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RESOURCE USE EFFICIENCY AND SYSTEM PRODUCTIVITY AS INFLUENCED BY CROP INTENSIFICATION IN FCV TOBACCO GROWING VERTISOLS OF ANDHRA PRADESH

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In the present context of doubling the farmer's income, crop intensification and diversification is one of the most reliable and suggested interventions for enhancing resource use efficiency and productivity. Crop intensification with pre-tobacco season crops like maize/sorghum during rainy (*kharif*) season followed by tobacco during post-rainy (*rabi*) season are best available options instead of Fallow- tobacco which is generally followed by the farmers over the years. In view of this, a field experiment was carried out at ICAR-CTRI research farm, Katheru, Rajahmundry on Vertisols to evaluate the crop intensification and diversification strategies for higher system productivity and resource use efficiency. Results revealed that highersystem productivity based on tobacco leaf equivalent yield (TLEY) of 1900 kg/ha was recorded under maize-tobacco system followed by sorghum-tobacco (1758 kg/ha) compared to the existing fallow-tobacco system (1507 kg/ha). Maize-tobacco and sorghum-tobacco systems also recorded highest land use efficiency (65.5 % and 63.3 respectively), relative production efficiency (+26.1% and + 16.7%, respectively) over the existing fallow-tobacco system. Maize–tobacco system also recorded highest system profitability (232 Rs./ha/day) compared to all other systems.

INTRODUCTION

Tobacco (*Nicotiana tabacum* L.) is an important commercial crop grown in an area of 4.5 lakh hectares in India. It is contributing a sizeable foreign exchange (6000 Cr) and excise revenue (22,378 Cr) apart from employment and livelihood opportunities to 45.7 million people. Flue-cured Virginia tobacco (FCV) is a major tobacco type grown in the states of Andhra Pradesh and Karnataka to an extent of 1.45 lakh ha which accounts to 30% of the total tobacco production in the country. The crop is generally grown during *rabi* season on conserved soil moisture in traditional black soils (Vertisols) covering Guntur, Krishna, East and West Godavari districts in Andhra Pradesh. At present the crop is facing several production impediments *viz.*, resource degradation, climate change, deforestation and escalation of production costs that affects the farmers' income (Reddy and Prasad, 2016). Crop intensification is one of the important approaches for enhancing resource use efficiency, system productivity, profitability and soil health in FCV tobacco growing regions of Andhra Pradesh. Sustainable crop intensification aims to enhance the output and returns from the same land by increasing the on farm resource efficiency, natural resource conservation with a due emphasis on reducing the negative impact on the environment. Cropping system diversification refers to a shift from often a less productive, less resilient and less sustainable crop or cropping system to a more productive, resilient and sustainable system (Reddy, 2016). Crop diversification in FCV tobacco growing areas is seen as an important strategy in the context of changing tobacco policy regimes and stakeholders' concerns on livelihood security, health and environmental issues related to production and consumption of tobacco (Reddy and Prasad 2016). In this context various cropping systems were evaluated for enhancing the resource use efficiency and system productivity in the FCV tobacco growing Vertisols of Andhra Pradesh.

MATERIAL AND METHODS

A field experiment was conducted during rainy (*kharif*) and post rainy (*rabi*) seasons during 2017-18 at research farm of Central Tobacco Research Institute, Rajahmundry, (16° 59' N and

Key words: System productivity, Crop Intensification, Vertisols

81 48' E at 25.3 m above mean sea level) in East Godavari district of Andhra Pradesh. It is a hot dry, sub humid semi arid tropical climate with an average annual rainfall of 1100 mm. The experimental soils were Godavari deltaic alluvium-derived Vertisols, slightly alkaline (pH 7.71), low in electrical conductivity (0.31 dS/m), available N (233 kg/ha) and organic carbon (0.40 %), high in available phosphorus (36.0 kg/ha) and potassium (414 kg/ha).The treatments include, three *kharif* crops (fallow, maize (var. DHM 117) and sorghum (var. CSH 16) and three *rabi* crops (tobacco (var. Siri), chickpea (var. JG-11) and mustard (Pusa mustard 25) in a system mode in a split plot design replicated four times. The recommended seed rate, spacing, fertilizers and all other agronomic interventions were followed to raise these crops. The grain yields of *kharif* and *rabi* season crops (Non-Tobacco) *viz.*, maize, sorghum, chickpea and mustard were converted into tobacco leaf equivalent yield (TLEY) based on prevailing market prices. System productivity was worked out by adding tobacco leaf equivalent yield of *kharif* season crops to their respective *rabi* crop component (tobacco leaf yield or tobacco leaf equivalent yield (TLEY) of chickpea or mustard). Land use efficiency (LUE) was calculated with the formulae LUE (%) = TND (i) /365 100, where TND (i) is total number of days (TDN) field remained occupied under different crops in a system (i=1…n). Relative production efficiency (RPE) was calculated by formulae RPE (%) = (EYD-EYE)/EYE 100, where, EYD = equivalent yield under improved/diversified system, EYE = equivalent yield under existing system and System profitability = (net returns /ha)/ 365 days.

RESULTS AND DISCUSSION

Among the various cropping systems studied, maize-tobacco (1900 kg/ha) and sorghum-tobacco (1758 kg/ha) were best cropping system in terms of tobacco leaf equivalent yield (TLEY) than non-tobacco systems.Tobacco based systems with maize and sorghum recorded highest productivity which might be due to high yields in maize and sorghum coupled with high prevailing market

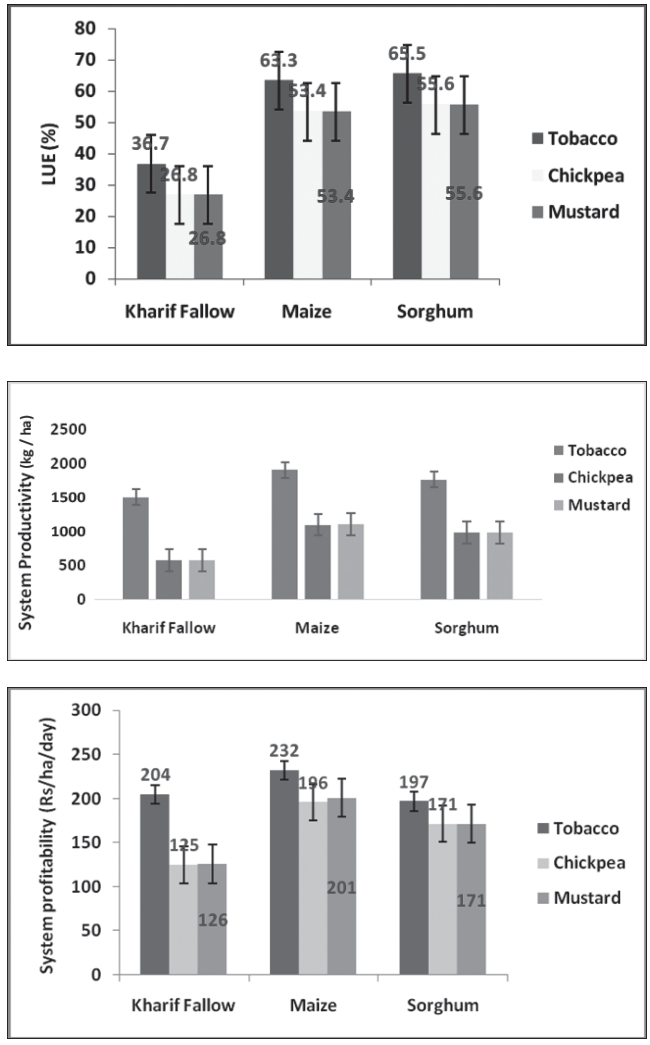

Fig. 1. Land use efficiency (%), system productivity (kg/kg) and system profitability (Rs./ha/day) influenced by crop intensification and diversification

Table 1: Relative production efficiency of different cropping systems influenced by crop intensification and diversification

Treatment	Kharif Fallow	Maize	Sorghum
Tobacco	-	+26.1	+16.7
Chickpea	-61.7	-27.3	-34.6
Mustard	-61.8	-26.6	-34.9

prices. High productivity levels of maize and sorghum in *kharif* season as preceding crop followed by tobacco in *rabi* season enhanced the overall productivity and resource use efficiency. Maize-tobacco and sorghum-tobacco systems recorded highest relative production efficiency (+26.1% and + 16.7%, respectively) over the existing fallow-tobacco system. Highest land use efficiency was also recorded under sorghum-tobacco (65.5%) and maize –tobacco (63.3%) systems. Highest system profitability of 232 Rs./ha/day was also recorded under maize –tobacco system compared to all other systems studied. Earlier studies also revealed that monocropping of crops other than tobacco are not as remunerative as that of tobacco crop based on prevailing market prices, while cropping systems are remunerative (Kasturi Krishna *et al.,* 2007 and Krishna Reddy *et al.,* 2007).

CONCLUSION

Based on the system productivity, profitability and resource use efficiency, maize-tobacco cropping system was found to be highly productive and efficient and could greatly enhance farm returns in FCV tobacco growing Vertisols of Andhra Pradesh.

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