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Response of foliar spray of different chemicals on yield and quality of Dashehari mango under ultra-high density plantation

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Abstract
The present experiment entitled "Response of foliar spray of different chemicals on yield and quality of Dashehari mango under ultra-high density plantation" was conducted during the year 2015-16 at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari. The experiment was laid out in Randomized Block Design and replicated thrice. Nine treatments comprising urea (1, 1.5 and 2 %), KNO_3 (1 and 2 %), novel organic liquid fertilizer (1 and 2%) and ethephon 200mgl^{-1} along with one control and they were sprayed twice, first fortnight of October and November. The effect of these treatments on different parameters of yield and quality were recorded and analyzed statistically. The results of present investigation revealed that the number of fruits, average fruit weight and yield (kg/tree) were significantly the maximum in KNO_3 @ 2% treatment. Untreated trees of mango produced minimum yield and its attributes as compared to other treatments. In case of quality parameters, foliar application of KNO_3 @ 2% treatment improved the quality parameters like shelf life, TSS, total sugar, non reducing sugar, reducing sugar, fruit firmness, ascorbic acid and minimum titrable acidity in Dashehari mango under ultra high density plantation. On the basis of results obtained in present investigation, it can be summarized that foliar application of KNO_3 @ 2% at first fortnight of October and November, can be utilized for enhancing yield and quality in Dashehari mango under ultra high density plantation.

Keywords: Mango, Dashehari, KNO_3, yield and quality parameters

1. Introduction
Mango (*Mangifera indica* L.) belongs to the family Anacardiaceae is universally accepted as the finest tropical fruit of the world and has been called, in the orient, "King of fruits". Mango is rightly known as 'National Fruit of India', owing to it's nutritional richness, unique taste and flavour, religious and medicinal importance. It is third widely produced fruit crop of the tropics after banana and citrus. It possesses good nutritive and medicinal values. It is internationally known as the fruit ambassador of India. It is because of its excellent flavour, attractive fragrance, beautiful shades of colour, delicious taste and high nutritive value.

The flowering, fruit set and fruit yield of mango are the most critical events and it's depend upon many biotic and abiotic factors, amongst them foliar spray of growth regulators and growth retardants play very important role in regulating them in mango. Potassium is major nutrient attributed to the stimulating effect of K on photosynthesis, phloem loading and translocation as well as synthesis of large molecular weight in the developing fruits (Rabeh and Sweelam, 1990) [7]. Further sulphur increase the absorption of potassium or it react with nitrogen and potassium (Farrag *et al*., 1990) [3]. It helps in energy transformation and activation of enzymes in carbohydrate metabolism which subsequently partitioning of photosynthates to the developing fruits.

Potassium nitrate (KNO_3), also known as saltpeter or nitric acid is considered a special fertilizer. It is a colorless transparent crystal or white powder with 13 % nitrogen (N) and 45 % potassium (K). KNO_3 is one of the chemical inducing substances that have shown some potential for inducing flowering in mango by increasing the activity of nitrate reductase and stimulating the production of ethylene. (Beevers and Hageman, 1969) [2]. The use of KNO_3 has been employed in various countries, like Mexico, United States (Hawaii) and Malaysia for off season flowering and yield improvement. (Afiqah *et al*., 2014) [1].

Material and Methods

A Field experiment was conducted on Ultra High Density plantation. About eight year old mango trees planted at 3 m x 1.5 m spacing. All the trees under the experiment was given uniform cultural practices during the course of investigations. The experiment was laid out in Randomized Block Design (RBD). All the treatments were replicated thrice and a double tree served as a unit. Nine treatments comprising urea (1, 1.5 and 2%), KNO3 (1 and 2%), novel organic liquid fertilizer (1 and 2%) and ethephon 200 mgl-1 along with one control and they were sprayed twice, first fortnight of October and November. The effect of these treatments on different parameters of yield and quality parameters were recorded. The data collected were subjected to statistical analysis suggested by Panse and Sukhatme (1985) [6].

Foliar spray of prepared solution of chemicals were done at first fortnight of October and November as per the treatments. The spray was done by using tractor operated sprayer. According to the treatments, the freshly prepared solutions were sprayed on the trees till they were thoroughly wet.

Results and Discussion

The data presented in Table-1 revealed that foliar application of different chemicals treatment at first fortnight of October and November, among them foliar application of KNO3 @ 2% (T5) treatment gave maximum average fruit weight and number of fruits were recorded in KNO3 @ 2% (T5) treatment followed by novel organic liquid fertilizer @ 2% (T8), KNO3 @ 1% (T4) and ethephon @ 200ppm (T6). While, minimum (118.66 gm) average fruit weight and number of fruits were recorded in control (T9) treatment. This might be due to increased efficiency on fruit which caused more food material in treated trees and ultimately gave higher fruit weight.

Table 1: Effect of foliar spray of different chemicals on yield and quality on Dashehari mango under ultra-high density plantation.

Treatments	Number of fruits per tree	Average fruit weight (g)	Yield (kg / tree)	Shelf life (days)	TSS (°Brix)	Ascorbic acid (mg/100gm pulp)	Total sugar (%)	Reducing sugar (%)	Non reducing sugar (%)	Titrable acidity (%)	Fruit firmness (kg/cm^2)
T_1 : Urea @ 1%	164.32	125.12	20.69	15.86	17.43	18.23	10.50	7.32	3.27	0.24	3.36
T_2 : Urea @ 2%	165.88	141.98	23.53	18.33	18.32	18.58	11.07	8.67	2.40	0.22	3.44
T_3 : KNO_3 @ 1	169.26	144.45	24.48	17.40	17.68	18.98	11.53	9.10	2.40	0.22	3.68
T_4 : KNO_3 @ 1.5%	172.55	160.05	27.59	17.47	19.27	19.12	12.06	9.87	2.23	0.21	3.73
T_5 : KNO_3 @ 2%	191.34	170.19	32.49	18.13	19.79	20.44	13.70	10.50	3.27	0.19	4.17
T_6 : Ethephon @200mll^{-1}	165.72	145.37	24.09	16.47	18.73	18.52	10.83	8.08	2.80	0.23	3.39
T_7 : NOLF @ 1%	167.33	143.90	24.12	17.33	18.23	18.65	11.50	9.07	2.47	0.22	3.67
T_8: NOLF @ 2%	179.72	166.76	29.89	16.47	19.27	19.45	12.69	10.30	2.60	0.19	4.08
T_9 : Control	157.33	118.66	18.96	14.80	15.90	17.15	9.37	7.13	2.20	0.24	3.17
S. Em. ±	6.07	8.18	1.15	0.39	0.45	0.50	0.16	0.14	0.07	0.005	0.06
C. D. @ 5%	18.19	24.51	3.44	1.18	1.34	1.51	0.49	0.41	0.21	0.15	0.19
C.V. %	6.17	9.68	7.92	4.02	4.24	4.65	2.45	2.68	4.68	3.68	3.09

Foliar application of KNO3 @ 2 % at first fortnight of October and November gave maximum fruit yield. This might be due to KNO3 induced flowering, the beneficial effect of nutrients in increasing the fruit yield seems to the increased of fruit retention per panicle, fruit length and fruit girth. Moreover, the applied nutrients (N and K) might have stimulated the functioning of a number of enzymes which in turn increased the translocation and mobilization of metabolites and photosynthetic towards the developing fruits, resulted in highest number of fruits and fruit yield (Sudha *et al*., 2012) [10]. The increased in the fruit yield in KNO3 might be due to increase in fruit set and due to that synthesis of proteins from amino acids for which potassium is essential.

The maximum TSS, total sugar, non-reducing and minimum acidity were recorded in KNO3 @ 2% (T5) treatment. This might be due to neutralization of organic acids due to high K level in tissues could have also resulted in a reduction in acidity (Tisdale and Nelson, 1966) [11] Similar results are in agreement with the results of Sharma *et al*. (1990) [8]. The maximum total sugar was noted in KNO3 @ 2% (T5) treatment this might be due to potassium is involved in carbohydrate synthesis, breakdown and translocation and synthesis of protein and neutralization of physiologically important organic acids (Tisdale and Nelson, 1966) [11]. Besides K is involved in phloem loading and unloading of sucrose, amino acid and storage in form of starch in developing fruits by activating the enzymes starch synthesis (Narhar, *et al*. 2010) [5].

Acidity was minimum in KNO3 @ 2% (T5) treatment. This might be due to neutralization of organic acids due to high K level in tissues could have also resulted in a reduction in acidity (Tisdale and Nelson, 1966) [11]. KNO3 @ 2% (T5) and urea @ 1% (T1) treatment recorded significantly the maximum non-reducing sugar content. This might be due to the non-reducing sugars under the influence of chemicals might have either been fastly converted into sugar by the reaction involving the reversal of glycotic path way or might be used in respiration or both. Similar results were also reported by Hoda *et al*. (2001) [4] in mango. Also when plants well supplied with K, the osmotic potential of the phloem sap and the volume flow rate are higher than in the plants supplied with low K level and as a result, sucrose concentration in the phloem sap was increased.

The results of present experiment indicated that the significantly maximum shelf life of the fruits was recorded in urea @ 1.5% (T2) treatment followed by KNO3 @ 2%. This might be due to potassium reduces respiration, preventing energy losses through maintaining turgor pressure and reduces water loss in fruits which helps in improving the shelf life of fruits (Srivastava, *et al*., 2013) [9].

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