Tobacco Research 47(1): 35-38, 2021

AGRONOMIC MEASURES FOR ENHANCING SEEDLING GROWTH & FIELD ESTABLISHMENT, CROP GROWTH, LEAF PRODUCTIVITY AND QUALITY OF FCV TOBACCO GROW IN KLS

M.MAHADEVASWAMY[1], C.CHANDRASHEKAR RAO[1], D.DAMODAR REDDY[1], S. RAMAKRISHNAN[1] AND P.SREENIVAS[2]

[1]ICAR- Central Tobacco Research Institute, Hunsur, Mysore District, Karnatak-571105
[2]ITC-ILTD Ltd., Rajahmundry, Andhra Pradesh

(Received on 1st March, 2021 and accepted on 30th April, 2021)

Flue cured Virginia (FCV) tobacco is an important commercial crop grown under rainfed farming on red sandy to sandy loam soils in Southern Transitional Zone of Karnataka FCV tobacco grown under this region experiences lower and unsustainable productivity due to poor seedling growth, field establishment, moisture stress at critical stages, poor nutrient uptake, high temperatures, soil compaction and exhaustion of soil nutrients due to continuous cropping over the years. Among the various cations, calcium is one of the principle organic constituent of the leaf next only to potassium. Achieving initial plant vigor helps in quick and healthy growth of plant that can effectively withstand drought and in this context application of starter dose of calcium nitrate which supplies readily available calcium and nitrate nitrogen to the plant has been a successful practice in many crops/vegetables to kick start early growth by stimulating root growth apart from foliar nutrition of N and K. With this objective the field experiments conducted on red sandy loam soil during 2017-2019 crop season reveled that agronomic interventions like application of starter dose Calcium nitrate fertilizer at planting time @ 25 kg /ha and foliar nutrition of N and K through Potassium nitrate N at 1% proved beneficial in increasing both the cured leaf productivity and bright grade production compared to control / normal practice in FCV tobacco growing areas of KLS.

FCV tobacco is an important commercial crop grown on red sandy to sandy loam soils in Southern Transitional Zone (STZ) of Karnataka under rainfed conditions. The STZ in Karnataka is characterized by dry sub- humid to semi arid climate, inherently poor in soil fertility and low in organic matter status. As the planting season starts right from the month of May (in early Kharif season), the crop often experiences lower and unsustainable productivity due to poor seedling growth and field establishment as a result OF moisture stress at critical stages, poor nutrient uptake, high temperature regimes, soil compaction and exhaustion of soil nutrients due to continuous cropping of FCV tobacco over the years.

The soils of FCV tobacco grown in this area are slightly acidic to neutral in pH, low in nitrogen levels, and high in available phosphorus and medium in available potassium status. The secondary nutrients like calcium and magnesium in soils even though in medium range, are often unavailable to the growing seedlings due to moistures stress or high leaching/erosion losses due to sandy nature of the soil and high intensity rains making them highly deficient for seedling growth and development. Among the various cations, calcium is one of the principle organic constituent of the leaf next only to potassium. Calcium is a mineral element with a much higher demand by tobacco plant like K and its content in cured leaf usually ranged between 1.5-2.0% (Lopez_ Lefbre *et al.,* 2001). Calcium helps in increasing cell wall strength, thickness and helps in better root development and can better tolerate drought conditions. Apart from protection from aluminum and manganese toxicity, it enhances the plant defence responses to several fungal pathogens/ diseases. In this context application of starter dose

Key words: FCV Tobacco, Calcium Nitrate, Potassium Nitrate, cured leaf productivity, Bright grade

of calcium nitrate which supplies readily available calcium and nitrate nitrogen to the plant has been a successful practice in many crops/vegetables to kick start early growth by stimulating root growth. Achieving initial plant vigor helps in quick and healthy growth of plant that can effectively withstand drought. Similarly the use of organic mulching has been established as a proven practice for avoiding soil evaporation losses, reducing weed infestation and moderating soil temperature in many dry land/rainfed farming situations.

The poor uptake of N and K by the plant especially during the growth phase owing to various biotic and abiotic stresses (due to drought, soil compaction and lack of soil moisture) leads to poor growth and productivity apart from low grade out turn, immature and J style leaf tobacco. 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. Nitrogen, potassium and calcium are the most important elements for the production of quality of FCV tobacco with more implication on quality parameters such as flavor, texture, sugars, nicotine, flammability and smoke flavor apart from productivity (Smith et al, 2009). In the light of the above productivity constraints experienced in KLS, various agronomic interventions were evaluated to improve the seedling growth, leaf development, productivity and bright grade production in dry and semi dry tracts of FCV tobacco growing regions in KLS.

MATERIAL AND METHODS

The field experiment was conducted at farmers field located at dry and semi dry zone of KLS region on red sandy loam soils during the kharif seasons of 2017-2018 and 2018-2019 with six treatments replicated 4 times in Randomized Block Design. The soils have neutral pH with low nitrogen, high in phosphorus and medium in available potassium status. Treatments consisted of Calcium nitrate fertilizer applications as starter nutrient dose at planting time (@ 25, 75 and 150 kg/ha). Calcium nitrate is a water soluble fertilizer containing 15.5% N and 19.0% calcium, and because of its higher solubility in the soil it helps plants in absorbing the other nutrients in the soil and known to increase the uptake of potassium and magnesium. Mulching with locally available paddy straw was applied to a thickness of 2" after planting. Foliar application treatment of N and K nutrients with Potassium Nitrate fertilizer (fully water soluble foliar grade containing 13.5 % N and 45% K_2O) @ 1.0% was done during crop growth phase at 45 and 55 DAT (Table 1). In case of Calcium Nitrate N applied treatments, the recommended level of nutrients (60:40:120 Kg N, P_2O_5, and K_2O/ha) were applied after taking into consideration the amount of nitrogen supplied by the starter dose of calcium nitrate fertilizer at various doses in the respective treatments . All the other agronomic management practices followed were common to all the treatments. Yield parameters like Green Leaf yield, Cured leaf yield and Top grade equivalent yields were recorded and statistically analyzed. Cured leaf samples were collected and analyzed for leaf quality parameters like nicotine, reducing sugars and chlorides.

RESULTS AND DISCUSSION

The effect of various agronomic measures adopted on the cured leaf and bright grade productivity parameters are given in Table 2. All the agronomic practices evaluated gave significantly higher leaf productivity compared to control during both the crop seasons. Application

Table 1: Treatment Details of the experiment

Trts.	Treatment details
T_1	Control (Normal practices)
T_2	Starter dose of calcium nitrate fertilizer at planting time @ 25 kg/ha
T_3	Starter dose of calcium nitrate fertilizer at planting time @ 75 kg/ha
T_4	Starter dose of calcium nitrate fertilizer planting time @ 150 kg/ha
T_5	Mulching with organic materials using paddy straw after transplanting
T_6	Foliar application of N and K using Potassium nitrate @ 1% at 45 and 55 DAT

of CN at 25kg, 75 kg and 150 kg/ha significantly increased the cured leaf productivity by 6.5, 9.8 and 11.6% respectively over the control during 2017-18. This is due to better uptake of both the soluble calcium and nitrate nutrients by the plants encouraging quicker seedling growth and development. Collins and Hawks (1993) reported that an increase in the percent of N supplied through nitrate sources increased the yield as well as calcium and potassium uptake in tobacco. However the differences in yield within the CN doses were not significant. Similarly the foliar application of N and K through potassium nitrate (T_6) treatment resulted in increase of 10.3% in the cured leaf productivity over the normal practice indicating the importance of these nutrients during the growth phase of FCV tobacco raised under rainfed farming situations such as KLS. Cured leaf yield was significantly higher when foliar application of potassium nitrate (PN) @ 2.5% was given at 45 and 60 DAT in bidi tobacco raised under rainfed conditions of Andhra Pradesh (Jaffer Basha *et. al.,* 2019). The application of paddy straw as organic mulching (T_5) could increase the yield by only 8.3% and may be helpful under extreme dry conditions after planting. Mulching with organic materials likely to increase the soil nutrients and organic matter slowly apart from restricting the soil evaporation and weed growth. Dixit and Majumdar (1995) reported that of potato yield was higher by 27.9% under paddy straw mulch compared to unmulched plot

During the second crop season of 2018-19 also, CN application at planting time (especially at higher rates of 75 and 150 kg/ha) significantly produced higher cured leaf yield (8.0 and 12.9% respectively) over the normal practice but differences among the CN rates of application, were not significant and were on par with each other. Application of calcium nitrate as source of N improved the cured leaf yield and bright grade index with acceptable leaf quality parameters in Northern Light Soils of Andhra Pradesh (Chandrasekhar Rao *et al.,* 2005).

In the semi dry zone location also, various agronomic measures evaluated improved the cured leaf yield ranging from 7.5% to 14.9% during 2017-18 and by 4.3 to 10.2% during 2018-19. But the differences were not statistically significant. Maximum yield was recorded with the application of CN at 25 hg/ha in both the crop seasons with increase in the productivity ranging from 10.2% to 14.9%. The foliar nutrition of N and K through PN application at 1% apart from increasing the leaf prodcuvity by 11.2% (2017-18) and 9.3% (2018-19) significantly influenced the bright grade productivity in both the crop seasons compared to the normal practice. The increase was in the order 19.0% and 12.2% during 2017-18 and 2018-19 respectively. Foliar sprays of nutrients can result in increasing the photosynthetic efficiency as it is possible to modify the physiology of the leaf and the onset of senescence can be delayed and the photosynthetic efficiency of the leaf can be promoted. Mahadevaswamy (2017) has reported the significant enhancement in the bright grade leaf of FCV tobacco to an extent of 13.4-15.7% through foliar feeding of N and K either through Potassium nitrate fertilizer or Ammonium sulphate + SOP combination spray in Karnataka Light Soils.

Table2: Cured leaf yield and bright grade productivity as influenced by agronomic measures (Kg/ha)

Treats	Dry Zone				Semi dry Zone				Pooled mean data	
	2017-18		2018-19		2017-18		2018-19			
	CLY*	BG**	CLY	BG	CLY	BG	CLY	BG	CLY	BG
T_1	2587	1320	2155	1090	2051	1140	1876	1253	2167	1201
T_2	2756	1493	2279	1165	2358	1297	2069	1329	2365	1321
T_3	2842	1384	2327	1153	2255	1309	2011	1334	2358	1296
T_4	2889	1408	2434	1164	2245	1329	1988	1321	2389	1305
T_5	2804	1492	2174	1111	2205	1184	1957	1285	2285	1268
T_6	2854	1393	2265	1126	2281	1357	2050	1406	2362	1308
C.D.5%	168.1	NS	165.4	NS	NS	211.8	NS	88.6	84.3	72.0

* Cured Leaf Yield Kg/ha; ** Bright grade productivity Kg/ha

Considering the mean values of both the seasons and across the locations, productivity was significantly improved with starter doses of CN application compared to control. However CN application at 25 kg/ha was found be optimum for maximizing both the cured leaf and bright grade productivity. Similarly the foliar nutrition of potassium nitrate at 1% proved beneficial in increasing both the cured leaf productivity and bright grade production compared to control / normal practice. The study clearly indicated promising role of Agronomic interventions like starter nutrition of Calcium nitrate fertilizer application at planting time (at 25 kg/ha) and foliar spray of N and K nutrients through PN (at 1% concentration during crop growth phase at 45 and 55 DAT) in improving and maximizing the cured leaf productivity as well as bright grade production in the dry /semi dry FCV tobacco growing areas of KLS.

The cured leaf quality parameters like nicotine, reducing sugar and chlorides were not significantly influenced by various agronomic measures evaluated in both dry and semi dry zones. The values were foumd to be normal and in acceptable range for KLS (Table 3).

REFERNCES

Chandrasekhar Rao, C., P.R.S. Reddy and S.V. Krishna reddy. 2005. Evaluation of calcium nitrate as a nitrogenous fertilizer for FCV tobacco in NLS of Andhra Pradesh. Indian Journal of Agricultural Research. 39(3):198-202.

Collins W.K. and Hawks, Jr. S.K. (1993). Principles of Flue Cured tobacco production, NC State University. pp301.

. Dixit, C.K and A. M. Majumdar, 1995. Effect of mulching on water use efficiency, yield and quality of potato (Solanum tuberosum L) . Indian Journal of Horticultural Sciences, 24:289-290.

Jaffer Basha, S., J. Manjunath, P. Pulli Bai and C. Chandrasekhar Rao. 2019. Response of Bidi Tobacco (Nicotiana tabacum L) to foliar nutrition with N and K under rainfed conditions. Journal of Pharmacognosy and photochemistry, 8(1): 205-207 .

Lopez_ Lefabre, L.R., R.M. Rivero. P.C. Gracia, E. Sanchez, J.M. Ruiz and L. Romero. 2001. Effect of calcium on mineral nutrient uptake and growth of tobacco. J. Sci. Food Agric., 81 1334-1338.

Mahadevaswamy, M.2017. Foliar nutrition of Nitrogen and Potassium for optimizing the productivity and enhancing bright grade leaf production of FCV tobacco in KLS. Tob. Res. 43(1):27-31.

Smith. W.2009. Managing nutrients In: flue Cured tobacco Guide. North Carolina University. Raleigh, NC. pp 58-81.

Table 3: Cured Leaf Quality parameters as influenced by Agronomic practices (Mean values)

Treatments	Dry zones			Semi dry zones		
	Nicotine %	Sugars %	Chlorides %	Nicotine %	Sugars %	Chlorides %
T_1	2.28	17.81	0.43	1.98	17.13	0.33
T_2	2.47	17.82	0.42	1.82	18.14	0.26
T_3	2.38	17.92	0.33	1.85	18.10	0.28
T_4	2.24	20.02	0.32	1.83	20.40	0.25
T_5	2.25	16.45	0.44	1.72	18.78	0.38
T_6	2.31	16.70	0.38	1.86	18.72	0.36
C.D. 5%	NS	NS	NS	NS	NS	NS