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Effect of potassium on yield and quality of 'Alphonso' mango (*Mangifera indica*)*

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Mango (*Mangifera indica* L.) is the most important fruit of Asia and worldwide currently ranks fifth in total production among major fruit crops (FAO 1993). Mango is grown in about 111 countries spread over five continents with a total production of 26.10 million metric tonnes. India ranks first in production with its alone share near about 40% of total world mango production. The total production of mango in India is about 13 million metric tonnes with an area of about 1.52 million ha. Among different varieties, 'Alphonso' is rated as one of the choicest and prime variety of India with its alone share of over 80% in total mango export. It is internationally accepted because of its characteristics sugar-acid blend, attractive colour, pleasant aroma, highly acceptable flavour, taste and long keeping quality.

The objective of fertilizer practices for young trees is to establish the tree and maintain constant canopy growth, maintenance of tree health, avoidance of alternate bearing and allowance for a period of vegetative dormancy which results in flower induction. Potassium has an important role in major plant processes, such as photosynthesis, respiration, protein synthesis, enzyme activation, water uptake, transpiration, growth, development and yield. It also imparts quality characters like attractive colour to skin and pulp, improve flavour, sugar, texture, weight and keeping quality of fruit. The effect of different doses and sources of potassium were studied on yield and quality of Alphonso mango as carriedout by Jadhav *et al.* (2004).

The field experiment was conducted at central experimental station, Wakawali of Dr Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli Maharashtra situated between north latitude 17° 40" to 17° 45" and east longitude 73° 16" to 73° 19". Thirty-two-years old 'Alphonso' mango trees of uniform size planted at 10m×10 m distance were selected for the study. Various sources and doses of potassium were tested along with recommended farmyard manure, nitrogen and phosphorus. The treatments are T_1, Control (no fertilizers); T_2, recommended dose of N and P without K (1.5 kg N, 0.5 kg P_2O_5/tree); T_3, recommended dose of N, P and K but K through muriate of potash (1.5 kg N, 0.5 kg P_2O_5 and 0.5 kg K_2O/tree); T_4, recommended dose of N, P and K but K through sulphate of potash (1.5 kg N, 0.5 kg P_2O_5 and 0.5 kg K_2O/tree); T_5, recommended dose of N, P + 1 kg of K_2O through sulphate of potash/tree; T_6, recommended dose of N, P and K (K_2O through sulphate of potash)/tree + 1% nitrate of potash through foliar application; T_7, recommended dose of N, P and K (K_2O through sulphate of potash)/tree + 0.9% sulphate of potash through foliar application; T_8, recommended dose of N, P and K (K_2O through sulphate of potash)/tree + 1.8% sulphate of potash through foliar application; T_9, recommended dose of N, P + 1 kg K_2O through sulphate of potash/tree + 0.9% sulphate of potash through foliar application; T_{10}, recommended dose of N and P + 1 kg K_2O through sulphate of potash/tree + 1% nitrate of potash through foliar application. Farmyard manure (50 kg/plant) and inorganic fertilizers (N 1.5 kg, P_2O_5 0.5 kg) were applied in June with two sources of potassium fertilizers (muriate of potash and sulphate of potash). The experiment was planned in randomized block design with three replications. Paclobutrazol @ 0.75 g ai/meter canopy diameter was applied in August to all experimental trees. The foliar application of 1% nitrate of potash, 0.9% sulphate of potash and 1.8% sulphate of potash was done at peanut, marble and egg fruit stage of fruit development. The observations on yield and quality were recorded for four years (2003–07) and pooled data are presented in Table 1.

Treatment T_9 (recommended dose of NP + 1 kg K_2O through sulphate of potash/tree + 0.9% sulphate of potash through foliar application) recorded significantly higher flowering (88.34%) which was at par with all other treatments over control (72.92%) (Table 1). Fruit retention significantly varied among different doses and sources of potassium. T_8 (recommended dose of NPK (K_2O through sulphate of potash)/tree + 1.8% sulphate of potash through foliar application) recorded higher fruit retention (0.49 panicle)

*Short note

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Table 1. Yield and quality of 'Alphonso' mango (pooled data of four years)

Treatment	Flowering (%)	Fruits retained/ panicle at harvest	Yield (kg/tree)	Average fruit weight (g)	Pulp recovery (%)	Physiological loss in weight (%)	Shelf-life (days)	TSS (°Brix)	Acidity (%)	Ascorbic acid (mg/100g)	Occurrence of spongy tissue (%)
T_1= Control (no fertilizers)	72.92 (58.87)*	0.25	42.86	246.86	70.44 (57.07)*	20.21 (26.58)*	10.63	16.17	0.23	27.30	15.74 (23.37)*
T_2 = 1.5 kg N + 0.5 kg P_2O_5	79.59 (62.35)	0.33	57.94	262.90	73.79 (59.24)	18.50 (25.26)	11.33	16.34	0.26	35.09	12.70 (20.91)
T_3 = 1.5 kg N + 0.5 kg P_2O_5 + 0.5 kg K_2O (MOP)	85.00 (68.26)	0.33	66.13	263.80	73.14 (58.78)	18.38 (25.36)	12.38	16.68	0.30	35.26	13.43 (21.34)
T_4 = 1.5 kg N + 0.5 kg P_2O_5 + 0.5 kg K_2O (SOP)	81.67 (66.24)	0.41	76.00	265.91	74.60 (59.78)	18.45 (25.43)	12.34	17.34	0.30	30.51	7.41 (14.36)
T_5 = 1.5 kg N +0.5 kg P_2O_5 + 1.0 kg K_2O (SOP)	82.50 (67.64)	0.42	72.29	277.27	75.64 (60.41)	17.87 (25.04)	13.34	17.06	0.30	34.11	8.43 (16.86)
T_6 = 1.5 kg N + 0.5 kg P_2O_5 + 0.5 kg K_2O (SOP) + foliar spray 1% KNO_3	81.25 (65.48)	0.47	74.75	278.92	74.54 (59.90)	17.64 (24.77)	13.59	16.82	0.31	29.18	4.84 (12.62)
T_7 = 1.5 kg N + 0.5 kg P_2O_5 + 0.5 kg K_2O (SOP) + foliar spray 0.9% SOP	85.42 (69.76)	0.44	71.36	279.64	73.03 (58.54)	18.27 (25.03)	12.88	17.91	0.32	30.32	8.81 (17.19)
T_8 = 1.5 kg N + 0.5 kg P_2O_5 + 0.5 kg K_2O (SOP) + foliar spray 1.8% SOP	80.00 (64.88)	0.49	74.31	283.61	75.06 (59.91)	18.04 (25.48)	13.00	17.39	0.31	34.02	4.28 (12.39)
T_9 =1 .5 kg N + 0.5 kg P_2O_5 + 1.0 kg K_2O (SOP) + foliar spray 0.9% SOP	88.34 (72.91)	0.48	83.40	302.70	75.62 (60.21)	18.09 (24.54)	13.63	17.78	0.30	35.00	6.04 (13.10)
T_{10} = 1.5 kg N + 0.5 kg P_2O_5 + 1.0 kg K_2O (SOP) + foliar spray 1% KNO_3	82.70 (68.10)	0.46	77.80	286.4	74.8 (59.84)	17.80 (25.00)	13.4	17.3	0.31	31.60	7.36 (14.16)
SE ±	3.92	0.29	2.98	9.8	0.49	0.52	0.32	0.43	0.020	1.32	1.03
C D (P = 0.05)	11.9	0.075	8.331	28.2	1.46	NS	0.90	NS	NS	3.71	2.94

Figures in parentheses indicates arc sine values

which was at par with T_9, T_5 T_6, T_{10} and T_7 over rest of the treatments and control (0.25). T_9 (recommended dose of NP + 1 kg K_2O through sulphate of potash/tree + 0.9% sulphate of potash through foliar application) gave significantly higher fruit yield (83.40 kg/tree) which was at par with T_4 and T_{10} over rest of the treatments and control (42.86 kg/tree). Similar findings were recorded for increased flowering, fruiting and yield of mango by number of scientists with use of fertilizers. Higher application of fertilizers resulted in greater shoot growth, leaf and flower number, fruits set, retention and yield. Ramesh Kumar and Kumar (2008) revealed that foliar spray of 1.5% K_2SO_4 at seven month after planting on banana increased the fruit yield and quality of banana. This treatment increased total dry matter production. Similar observations were recorded by Sharma *et al*. (1990) and Jadhav *et al.* (2004).

Fruit weight showed significant variation among the treatments. Treatment T_9 (recommended dose of NP + 1 kg K_2O through sulphate of potash/ tree + 0.9% K_2SO_4 through foliar application) recorded higher individual fruit weight

(302.7g) which was at par with T_5, T_6, T_7, T_{10} and T_8 over the rest of the treatments and control (246.86 g). There was significant variation in pulp recovery and shelf-life of fruit due to potassium treatments, however, physiological loss of weight did not vary significantly. Maximum pulp recovery (75.64%) was observed in treatments T_5 (recommended dose of NP + 1 kg of K_2O through sulphate of potassium/tree) which was at par with T_9, T_8, T_4 and T_6 over rest of the treatments and control (70.44%). The maximum shelf-life of fruit (13.63 days) was recorded in T_9 (recommended dose of NP + 1 kg K_2O through sulphate of potash per tree + 0.9% sulphate of potash through foliar application) which was at par with T_5, T_6, T_{10}, T_7 and T_8 over rest of the treatments and control (10.63 days). Most woody species and mango in particular are highly sensitive to chloride toxicity. Potassium sulphate also supplies the much needed sulphur. Khayyat *et al.* (2007) studied the effect of foliar spray of sulphate of potash on yield and quality of date palm revealed that K_2SO_4 2% increased the fruit size and seed length. The foliar feeding is one of the way to achieve efficient and economic use of fertilizers because nutrients can be applied directly to the site of their metabolism and are therefore not subjected to various losses and occur in soil application. These applications can be combined with plant protection measures and growth regulators which reduced the cost.

The data presented in Table 1 indicated that TSS and acidity did not vary significantly due to potassium treatments. However, increased in values of TSS and acidity was observed due sulphate of potash treatments (T_4 to T_9). There was a significant variation in ascorbic acid due to potash treatments. Maximum ascorbic acid (35.26 mg/100g) was recorded in T_3 (recommended dose of N and P and K but K through muriate of potassium (ie 1.5 kg N, 0.5 kg P_2O and 0.5 kg K_2O/tree) which was at par with T_2, T_5, T_{8-}, T_{10} and T_9 over rest of the treatments and control (27.30 mg/100g). Ramesh Kumar and Kumar (2008) studied the effect of sulphate of potash on yield and quality of banana and observed that the bunch weight, total finger, finger weight and chlorophyll content, relative water content, soluble protein increased in banana with recommendend dose of 'K' through sulphate of potash at 2, 4, 6, 8 month of planting. There was a significant variation in occurrence of spongy tissue due to potassium treatment. Treatment T_8 (recommended dose of NPK (K_2O through sulphate of potash) per tree + 1.8% sulphate of potash through foliar application) recorded minimum occurrence of spongy tissue (4.28%) which was at par with T_6 (4.84%) and T_9 (6.04%) over the rest of the treatments and control (15.74%). Treatment T_3 (recommended dose of N and P and K but K through muriate of potassium (ie 1.5 kg N, 0.5 kg P_2O and 0.5 kg K_2O/tree) recorded higher spongy tissue occurrence in fruits (13.43%). Similarly, Shinde *et al*. (2006) recorded the application of N (1.5 kg) P (0.5 kg) and K (1.0 kg) through sulphate of potash in June with three foliar sprays of nitate of potash 1% reduced spongy tissue (4.50%) as compared to without fertilizers (13.80%) and with use K through MOP (14.10%).

Thus, all potassium treatments increased the fruit yield compared to control. Among the potassium sources all sulphate of potash treatment (T_4 to T_{10}) recorded higher yield than muriate of potash (T_3). Among the doses of sulphate of potash Treatment T_9 (recommended doses of NPK 1 kg K_2O through sulphate of potash + 0.9% sulphate of potash spray) recorded highest fruit yield (8.34 tonnes/ha) because of maximum flowering, fruit retention, individual fruit weight. This treatment also recorded higher pulp recovery, shelf-life with minimum spongy tissue incidence.

SUMMARY

Field experiment was conducted during 2003–07 to study the effect of different doses and sources of potassium on yield and quality of 'Alphonso 'mango (*Mangifera indica* L.). The pooled results of this experiment revealed a new recommendation to mango growers as soil application of 50 kg farmyard manure, 1.5 kg N, 0.5 kg P_2O_5 and 1.0 kg K_2O in the form of sulphate of potash/tree in first fortnight of June and application of paclobutrazol @ 0.75 gai/m canopy diameter during second fortnight of July to first fortnight of August with three foliar sprays of 0.9% K_2SO_4 at peanut, marble and egg stage of fruit development to increase yield and quality of 'Alphonso' mango. This treatment increased flowering (3.92%), fruit retention (45.45%), fruit yield (26.11%), fruit weight (14.48%), shelf-life (10.09%) and reduced spongy tissue (122.35%) over the control.

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