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BURN RELATED POTASSIUM, CURED LEAF QUALITY AND PRODUCTIVITY AS AFFECTED BY POTASSIUM LEVELS IN FCV TOBACCO CULTIVARS GROWN IN KARNATAKA LIGHT SOILS

M. MAHADEVASWAMY

Central Tobacco Research Institute Research Station, Hunsur- 571 105

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Among the major nutrients potassium plays an important role in increasing the leaf size, leaf colour and quality parameters of FCV tobacco by affecting the various biochemical processes. The burn related K (organically bound K in the tobacco leaf) in cured leaf which is directly related to the leaf burn of cigarette is largely determined by the amount of K uptake by the tobacco plant which depends on the growing environments. FCV tobacco grown in Karnataka Light Soils (KLS) are of typical sandy to sandy loam in nature with inherently low fertility. Recent studies have shown that there is a faster depletion of available K status in these soils owing to the removal of the nutrient by continuous FCV tobacco cultivation (Krishnamurthy *et al.*, 2007). The cultivation of high yielding varieties like Kanchan coupled with potential K losses in these soils do affect the optimum uptake and desired K concentration levels in leaf for optimum burn. Maintenance of sufficient potassium levels in soil for tobacco cultivation plays an important role for sustaining the productivity and quality of FCV tobacco. Hence, an attempt was made to study the influence of different levels of K application on the cured leaf productivity, leaf chemistry and burn related K in two popular FCV tobacco cultivars (Kanchan and Rathna) grown in KLS.

The field experiments were conducted with graded levels of K application and two popular FCV tobacco cultivars of KLS (Kanchan and Rathna) during the crop seasons of 2006-07 to 200-09) at Sollepura farm of CTRI Research Station Hunsur. Soils are sandy loam in nature, having acidic to neutral pH (5.5 to 6.5), poor in organic carbon (0.35%), medium to high in available P_2O_5 (22-55 kg/ha) and medium in available K (250-280 kg/ha). The treatments consisted of 4 levels of K (60,100,140, and 180 kg/ha) and 2 varieties (Kanchan and Rathna) replicated four times in FRBD. The plot size of the treatments was 44 m^2 with a spacing of 100 x 55 cm. Nitrogen application at the recommended dose the (60 kg/ha) and P_2O_5 (40 kg/ha) were applied to all the treatments. Except levels of K, all the other management practices were common to all the treatments. Potassium (as per the treatments) was applied in 2 equal splits along with the recommended N dose. the cured leaf productivity, top grade equivalent and leaf quality parameters were recorded in all treatments. The smoke related quality parameters like leaf lamina K and the burn related K were analyzed and the results were statistically analyzed.

The pooled mean data of three crops seasons (2005-2007) on the yield parameters are presented in Table 1. Results indicated that the cultivar Kanchan (a dark cast variety) was found to produce significantly higher yields of both the cured leaf and top grade equivalent as compared to variety Rathna (a light caste variety). Variety was significantly superior to Rathna with 10.2% higher cured leaf yield and 12.8% more Top Grade Equivalent yield (Giridhar and Chandrasekhar rao, 2001). Maximum productivity of cured leaf was recorded at the application of 140 kg K_2O/ha, which was significantly superior to lower dose of 60 kg K_2O/ha. The application of K_2O at 140 kg/ha increased the cured leaf yield by 8.3% and TGE by 9.0% compared to 60 kg K_2O/ha, respectively. However differences in the productivity of CLY and TGE were not significant between 100, 140 and 180 kg/ha. The maximum response of both the cured leaf and top grade equivalent was seen at 140 kg/ha. Even though most of KLS soils appeared to be sufficient in available K status the specifically bounded Kx (K associated with specific sites) indicated lower volumes of Kx due to lighter texture of the soils (Gurumurthy *et al.*, 2008). The variety x potassium interactions effect was found to be non-significant.

The different level of K did not affect the cured leaf chemistry parameters like nicotine, reducing sugars and chlorides in both the cultivars. The nicotine content ranged from 1.50 to 1.65% in X position and 2.41 to 2.44% in L position in Kanchan variety, while in case of Rathna, it varied from 1.05 to 1.13% and 1.99 to 2.09%, respectively. The nicotine content tends to be slightly higher at higher levels of K application especially in the L position in cultivar Rathna. However the chloride content tends to be lower at higher level of K application in both the cultivars indicating the beneficial effect of K on reduction of leaf chloride content. The leaf lamina K content ranged from 1.75 to 1.94% in X position and 1.60 to 1.76% in L position and was maximum at 140 kg/ha in variety Kanchan and 180 kg/ha in the variety Rathna. With respect to the burn related K, the application of K at the rate of 140 kg in case of Kanchan and at the rate of 180 kg/ha in case of Rathna resulted in maximum burn related K in leaf compared to other K levels indicating the influence of K supply on the burn related K content of the leaf. In general the burn related K varied from 42.9 to 46.7 c mol/kg in X position and 36.5 to 40.1 c mol/kg in L position. Vageesh *et al.* (2008) observed that burn related K ranged from 24.9 to 36.4 c mol/kg in X position and 25.7 to 35.3 c mol/kg L position of the cured leaf due to different INM practices on light textured soils with medium K status under Shimoga conditions of Karnataka. Increase in the burn related K was to the extent of 11.5% and 20.0% in the varieties Kanchan and Rathna respectively, when supplied with 140 kg K_2O/ha over the lower dose of 60 kg/ha. This indicates that there is a greater response in case of Rahtna compared to the variety Kanchan. Even though increased K application and consequent uptake may not result in comparatively higher yields, attempts should be made to enhance the K content and reduce the chloride content of the natural tobaccos which are blend components in cigarette manufacture. In other words, the burn related K which is organically bound K in tobacco should be increased (Ramakrishnayya *et al.*, 2003). The three year study clearly indicated that application of K at 140 kg /ha is required to be maintained in FCV tobacco growing soils of Karnataka for achieving the optimum smoke chemistry with desired burn related K and productivity levels for sustaining the export demand in the international market. Mahadevaswamy and Krishnamurthy (2006) observed that maximum response to K was noticed at 120 kg K_2O/ha for cured leaf yield while the response to applied K was maximum at 140 kg K_2O/ha in case of top grade equivalent

The productivity of both the cured leaf and the top grade equivalent production could be maximized by the application of potassium at 140 kg/ha in the presently cultivated popular varieties (Kanchan and Rathna) of FCV tobacco under sandy loam soils of KLS. The increased levels of K did not influence the cured leaf quality parameters like nicotine, reducing sugars and chlorides. However mean leaf lamina and burn related K was maximum at 140 kg K_2O/ha. The cultivar Rathna responded up to 180 kg/ha for maximizing the burn related potassium while Kanchan required application of K_2O at 140 kg/ha. In general it could be concluded that maximum rate of K application is 140 kg/ha (applied in 2 equal splits at 10 and 30 DAT) for maximizing the burn related K content, the leaf lamina K content cured leaf quality and productivity in popular FCV tobacco cultivars (Rathna and Kanchan), grown under Karnataka Light Soil conditions.

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Table 1: Effect of graded levels of potassium on yield parameters (kg/ha)

Levels of kg K_2O/ha	Rathna		Kanchan		Mean	
	Cured leaf yield	Top grade equivalent	Cured leaf yield	Top grade equivalent	Cured leaf yield	Top grade equivalent
60	1501	1102	1587	1215	1544	1158
100	1567	1171	1656	1260	1612	1215
140	1611	1207	1735	1317	1673	1262
180	1607	1205	1670	1306	1638	1256
Mean	1571	1171	1662	1274		

Source of variance	Cured leaf yield	Top grade equivalent	Cured leaf yield	Top grade equivalent
	SEm±	**CD (P=0.05)**	**SEm±**	**CD (P=0.05)**
Variety	**19.4**	**53.5**	**18.3**	**50.4**
K levels	**29.4**	**85.6**	**25.8**	**71.4**
Variety x Poatssium	**33.6**	**NS**	**31.6**	**NS**

Table 2: Effect of K levels on the cured leaf quality constituents (%)

Levels of K_2O (kg)	Kanchan						Rathna					
	Nicotine		Reducing sugars		Chlorides		Nicotine		Reducing sugars		Chlorides	
	X	L	X	L	X	L	X	L	X	L	X	L
60	1.51	2.44	15.4	14.9	0.12	0.14	1.00	1.86	17.0	15.6	0.10	0.16
100	1.50	2.46	16.5	15.9	0.12	0.13	1.13	1.99	18.9	14.6	0.12	0.20
140	1.65	2.41	16.6	16.3	0.14	0.11	1.06	2.00	16.3	15.2	0.11	0.15
180	1.50	2.43	16.4	16.5	0.13	0.11	1.05	2.09	16.0	14.9	0.11	0.13

Table 3: Leaf lamina K (%) as affected by K levels

Levels of K_2O (kg/ha)	Kanchan		Rathna	
	X Position	L Position	X Position	L Position
60	1.79	1.55	1.72	1.66
100	1.81	1.65	1.80	1.83
140	1.93	1.73	1.91	1.80
180	1.96	1.45	1.93	1.86
Mean	**1.87**	**1.60**	**1.84**	**1.78**

Table 4: Burn related K in X and L position of leaf (C mol kg^{-1}) as affected by K levels

Levels of K_2O (kg/ha)	Kanchan		Rathna	
	X Position	L Position	X Position	L Position
60	46.2	35.7	39.6	37.4
100	46.1	37.8	42.5	36.7
140	47.3	39.8	45.7	40.5
180	48.4	35.3	45.0	44.3
Mean	**47.0**	**37.1**	**43.2**	**39.8**