4:** 4164-4172.

Kakkar, R. K. and Ray, V. K. 1993. Plant polyamines in flowering and fruit ripening. *Phytochem.* **33:** 1281-1288.

Kamiab, F., Heidari Salehabad and Zamanibahramabadi, E. 2015. Evaluating the effects of foliar treatments of polaymines and some organic acids on quantitative and qualitative traits in some pistachio cultivars. *Journal of Nuts*. **6**(2): 131-142.

Kassem, H. A., Al-Obeed, R. S., Ahmed, M. A. and Omar, A. K. H. 2011. Productivity, fruit quality and profitability of jujube trees improvement by pre harvest application of agro- chemicals. *Middle-East J. Sci. Res.* **9**(5)**:** 628-637.

Malik, A.U. and Singh, Z. 2003. Abscission of mango fruitlets as influenced by biosynthesis of polyamines. *J. Horti. Sci. Biotechnol.* **78:** 721-727.

Malik, A.U. and Singh, Z. 2006. Improved fruit retention, yield and fruit quality in mango with exogenous application of polyamines. *Sci. Hort.* **110:** 167-174.

NHB. 2014. Indian Horticulture Database-2014. National Horticulture Board, Gurgaon, India.

Panse, V. G. and Sukhatme, P.V. 1967. *Statistical Methods for Agricultural Workers*. ICAR, New Delhi.

Singh, Z. and James, J. 2000. Regulation of fruit set and retention in mango with exogenous application of polyamines and their biosynthesis inhibitors. *Acta. Hort.* **509:** 675-680.

Srivastav, S. C. 2007. India: Gujarat to begin export of 'Kesar' mangoes to US and Japan, Managing Director, Gujarat Agro Industries Corporation Gujarat state, source: *www.indiatimes.com.*

Toumadje, A. and Richardson, D. G. 1988. Endogenous polyamine concentrations during development, storage and ripening of pear fruits. *Phytochem.* **27:** 335-338.

Ullah, Summy and Jawandha, S. K. 2014. Effect of polyamines on quality attributes of stored peach fruits. *Int. J. Agric. Sci.* **10 (1):** 317-321.