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RESEARCH ARTICLE

Sustainable farming systems for hill areas of north coastal Andhra Pradesh

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SUMMARY

An on-station farming system experiment was carried for two years during 2012-13 and 2013-14, at Agricultural Research Station, Seethampeta, Andhra Prtadesh, India to arrive a profitable farming system module for hilly and agency area of north coastal districts in Andhra Pradesh , where major population is scheduled tribes. Rice-Maize system,Paddy - Dairy - cum poultry system, Paddy- Fish – Banana-Vegetable system and Paddy-Dairy cum apiary system were the test modules, where rice- maize is the traditional system considered as check. Among different integrated farming system modules evaluated for two years for hilly areas of north coastal Andhra Pradesh showed that, Paddy -Dairy - poultry system recorded 202 per cent higher rice equivalent yield, 97 per cent higher gross returns, 191 per cent higher net returns and 134 per cent additional man days over sole crop component, while B:C ratio was higher with Paddy-Dairy cum apiary system.

Key Words : Integrated farming systems, Rice equivalent yield, Economics, Employment generation

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Phenomenon of unchecked population growth, urbanization and industrialization are leading to continuous reduction in availability of vital agricultural resources and also fragmentation of farm holdings, making farming operationally uneconomic. The Indian economy is principally agraian economy and the declining trend in size of land holding poses a serious threat to the sustainability and profitability of farming. Majority (82%) of our farmers at national level falls under marginal and small categories. The process of marginalization of land holdings is likely to continue further due to various demographic reasons. The per capita arable land has decreased from 0.34 ha in 1950-51 to 0.15 ha in 2000-01 and is expected to shrink to 0.08 ha in 2025. On the other hand, with more intensive agriculture, there has been an increasing stress on natural

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Module-1	Rice-Maize system	2000m^2	
Module-2	Paddy - Dairy - cum poultry system.	Area for fodder	: 900 sqm.
		Area of the poultry shed	: 100 sq.m
		No. of the Vanaraja. poultry birds	: 100 Nos
		Area for the cereals/pulses/oilseeds/fodder	: 1000 m^2
Module-2	Fish -Paddy cum horticulture system.	Area of the paddy field	: 1000 m^2
		Area for the fish pond around the paddy field	: 1000m^2
		No of banana plants around the field bund	: 20 plants
Module-4	Paddy-Dairy cum apiary system	Area of the paddy field	: 1000 m^2
		Area for fodder and cattle shed	:1000m^2
		No. of dairy cattle in the system	: 4
		No of apiary units	: 5

resource base in several parts of the country. Therefore, it is very essential to develop sustainable technologies and strategies especially for small and marginal farmers who constitute the major share of the farming community today. In this context, "farming system approach is one of the important solutions to face this peculiar situation as in this approach the different enterprises can be carefully undertaken and the location specific systems are developed based on available resources which will result into sustainable development" (Dashora and Singh, 2014). Integrated Farming system is a "judicious mix of one or more enterprises with cropping in which there is a complementary effect through effective recycling of waste / residues and encompasses additional source of income to the farmers". Integrated farming system is a multidisciplinary holistic approach and proved to be effective in solving the problems of small and marginal farmers throughout the world and suits well for Indian conditions in general and hilly tracts of Andhra Pradesh in particular where majority of population is scheduled tribes with very small holdings with poor economic status. "Integrated farming systems enhanced the productivity as well as the profitability and sustainability compared to the conventional farming system and earned seven times higher net monetary returns" (Mohanty *et al*., 2010). Keeping this in view, an experiment was undertaken to make linkage between individual components are in vogue with farmers to evolve a suitable profitable and acceptable farming systems for tribal farmers and hilly regions.

MATERIAL AND METHODS

An on-station farming system experiment was carried for two years during 2012-13 and 2013-14, at Agricultural Research Station, Seethampeta, Andhra Pradesh, India to arrive a profitable farming system module for hilly and agency areas of north coastal districts in Andhra Pradesh, where major population is scheduled tribes with very small holdings. The soil was sandy clay loam having pH 6.95, organic carbon 0.71 per cent, available nitrogen 297 kg ha^{-1}, available P_2O_5 30.1 kg ha^{-1} and K_2O 341 kg ha^{-1}. Rice - Maize system, Paddy - Dairy - cum poultry system, Paddy- Fish – Banana-Vegetable system and Paddy-Dairy cum apiary system were the test modules where rice- maize is the iumproved cropping system considered as check. MTU 1001 rice variety, DHM 117 Maize hybrid, Vanaraja is an improved breed of poultry, dwarf cavindish banana variety, Katla grass carp and mrugala were the fish breeds, cauliflower and cowpea were the vegetables, Jersey improved cow breed selected for study. Local market price of different inputs and outputs considered for calculation of cost of production and returns. All the components value considered as arrived the rice equivalent yields. Eight hours working considered as one man day.

RESULTS AND DISCUSSION

Perusal of consecutive two years and mean of two years data revealed that, all the IFS modules performed well and enhanced productivity and returns besides employment generation over sole cropping system (Table 1 and 2). Among different IFS modules, Paddy - Dairy - poultry system produced higher rice equivalent yields and resulted to higher gross returns, net returns and generated more man days per annum. Poultry component especially Vanaraja birds were proved to be regular with higher capacity of egg laying in case of layers and very swift

natural growth of broilers with low cost of maintenance and steady and regular income from dairy component probably the reson behind the impressive performance of Paddy - Dairy - poultry system compared to other components. Biswas (2010) reported that "the farming system revolves around better utilization of time, money, resources and family labour and also the farm family gets scope for gainful employment round the year thereby ensuring good income and higher standard of living even from the small holdings". Two years mean of Paddy - Dairy - poultry system recorded 202 per cent higher rice equivalent yield, 97 per cent higher gross returns, 191 per cent higher net returns and 134 per cent additional man days over sole crop component. Better resource utilization with lesser dependence on costly off-farm inputs might be reason behind the superior performance of Paddy - Dairy - poultry system. Jagadeeshwara *et al*. (2011) reported that "the productivity of IFS was 26.3 per cent higher than the conventional system".

Though the Paddy- Fish – Banana-Vegetable system was the second best module in terms of rice equivalent yield and gross returns , due to higher cost of production recorded lowest net returns and B:C ratio. Whereas Paddy-Dairy cum apiary system proved better over Paddy- Fish – Banana-Vegetable system in terms of net returns and man days generated per ha besides resulted to the highest B: C ratio among all IFS modules. Ramasamy *et al*. (2008) reported that "the income from integrated crop+ livestock + goat + poultry was Rs. 98,270 than Rs. 28,600 in traditional farming system and similarly income of Rs. 99,209 in IFS with the crop+livestock +goat + poultry than conventional farming system". Higher employment generation and besides spread of income throughout the year are some of the positive notable aspects with IFS modules over sole cropping. Singh *et al*. (1997) observed that "the integration of various enterprises on various sizes of land holdings tend to be more profitable than arable farming alone, and generate more employment". The impressive productivity, profitability of different modules of IFS over sole arable cropping appeared to be the answer for averting the declining trend of factor productivity in many intensive farming situations especially for small and marginal farmers "Adoption of IFS could generate additional income ranging from Rs.9,000 to Rs. 2,00,000 per hectare, depending on inclusion of number and kind of additional farm enterprises and their effective combination was also previously" reported by Ponnusamy and Gupta (2009).

Table 1 : Rice equivalent yield, cost of production and gross returns as influenced by different IFS modules

IFS modules	Rice equivalent yield (kg ha^{-1})			Cost of production (Rs. ha^{-1})			Gross returns (Rs. ha^{-1})		
	2012-13	2013-14	Mean	2012-13	2013-14	Mean	2012-13	2013-14	Mean
Rice-Maize	10093	9857	9975	121110	115250	118180	71103	75150	73127
Paddy – Dairy – poultry system	31250	28980	30115	261000	289277	275139	132500	155500	144000
Paddy- Fish – Banana-Vegetable system	11125	12525	11825	133500	142700	138100	85000	90000	87500
Paddy-Dairy cum apiary system	11250	11550	11400	172500	181500	177000	72500	75500	74000

Table 2 : Net returns B:C ratio and man days generated per ha as influenced by different IFS modules

IFS Modules	Net returns (Rs. ha^{-1})			B:C ratio			Man days generated per ha		
	2012-13	2013-14	Mean	2012-13	2013-14	Mean	2012-13	2013-14	Mean
Rice-Maize	50007	40100	45054	1.70	1.53	1.62	513	521	517
Paddy -Dairy - poultry system.	128500	133777	131139	1.97	1.86	1.92	1213	1203	1208
Paddy- Fish – Banana-Vegetable system.	48500	52700	50600	1.57	1.59	1.58	818	810	814
Paddy-Dairy cum Apiary system	100000	106000	103000	2.38	2.40	2.39	945	950	948

Conclusion:

Among different IFS modules evaluated for two years for hilly areas of north coastal Andhra Pradesh showed that, Paddy -Dairy - poultry system recorded 202 per cent higher rice equivalent yield, 97 per cent higher gross returns, 191 per cent higher net returns and 134 per cent additional man days over sole crop component, while B:C ratio was higher with Paddy-Dairy cum apiary system.

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