

Original Research Article

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Effect of Different Chemicals on Yield and Quality of Mango (*Mangifera indica* L.) cvs. Bombay Green, Dashehari and Langra

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ABSTRACT

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An experiment was carried out at mango orchard, Department of Crop Sciences, Faculty of Agriculture, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya Chitrakoot, Satna (M.P.) India, during 2016-17 and 2017-18 to study the response of different mango cultivars viz. Bombay Green, Dashehari and Langra to various chemicals namely potassium nitrate, potassium di-hydrogen orthophosphate, di-potassium hydrogen orthophosphate in respect of yield, quality and shelf-life of fruits. The results of the experiment indicated that the fruit yield among the test cultivars was highest significantly with KH_2PO_4 -1%+ KNO_3 -1% treatment.

Introduction

Mango (*Mangifera indica* L.) is only fruit that created mango mania in its consumer's choice due to its excellent fragrance and flavour, attractive blushes, delicious taste and high nutraceutical value. Its genus *Mangifera*, belongs to the family Anacardiaceae, has 41 valid species of *Mangifera* distributed throughout the world. Mango is a cross pollinated allopolyploid crop having

chromosome number $2n=40$. All the commercial cultivars of mango are integrated in single species *Mangifera indica*. The majority of the mango varieties are area specific (Rymbai, 2014).

In general, the productivity of mango is revealed to be decreasing annually. There is a need to take productivity enhancing measures in mango cultivation for quality fruit production. Several workers have also

suggested that foliar feeding of nutrients directly to the site of metabolism as a substitute for or supplement to soil application noticeably improved fruit yield and quality attributes (Samra *et al.*, 1977; Singh *et al.*, 1994). It has also been considered that mango leaves absorb most of the nutrients within 24 - 72 hours after spray and, thereafter, depletion of leaf nutrient content is seen owing to translocation of N, P, K to actively developing organs within the plant system (Singh, 2002). Potassium is macronutrient attributed to the invigorating effect of K on phloem loading, photosynthesis and translocation and large molecular weight synthesis in the developing fruits (Rabeh and Sweelam, 1990). Singh *et al.*, (2008) opined that potassium is an important nutrient for fruit filling in terms of size and weight of fruits. They also stated that, potassium is required for production and transport of plant sugars that increases the weight of mango fruits. Potassium helps in energy transformation and activation of enzymes in carbohydrate metabolism which subsequently partitioning of photosynthates to the developing fruits.

Moreover, induction of early flowering results in early maturity of mango fruits which fetch the higher price in the market as compared to late maturing mango fruits. In view of above research work was undertaken to ascertain the effect of different chemical alone and in combination on yield and quality attribute of mango fruits cultivars viz. Bombay Green, Dashehari and Langra.

Materials and Methods

The present investigation was conducted to ascertain the effect of different chemicals on fruit quality and yield of different commercial cultivars of mango during 2016-17 and 2017-18 at mango orchard, Department of Horticulture, CSA University of Agriculture Technology, Kanpur (UP). There were nine

treatments associated with different chemicals along with control and replicated three times. During the investigation, the efficacy of different chemicals containing, nitrogen, phosphorus and potassium viz. Potassium di hydrogen orthophosphoric acid (KH_2PO_4), Dipotassium hydrogen orthophosphate (K_2HPO_4), Potassium nitrate (KNO_3) and Thiourea ($\text{CH}_4\text{N}_2\text{S}$) alone and in combination were tried foliar application in different cultivars of mango viz. Bombay Green, Dashehari and Langra. The observations on the yield per tree were recorded after harvesting of the mature fruits. With regard to quality parameters of fruits in different cultivars of mango, total soluble solids (TSS) in the fruits were estimated with the help of a LCD Digital pocket refractometer. Acidity of fruits, under different treatment was determined as per the methods suggested by AOAC (1990). Reducing and total sugars were estimated by Lane and Eynon (1923). Non-reducing sugar was estimated by deducting the estimated value of reducing sugar in estimated value of total sugar of the particular replication and treatment.

Results and Discussion

In the present investigation, the highest yield per tree was recorded with KH_2PO_4 -1% + KNO_3 -1% treatment in all the tested cultivars of mango. The highest yield with KH_2PO_4 -1% + KNO_3 -1% treatment may be attributed due to maximum per cent of flowering shoot, fruit set, increase in fruit set per panicle, prevention of abscission of young fruit lets, and increase in the number of fruits per tree would have resulted in the increase in yield in the trees sprayed with the above treatment in the present study. Moreover, early flowering, fruiting and better retention of fruits would have facilitated the better utilization of nutritional resources within the tree resulting in maximum yields (Kumar and Reddy, 2008). Phosphoric acid and potassium nitrate may

have acted synergistically to increase the number of flowering shoots thereby increasing in fruit yield of mango cv. Alphonso (Reddy and Kurian, 2012). Similar results were also reported in mango by MC Kenzie (1994) in cv. Sensation, Rojas (1996) in cv. Haden, Srihari and Rao (1998) in cv. Alphonso, Nahar *et al.*, (2010) in cv. Amrapali, Elkhishen (2015) in cv. Zebda, Dheeraj *et al.*, (2016) in cv. Banganapalli, Amarcholi *et al.*, (2016) in Kesar.

Among all the test cultivars, Langra was found to be superior over other cultivars in respect of total soluble solids found in the fruits. However, the maximum increase in Total Soluble Solids (TSS) was observed with KNO_3 -1% followed by K_2HPO_4 -1% + KNO_3 -1% in all the test cultivars as compared to K_2HPO_4 -1% treatment and control. Increase in TSS content with potassium nitrate confirmed by Khayyat *et al.*, (2012), Sarker and Rahim (2013) Yadav *et al.*, (2014), Baiea *et al.*, (2015) and Patolia *et al.*, (2017b) in mango. Increase in TSS may be due to the hydrolysis of the polysaccharides, conversion of organic acids into soluble sugars and enhanced

solubilisation of insoluble starch and pectin present in cell wall and middle lamella (Gupta and Brahmchari, 2004). Gharge *et al.*, (2014)) in mango confirmed Increase in TSS with potassium nitrate in combination with di potassium hydrogen phosphate treated trees. It was observed that the titratable acidity of fruits (in terms of citric acid) was decreased when thiourea or di potassium hydrogen phosphate applied singly or alone during both years of studies. The Maximum decrease in acidity was recorded with K_2HPO_4 1% + Thiourea (1%). Decrease in acidity of fruits following Potassium is in accordance with reports of Kumar and Reddy (2008) and Baiea *et al.*, (2015). The highest acidity was recorded with KH_2PO_4 -1% + KNO_3 -1% treatment. The findings of the present study indicated that the total sugar was markedly increased by spraying of chemicals, however, KHPO_4 (1%) + KNO_3 (1%) were most effective. The findings are in the line of earlier reports of Dutta *et al.*, (2011), Baiea *et al.*, (2015), Elkhishen (2015), Patolia *et al.*, (2017b) and Singh and Kaur (2018) in mango fruits itself (Table 1–6).

Table.1 Effect of chemicals on yield per tree in mango cv. bombay green, dashehari and langra

Treatments	Yield per Tree (kg)					
	Bombay Green		Dashehari		Langra	
	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18
KNO_3 -1%	63.54	51.42	39.00	48.86	92.17	70.50
KH_2PO_4 -1%	65.56	81.28	53.80	64.01	184.37	114.00
K_2HPO_4 -1%	115.89	102.40	71.41	60.86	140.05	184.87
$\text{CH}_4\text{N}_2\text{S}$ -1%	49.62	66.77	61.94	52.86	157.82	164.83
KH_2PO_4 -1% + KNO_3 -1%	120.03	144.29	100.83	119.33	233.47	283.20
K_2HPO_4 -1% + KNO_3 -1%	83.38	68.23	66.22	52.45	228.96	183.94
KNO_3 -1% + $\text{CH}_4\text{N}_2\text{S}$ -1%	79.04	65.39	59.84	48.30	192.89	157.21
K_2HPO_4 -1% + $\text{CH}_4\text{N}_2\text{S}$ -1%	111.02	104.25	85.08	72.00	201.00	179.36
Control	26.77	27.15	25.95	34.93	65.10	46.03
C.D. (at 5%)	3.5	1.78	3.9	2.9	6.5	12.5

Table.2 Effect of chemicals on TSS in the fruits of mango cv. bombay green, dashehari and langra

Treatments	TSS (° brix)					
	Bombay Green		Dashehari		Langra	
	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18
KNO₃ -1%	23.60	23.80	22.00	22.20	24.50	24.65
KH₂PO₄-1%	22.80	22.85	21.75	21.85	23.85	23.80
K₂HPO₄-1%	21.60	21.70	21.50	21.52	21.80	21.78
CH₄N₂S-1%	22.00	22.05	21.85	22.00	23.85	23.84
KH₂PO₄-1% + KNO₃ -1%	22.60	22.80	21.60	21.80	23.95	24.00
K₂HPO₄-1% + KNO₃ -1%	22.90	23.50	23.00	23.20	24.00	24.40
KNO₃ -1% + CH₄N₂S-1%	22.40	22.50	21.80	22.05	24.02	24.04
K₂HPO₄-1% + CH₄N₂S-1%	22.60	22.80	22.00	22.25	22.80	23.85
Control	21.80	21.75	21.66	21.70	23.40	23.50
C.D. (at 5%)	0.15	0.16	0.15	0.17	0.09	0.09

Table.3 Effect of chemicals on titratable acidity in the fruits of mango cv. bombay green, dashehari and langra

Treatments	Titratable Acidity (%)					
	Bombay Green		Dashehari		Langra	
	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18
KNO₃ -1%	0.31	0.31	0.19	0.19	0.27	0.27
KH₂PO₄-1%	0.32	0.33	0.20	0.21	0.28	0.29
K₂HPO₄-1%	0.29	0.28	0.16	0.16	0.24	0.25
CH₄N₂S-1%	0.30	0.30	0.17	0.17	0.26	0.25
KH₂PO₄-1% + KNO₃ -1%	0.33	0.33	0.21	0.22	0.29	0.29
K₂HPO₄-1% + KNO₃ -1%	0.30	0.30	0.18	0.18	0.27	0.26
KNO₃ -1% + CH₄N₂S-1%	0.30	0.29	0.19	0.18	0.27	0.27
K₂HPO₄-1% + CH₄N₂S-1%	0.28	0.28	0.15	0.15	0.24	0.24
Control	0.31	0.31	0.18	0.19	0.26	0.27
C.D. (at 5%)	0.01	0.02	0.02	0.01	0.01	0.01

Table.4 Effect of chemicals on reducing sugar in the fruits of mango cv. bombay green, dashehari and langra

Treatments	Reducing Sugar (%)					
	Bombay Green		Dashehari		Langra	
	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18
KNO₃ -1%	8.37	8.46	7.65	7.74	8.78	8.84
KH₂PO₄-1%	8.27	8.29	7.59	7.63	8.73	8.71
K₂HPO₄-1%	8.80	8.88	8.75	8.80	8.90	8.93
CH₄N₂S-1%	8.93	8.95	8.85	8.93	9.87	9.48
KH₂PO₄-1% + KNO₃ -1%	10.30	10.40	9.30	9.40	10.48	10.50
K₂HPO₄-1% + KNO₃ -1%	9.26	9.56	9.28	9.38	9.31	9.51
KNO₃ -1% + CH₄N₂S-1%	9.44	9.49	9.13	9.26	10.28	10.29
K₂HPO₄-1% + CH₄N₂S-1%	9.36	9.46	9.05	9.18	9.46	10.00
Control	8.75	8.82	7.83	7.85	9.10	9.21
C.D. (at 5%)	0.16	0.17	0.09	0.11	0.13	0.11

Table.5 Effect of chemicals on total sugar in the fruits of mango cv. bombay green, dashehari and langra

Treatments	Total Sugar (%)					
	Bombay Green		Dashehari		Langra	
	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18
KNO₃ -1%	18.60	18.80	17.00	17.20	19.50	19.65
KH₂PO₄-1%	18.80	18.85	17.25	17.35	19.85	19.80
K₂HPO₄-1%	17.60	17.75	17.50	17.60	17.80	17.85
CH₄N₂S-1%	17.50	17.55	17.35	17.50	19.35	18.59
KH₂PO₄-1% + KNO₃ -1%	20.60	20.80	18.60	18.80	20.95	21.00
K₂HPO₄-1% + KNO₃ -1%	18.15	18.75	18.25	18.45	18.25	18.65
KNO₃ -1% + CH₄N₂S-1%	18.15	18.25	17.55	17.80	19.77	19.79
K₂HPO₄-1% + CH₄N₂S-1%	18.35	18.55	17.75	18.00	18.55	19.60
Control	17.15	17.30	15.35	15.40	17.85	18.05
C.D. (at 5%)	0.72	0.68	0.64	0.43	0.51	0.42

Table.6 Effect of chemicals on non-reducing sugar in mango cv. bombay green, dashehari and langra

Treatments	Non- Reducing Sugar (%)					
	Bombay Green		Dashehari		Langra	
	2016-17	2017-18	2016-17	2017-18	2016-17	2017-18
KNO₃ -1%	10.23	10.34	9.35	9.46	10.73	10.81
KH₂PO₄-1%	10.53	10.56	9.66	9.72	11.12	11.09
K₂HPO₄-1%	8.80	8.88	8.75	8.80	8.90	8.93
CH₄N₂S-1%	8.58	8.60	8.50	8.58	9.48	9.11
KH₂PO₄-1% + KNO₃ -1%	10.30	10.40	9.30	9.40	10.48	10.50
K₂H-O₄-1% + KNO₃ -1%	8.89	9.19	8.94	9.04	8.94	9.14
KNO₃ -1% + CH₄N₂S-1%	8.71	8.76	8.42	8.54	9.49	9.50
K₂HPO₄-1% + CH₄N₂S-1%	8.99	9.09	8.70	8.82	9.09	9.60
Control	8.40	8.48	7.52	7.55	8.75	8.84
C.D. (at 5%)	0.36	0.31	0.29	0.19	0.41	0.23

Higher sugar content might be due to the role of potassium in carbohydrate metabolism, protein synthesis and neutralization of organic acids. Datta *et al.*, (2011) showed that the foliar ‘K’ application favours the conversion of starch into simple sugar during ripening by activating the sucrose synthase enzyme.

The data showed that the fruits treated with potassium nitrate in combination with potassium di hydrogen ortho phosphate exerted highest TSS, total sugars, reducing sugars and reducing sugars. It might be possible due to the reason that potassium treatment could be attributed to enhance photosynthetic efficiency of the leaves and a possible increase in translocation of assimilates into the fruit (Singh *et al.*, 1982).

The present findings are in accordance with Kaur *et al.*, (2012) in peach fruits and Prasad *et al.*, (2015) in pear fruits. Maximum increase in this line was noted with KH₂PO₄ (1.5%) + KNO₃ (1%). These findings are in conformity with several workers along with Kumar and Reddy (2008), Sarker and Rahim

(2013), Baiea *et al.*, (2015) in mango fruit. Increase in this ratio is directly due to increase in sugar content and decrease in acidity of fruits.

The effects of pre-harvest sprays of various chemicals on self-life of mango fruits were also observed after 7th days of harvest. The physiological loss in weight of fruits increased gradually and progressively under all treatments with prolongation of duration of storage. Although all the treatments under study reduced the loss (PLW) but fruits sprayed with KH₂PO₄ (1.5%) with KNO₃ (1%) showed least loss in weight. The possible region for reduction in weight loss by chemicals used in the experiment might be due to some chemical changes caused by them within fruits so that the fruits could retain more water against the force of evaporation and possibly they may also alter some of the proteinaceous constituent of the cell so as to increase the affinity for water (Rydahl *et al.*, 2018). The treated fruits exhibited low incidence of rotting or spoilage as compared to control. The incidence of

rotting (spoilage) was effectively minimized by the application of KH_2PO_4 -1%) + KNO_3 -1%.

In conclusion, the treatment K_2HPO_4 -1% + KNO_3 -1% proved superiority in improving the quality of fruits regarding total soluble solids and titratable acidity however acidity was lowest in fruits produced by treated trees with K_2HPO_4 -1% + $\text{CH}_4\text{N}_2\text{S}$ -1% and K_2HPO_4 -1%. With regard to reducing sugar per cent, it was noticed that total sugar and reducing sugar were highest with KH_2PO_4 -1% + KNO_3 -1% treatment over control in all the cultivars of mango cultivar Bombay Green, Dashehari and Langra, respectively. The non-reducing sugar was the highest with KH_2PO_4 -1% followed by KH_2PO_4 -1% + KNO_3 -1% and KNO_3 -1% among all the test cultivars of mango.

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