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EFFECT OF POLYAMINES AND NAA APPLICATION ON YIELD OF MANGO (*Mangifera indica* L.) CV. KESAR

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ABSTRACT
A study was conduct to investigate the effect of polyamines and NAA on yield attributes like, fruit set, fruit retention, fruit drop, number fruits per panicle, number of fruits per tree, number fruits per hectare and fruit weight, fruit length, fruit volume in 15 years old trees of mango cv. Kesar, under Junagadh Agricultural University, Junagadh, saurastra region of Gujarat during 2015-16 and 2016-17. Results indicated that spermine 3 ppm increased fruit set (0.24 %), fruit retention (21.05 %), number of fruits per panicle (2.49), number of fruits per plant (394.68), fruit yield (99.61 kg/ tree & 9961.33 kg/ ha), fruit weight (288.97 g), fruit length (12.16 cm), fruit volume (282.04 ml) and minimum fruit drop (66.00%) in treated trees over non-treated trees at full bloom stage. Our results suggested that effect of polyamines on mango cv. Kesar to increased yield parameters.

INTRODUCTION

Mango (*Mangifera indica*. L.) belongs to the family *Anacardiceae*, 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, Alphanso, 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 (Arogba, 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 were 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).

There is a need to generate scientific information regarding the impact of polyamines on fruit set and fruit retention of commercially grown fruits in the country. Even in Gujarat, there are hardly any reports on the use of polyamines in mango. Therefore, the present investigation entitled "Effect of polyamines and NAA application on yield, quality and shelf life of Mango (*Mangiferaindica* L.) cv. Kesar" will envisaged with the below mentioned objectives.

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 21.5° N latitude and 70.5° 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: T_1 – Spermine 2 ppm; T_2 –spermine 3 ppm; T_3 – Spermine 4 ppm; T_4 – Putrescine 100 ppm; T_5 – Putrescine 150 ppm; T_6 – Putrescine 200 ppm; T_7 – NAA 20 ppm; T_8 – NAA 30 ppm; T_9 – NAA 40 ppm; T_{10} – Control (No spray). One spray was done at the full bloom stage of mango cv. Kesar.

RESULTS AND DISCUSSION

The maximum fruit set (0.22, 0.26 and 0.24 %) was recorded from treatment T_2 (Spermine-3 ppm) (Table -1) as compared to other treatments. The increase in fruit set due to polyamine may be attributed to inhibition of ethylene biosynthesis. It is known that abscission is related to plant tissues and ethylene has the same precursor as the polyamines i.e., s-adenosyl methionine. These polyamines are known to inhibit ethylene biosynthesis largely by preventing 1- aminocyclopropane-1-carboxylicacid synthase activity (Tiburico *et al.*, 1993).

The minimum fruit drop (66.17, 65.82, and 66.00 %) and maximum fruit retention (20.86, 21.23 and 21.05 %) were recorded from treatment T_2 (spermine 3 ppm) (Table -1). The increase in fruit retention and decrease in fruit drop 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 as well as reduce fruit drop, possibly by inhibiting ACC synthase (Kakkar and Ray, 1993) and endogenous ethylene bio-synthesis which is known to trigger abscission (Brown, 1997). The increased effectiveness of spermine at early stages (before final fruit set stage) may be due to improved floral organ development,

Table1: Effect of polyamines and NAA application on yield of mango (*Mangifera indica* l.) cv. Kesar

Treatments	Fruit set%		Fruit drop%		Fruit retention %		Number of fruits /panicle		Number of fruits / tree	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
T_1	0.17	0.21	79.18	81.15	18.49	19.15	1.86	1.90	258.81	297.76
T_2	0.22	0.26	66.17	65.82	20.86	21.23	2.69	2.29	393.79	395.56
T_3	0.18	0.22	78.64	79.25	19.03	19.68	1.91	1.97	266.42	304.14
T_4	0.15	0.19	79.34	80.59	18.32	18.94	1.82	1.90	256.48	292.44
T_5	0.19	0.23	77.61	78.29	19.60	20.15	2.01	2.06	274.45	278.05
T_6	0.16	0.20	80.72	79.66	17.93	18.08	1.78	1.82	251.07	279.29
T_7	0.18	0.22	83.60	82.27	18.11	17.62	1.83	1.85	253.49	272.29
T_8	0.14	0.18	84.87	83.63	17.07	16.53	1.66	1.70	238.93	255.26
T_9	0.13	0.17	85.56	84.87	16.51	15.26	1.56	1.60	231.09	235.59
T_{10}	0.12	0.16	86.32	85.69	14.47	13.89	1.38	1.43	202.63	233.70
S.Em. ±	0.01	0.01	3.71	3.55	1.11	1.10	0.10	0.10	18.15	17.96

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

Treatments	fruit yield (kg / tree)		fruit yield (kg / hactare)		fruit weight (g)		fruit length (cm)		fruit volume (ml)	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
T_1	70.95	72.23	7094.67	7223.00	257.66	261.23	11.08	11.12	266.75	269.19
T_2	97.30	101.93	9729.67	10193.00	287.81	290.12	12.15	12.17	280.54	283.54
T_3	76.12	78.32	7612.00	7832.33	268.13	272.31	11.15	11.19	254.91	257.05
T_4	73.28	75.31	7328.00	7531.00	253.00	259.31	10.92	10.95	264.95	267.92
T_5	78.41	79.25	7841.33	7925.00	278.91	283.13	11.56	11.59	278.91	281.62
T_6	71.73	73.83	7173.33	7383.33	251.07	254.74	10.47	10.50	257.48	260.17
T_7	68.71	73.16	6870.67	7316.00	253.49	257.82	10.33	10.37	251.60	254.23
T_8	68.27	70.04	6826.67	7004.00	238.93	241.00	10.22	10.24	248.24	251.20
T_9	66.03	67.38	6602.67	6738.33	231.09	234.55	10.09	10.13	243.60	247.53
T_{10}	57.89	57.76	5789.33	5776.00	202.63	203.10	9.92	9.98	216.01	219.43
S.Em. ±	4.62	4.89	461.70	488.60	15.03	16.05	0.45	0.44	11.95	11.79

pollination, fertilization and subsequent embryo and initial fruit development (Malik and Singh, 2003).

Among the different hormones, spermine 3 ppm *i.e.* treatment T_2 (Table -1) was found to be the most effective and resulted in maximum number of fruits per panicle (2.69, 2.29 and 2.49), maximum number of fruits per tree (393.79, 395.56 and 394.68), yield (97.30, 101.93 and 99.61 kg/tree) and yield per hectare (9729.67, 10193.00 and 9961.00 kg/ ha) in both the years as well as in pooled respectively. Whereas, the highest average fruit weight (287.81, 290.12 and 288.97 g) was found in treatment T_2. In the present investigation, the trees sprayed with spermine-3 ppm showed significantly higher fruit retention which directly contributed to increased number of fruits per panicle and number of fruits per tree and ultimately resulted in higher yield.

The physical parameters like fruit length, fruit volume and pulp weight were significantly influenced by foliar application of different polyamines on mango cv. Kesar. However, spermine 3 ppm was found to be most effective and resulted in significantly highest fruit length (12.15, 12.17 and 12.16 cm), fruit volume (280.54, 283.54 and 282.04 ml) and pulp weight (153.20, 155.08 and 154.14 g) in both the years as well as in pooled respectively(Table -2). Whereas, firmness of the fruit was significantly influenced by the application of putrescine 150 ppm. Fruit firmness decreased with the increase in storage period. It was the highest in treatment T_5 (putrescine 150 ppm) from till the storage *i.e* 14.51 kg/cm^2, 8.81 kg/cm^2 and 4.10 kg/cm^2 in both the years as well as in pooled respectively. Regarding fruit breadth of the fruits, no positive effect was observed with the spray of polyamines.

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).

The increase in fruit firmness with putrescine application could be attributed to their influence on inhibiting ethylene biosynthesis (Kassem *et al.*, 2011) and the activity of cell wall degrading enzymes such as pectnesterase, pectin methylesterase and polygalacturonase involved in fruit softening (Valero *et al.*, 2002). Cross linking of polyamines to the -coo- group of pectic substance in the cell wall binds or blocks the access of degrading enzymes leading to rigidification and increased fruit firmness (Valero *et al.*, 1998).

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