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EFFECT OF SOURCES AND LEVELS OF POTASSIUM ON THE YIELD AND QUALITY OF CHEWING TOBACCO (*NICOTIANA TABACUM* L.)

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Field experiments were conducted during 2004-05 and 2005-06 at Central Tobacco Research Institute Research station, Vedasandur to study the effect of sources and levels of K_2O on the yield, chewing quality, economics and residual soil K status. The treatments consisted of two sources of K_2O *viz.*, KCl and K_2SO_4 with three levels of K_2O *viz.*, 50, 100 and 150 kg K_2O/ha. First grade leaf yield (2.59 t/ha) increased with 50 kg K_2O as KCl by 17% over no K_2O. Significantly higher chewing quality scores (74 to 76) out of 80 were recorded with K_2O applied treatments over no K_2O. Net return (Rs. 34,700/ha) was 52% higher with 50 kg K_2O as KCl over no K_2O. Lamina K uptake and residual soil K was significantly higher with 150 kg K_2O/ha irrespective of the sources. It was concluded that 50 kg K_2O/ha as KCl would be optimum for increased first grade leaf yield, chewing quality, net returns and soil residual K.

INTRODUCTION

Chewing tobacco (*Nicotiana tabacum* L.) is an important commercial crop of Tamil nadu grown under irrigated conditions. The crop is mostly grown in sandy gravel and red soils. Due to the high soil K, N and P alone was recommended for chewing tobacco in Tamil nadu. But in recent years due to the introduction of nutrient exhaustive crops like maize, sunflower, annual moringa and vegetable crops in the chewing tobacco based cropping system, there is a need to supplement the soil K for getting quality leaf in chewing tobacco. Potassium is considered to be an element of quality in tobacco crop. In FCV tobacco, high K content in cured leaves is a criterion of quality (Krishnamurthy and Ramakrishnayya, 1993). In motihari tobacco, potash @ 50 kg/ha is essential for improving the yield, quality and maintaining the available K status of the soil under North Bengal conditions. Cheroot tobacco types grown in Tamil nadu required 75 kg K_2O /ha as K_2SO_4 for leaf quality (Kumaresan and Palanichamy, 2008). Hence based on the above back ground the present investigation was carried out to find out a suitable level and source of K_2O for chewing tobacco.

MATERIALS AND METHODS

A field experiment was conducted during 2004-05 and 2005-06 at the farm of Central Tobacco Research Institute- Regional Station, Vedasandur, Tamil Nadu on sandy gravel soil with a pH of 8.3, low in organic carbon (0.45%), available N (220 Kg/ha), available P (6.5 kg/ha) and medium in available K (185 kg/ha). The different levels and sources of K_2O were, T1-50 kg K_2O as KCl, T2-50 kg K_2O as K_2SO_4, T3- 100 kg K_2O as KCl , T4-100 kg K_2O as K_2SO_4, T5-150 kg K_2O as KCl , T6- 150 kg K_2O as K_2SO_4 , T7-No K_2O .The experiment was laid out in a randomized block design with 3 replications. Chewing tobacco (Cv. Abirami) was planted at a spacing of 75 x 75 cm during the month of October. Farm yard manure 25 t/ha was applied as basal manurial dose for all the treatments. Phosphorous in the form of single super phosphate, mixed with 2.5 t/ha of sieved FYM was spot-applied at planting. Farm yard manure was applied at 30 % moisture content with C (10 %), N (0.9 %), P (0.22 %) and K (0.48 %). Nitrogen and potassium was applied in two equal splits, first dose on 45th day and the second dose on 60th day. The total rainfall was 476.2 mm and 362 mm during the seasons 2004-05 and 2005-06 respectively. The maximum temperature was 31.5 and 33.6 ^{o}C during 2004-05 and 2005-06 respectively while the minimum temperature was 19.1 ^{o}C and during both the years. The experimental net plot size was 4. 5 m x 3.0 m. The crop was irrigated once in 4 days and harvested at 120 days by stalk cut method. The soil sample drawn from 0-22.5 cm depth was analyzed for available K. The first grade leaf yield

(FGLY) and total cured leaf yield (TCLY) were recorded after sun curing and standard fermentation process. The leaf samples were analyzed for N, P, K, nicotine, reducing sugars and chloride content following standard procedures. The quality in terms of chewability was evaluated by various parameters viz. body of the leaf (10), aroma (10), whitish incrustation (10) , taste (10), pungency (10), saliva secretion (10), retention of pungency (10), stiffness in mouth, totaling to 80 (Palanichamy and Nagarajan, 1999). Samples of the cured leaves were given to three tobacco chewers and scores were recorded. A score of 60 and above was considered to indicate preferably the better quality for chewing purposes.

RESULTS AND DISCUSSION

Growth and yield

Leaf length was significantly influenced by sources and levels of K. The response to K with respect to leaf length was up to 50 kg K_2O/ha. Leaf length with levels and sources of K were significantly superior over no K. Zehler *et al* (1981) reported that among the major nutrient potash plays a key role in increasing the leaf size of tobacco. Leaf width was not significantly influenced by levels and sources of K.

First grade leaf yield (FGLY) during 2004-05 with sources and levels of K_2O were comparable with each other. Significantly lower FGLY was recorded with no K_2O. The yield increase with 150 kg K_2SO_4 and 50 kg KCl was 25% and 22% over no K_2O . During 2005-06, the yield response was up to 100 kg K_2O /ha. The FGLY increase with 100 kg K_2O as K_2SO_4 and 50 kg K_2O as KCl was 17% and 12% respectively over no K_2O. The mean FGLY showed a yield increase of 17% with 50 kg K_2O as KCl over no K_2O. The increase in leaf length and thickness of the leaf could be attributed for increased FGLY. The cured leaf yield of FCV tobacco in irrigated light soils significantly increased with potassium application over no K (Krishnamurthy *et al.*, 1989). Total cured leaf yield (TCLY) did not show significant differences between the levels of K_2O as well as with no K_2O (Table 1).

The sources and levels of K_2O altered the chewability score. Application of K_2O either by KCl or K_2SO_4 improved the chewability over no K_2O, during both the years as well as in mean data. Significantly higher quality scores were recorded with different levels of K_2O over no K_2O. As K is said to be an element of quality (Krishnamurthy *et al.*, 1989) addition of K might be attributed for the improved quality scores.

Economics

The cost of cultivation was higher with 150 kg K_2O as K_2SO_4 followed by 100 kg K_2O as K_2SO_4 , which could be due to the higher cost of K_2SO_4. Gross return was higher with 150 kg K_2O as K_2SO_4 followed by 50 kg K_2O as KCl. The increased FGLY could be attributed for the higher gross returns. Net return was higher with 50 kg K_2O as KCl, due to the less cost of cultivation. Benefit: cost ratio (B:C) was higher with 50 kg K_2O as KCl. Higher net return and less cost of cultivation could be attributed for higher B:C ratio.

Table 1: Growth, yield and economics as influenced sources and levels of K

Treatments	Leaf length (cm)	Leaf width (cm)	First grade leaf yield (t/ha)			Total cured leaf yield (t/ha)			Cost of cultivation (Rs/ha) ($x10^3$)	Gross returns (Rs/ha) ($x10^3$)	Net returns (Rs/ha) ($x10^3$)	B:C ratio
			2004-05	2005-06	Mean	2004-05	2005-06	Mean				
50 kg K_2O as KCl	70.3	41.0	2.82	2.37	2.59	3.11	3.17	3.29	36.0	70.7	34.7	0.96
50 kg K_2O as K_2SO_4	70.0	40.4	2.63	2.35	2.49	3.29	2.90	3.10	37.3	66.4	29.1	0.78
100 kg K_2O as KCl	72.7	42.9	2.67	2.35	2.51	3.31	3.03	3.17	36.5	68.0	31.6	0.86
100 kg K_2O as K_2SO_4	72.3	41.7	2.67	2.47	2.57	3.12	3.01	3.07	38.7	65.9	27.1	0.70
150 kg K_2O as KCl	71.7	41.2	2.54	2.20	2.37	3.43	2.93	3.18	36.6	68.2	31.6	0.86
150 kg K_2O as K_2SO_4	71.5	40.6	2.88	2.28	2.58	3.53	3.05	3.29	40.4	70.6	30.1	0.75
No K_2O	68.3	39.7	2.31	2.12	2.22	2.73	2.70	2.71	35.6	58.4	22.8	0.64
SEm±	**0.89**	**0.02**	**0.11**	**0.06**	**0.06**	**0.20**	**0.17**	**0.12**				
CD (P=0.05)	**2.59**	**NS**	**0.33**	**0.17**	**0.18**	**NS**	**NS**	**NS**				

Table 2: Ntrient uptake, chemical quality and residual soil K as influenced by sources and levels of K

Treatments	Lamina uptake (kg/ha)			Quality score (Out of 80)			Chemical quality (%)			Residual Soil K (kg/ha)
	N	P	K	2004-05	2005-06	Mean	Nicotine	Reducing sugars	Chlorides	
50 kg K_2O as KCl	66.3	5.06	51.6	75	74	74	2.98	0.19	5.49	176
50 kg K_2O as K_2SO_4	64.7	4.82	54.0	74	77	75	2.99	0.17	5.33	180
100 kg K_2O as KCl	72.2	4.61	54.3	76	75	75	3.05	0.16	5.38	179
100 kg K_2O as K_2SO_4	67.6	4.40	55.2	76	76	76	3.35	0.20	5.27	184
150 kg K_2O as KCl	70.2	4.83	56.0	76	76	76	3.05	0.16	5.47	188
150 kg K_2O as K_2SO_4	65.0	5.24	57.7	76	76	76	3.04	0.17	5.08	190
No K_2O	52.6	4.57	41.5	67	66	66	2.91	0.17	5.00	169
SEm±	**2.98**	**0.26**	**2.62**	**1.31**	**1.55**	**1.01**	**0.19**	**0.03**	**0.17**	**1.65**
CD (P=0.05)	**8.69**	**NS**	**7.66**	**4.02**	**4.75**	**2.96**	**NS**	**NS**	**NS**	**4.83**

Nutrient uptake and chemical quality

Nitrogen uptake was significantly higher with 100 kg K_2O as KCl over no K_2O, followed by 150 kg K_2O as KCl. The increased N uptake is due to the increase in N content in the lamina and lamina yield. Increased levels of K to the soil increased the N content of tobacco leaf (Pal *et al.*, 1966). Levels and sources of K did not influence the P uptake. Lamina K uptake was significantly higher with 150 kg K_2O as K_2SO_4 and KCl over no K_2O. The higher available K in the soil increased the leaf K content and thereby higher uptake. Ramakrishnayya and Krishnamurthy (1990) reported that the potassium content in tobacco leaf was positively correlated with available K status in sandy and sandy loam soils. Lower uptake was recorded with no K_2O. Lower available K in soil could be attributed for lower uptake of K.

Lamina chemical quality and soil residual K

Chemical quality parameters *viz.*, nicotine, reducing sugars and chlorides in the lamina were not affected by sources and levels of K_2O. Potassium does not seem to have effect on the nicotine content of leaf (Janardhan *et al.*, 1997). In FCV tobacco of Karnataka light soils, Mahadevaswamy and Krishnamurthy (2006) reported that the nicotine and reducing sugars were not affected by sources or levels of K. Residual soil K significantly increased with 150 kg K_2O as KCl or K_2SO_4 over no K_2O. Higher dose of K_2O application in soil could be attributed for higher residual K. Non application of K_2O recorded the lowest soil residual K.

It was concluded that 50 kg K_2O/ha as KCl would be optimum for increased first grade leaf yield, chewing quality, net returns and soil residual K.

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