International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(5): 39-42

Received: 25-07-2018
Accepted: 28-08-2018

Effect of different sources of potassium on soil and leaf nutrient status of Nagpur mandarin

Chavan SP, Bharad SG, Deshmukh UB and Jadhav SV

Chavan SP
University Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Bharad SG
University Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Deshmukh UB
University Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Jadhav SV
University Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Correspondence
Chavan SP
University Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Abstract
The study on Effect of Different sources of potassium on soil and leaf nutrient status of Nagpur Mandarin was carried out at AICRP (Fruits) and Department of Horticulture Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, to study the effect of different sources of potassium on soil and leaf nutrient status of Nagpur mandarin. An experiment was laid out in Randomized Block Design with nine treatments viz., T_1 – 200, T_2- 400, T_3- 600, T_4- 800 g K_2O through SOP/plant/year and T_5- 200, T_6- 400, T_7- 600, T_8- 800 g K_2O through MOP/plant/year and T_9- control Soil and leaf nutrient status was found higher with higher level of potassium application apart from sources.

Keywords: Potassium, Nagpur mandarin, quality parameters

Introduction

Among the major nutrients, potassium is an important nutrient because it not only improves yields, but also benefits various aspects of quality (Nijjar, 1996) [3]. The potassium requirement of citrus is high as its uptake is more than any other nutrient element and large amount of potassium are reflected in the high percent of citrus juice. Generally citrus crops uptake 350 kg/ha of potassium and it remove 11.7 kg/t of produce. Most of the citrus cultivars are heavy removal of potassium, signifying the relative importance of potassium in improving the efficiency of N and P. High rate of potassium is needed to achieve not only for the highest total fruit production, but also for the greatest percentage of fruit production suitable for marketing. A high unbalanced N: K ratio is associated with poor set fruit and poor carrying quality (Gerald son, 1985) [5]. Among the major nutrients, potassium is an important nutrient because it not only improves yields, but also benefits various aspects of quality (Nijjar, 1996) [3]. The potassium requirement of citrus is high as its uptake is more than any other nutrient element and large amount of potassium are reflected in the high percent of citrus juice. Generally citrus crops uptake 350 kg/ha of potassium and it remove 11.7 kg/t of produce. Most of the citrus cultivars are heavy removal of potassium, signifying the relative importance of potassium in improving the efficiency of N and P. (Gerald son, 1985) [5]. Potassium affects external fruit characteristics, since those become larger and coarser as the potassium supply increases; on the other hand, potassium deficiency reduces number and fruit size of all citrus varieties and decreases soluble solids content of juice (Alva *et al*., 2006) [1]. As muriate of potash is commonly used as the source of potassium, chloride toxicity is occurred on the crop. In this context, sulphate of potash is use as potassium source which have additional sulphur content would be more use full, whereas, $S0_4$ ions present in sulphate of potash favors enzyme activity while Cl ions present in muriate of potash reduces the activity of anabolic enzymes (carbohydrates) so that $S0_4$ in comparison with Cl favours the accumulation of highly polymerised carbohydrates (starch) and more polymerised N compounds which increase the yield and quality parameters of fruit crop (Smith, 1966) [6]. The challenge in the crop production is to measure the concentration of readily available potassium and to relate this measurement to the amount of potash fertilizer that must be supplied to achieve optimum yield (Tandon, 1987) [7]. As muriate of potash is commonly used as the source of potassium, chloride toxicity is occurred on the crop. In this context, sulphate of potash is use as potassium source which have additional sulphur content would be more helpful. It has also low salinity index i.e. less than 20 whereas, muriate of potash has more than 40 salinity index (Nijjar, 1996) [3]. Hence, keeping all these point in view, the attempts were made to find out suitable source and optimum quantity of potassium on growth and better fruit quality in Nagpur mandarin.

Materials and Methods

The experiment was carried out on 10 year old 'Nagpur mandarin' trees planted at the spacing of 6 X 6 m at AICRP (Fruits), Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. In an experiment nine treatments *viz*., T_1 – 200 g K_2O through SOP /plant/year, T_2 – 400 g K_2O through SOP /plant/ year, T_3 600 g K_2O through SOP /plant/ year T_4- 800 g K_2O through SOP /plant/ year, T_5-200 g K_2O through MOP /plant/ year, T_6- 400 g K_2O through MOP /plant/ year, T_7-600 g K_2O through MOP /plant/ year, T_8- 800 g K_2O through MOP /plant/ year, T_9- Control replicated three times and treatments was arranged in Randomized Block Design Panse and Sukhatme (1985). Potassium was applied in the form of two sources as Muriate of potash and sulphate of potash as per treatments.

Result and Discussion

Effect of different sources of potassium on soil macro nutrient status

The data presented in Table 1 indicate that, effect of different sources of potassium on soil macronutrient status was found to be significant during both year of experimentation. Maximum available nitrogen content in soil (222.75 kg ha^{-1}) was recorded with the application of 600 g K2O through SOP /plant/ year, whereas during second season 230.20 kg ha-1 nitrogen content in soil was found with the application of 800 g K_2O through SOP /plant/ year. At insufficient potassium supply, NO3- accumulates in the roots, then partially reduced and converted into amino acids. The buildup of amino acids signals in a feedback effect on the plant to further reduce nitrogen uptake. As a consequence, with increased K depletion N use efficiency is decreased. (Brar *et al*., 2008). Very few K x P interaction studies have been reported perhaps due to lack of evidence for K x P interaction in plant metabolism except for maintain ionic balance (Adams, 1980), While during two year study the maximum available soil phosphorus content (16.17 and 16.07 kg ha^{-1}) in soil was recorded in treatment T_3 (600 g K_2O/plant through SOP) respectively during both year. The maximum available soil potassium (368.40 and 372.47 kg ha^{-1}) was recorded in treatment T_8 (800 g K_2O/plant through MOP) during both year Increasing soil potassium with higher rates might be due to fact that, the KCl concentration produces more osmotically active ions than K_2SO_4 because Cl is never de-ionized it always remains osmotically active and thus is responsible for rapid adjustment of the cell plasma.

Table 1: Effect of different sources of potassium on soil macro nutrient status

Treatments	Soil N (Kg/ha)		Soil P (Kg/ha)		Soil K (Kg/ha)	
	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14
T_1	211.80	214.64	13.40	13.75	353.20	360.10
T_2	213.95	219.00	14.10	14.94	357.77	361.90
T_3	222.75	225.58	16.17	16.07	367.27	365.37
T_4	220.90	230.20	15.11	15.96	363.53	370.57
T_5	210.31	212.58	13.05	14.28	343.07	361.83
T_6	218.75	221.29	13.74	14.50	362.00	367.87
T_7	217.29	220.20	14.08	14.81	364.43	369.23
T_8	219.28	226.24	13.40	13.77	368.40	372.47
T_9	213.93	216.42	13.05	12.72	320.57	313.83
SE (m) ±	1.89	3.18	0.79	0.584	2.74	1.37
CD at 5 %	5.68	9.55	2.38	1.749	8.29	4.14

Effect of different sources of potassium on Soil micro nutrient status

From data presented in table 2 clearly revealed that the effect of different sources of potassium significantly influenced the soil micro nutrient status viz. Iron, zinc and copper except manganese The maximum iron content in soil (4.91 and 4.73 kg ha-1) was recorded in treatment T_8 (800 g K_2O/plant through MOP) during both the year. The maximum zinc content (0.76 mg kg^{-1}) in soil was observed with application of 800 g K2O/plant through MOP during first year and (0.79 mg kg^{-1}) was recorded during second year in treatment with the application of 800 g K_2O/plant through SOP. The maximum copper content (4.21 and 5.05 mg kg-1) was recorded in treatment T_4 (800 g K_2O/plant through SOP) during both the year However in manganese content, variation was found non-significant. Increase in soil micronutrients might be due to the application of potassium as sulphate of potassium that might have caused a temporary reduction in soil pH of the rizosphere. Romheld (1986) [9] reported that lowering of the pH in alkaline soils improves the availability of micronutrients.

Table 2: Effect of different sources of potassium on Soil micro nutrient status

Treatments	Soil Micro Nutrients status (mg kg^{-1})							
	Fe		Mn		Zn		Cu	
	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14	2012-13	2013-14
T_1	4.50	4.50	8.30	8.07	0.70	0.73	3.61	3.87
T_2	4.60	4.67	9.17	9.10	0.72	0.78	3.66	4.10
T_3	4.58	4.64	8.67	8.63	0.73	0.76	3.69	4.19
T_4	4.77	4.71	8.97	8.87	0.75	0.79	4.21	5.05
T_5	4.61	4.55	7.77	9.00	0.69	0.72	3.88	4.29
T_6	4.72	4.60	8.17	8.30	0.72	0.78	4.03	4.19
T_7	4.84	4.60	9.07	8.90	0.74	0.76	3.95	4.35
T_8	4.91	4.73	9.63	9.17	0.76	0.77	4.17	4.27
T_9	4.60	4.45	7.67	8.03	0.68	0.71	3.71	3.65
SE (m) +	0.03	0.04	-	-	0.013	0.011	0.13	0.10
CD at 5 %	0.10	0.12	-	-	0.038	0.032	0.39	0.30

Effect of different sources of potassium on leaf nutrient status

The data presented in Table 3 clearly indicate that, application of muriate of potash and sulphate of potash on macro leaf nutrient content was found to be significant.

Pooled mean of two seasons also shows significant variation among the treatments. The maximum leaf nitrogen content (2.77 %) was observed in treatment T_2 which was found at par with T_6 (2.72 %), T_8 (2.64 %) and T_4 (2.52 %). The maximum nitrogen leaf content is due to availability of NH4 + and NO3 - in aqueous solution, as sufficient urea and FYM were applied.

The significantly maximum phosphorous content in pooled mean was recorded in treatment T_4 and T_8 (0.14 %) followed by T_3 (0.12 %) while minimum (0.05 %) in treatment T_1. Maximum potassium content in pooled mean (1.99 %) was recorded in treatment T_4 which was found at par with T_8 (1.95 %), T_7 (1.89 %) and T_3 (1.87 %). Higher potassium content in the leaves might be due to fact that the most of the K movement in the soil was associated with diffusion and adequate soil K levels are required to ensure optimal root uptake of potassium (Mills *et al.* 1996) [4]. However improved potassium management must translate the optimal adequacy between nutrients supplied to the soil solution and trees nutritional request through their physiological cycle of growth under given climatic condition.

The data regarding leaf micro nutrient content *viz.* iron zinc manganese and cupper of Nagpur mandarin was significantly influenced by different sources and level of potassium fertilization in pooled mean presented in Table 4. The maximum leaf iron content (95.57 ppm) was recorded in treatment T_6 (400 g K_2O/plant through MOP) which was at with treatments (T_2), (T_7). The maximum leaf Mn content (72.80 ppm) was observed in treatment T_8 (800 g K_2O/plant through MOP) which was at par with treatments (T_2), (T_4) and (T_7) whereas, maximum leaf zinc content (32.08 ppm) was observed in treatment T_3 (600g K_2O through SOP /plant/ year) which was at par with treatments (T_4). Leaf copper content showed significant variation. The maximum leaf copper content (17.07 ppm) was recorded in treatment T_4 (800g K_2O through SOP /plant/ year) which was at par with treatments (T_6), (T_3), (T_2) and (T_8). Domino effects of potassium are very common in the plant system due to the complex relationship between potassium and other nutrients. Potassium has direct synergistic relationships with two micronutrients namely iron and manganese. Zinc and copper also have indirect effects on potassium (Ujwalaranade 2011) [8]

Table 3: Effect of different sources of potassium on leaf macro nutrient status

Treatments	N (%)			P (%)			K (%)		
	2012-13	2013-14	Pooled mean	2012-13	2013-14	Pooled mean	2012-13	2013-14	Pooled mean
T_1	1.59	1.89	1.74	0.09	0.08	0.09	1.72	1.63	1.67
T_2	2.89	2.64	2.77	0.11	0.10	0.10	1.78	1.78	1.78
T_3	1.40	1.91	1.66	0.12	0.12	0.12	1.93	1.82	1.87
T_4	2.52	2.52	2.52	0.13	0.15	0.14	1.99	1.98	1.99
T_5	2.33	2.33	2.33	0.08	0.08	0.08	1.63	1.60	1.62
T_6	2.80	2.64	2.72	0.09	0.10	0.10	1.70	1.67	1.68
T_7	1.59	1.87	1.73	0.10	0.12	0.11	1.91	1.87	1.89
T_8	2.71	2.57	2.64	0.14	0.13	0.14	1.97	1.92	1.95
T_9	1.40	1.51	1.46	0.08	0.08	0.08	0.83	0.73	0.78
SE (m) $\pm$	0.18	0.131	0.12	0.008	0.009	0.006	0.04	0.06	0.04
CD at 5 %	0.56	0.393	0.38	0.024	0.029	0.018	0.19	0.19	0.12

Table 4: Effect of different sources of potassium leaf nutrient Fe, Mn, Zn and Cu on tent.

Treatments	Fe (ppm)		Pooled mean	Mn (ppm)		Pooled mean	Zn (ppm)		Pooled mean	Cu (ppm)		Pooled mean
	2012-13	2013-14		2012-13	2013-14		2012-13	2013-14		2012-13	2013-14	
T_1	90.60	91.07	90.83	66.87	67.67	67.27	26.39	26.47	26.43	14.93	16.33	15.63
T_2	93.47	94.00	93.73	71.00	72.53	71.77	27.38	27.46	27.42	16.20	17.07	16.63
T_3	92.33	93.20	92.77	67.67	68.93	68.30	31.34	32.81	32.08	16.67	17.27	16.97
T_4	92.07	89.87	90.97	71.60	72.20	71.90	30.29	30.98	30.63	16.93	17.20	17.07
T_5	90.27	91.47	90.87	67.40	69.33	68.37	27.81	28.91	28.36	15.33	15.80	15.57
T_6	95.27	95.87	95.57	67.13	68.27	67.70	29.05	29.77	29.41	16.80	17.13	16.97
T_7	94.47	95.40	94.93	69.40	70.33	69.87	27.53	29.08	28.30	15.13	15.53	15.33
T_8	90.67	91.67	91.17	72.47	73.13	72.80	28.73	29.65	29.19	15.73	15.87	15.80
T_9	82.80	85.20	84.00	64.20	65.20	64.70	25.84	26.78	26.31	14.27	14.67	14.47
SE (m) +	1.77	1.87	1.75	1.35	1.42	1.30	0.81	0.74	0.67	0.43	0.50	0.43
CD at 5 %	5.30	5.62	2.27	4.07	4.27	3.92	2.43	2.24	2.03	1.30	1.51	1.30

Conclusion

On the basis of findings reported in present study soil and leaf nutrient status of Nagpur Mandarin varied significantly due to potassium fertilization. In general macro and micro nutrient was found higher with higher level of potassium application apart from sources.

Literature cited

1. Alva AK, Mattos JD, Paramasivam S, Patil B, Dou H, Sajwan K. Potassium management for optimizing citrus production and quality. International Journal of Fruit Science. 2006; 6:3-43.
2. Bar-Akiva A. Effect of potassium nutrition on fruit splitting Valencia orange, J Hort. Sci. 1975; (50):85-89.
3. Nijjar GS. Nutrition of fruit trees. Kalyani Publications Rajinder Nager Ludhinia, 1996, 82-124.
4. Mills HA, Benton Jones. Plant Analysis Handbook II. Micro Macro publishing, Athens, GA, 1996, 422.
5. Gerald son CM. Potassium nutrition of vegetable crops. In: Potassium in Agriculture Ed: Munson R.S., ASA-CSSASSSA, Madison, WI, 1985, 915-927.

6. Smith PF. Citrus Nutrition In: Nutrition of fruit crops. Ed. Childers, N.F. Horticultural publication, Rutgers, New Brunswick NJ, 1966.
7. Tandon HLS. Fertilizer Recommendations for Horticultural crops in India. A Guide Book. Fert. Dev. Consult. Org., New Delhi, 1987, 1-112.
8. Ujwalaranade Malvi. Interaction of micronutrients with major nutrients with special reference to potassium. Karnataka J Agric. Sci. 2011; 24(1):106-109.
9. Romheld V. pH changes in the rhizosphere of various crop plants in relation to the supply of plant nutrients. Pot Rev. Subj. 1986; 6:65.