

Influence of Different Sources of Potassium on Fruit Quality and Shelf-Life of Mango cv Himsagar

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Received 28 July 2016; Accepted 24 August 2016; Published online 10 September 2016

Abstract An investigation was carried out to study the influence of different sources of potassium on fruit quality, yield and shelf-life of mango cv Himsagar grown in new alluvial zone of West Bengal. The experiment was laid out in randomized block design consisting of seven treatments with three replications. All the plants were uniform in age (12 years and healthy) spaced at 10m × 10m. The results revealed that the application of different sources of potassium significantly improved the physico-chemical qualities and leaf mineral content. Among the different sources of potassium, application of KNO_3 @ 0.5% + K_2SO_4 @ 0.5% along with doses of N @ 1,000g and P_2O_5 @ 500g/plant/year was found to give the maximum yield (40.13 kg/plant), TSS (18.2°B), total sugar (14.52%), least acidity (0.21

%) with highest vitamin C (24.12 mg/100 g) and highest mineral content (N,P,K) of leaf.

Keywords *Mangifera indica*, Himsagar, Potassium, Shelf-life, Quality and yield.

Introduction

Mango (*Mangifera indica* L.) the king of fruits is the most important fruit in the tropical and subtropical region of the world. India is the largest producer of mango and occupies only third position in the international trade. Mango is the most important fruit of West Bengal covering about 93.50 thousand ha with an annual production of 4.31 lakh tons [1]. Potassium plays a dominant role in the mineral nutrition of perennial fruit crops. Its magnificent role as quality builder is well established in many fruit crops including mango dutta and Dhua [2]. In West Bengal, Himsagar is the choicest cultivar of mango but, scanty information regarding the effect of potassium is available. Supply of potassium in a balanced manner is very important for improving soil health and plant nutrition. To maintain sustainability of soil and growth of the tree, it is therefore important to sup-

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ply potassium through inorganic and organic sources. The quality of the fruits, especially coloration of the skin, aroma, size and shelf-life, is improved when there is adequate K. It is an important mineral for the proper function of all cells, tissues and organs in the plant and also regulates the other physiological processes such as photosynthesis, protein synthesis. Thus considering the importance of this mineral on fruit crops the present investigation was carried out to find the effect of different sources of potassium on fruit quality, yield and shelf-life of mango cv Himsagar in West Bengal.

Materials and Methods

The present investigation was carried out at Regional Research Station, New Alluvial Zone, Bidhan Chandra Krishi Viswavidyalaya, Gayeshpur during 2011-2013. The soil of the experimental field was alluvial in nature and sandy loam in texture with good water holding capacity. The soil pH is 6.6 having 0.69% organic carbon, 0.39% total nitrogen, 95 kg/ha available phosphorus and 280 kg/ha available potassium. Twelve years old healthy mango trees cv Himsagar spaced at 10 m × 10 m having uniform growth and vigor were selected for the present study. The experiment was laid out in a randomized block design and the following seven treatments were replicated thrice viz. KNO₃ 1.0%, KCl 1.0%, K₂SO₄ 1.0%, KNO₃ 0.5% + KCl 0.5%, KNO₃ 0.5% + K₂SO₄ 0.5%, KCl 0.5% + K₂SO₄ 0.5% and control (water spray).

The above treatments were applied separately along with fixed doses of N @ 1000g and P₂O₅ @ 500g per plant per year as soil application in two split doses once after fruit set and remaining at after harvest of fruit (June - July). The different sources of potassium were applied as foliar spray thrice starting from September, October and November through foot sprayer. The matured mango fruits were harvested and allowed to ripe in the laboratory. The physico-chemical analysis was made following standard methods as described by Ranganna [3]. The leaf samples were taken in the month of April. Three months old 3rd and 4th leaves of the shoot from top portion were taken for leaf mineral analysis. Standard methods were followed for analysis of leaf.

Table 1. Effect of different sources of potassium on growth characteristics of mango cv Himsagar.

Treat-ments	Plant height (m)	Canopy spread (m)		Trunk girth (cm)
		East-West	North-South	
T ₁ KNO ₃ 1.0%	9.87	8.92	8.92	51.2
T ₂ KCl 1.0%	9.71	9.11	8.91	49.91
T ₃ K ₂ SO ₄ 1.0%	10.11	9.47	9.14	50.14
T ₄ KNO ₃ 0.5% + KCl 0.5%	9.93	9.11	9.0	49.32
T ₅ KNO ₃ 0.5% + K ₂ SO ₄ 0.5%	10.77	10.11	9.12	56.11
T ₆ KCl 0.5% + K ₂ SO ₄ 0.5%	10.12	10.0	9.43	53.23
T ₇ Control (water spray)	9.31	9.11	8.92	49.71
SE±	0.002	0.002	0.003	0.003
CD(0.05)	0.007	0.007	0.007	0.008

Results and Discussion

Effect of different sources of potassium on growth characteristics

Data presented in Table 1 revealed that different sources of potassium significantly increased the plant height, canopy spread and girth of trunk. Maximum (10.77 m) plant height was obtained for T₅ (KNO₃ 0.5% + K₂SO₄ 0.5%) followed by (10.12 m) in T₆ (KCl 0.5% + K₂SO₄ 0.5%) while control recorded the minimum 9.31 m. Double sources of potassium i.e. KNO₃ + K₂SO₄ or KCl + K₂SO₄ proved more effective as compared to single source of potassium. Like plant height, canopy spread in both the direction and girth of trunk were also affected by different sources of potassium. T₅ recorded maximum (10.11 m × 9.12 m) canopy spread in both the direction (East-West and North-south) followed by T₆ while minimum (9.11 m × 8.92 m) was recorded in T₇ (control). Girth of trunk varied from 49.71 to 56.11 cm due to application of different sources of potassium T₅ recorded maximum (56.11 cm) trunk girth followed by T₆ while control recorded minimum (49.71 cm).

Effect of different sources of potassium on physico-chemical composition of fruit

Table 2 indicates that different sources of potassium

Table 2. Physico-chemical composition of ripe mango fruits as influenced by different sources of potassium.

Treatments	Fruit wt (g)	Fruit length (cm)	Fruit breadth (cm)	Fruit yield (kg/plant)	TSS (°Brix)	Total sugar (%)	Reducing sugar (%)	Non-reducing sugar (%)	Acidity (%)	Vitamin C (mg/100 g)	Shelf life (Days)
T ₁ KNO ₃ 1.0%	255	7.23	7.11	38.44	17.4	12.92	3.18	9.74	0.28	21.15	6
T ₂ KCl 1.0%	262	7.77	7.0	39.18	17.6	13.11	2.99	10.12	0.27	22.44	6
T ₃ K ₂ SO ₄ 1.0%	271	7.91	7.13	38.46	16.8	14.11	3.39	10.72	0.26	21.72	7
T ₄ KNO ₃ 0.5% + KCl 0.5%	270	7.91	7.15	39.82	17.4	13.93	3.81	10.12	0.26	20.82	6
T ₅ KNO ₃ 0.5% + K ₂ SO ₄ 0.5%	282	8.12	7.91	40.13	18.2	14.52	2.41	12.11	0.21	24.12	7
T ₆ KCl 0.5% + K ₂ SO ₄ 0.5%	272	7.93	7.0	38.13	18.0	13.94	2.11	11.83	0.23	23.12	8
T ₇ Control (water spray)	235	7.11	6.92	36.12	16.8	11.41	1.70	9.71	0.32	20.12	4
SE±	1.225	0.035	0.033	0.244	0.131	0.045	0.023	0.034	0.011	0.175	0.171
CD(0.05)	3.774	0.106	0.102	0.751	0.404	0.139	0.071	0.105	0.034	0.541	0.526

significantly increased the physico-chemical composition of fruit. Maximum (282.0 g) fruit weight was recorded from T₅ (KNO₃ 0.5% + K₂SO₄ 0.5%) followed by (KCl 0.5% + K₂SO₄ 0.5%) T₆ (272.0 g) while minimum was recorded from control plant. Significant differences among fruit length was observed due to different treatments of K. Maximum (8.12 cm) length of individual fruit was noted from T₅ followed by T₆. Like fruit length, breadth of fruit was also influenced by application of different sources of potassium (Table 2). T₅ recorded maximum (7.91 cm) breadth of fruit while control fruit recorded minimum (6.92 cm). Application of different sources of potassium significantly increased the yield of fruits per plant as compared to control plant. T₅ (KNO₃ 0.5% + K₂SO₄ 0.5%) treated plants recorded maximum yield (40.13 kg/plant) followed by (39.82 kg/plant) in T₄ (KNO₃ 0.5% + KCl 0.5%) while minimum (36.12 kg/plant) yield was obtained from control plants. Bio-chemical composition and shelf-life of fruit were also influenced by application of different sources of K in Table 2. The different treatments K significantly increased the total soluble solid control of fruit. Maximum (18.20 °Brix) TSS content of fruit was measured in T₅ followed by T₆ while minimum (16.80 °Brix) was noted in T₃ (K₂SO₄ 1.0%) and control. TSS content of fruit was increased more due to combined sources of K rather than single source. Total sugar and non-reducing sugar were also influenced by the application of different sources of potassium. Maximum total sugar (14.52%) and non-reducing sugar (12.11%) were ob-

tained from T₅ followed by T₆. Sugar content of fruit was found minimum in treated control.

Application of different sources of potassium significantly decreased the acid content of fruit as evident from Table 2. Minimum (0.21%) acidity of fruit was obtained from T₅ followed by T₆ (0.23%) while T₇ control recorded maximum (0.32%) acid content of fruit. Fruit treated with KNO₃ 0.5% + K₂SO₄ 0.5% (T₅) showed maximum (24.12 mg/100g pulp) ascorbic acid followed by T₆. Control fruit recorded minimum (20.12 mg/100 pulps) ascorbic acid content. Shelf-life of fruit at ambient room temperature varied due to different treatments of K. T₆ (KCl 0.5% + K₂SO₄ 0.5%) exhibited maximum 8 days of storage at ambient room temperature followed by T₅ and T₃ while control fruit can be stored upto 4 days i.e. minimum shelf-life.

Effect of different sources of potassium on leaf nutrient content

Data in Table 3 revealed that different sources of potassium significantly increased the leaf nutrient (N, P and K) content. T₅ (KNO₃ 0.5% + K₂SO₄ 0.5%) showed maximum (1.84%) leaf N content followed by T₆ while control recorded (1.71%) and minimum (1.70%) in T₄. Application of different K salts significantly increased the phosphorus content of leaf. Maximum (0.97%) P content was measured from T₅ followed by T₆. Control plant recorded minimum (0.79%) content. Leaf K nutrient varied between

Table 3. Effect of different sources of potassium on leaf mineral content.

Treatments	Nitrogen (%)	Phosphorus (%)	Potassium (%)
T ₁ KNO ₃ 1.0%	1.72	0.81	0.97
T ₂ KCl 1.0%	1.74	0.83	0.96
T ₃ K ₂ SO ₄ 1.0%	1.81	0.82	0.98
T ₄ KNO ₃ 0.5% + KCl 0.5%	1.70	0.81	1.11
T ₅ KNO ₃ 0.5% + K ₂ SO ₄ 0.5%	1.84	0.97	1.17
T ₆ KCl 0.5% + K ₂ SO ₄ 0.5%	1.81	0.84	1.0
T ₇ Control (water spray)	1.71	0.79	0.89
SE±	0.008	0.004	0.004
CD(0.05)	0.024	0.011	0.001

0.89 and 1.17%. Maximum (1.17 %) was recorded from T₅ while minimum (0.89%) was noted from T₇ (control). Combined sources of potassium proved effective in increasing K content of leaf as compared to single source of potassium.

In the present investigation application of potassium as foliar spray from different sources viz. K₂SO₄, KCl and KNO₃ showed marked effect on plant character, yield and physico-chemical composition of mango fruit. The increase in the number and size of fruits due to K application may be attributed by improvement in the vegetative growth of the plant. When the vegetative growth is better, increased dry matter production is obvious. According to Nijjar [4] potassium might have acted as an activator for a number of complex enzyme systems and these enzymes catalyse metabolic reactions related to the carbohydrates, nucleic acid and nucleotides, amino acids, protein and folic acid. Improvement in fruit yield and quality was more marked with combined sources of k, i.e. KNO₃ and K₂SO₄. The present results are in close conformity with the previous findings as obtained by Dalal et al. [5] and dutta et al. [6] in mango.

The present study showed considerable improvement in fruit quality with K application which increased the total sugar content and ascorbic acid content of fruits than that of control. This may be attributed to faster rate of ripening with K application. Higher fruit quality especially higher sugar content, can be explained by the role of K in carbo-

hydrate synthesis, breakdown and translocation and synthesis of protein and neutralization of physiologically important organic acids. With regard to the effect of different potassium applications on fruit chemical properties the obtained results are in agreement with those of Stino et al. [7]; Abd El-Razek et al. [8] and Ebeed and Abd El-Migeed [9] on mango trees. They found that potassium improved fruit chemical properties as TSS, acidity and vitamin C. In addition, Kumar et al. [10] found that potassium have profound influence on fruit chemical properties through its influence on soluble solids, acidity and vitamin C content.

Remesh and kumar [1] observed similar results in banana fruits treated with KCl and K₂SO₄ recorded maximum shelf-life at ambient room temperature. This might be due to the fact that K₂SO₄ contains considerably more SO₄⁻² than other sources.

Irrespective of different K sources, application of K increased N, P and K content in mango leaf and combined sources of potassium proved more effective in increasing leaf nutrients (N, P and K) as compared to single sources. Similar results were obtained by Dutta et al. [6] in mango.

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