Tobacco Research 44(2) : 63 - 67, 2018

EFFECT OF SPLIT APPLICATION OF POTASSIUM ON GROWTH, PRODUCTIVITY AND QUALITY OF FCV TOBACCO GROWN UNDER KARNATAKA LIGHT SOILS

M. MAHADEVASWAMY, C.CHANDRASHEKAR RAO AND D. DAMODAR REDDY

ICAR- Central Tobacco Research Institute, Research station, Hunsur - 571105
ICAR- Central Tobacco Research Institute, Rajahmundry, Andhra Pradesh-531005

(Received on 20th August 2018 and accepted on 15th November, 2018)

Among the major plant nutrients, potassium plays a fundamental role in increasing the leaf size, colour, yield and quality of FCV tobacco. The field experiments was conducted at ICAR-CTRI Research station, Hunsur farm on sandy loam soils during the *kharif* crop seasons of 2014-15 to 2016-17 to evaluate two levels of K application (90 kg and 120 kg/ha) with 4 split applications (10, 25, 40 and 55 Days after transplanting (DAT). All the K applied treatments (90 or 120 kg/ha) with more than one split application of K recorded higher productivity of both cured leaf yield (CLY) and top grade equivalent (TGE) compared to single split application of K. The increase in the cured leaf yield and top grade equivalent due to maximum no. of splits application (4 times) ranged from 5.0-7.0% and 9.0-14.0% respectively in different years over the presently recommended K application with only two splits. The maximum yield was recorded at 120 kg /ha applied in 4 splits (10, 25, 40 and 55 DAT) and was comparable with 4 split applications of K @ 90kg /ha. The K content increased by more than 30% by K application in 4 splits over no K (control) and by 10% over single split application and by 7% over the recommended 2 split application of K indicating the improvement in the leaf K content which will play a greater role in enhancement of leaf quality both physically and chemically. The study has revealed enhanced bright grade production and increased leaf K of FCV tobacco by applying the recommended quantity of potassium in 3-4 splits with the scope to further economize the total quantity of potassium to an extent of 25% under sandy loam conditions of KLS.

INTRODUCTION

Flue Cured Virginia (FCV) tobacco is an important commercial crop grown in Southern Transitional Zone in Karnataka. This crop is mainly grown under rainfed situation and called as KLS tobacco which is having high export demand in international market. Flue cured tobacco production in this Zone of Mysore and Hassan is confined to the red soils which are yellow to deep red in colour, loamy sands to sandy clay loam in texture (clay content varies from 10-25%) with slightly acidic to neutral in soil reaction, well drained and are highly leached. The clay complex of red soils consist of a mixture of kaolinite and traces of montmoillonite. In general, the soils are low in nitrogen and medium to high in available phosphorous and medium to high in available potassium.

Among the major plant nutrients, potassium is considered to be of considerable importance in influencing not only crop yields but also its quality and plays a fundamental role in increasing the leaf size, colour, yield and quality of FCV tobacco (Zehler *et al.,* 1981 and Krishnamurthy *et al.,* 1993. It has been observed that the tobacco bright grade and leaf burn improved tremendously with the addition of K even beyond the rates required for maximum yield. In addition maintaining sufficiently higher K (2.5-3.0%) in the leaf is highly desirable for enhancing the bright grade yields and improving the leaf burn. Considering the high requirement of potassium by the crop, sandy nature of soil and the growing environment, potassium nutrition with respect to optimum dose, time and method of application is very important for getting higher productivity as well as quality of the crop. Owing to the sandy nature, clay mineralogy (kaolinite) of the soil and rainfed environment and faster depletion of K from the soil due to the cultivation for high yielding varieties, potassium nutrient management strategies with regards to its supply and use

Key words: Potassium, split applications, cured leaf yield, bright grades, K content

efficiency becomes very important in sustaining FCV tobacco production in KLS region. With this background field experiments were conducted to evaluate the levels, time and number of split applications of K for optimizing the productivity and improving the grade out turn of FCV tobacco in KLS conditions.

MATERIALS AND METHODS

The present study was conducted during 2014-2017 at ICAR-CTRI Research station, Hunsur farm on sandy loam soils during the *kharif* seasonwith 7 treatments. The treatments consisted of two levels of K application (90 kg and 120 kg/ha) with 4 times split applications of K (10, 25, 40 and 55 DAT). The recommended dose of N and P @ 60 and 40 Kg/ha were common to all the treatments. While 120 kg/ha of K_2O was applied in 1, 2, 3 and 4 equal splits, 90 kg/ha of K_2O was evaluated in 3 and 4 equal splits (Table 1). The control treatment without K application was maintained for comparing the efficacy. The experimental design was Randomized Block Design with four replications. The soils were having neutral PH with low nitrogen, medium to high in phosphorus and medium in available potassium status. The ruling variety Kanchan was included in the experiment with a plot size of 80 plants /treatment. All the other agronomic management practices followed were common to all the treatments. The various growth parameters like green leaf yield, cured leaf yield and top grade equivalent were recorded and statically analyzed. The cured leaf quality parameters like nicotine, reducing sugars and chlorides were analyzed and interpretations were drawn.

RESULTS AND DISCUSSIONS

The effect of number of split applications of K at different levels on the performance of yield parameters and cured leaf quality parameters are given in Table 2 (a, b, c). In all the 3 years, K applied treatments with one or more splits recorded significantly higher yield parameters compared to control (no K). All the K applied treatments (90 or 120 kg/ha) with more than one split application of K recorded higher productivity of both CLY and TGE compared to single split application of K. The increase in the cured leaf yield and top grade equivalent due to maximum no. of splits application (4 times) ranged from 5.0-7.0% and 9.0-14.0% respectively in different years over the presently recommenced K application with only two splits. The maximum yield was recorded at 120 kg /ha applied in 4 splits (10, 25, 40 and 55 DAT) which recorded 23.0%, 32.0% and 25.0% higher cured leaf productivity when compared to no K and 10.3%, 10.5% and 7.7% higher yield when compared to one split application of K and 43.0%., 7.0% and 5.0% when compared to two split application respectively during the first, second and third crop seasons respectively. Mahadevaswamy and Krishnamurthy (2006) observed that maximum response to K was noticed at 120 kg K_2O/ha for cured leaf yield but the response to applied K was maximum at 140 kg K_2O/ha in case of top grade equivalent or bright grades. As the Solution K and Exchangeable K representing the available K status of the soil which contribute only 1-2% of the total K that regular application of potash is advocated to light soils crops like KLS because of low K reserves and higher K requirement of tobacco crop and greater

Table1: Treatment details showing Potassium levels, number of splits and time of application

Treats	Treatment details
T1	60:40:**120** kg NPK/ha with K applied as basal (10 DAT)
T2	60:40:**120** kg NPK/ha with K applied in 2 equal splits (10 & 25 DAT)
T3	60:40:**120** kg/ha with K applied in 3 equal splits (10, 25 & 40 DAT)
T4	60:40:**90** kg/ha with K applied in 3 equal splits (10, 25 & 40 DAT)
T5	60:40:**120** kg/ha with K applied in 4 equal splits (10, 25, 40 & 55 DAT)
T6	60:40:**90** kg/ha with K applied in 4 equal splits (10, 25, 40 & 55 DAT)
T7	60:40:**0** (No K)- control required for computing K use efficiencies)

leaching loss of K in light soils (Krishnamurthy and Ramakrishnayya (1997). Apart from high Leaching loss of K in light soils, poor soil structure and poor K fixation capacity (10-20%) is a great disadvantage and in such cases split application of K is always advocated. Further intermittent drought also affects the K availability to the tobacco plant by reducing the K availability to the plant root surface. In sandy soils with low buffering capacity, 35% increase in yield and 65% in quality improvement can be seen compared to no K application,

The mean data of three crop seasons (Table 3) indicated that while the cured leaf productivity was enhanced by 5.5% by 4 splits compared to the present recommended application of K in 2 splits, the top grade equivalent production of tobacco was much influenced (>10.0%) by more number of splits which will ultimately result in better bright grades and higher market price. Under existing farming conditions wherein most of the farmers are applying the entire Potash dose in one split in KLS , in such cases the bright grade out turn can be increased by more than 16.0% by applying the recommended K in 4 splits at 10,25, 40 and 55 DAT. In the present study the top grade equivalent yield was significantly enhanced by more than 14% by 4 split applications of K compared to single split application of the entire quantity of K as basal only and by 9.1% compared to currently recommend 2 splits of K. Further the K use efficiency was found to be highest at 4 split applications and there was not much difference in productivity and bright grade production between 90 and 120 kg levels/ha. This implies that there could be possibility of economizing the potassium use in KLS with K nutrient management strategies.

The cured leaf K content (Table 4) was also greatly enhanced by more no. of split applications of K. The K content increased by more than 30% by K application in 4 splits over no K (control) and by 10% over single split application and by 7% over the recommended 2 split application of K indicating the improvement in the leaf K content which will play a greater role in enhancement of leaf quality both physically and chemically. The cured leaf quality parameters were not much altered by the dose and number of split applications of K. Krishnamurthy *et al.* (1983) observed that when the available K supply in the light soil was high, the K content and the reducing sugars content of the cured leaf were also high ranging from 2.5 to 3.0% K and 18.65 to 20.42 % sugars respectively. However the increase in the K content of the leaf generally considered to have no significant influence on the nicotine content of tobacco. Sabeti Amirhendeh *et al.*, (2013) observed that application of K fertilizers significantly increased the dry weight, reducing sugars, quality index and yield while significantly decreased the nicotine content in comparison with control treatment. The study has revealed that there is a possibility to optimize the productivity and enhance the bright grade production of FCV tobacco in KLS by applying the recommended quantity of potassium in 3-4 splits with the scope to economize the total quantity to an extent of 25% under sandy loam conditions of KLS.

Table2a: Effect of split applications of K on productivity and leaf quality parameters (2014-15)

Treat	GLY (kg/ha)	CLY (kg/ha)	TGE (kg/ha)	Leaf Nicotine (%)		Reducing sugars (%)	
				X	L	X	L
T1	7980	958	676	0.78	1.51	18.33	16.50
T2	8194	1013	713	0.87.	1.73	14.74	14.92
T3	8390	1046	782	1.12	1.51	12.36	14.00
T4	8380	1038	802	0.95	1.50	15.20	14.72
T5	8501	1057	816	0.94	1.43	14.56	15.82
T6	8398	1043	792	0.90	1.46	15.50	16.19
T7	7003	857	545	1.06	1.63	13.14	17.10
C.D. 5%	NS	116.6	95.9	0.11	NS	2.70	NS

Table2b: Effect of split applications of K on productivity and leaf quality parameters (2015-16)

Treat	GLY (kg/ha)	CLY (kg/ha)	TGE (kg/ha)	Leaf Nicotine (%)		Reducing sugars (%)	
				X	L	X	L
T1	8483	1030	712	1.31	1.56	17.15	16.40
T2	8884	1064	752	1.27	1.71	18.30	15.39
T3	9078	1127	782	1.03	1.77	17.76	16.12
T4	9041	1088	772	1.19	1.61	17.22	16.03
T5	9291	1139	819	1.11	1.74	17.10	16.49
T6	9168	1101	789	1.15	1.68	18.10	16.51
T7	7786	862	572	1.31	1.46	18.20	17.09
C.D. 5%	867.0	101.5	94.6	NS	NS	NS	NS

Table2c: Effect of split applications of K on productivity and leaf quality parameters (2016-17)

Treat	GLY (kg/ha)	CLY (kg/ha)	TGE (kg/ha)	Leaf Nicotine (%)		Reducing sugars (%)	
				X	L	X	L
T1	11216	1625	1138	1.35	2.27	10.25	19.35
T2	11972	1666	1188	1.39	2.25	12.76	17.46
T3	12114	1734	1228	1.24	2.25	12.25	18.14
T4	11987	1671	1199	1.31	2.00	13.53	20.36
T5	12263	1750	1294	1.33	2.30	12.83	17.66
T6	12250	1732	1257	1.38	2.17	11.71	19.90
T7	9513	1396	962	1.30	2.38	12.06	19.70
C.D. 5%	1672.0	209.2	144.9	NS	NS	NS	NS

Table 3: Effect of split applications of K on productivity and leaf quality (mean of 3 seasons)

Treat	GLY (kg/ha)	CLY (kg/ha)	TGE (kg/ha)	Leaf Nicotine (%)		Reducing sugars (%)	
				X	L	X	L
T1	9226	1204	842	1.14	1.78	15.24	17.41
T2	9683	1247	884	1.17	1.89	15.26	15.92
T3	9860	1302	930	1.13	1.84	14.12	16.08
T4	9802	1265	924	1.15	1.70	15.32	17.03
T5	10018	1315	976	1.12	1.82	14.83	16.65
T6	9938	1292	946	1.14	1.77	15.10	17.53
T7	8100	1038	693	1.22	1.82	14.46	17.96

Table 4: Effect of split applications of K on mean leaf Nutrient content and potassium use efficiency

Treat	Cured leaf nutrient content (%)			Potassium use efficiency (KUE)	
	N	P	K	CLY kg/kg K	TGE kg/kg K
T1	2.26	0.30	3.40	10.03	7.01
T2	2.03	0.29	3.49	10.39	7.36
T3	2.00	0.28	3.58	10.85	7.75
T4	2.14	0.33	3.69	10.26	10.26
T5	2.25	0.31	3.73	10.95	8.13
T6	2.20	0.27	3.67	14.35	10.50
T7	2.07	0.30	2.83	-	-

REFERENCES

Sabeti Amirhendeh M.A., Mehdi Norouzi, Abdolaneir Moezzi and Sharam Shoua Kazami, 2013 Influence of rates and split application of K fertilizer on nutrient uptake and quality characteristics of Virginia tobacco. **Pro-environment, 6:26-32**

Zehler, E Kreipe, H and Gething, P.A. 1981. Potassium sulphate and Potassium chloride. ***Research Topic no. 9,*** *International Potash institute*, .pp 108

Krishnamurthy, V, Ramakrishnayya B.V. and Murthy K.S.N. 1993. Fertility status of soils growing FCV tobacco in Mysore District, ***Research Bulletin. 7***, CTRI (ICAR), Rajahmundry, India

Mahadevaswamy, M and Krishnamurthy V, 2006. Effect of levels and methods of potassium application on growth, yield and quality of FCV tobacco in Karnataka Light Soils. ***Tob.Res.32 (2):***56-60.)

Krishnamurthy, V and Ramakrishanyya B.V., 1997. Potassium fertility of flue cured tobacco growing soils of India, ***Indian Journal of Potassium Research***. ***13*** (2): 159-169

Krishnamurthy, Reddy, P.R.S., and Ramakrishanyya, B.V., 1983.Visual symptoms of potassium deficiency in tobacco. ***Tobacco news 6(2):***8-10