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FOLIAR NUTRITION OF NITROGEN AND POTASSIUM FOR OPTIMIZING THE PRODUCTIVITY AND ENHANCING BRIGHT GRADE LEAF PRODUCTION OF FCV TOBACCO IN KLS

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Among the major nutrients, nitrogen and potassium are very important and required in larger quantities for not only getting higher cured leaf productivity but essential for proper ripening, desired cured leaf quality, smoke chemistry, bright grade production and high burn rate in FCV tobacco. The poor uptake of N and K owing to various biotic and abiotic stresses has lead to poor grade out turn, immature and J style Tobacco resulting in low grade production and economic losses to the growers. Given the vagaries in climate and weather conditions apart from the biotic stresses experienced in the rainfed farming situations of KLS, foliar feeding of nutrients appears to be the ideal option for maintaining the desired N and K nutrient levels in the tobacco plant for realizing optimum productivity and quality leaf production. Field experiment were conducted during 2012-12 and 2013-14 crops seasons to evaluate the foliar nutrition of N and K using Potassium Nitrate and Ammonium sulphate + Sulphate of Potash sources on the cured leaf productivity, bright grade production, cured leaf K content and leaf quality parameters on red sandy loam soils in KLS. Potassium Nitrate and Ammonium sulphate + SOP (sprayed twice at 45 and 55 DAT @ 2%) increased the cured leaf productivity by 9.2 and 9.8% and greatly enhanced the bright grade production by 13.4 and 15.7% respectively compared to the control plot. Further the foliar applications also significantly improved the cured leaf K (by 14.8-15.9%), which is highly desirable in flue cured tobaccos for better leaf combustibility, burn rate and reducing the harmful smoke constituents. The cured leaf quality parameters were not altered by the foliar treatments and were in the acceptable range. The two years study has clearly indicated that the foliar application of N and K can greatly enhances the bright grade leaf production, productivity and cured leaf K in the rainfed tobacco farming of KLS.

Key-words: FCV tobacco, Foliar nutrition, Nitrogen & Potassium, Productivity, bright grade

INTRODUCTION

Flue Cured Virginia (FCV) tobacco is an important commercial crop grown under rainfed situation during Kharif (May-Sept) season in Karnataka Light Soil (KLS) region of Southern Transitional Zone in Karnataka. Among the major nutrients, Nitrogen and Potassium are very important and required in larger quantities for not only higher cured leaf productivity but for maintaining optimum and desired N and K contents in leaf which are very essential for proper ripening, desired cured leaf quality, smoke chemistry, bright grade production and high burn rate. An FCV tobacco raised under optimum conditions crop can remove as high as 60-70 kg N and 80-100 Kg K_2O per ha. Among the different nutrients, soil potassium was removed in highest amount by the crop (101.5 kg/ha) indicating the importance of K in the mineral nutrition of FCV tobacco (Gurumurthy and Vageesh, 2007).The light soils of the tobacco growing area of this zone are inherently low in soil OM consequently low available soil nitrogen and moderate to rich in available soil K status. The poor uptake of N and K owing to various biotic and abiotic stresses has lead to poor grade out turn, immature and J style Tobacco resulting in economic losses to the growers.

Nutrient application through foliar sprays is highly beneficial and is well accepted practice globally to solve nutrient deficiencies as it helps in direct assimilation of nutrients to improve productivity and proved to be economical and efficient methods for solving plant nutrient deficiency. In recent years the potential of foliar fertilizer treatments as a sustainable tool to improve yield and quality of horticulture and field

crops subjected to biotic stress have been widely recognized. Comparing the efficacy of plant use of foliar fed nutrient v/s the soil applied nutrients; they found foliar feeding provided about 95% efficiency of use compared to 10% of use from soil applications (Charlie O'Dell, 2008). Even though foliar feeding of tobacco has generally been overlooked or ignored in many of the tobacco farming regions, given the vagaries in climate and weather conditions experienced by the tobacco growers in the rainfed farming situations such as KLS, foliar feeding appears to be still the ideal option for maintaining the desired N and K nutrient levels in the tobacco plant for realizing optimum productivity and quality leaf production. Foliar fertilization needs to be recommended as an integral plant production package because it is environmental friendly and gives the possibility to achieve higher productivity and good quality yields especially under soil constraints/abiotic stresses (Pawel Wojcik, 2004). Hence the present study was undertaken to study the effect of supplying a portion of total N and K plant nutrient needs through foliar applications on the cured leaf productivity, bright grade production, leaf nutrient content and cured leaf chemistry in FCV tobacco raised under rainfed farming situations in KLS.

MATERIALS AND METHODS

The study was conducted at ICAR-CTRI Research station, Hunsur farm on sandy loam soils during the *kharif* crop seasons of 2012-13 and 2013-14 in replicated trails with five treatment combinations in Randomized Block Design. The soils were having neutral pH with low nitrogen, high in phosphorus and medium in available potassium status. The treatments consisted of foliar applications of N and K with Potassium Nitrate and Ammonium sulphate + SOP sources at concentration levels of 2.5% applied twice during the crop growth (45 and 55 DAT) stage. The recommended level of nutrients (60:40:120 Kg N, P_2O_5, K_2O/ha) were applied after taking into consideration the amount of nutrients supplied by the foliar applications of N and K supplied from the different sources/combinations. About 6-9% N and 9-11% K of the total recommended nutrient quantities were applied thorough Potassium Nitrate and Ammonium Sulphate + SOP foliar sprays. The treatment details are given in (Table 1). 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 crop growth parameters and yield parameters like Green Leaf yield (GLY), Cured Leaf Yield (CLY) and Top Grade Equivalent (TGE) yields were recorded and statistically analyzed. The cured leaf samples were also analyzed for the changes in NPK nutrient content. The cured leaf quality parameters like nicotine, reducing sugars and chlorides were analyzed. The mean of 2 years data were analysed and results interpreted.

RESULTS AND DISCUSSION

The effect of foliar applications of N and K nutrients on the various crop growth parameters at different stages of crop growth are presented in (Table 2). Increase in the leaf expansion in terms of leaf area to an extent of 6-9.8% in the 12^{th} leaf and 4.0-8.5% in the 15^{th} leaf was observed in the foliar N and K treated plots compared to control plot where entire N and K were supplied through soil applications. Marginal increase in the individual plant height and number of leaves were also observed by the foliar treatments.

The effect of foliar application of N and K on the yield is given in (Table 3). The mean data of the two years study has revealed that N and K

Table 1: Treatment Details of the experiment

Trts.	Treatment details
T_1	Control (only soil application)
T_2	Foliar nutrition of N & K @2.5%(Potassium Nitrate) 1spray at 45 DAT
T_3	Foliar nutrition of N & K @2.5% (Potassium Nitrate) 2 spray at 45 & 60 DAT
T_4	Foliar nutrition of N&K @2.5% (Ammonium sulphate & SOP) 1 spray at 45 DAT
T_5	Foliar nutrition of N&K@2.5%(Ammonium sulphate & SOP) 2 sprays at 45 & 60 DAT

Table 2: Plant height, number of leaves and leaf area as influenced by foliar treatments

Trts.	Plant height(cm)	No.of leaves / plant	Leaf Area 7^{th} leaf cm^2	Leaf Area 9^{th} leaf cm^2	Leaf Area 12^{th} leaf cm^2	Leaf Area 15^{th} leaf cm^2
T_1	60.5	18	1024	1017	752	763
T_2	61.3	18	1033	1030	797	792
T_3	62.9	19	1060	1025	821	828
T_4	62.1	19	1056	1045	807	824
T_5	62.4	19	1050	1042	825	827
S.Em.±	9.40	0.81	54.07	47.57	41.43	35.54
C.D.5%	NS	NS	NS	NS	NS	NS

Table 3: FCV tobacco yield parameters and Top grade ratio as influenced by treatments

Trts.	Green leaf yield (kg/ha)	Cured leaf yield (kg/ha)	Top grade equivalent yield (kg/ha)	CLY:TGE Ratio
T_1	13528	1958	1350	1:0.689
T_2	14355	2070	1474	1:0.712
T_3	14833	2138	1564	1:0.731
T_4	14738	2106	1509	1:0.716
T_5	14725	2140	1530	1:0.714
S.Em ±	311.5	87.5	60.9	-
C.D. (5%)	907.9	NS	NS	-

nutrient greatly improved all the yield parameters. While the GLY was found to show significant differences, the differences in CLY and TGE were not significantly different. Even the cured leaf productivity was not significant; there was increase in the leaf productivity to an extent of 9.2 and 9.8% due to Potassium Nitrate and Ammonium sulphate + SOP (sprayed twice at @2%) applications respectively. Foliar nutrition of 2.5% potassium nitrate at 45 and 60 DAT significantly recorded higher cured leaf and was on par with AS + SOP @ 2.5% while control reordered significantly lower productivity in *Bidi* tobacco (Prabhakar et al., 2016). In the present trail, increase in the bright grade production in terms of TGE yield was much higher by application of Potassium Nitrate and Ammonium sulphate + SOP (13.4 and 15.8% respectively) compared to the control plot. This clearly indicates that the foliar application of N and K through various sources can greatly enhances the bright grade production which is very important for quality leaf production and higher economical returns to the farmers. Mahadevaswamy and Krishnamurthy (2006) observed that, out of the total recommended quantity of 120 kg K_2O/ha, application of 100 kg through soil and the rest 20 kg /ha through foliar application resulted in maximizing CLY and TGE in FCV tobacco in KLS. Two time application of potassium nitrate or AS+SOP (at 45 and 55 DAT) was found better than the one time application of the same at 45 DAT indicating the usefulness of the supply of these two elements at grand growth period of the crop through foliar applications. The CLY: TGE ratio also improved favourably by the foliar applications of N and K compared to no foliar treatment. The economic analysis of the foliar nutrition treatments indicated that the net returns can be greatly enhanced to an extent of Rs. 19,100 and Rs. 22,137 /ha by foliar spray of KN and AS+SOP, respectively. (Table 4). The cost benefit ratio were also highest in the foliar application(2.17 to 2.25) compared to control treatment (2.08).

The cured leaf nutrient content (N, P, K) as influenced by foliar nutrition of nitrogen mad potassium are given in Table 5. While the leaf N content improved only marginally, the leaf p contents was not influenced by the treatments. However the leaf K contents were significantly influenced by the application of N and K through foliar method. The application of N and K either

Table 4: Total gross returns, cost of cultivation, net returns and cost benefit ratio of the foliar nutrition treatments

Trts.	Gross returns (Rs/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)	Cost benefit Ratio
T_1	2,44,781	1,17,316	1,27,465	2.08
T_2	2,58,776	1,19,016	1,39,765	2.17
T_3	2,67,281	1,20,716	1,46,565	2.21
T_4	2,63,781	1,18,216	1,45,065	2.23
T_5	2,68,718	1,19,116	1,49,602	2.25

Table 5: Cured Leaf nutrient (NPK) content (%) as influenced by N & K foliar applications

Trts.	Leaf N%		Leaf P %		Leaf K%	
	X	L	X	L	X	L
T_1	1.43	1.64	0.31	0.27	3.44	3.12
T_2	1.58	1.67	0.33	0.30	3.79	3.70
T_3	1.50	1.72	0.32	0.29	3.94	3.72
T_4	1.50	1.66	0.32	0.29	3.95	3.60
T_5	1.45	1.73	0.31	0.28	3.90	3.69
C.D.(5%)	NS	NS	NS	NS	0.22	0.29
C.V. %	6.25	8.11	6.11	9.75	4.75	5.95

Table 6: Cured Leaf Quality parameters as influenced by N & K foliar applications

Trts.	Nicotine %		Reducing Sugars %		Chlorides %	
	X	L	X	L	X	L
T_1	1.14	1.71	21.0	17.6	0.32	0.33
T_2	1.17	1.75	20.0	18.5	0.31	0.48
T_3	1.24	1.76	19.8	17.9	0.29	0.25
T_4	1.20	1.76	18.3	18.8	0.30	0.48
T_5	1.29	1.74	19.7	17.9	0.29	0.39
S.Em ±	0.102	0.179	1.514	1.695	0.060	0.061
C.D.(5%)	NS	NS	NS	NS	NS	NS

through PN source or through AS + SOP sources significantly improved the percent leaf K compared to the control. The increase was as high as 14.1% in X position and up to 15.9% in L position of the plant. Higher leaf K in the cured leaf is always desirable as it greatly influences the leaf burn and smoke quality charctertsics. Even though the higher leaf K may not necessarily result in higher productivity, maintaining higher cured leaf K as well as higher K/Na ratio is highly desirable in flue cured tobaccos for better combustibility, burn rate and reducing the smoke harmful constituents like Total Particulate Matter (TPM) and tar etc. Application of KNO_3 in the nutrient solution proved to be effective in decreasing the Na/K ratio in leaves of the plants under salinity and drought stress in barley which alleviated the oxidation stress in barley plants caused by salinity/drought (Fayer and Bazaid, 2014). It has been noticed that while soil application improved the Tobacco yields and TBLE, foliar application improved the filling value and the K content of the leaf.

The cured leaf quality parameters like nicotine, reducing sugar and chlorides were not markedly influenced by the foliar treatments of N and K. There was slight marginal increase in leaf nicotine content due to the treatments, but were

in the normal acceptable range (Table 6).The study has clearly indicated that the bright grade production can be markedly enhanced and productivity levels of FCV tobacco can be greatly optimized by supplying part of recommended N and K through foliar sprays using Potassium nitrate or Ammonium sulphate + Sulphate of Potash as sources in rainfed farming situations of KLS. However care should be taken to add adjuvant to nutrient solutions and straying preferably during cool hours of the day for effective results. Despite many performed studies on foliar application of mineral nutrients, many aspects of the uptake and nutrient translocation and its use/efficacy within the plant are unfamiliar and further research in this regard may be initiated.

REFERENCES

Charlie O'Dell. 2008. Foliar feeding of nutrients. **Plant nutrition**. February, 2008.

Fayer, K. A. and S. A. Bazaid. 2014. Improving drought and salinity tolerances in barley by application of salicylic acid and potassium nitrate, **Journal. Saudi Soc. Agril. Sci.** 13 (1): 45-55.

Gurumurthy, K. and T.S. Vageesh. 2007. Leaf yield and nutrient uptake by FCV tobacco as influenced by K and Mg nutrition. **Karnataka J. Agric. Science**. 20 (4) :741-744.

Mahadevaswamy, M. and V. K. Krishnamurthy. 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.

Pawel Wojcik. 2004. Uptake of mineral nutrients from foliar fertilization. **J. Fruit. ornament. plants.** 12: 201-218.

Prabhakar, K., P. P. Bai, P. Munirathnam, J. Manjunath, T. Ragahavendra, T. Padmalatha, Y. and B.G. Reddy. 2016. Supplementation of nitrogen and potassium nutrients through foliar nutrition to Bidi Tobacco (*Nicotiana tabacum, L.*). **J. Acharya NGR Agril. University.** 44 (3/4):7-32.