Effect of sources and levels of potassium on growth of polybag plants of *Hevea*

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Introduction

Potassium (K) is a major nutrient, essential for plant growth. It is the most abundant cation in the cytosol, and has very important roles in plant water relations, pH stabilization, enzyme activation, protein synthesis etc. (Marschner, 1995).

Though soil contains considerable quantities of K, only limited quantities are available to plants, and hence K is usually supplemented through mineral fertilizers. There are two major sources of potassium viz. Mureate of Potash (MOP) and Sulphate of Potash (SOP). MOP is potassium chloride and SOP is potassium sulphate.

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MOP is the most common K fertilizer, containing 60 per cent K_2O in readily available form. However, its chloride content (47 per cent) is objectionable to some crops such as to

fruits and vegetables which are chloride sensitive. In all soils, chloride problem does not arise with the application of MOP. MOP can be used safely in well drained soils in high rainfall zones (> 50 cm annual rainfall), and on crops which are not chloride sensitive, as the chloride leaches down the profile with water and does not accumulate in the root zone (David *et al.*, 1986).

SOP is a two nutrient fertilizer containing 50 per cent K_2O and 18 per cent sulphur, both in readily available form to the plants. SOP is free of chloride and has a low salt index, and therefore ideal for crops that are sensitive to chloride and salt. Because of its sulphur content, SOP is preferred as a source of both K and S, when soil S status is low. SOP is reported as a better source of K for young plants in the nurseries of some perennial crops such as tea, grape wines etc. SOP is the proven best source of K for black pepper, contributing to yield and quality (Sadanandan and Hamza, 1996).

Most of the conventional rubber growing soils are inherently low in available potassium status. A survey on replanting fields in the traditional rubber growing regions showed that 62 per cent of the area was low, 31 per cent medium and 7 per cent high in available K status (NBSS& LUP, 1999). The requirement of K to rubber varies at different stages of growth.

Sulphur is also a major nutrient for plant growth, and it is an essential element of many aminoacids and some proteins. A survey on replanting fields in the estates of the traditional rubber growing regions indicated that 63 per cent of soils are low in available sulphur status (Ulaganathan *et al.*, 2012). Seedling nursery experiments showed positive effect of sulphur application on per cent buddability (RRII, 2008).

For rubber plantations in India, MOP is the recommended source of potassium. It is recently observed that higher concentration of K helped polybag plants to tide over transient drought (Prasannakumari *et al.*, 2011). The effect of supplying potassium as SOP on growth of rubber plants was not studied. Hence the present study was undertaken with the objective to compare the two sources and two levels of K on growth of young plants of *Hevea*.

Materials and methods

Brown budded stumps of clone RRII 105 were planted in polybags (45 cm x 18 cm) and raised in a nursery in the field. There were four treatments,

Table 1. Diameter and height of plants

Treatments	3 months after planting		4 months after planting	
	Diameter (mm)	Height (cm)	Diameter (mm)	Height (cm)
K as MOP @ 4 kg K_2O/ha	8.03	46.00	8.95	50.28
K as SOP @ 4 kg K_2O/ha	8.53	45.57	9.23	51.21
K as MOP @ 10 kg K_2O/ha	8.45	48.00	9.25	48.54
K as SOP @ 10 kg K_2O/ha	8.10	45.00	8.66	49.78
Critical Difference	NS	NS	NS	NS
Standard Error	0.22	1.85	0.21	0.77

NS - Not significant

Table 2. Root dry matter and total dry matter (g/plant)

Treatments	Root dry matter (g/plant)	Total dry matter (g/plant)
K as MOP @ 4 kg K_2O/ha	39.09	96.59
K as SOP @ 4 kg K_2O/ha	41.06	101.31
K as MOP @ 10 kg K_2O/ha	37.64	93.97
K as SOP @ 10 kg K_2O/ha	40.55	97.79
Critical Difference	NS	NS
Standard Error	2.33	5.85

viz. two sources and two levels of potassium. The two sources were MOP and SOP, and the two levels were 4 and 10 kg K_2O/ha. Treatments were incorporated along with recommended doses of N, P and Mg. As per treatments 10-10-4-1.5 or 10-10-10-1.5 NPKMg mixture was applied at the time of maturity of first and second whorls (15 and 30g respectively). There were twenty five plants under each treatment, and the design was CRD (Completely Randomized Design). The plants were kept in the field in trenches, and irrigated alternate daily.

Organic carbon content, pH and available nutrients in the soil used for filling polybags were estimated using the procedure outlined by Jackson (1958). Diameter and height of plants were recorded after three and four months, ie, two weeks after the first and second fertilizer applications, respectively. After five months, the plants were uprooted for estimation of dry matter, and subsamples were collected for determination of nutrient status in different plant parts. N and K content of leaf, stem and root were analysed by the procedure outlined by Piper (1950).

Results and discussion

The soil used for filling polybags was acidic in reaction (pH 5.2), medium in organic carbon status (1.02 per cent), and low in available phosphorus (5.0 mg/kg), available potassium (45 mg/kg) and available sulphur (0.42 mg/kg). Diameter and height of plants (Table 1) did not show significant difference between treatments, indicating that growth of plants was not influenced by the sources and levels of K. Any effect of addition

Table 3. N and K status of different plant parts

Treatments	N (%)			K (%)		
	Leaf	Stem	Root	Leaf	Stem	Root
K as MOP @ 4 kg K_2O/ha	3.45	1.10	2.36	0.87	0.71	0.92
K as SOP @ 4 kg K_2O/ha	3.71	1.07	2.34	0.86	0.88	0.83
K as MOP @ 10 kg K_2O/ha	3.74	1.15	2.43	1.16	1.18	1.20
K as SOP @ 10 kg K_2O/ha	3.79	1.17	2.45	1.04	1.13	0.87
Critical Difference	NS	NS	NS	0.12	0.23	NS
Standard Error	0.13	0.08	0.13	0.04	0.08	0.10

of sulphur through SOP was also not observed on the growth of plants, even though the soil used for filling the polybags was low in available sulphur content. Negative response of K application on growth of immature rubber plants was reported by Abdul Kalam *et al.*, (1977). In a review on potassium management in plantation crops with special reference to tea, coffee and rubber, Jessy (2010) reported that results of field experiments conducted by Rubber Research Institute of India at four different locations showed no response to K application on growth of immature rubber.

Root dry matter and total dry matter accumulation also did not vary significantly among treatments (Table 2). Experiments in ratoon sugarcane in a sandy clay loam soil showed that both MOP and SOP were equally effective in improving the growth and yield (Khosa, 2002). Another study on the effect of K sources and levels on growth and chloride accumulation of maize in two different textured soils showed that both MOP and SOP showed similar response to yield, and that MOP being a richer and cheaper source of K, could be safely used on well drained soils having adequate rain fall/ irrigation.

N and K status in different plant parts, viz. leaf, stem and root is shown in Table 3. N content in leaf, stem and root did not vary significantly among different treatments. However, K content of leaf and stem was significantly higher for the higher dose of K, irrespective of the source. 'Luxury consumption' of K by plants, when the amounts of K in the root zone are more than enough to meet the crop needs, is well documented.

The study showed that the two sources of K, viz. MOP and SOP were equally effective for the growth of polybag plants of *Hevea*. Higher rate of K application, i.e. 10 kg K_2O/ha, did not show any positive or adverse effect on growth of plants, though increased the K content of leaf and stem.

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