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ROLE OF VERMICOMPOST FOR SUSTAINABLE FLUE-CURED VIRGINIA TOBACCO (*NICOTIANA TABACUM*) PRODUCTION IN KARNATAKA LIGHT SOILS

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A field experiment was conducted for three consecutive seasons (2005-06 to 2007-08) to study the influence of graded doses of vermicompost (2,4, & 6 t/ha) on the crop growth, yield parameters, leaf quality and root-knot incidence in Flue-cured Virginia (FCV) tobacco grown in the light soils of Southern Transition Zone of Karnataka (STZ Zone No.7). The experiment was conducted with five treatments and four replications in a Randomized Block Design on red sandy loam soils, low in organic carbon, medium to high in available phosphorus and potassium status. Application of vermicompost @ 4-6 t/ha significantly influenced all the crop growth parameters like plant height, number of leaves and leaf expansion at 60 days after planting. Application of vermicopmost @ 2, 4 and 6 t/ha increased the cured leaf production by 8.4, 13.3 and 13.0% and top grade equivalent by 9.5, 15.5 and 14.5%, respectively over recommended NPK alone. Among all the treatments, vermicompost @ 4 t/ha along with recommended NPK recorded the maximum cured leaf yield and significantly higher top grade equivalent yield compared to the recommended FYM application (8 t/ha) + NPK schedule. The root-knot incidence (RKI) was also significantly decreased by the application of vermicompost @ 4-6 t/ha. The study revealed that application of vermicompost @4 t/ha along with the recommended NPK (60:40:120 kg/ha) was found to be ideal for maximizing the productivity and quality of FCV tobacco in Karnataka Light Soils.

Key words: FCV tobacco, KLS, Vermicompost

INTRODUCTION

Flue-Cured Virginia (FCV) tobacco (*Nicotiana tabacum*) is an important commercial crop grown under rainfed situation in the Southern Transitional Zone of Karnataka. As more than 80% of the produce is exported, sustaining its productivity and quality over the years is very important. FCV tobacco growing soils of the region are sandy to sandy loam in texture with poor moisture retention and cation exchange capacity. The recent study by Krishnamurthy *et al.,* (2006) clearly indicated that, while there is build up of available 'P' status in soils, there is faster depletion of organic matter content and potassium reserves in these soils due to continuous removal by the crop. Nutrient uptake studies on FCV tobacco under KLS conditions (with 60 kg N, 40 kg P_2O_5 and 120 kg K_2O) revealed that the crop removes 64.5 kg N, 18 kg P_2O_5 and 96 kg K_2O per hectare (Krishnamurthy *et al.,* 2003). Lack of organic manure application, excessive dependence on chemical fertilizers and large scale monocropping is greatly affecting the nutrient use efficiency resulting in poor and unsustainable productivity. Incidentally the soils are also prone to biotic stresses like nematode infection and wilt disease (Shenoi *et al.,* 2004). The locally available FYM is not only in short supply but also inferior in quality due to improper management. The other organics such as green manuring have their own limitation due to soil moisture constraints etc. Hence, the use of good quality organic manure with judicious use of chemical fertilizers is essential for increased and sustained production of this export oriented tobacco. The present investigation was taken up to assess the effect of vermicompost on the productivity, quality and root-knot nematode incidence in FCV tobacco under Karnataka Light Soil region.

MATERIALS AND METHODS

Field experiments were conducted at Central Tobacco Research Institute, Research Station, Hunsur, consecutively for three crop seasons (2004-05 to 2006-07) during *kharif* in a Randomized Block Design with four replications. The experimental soils were red sandy loam in texture with slightly acidic to neutral in soil reaction (pH 5.8-6.5), poor in soil organic carbon (0.34%), medium to high in available phosphorus (25-55 kg/ha) and potassium (280-400 kg/ha). Vermicomost at different doses (2, 4 and 6 t/ha)

and recommended FYM (8 t/ha) was applied at the time of planting as per the treatments. The nutrient content of the applied vermicompost revealed 1.1% N, 0.5% P_2O_5 and 0.6 % K_2O while that of FYM was 0.5% N, 0.15% P_2O_5 and 0.3% K_2O. The recommended dose of NPK @60:40:120 kg/ha in the form of CAN, DAP and SOP was applied to all treatments. Early planting (in the fourth week of May with popular variety Kanchan was done with recommended spacing of 100 x 55 cm adopting plot size of 10.0 x 3.3 m. Crop growth observations like plant height, number of leaves and leaf expansion were recorded at both 45 and 60 days after planting. Green leaf and cured leaf yields were recorded and Top Grade Equivalent was worked out for each treatment. Chemical parameters like nicotine, reducing sugars and chlorides were determined using standard procedures. The stalks were uprooted at the time of final harvest and root-knot index (RKI) for nematode infection was also recorded. The data were statistically analyzed and interpreted based on the mean value of three years.

RESULTS AND DISCUSSION

Growth parameters

The effect of vermicompost application on crop growth parameters like plant height, number of leaves per plant, leaf area (middle position) are given in Table 1. It was found that even though application of vermicompost did not significantly influence the crop growth parameters as compared to control at 45 DAT, it significantly influenced the growth parameters at 60 DAT. The crop growth parameters increased with the increase in the dose of vermicomopsot applied. However, there was no significant difference in growth parameters between 4 and 6 t/ha. Maximum crop growth values were observed at 6 t/ha. Application of vermicompost at 4 and 6 t/ha was found significantly superior to recommended NPK schedule as well as recommended NPK+FYM Schedule. All the vermicompost applied treatments showed significant increase in crop growth parameters as compared to recommended NPK which may be due to growth promoting hormones/ enzymes present in vermicompost apart from supply of mineral nutrients. Increase in germination percentage, root and shoot length, leaf weight, total biomass per plant and protein content of groundnut were observed by Kathiresawri *et al.* (2005) due to the application of vermicompost in the soil.

Yield parameters

Data on yield parameters like green leaf yield, cured leaf yield and top grade equivalent and the root-knot incidence are presented in Table 2. All the vermicompost applied treatments as well as recommended FYM schedule along with the NPK showed significant increase in cured leaf yield

Table 1: Effect of vermicompost on crop growth parameters of FCV tobacco grown in Karnataka light soil (2005-06 to 2007-08)

Treatments	45 DAT			60 DAT		
	Plant height (cm)	Leaves/ plant	12th Leaf area (cm^2)	Plant height (cm)	Leaves/ plant	12th Leaf area (cm^2)
FYM 8t/ha + NPK	8.5	9	318	19.1	15	534
Vermicompost 2t/ha + NPK	7.9	9	397	18.2	15	552
Vermicompost 4t/ha + NPK	8.1	9	485	18.2	15	549
Vermicompost 6t/ha + NPK	8.9	10	594	20.8	16	579
NPK alone (60:40:120 kg/ha)	7.0	8	216	14.3	14	390
SEm±	**0.52**	**0.39**	**17.8**	**0.52**	**0.20**	**17.4**
CD (P=0.05)	**NS**	**NS**	**55.1**	**1.44**	**0.80**	**54.0**

DAT-Days after planting; FYM-Farm yard manure

compared to recommended NPK schedule alone. While application of vermicompost @ 4t and 6 t/ha was significantly superior to recommend NPK + FYM treatment in terms of green leaf yield, cured leaf yields but both were on a par. Among all the treatments vermicompost at the rate of 4 t/ha recorded the maximum cured leaf yield and top grade equivalent. This treatment recorded 6% increase in the cured leaf yield and 7.5% increase in top grade equivalent compared to recommended NPK+FYM schedule indicating the efficacy of vermicompost over recommended dose of FYM. Top grade leaf production was significantly higher in vermicompst @ 4 t/ha compared to recommend FYM @ 8 t/ha indicating the effect of vermicomopsot on quality leaf production. Application of vermicompost @ 2, 4 and 6 t/ha increased the cured leaf production by 8.4, 13.3 and 13.0% and top grade equivalent by 9.5, 15.5 and 14.5% respectively over recommended NPK alone. Positive influence of organic amendments in improving the productivity of FCV tobacco has been reported by Giridhar *et al.* (2003). Kumareshan e*t al.* (2003) also reported positive effect on growth characters, cured leaf yield and quality of chewing tobacco by application of vermicompost.

Cured leaf quality and root - knot incidence

The different doses of vermicompost applied did not affect the cured leaf quality parameters. Among the vermicompost treatments, application of 4 t/ha recorded the highest leaf nicotine content with minimum reducing sugars (in L position). However all the cured leaf quality parameters like nicotine, reducing sugars and chlorides were in the normal acceptable range (Table 3). Application of vermicompost at different doses significantly reduced the root-knot incidence (RKI) by 54.3 to 42.2% indicating the efficacy of vermicomopst in the root-knot management (Table 2). Application of vermicompost @ 6 t/ha recorded significantly lower incidence of RKI compared to recommended NPK alone or recommended NPK+FYM. The possible suppression of root-knot nematodes in vermicompost treated plots and subsequent increase in yield of crop plants could be due to toxic products of decomposition of added organics (Ramakrishnan *et al.,* 1997; Raveendra *et al.,* 2003).

It can be concluded that since the application of vermicompost @ 4 t/ha produced maximum cured leaf and significantly higher top grade equivalent yield compared to FYM application @ 8 t/ha, vermicompost @ 4 t/ha along with recommended NPK can be advocated for maximizing both cured leaf yield and top grade equivalent of FCV tobacco besides managing the root-knot disease. The three years study has revealed that vermicomopost can be a superior and viable alternative source of organic manure and plays an important role in maintaining soil heatlh

Table 2: Effect of vermicompost on yield (kg/ha) and root-knot index (RKI) in FCV tobacco

Treatments	Green leaf yield	Cured leaf yield	Top grade equivalent	RKI	Reduction in RKI over NPK alone (%)
FYM 8t/ha + NPK	12058	1690	1319	2.05	29.5
Vermicompost 2t/ha + NPK	12271	1717	1350	1.68	42.2
Vermicompost 4t/ha + NPK	12740	1795	1418	1.50	48.5
Vermicompost 6t/ha + NPK	12929	1789	1411	1.33	54.3
NPK alone (60:40:120 kg/ha)	11381	1584	1232	2.91	-
SEm±	**226**	**45.4**	**29.2**	**0.21**	-
CD (P=0.05)	**628**	**126**	**81.0**	**0.59**	-

Table 3: Effect of vermicompost treatments on chemical quality of FCV tobacco

Treatments	Nicotine (%)		Reducing sugars (%)		Chlorides (%)	
	X	L	X	L	X	L
FYM 8t/ha + NPK	1.46	2.66	17.01	13.36	0.19	0.27
Vermicompost 2t/ha + NPK	1.36	2.63	17.10	14.20	0.20	0.28
Vermicompost 4t/ha + NPK	1.45	2.79	17.21	13.80	0.21	0.25
Vermicompost 6t/ha + NPK	1.35	2.41	17.37	13.90	0.24	0.28
NPK alone (60:40:120)	1.43	2.70	17.63	14.10	0.22	0.30
SEm±	**0.024**	**0.031**	**0.100**	**0.258**	**0.005**	**0.007**
CD (P=0.05)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

and sustaining FCV tobacco production in the red sandy loam soils of FCV tobacco growing region in Karnataka.

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