Agro Economist - An International Journal
Citation: AE: 5(2): 55-59, December 2018
DOI: 10.30954/2394-8159.02.2018.1

Diversified Farming System: The Answer to Achieve Triple Challenges of the Present day Indian Agriculture

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ABSTRACT

The sustainability of conventional agriculture practice in India is under threat from the continuous degradation of land and water resources, and from declining yields due to indiscriminate use of agro-chemicals. Sustainable agriculture practice with less pressure on natural resources is necessary to achieve triple challenges of Indian agriculture, viz., sustainable productivity, nutritional security and poverty eradication. Diversified farming system (DFS) is one such option to achieve the triple challenges of agriculture. The results indicated that, DFS generated year round annual income with the benefit- cost ratio ranging from 2.93 to 4.23 with an annual employment generation of more than 400 man-days during the study period.

Keywords: Conventional agriculture, sustainable productivity, nutritional security, poverty eradication, diversified farming system

Indian agriculture has come a long way from post-independent subsistence nature to present day market-led commercial agriculture. The paradox is, that the country has become self-sufficient while, the farmers have become market dependent not only for the agricultural inputs but also for their family food requirements. Commercialization of agriculture has led to specialization and intensification of agriculture leading to over exploitation of natural resources. In the meantime the ever increasing population of a country has resulted in decreasing land-to-man ratio. As a net result, single enterprise farming especially, cropping alone has become unsustainable as it cannot provide a sustainable livelihood security to the farm families. This has led to increasing realization that the traditional times-tested farming systems that integrate supplementary and complimentary activities like agroforestry, livestock, poultry and other land-based activities can allow the recycling of the by-products of one enterprise in the other as well as better utilization of natural resources and man power. Diversified farming system (DFS) is a traditional system of agricultural production through a range of practices that incorporates agro-biodiversity across multiple spatial and/or temporal dimensions which provides critical inputs for agriculture. The focal point of DFS is to maintain, restore and regenerate agro-biodiversity through better ecosystem services like soil fertility, soil flora and fauna, nitrogen fixation, pollination and natural pest control which provides critical inputs for agriculture. Hence, the study was an attempt to assess the DFS in the dimensions of agricultural sustainability as productivity, economical

profitability and employment opportunity over single crop enterprise.

Methodology

An attempt was made to study the benefits and profitability of diversified farming over single crop enterprise at the model farm developed at the University of Agricultural Sciences, Gandhi Krishi Vignana Kendra, Bengaluru, Karnataka. The one hectare model farm under rainfed condition included crop production, agroforestry, dry land horticulture, fodder crops, sheep rearing, dairy, poultry, fishery, compost making and kitchen gardening (Table 1).

Table 1: Crops and other enterprises included in one ha of DFS and conventional cropping system

Crops and cropping system	Area (ha)
Diversified farming system	
Finger millet +Red gram (8:2)	0.40
Kitchen garden of vegetable crops	0.06
Flower crops (Chrysanthemum, crossandra)	0.10
Agroforestry	
Tree lopping	Boundary/bunds
Biomass (Glyricidia)	Bunds
Grass/Fodder	0.20
Dry land orchard + Ragi + Mango	0.20
Livestock component	
Poultry birds (10+1)	
Sheep (5+1)	
Cows (2)	
Compost/Vermi compost	
Fishery (Farm Pond)	0.04
Conventional farming system	
Finger millet + Red gram (8:2)	1.00

Data were collected from the records maintained at AICRP, Agroforestry for a period of six years (2008-09 to 2013-14) and information about a control plot of one ha conventional crop production was also collected. The collected data were subjected to various economic analyses viz., tabular presentation, averages, percentage and benefit: cost ratios.

RESULTS AND DISCUSSION

Comparative economics of diversified farming and conventional cropping system

An economic evaluation with respect to net returns and cost of production in DF over conventional farming system (CFS) over a period of time is depicted in Figs 1-3. On an average, the cost of production (COP) for one ha DFS was ₹ 62433 and the net returns realized was ₹ 142,308. In case of CFS, the cost of production was ₹ 16210 and the net returns realized was only ₹ 20520. It was mainly due to the fact that, as the number of enterprises increases, automatically the profits gained was also increased due to better utilization of resources, which are obtained from the components included in DFS.

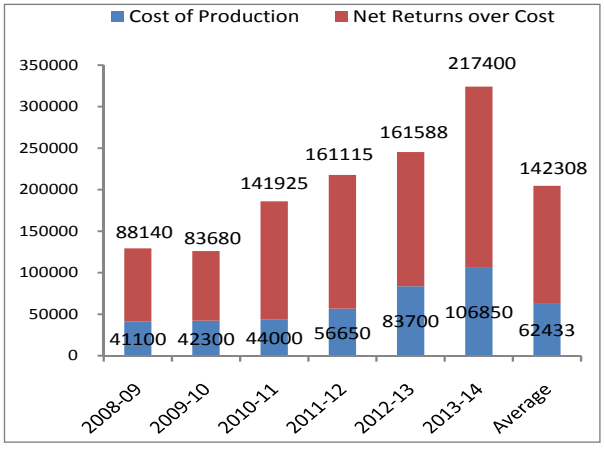

Fig. 1: Net returns and COP for 1 ha of DFS

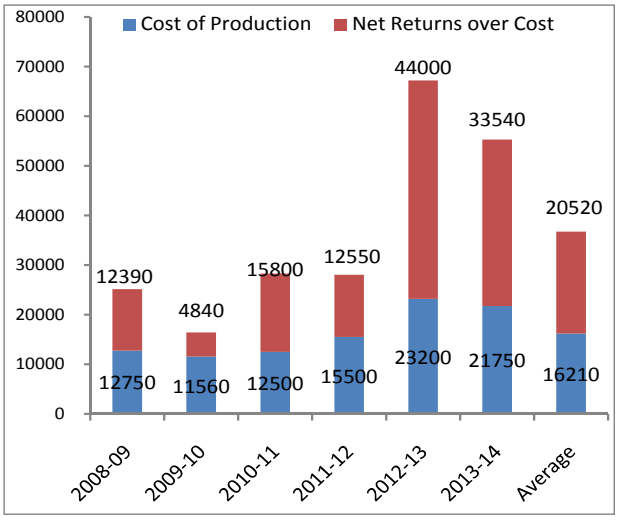

Fig. 2: Net returns and COP for 1 ha of CFS

Benefit cost ratio

The benefit: cost ratio for DFS as well as CFS was compared. It was clear from the data (Fig. 3) that B:C ratio for DFS was found to be higher over a six years ranging from 2.93 to 4.23 than that of CFS ranging from 1.42 to 2.90.

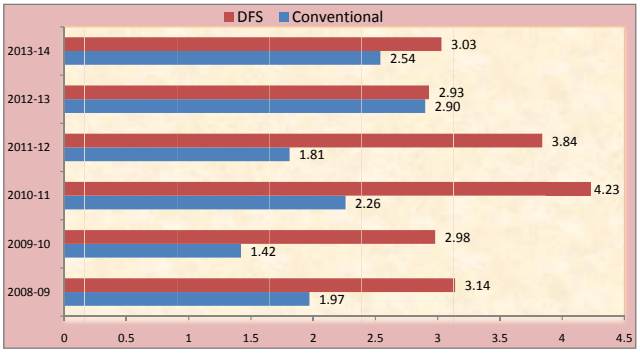

Fig. 3: Benefit cost ratios of diversified farming system versus conventional farming system

Employment generation

It is clear from the graph (Fig. 4) that, the DFS generates huge employment opportunity with a tune of more than 400 man-days/year in all the years compared to less than 100 man-days/ year in the CFS. In the year 2013-14, there was 685 man-days of employment was created in the DFS. The reason attributed to this high employment was due to the more number of activities included in the system.

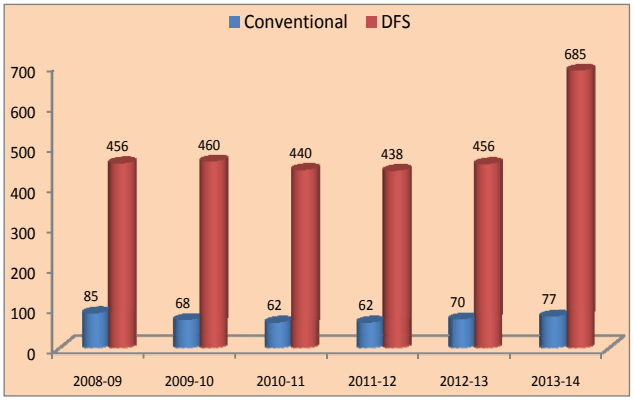

Fig. 4: Employment generation over the years in the DFS and CFS

Sustainable Yield Index and Sustainable Value Index

A sustainable value index (SVI) is the ratio of absolute value of the difference of average net income (ANI) from 1.96 times standard deviation of ANI's to the maximum net income in the whole period. In this way the SVI will take account of both variability and maximum net income over the years in the system. Similarly, sustainable yield index (SYI) can also be calculated by using the formula,

$$SYI = [Y - SD] / Y_{max} \quad Y = mean\ yield$$

The results of SYI and SVI are presented in Tables 2 and 3.

Table 2: Sustainable Yield Index for major crops grown under diversified farming system

Year	Finger millet	Deviation	Red gram	Deviation	Cowpea	Deviation
2008-09	750	167.33	350	184.17	60	12.83
2009-10	869	48.33	75	90.83	60	12.83
2010-11	1200	282.67	200	34.16	30	17.16
2011-12	985	67.67	205	39.16	40	7.16
2012-13	904	13.33	90	75.83	45	2.16
2013-14	796	121.33	75	90.83	48	0.83
Average	**917.33**		**165.83**		**47.17**	
Max	1200		350		60	
SYI	0.70		0.33		0.69	

Table 3: Sustainable Value Index for major crops grown under diversified farming

Year	Finger millet	Deviation	Red gram	Deviation	Cowpea	Deviation
2008-09	5400	5737.50	7000	722	900	858.33
2009-10	4690	7047.50	4500	1778	1800	41.66
2010-11	11300	262.50	10000	3722	1500	258.33
2011-12	10835	902.50	8000	1722	1750	8.33
2012-13	15800	7862.50	4068	2210	3000	1241.66
2013-14	14380	5562.50	4100	2178	1600	158.33
Average	**10400.83**		**6278**		**1758.33**	
Max	15800		10000		3000	
SVI	0.52		0.51		0.48	

Table 4: Sustainable Value Index for diversified farming system and conventional farming system

Year	Conventional cropping system	Deviation	DFS	Deviation
2008-09	12390	8130	88140	54168
2009-10	4840	15680	83680	58628
2010-11	15800	4720	141925	383
2011-12	12550	7970	161115	18807
2012-13	44000	23480	161588	19280
2013-14	33540	13020	217400	75092
Average	**20520**		**142308**	
Max	44000		217400	
SVI	0.31		0.55	

The SYI value for finger millet was 0.70 which indicates higher sustainability with respect to yield compared to cowpea (0.69) and red gram (0.33), respectively. Similarly, the SVI value was highest for finger millet (0.52) followed by red gram (0.51) and cowpea (0.48) (Table 3). The SVI for overall system (Table 4) for DFS (0.55) was more than that of CFS (0.31). Hence, better sustainability was achieved in the DFS due to the fact that various resources, inputs and farm operations were managed in an effective manner which improved the productivity and efficiency of the system. In addition, DFS also provides other requirements of the family like, cereals, pulses, fruits, vegetables, egg, meat, fodder, fiber and flowers which not only meet the food requirements of the family but also ensures balanced nutritional diet and additional income.

CONCLUSION AND POLICY IMPLICATIONS

The DFS involves both crop and non-crop components that are economically viable than the CFS. The DFS not only enhances income by minimizing risk factors but also provides employment opportunities during the leisure period as disguised unemployment is high in single crop enterprise and farmers are busy only during cropping season. It is time to increase the water productivity (i.e., per drop more crop) rather than land productivity as the water resource are dwindling rapidly in the country. Hence, the DFS will address the water crisis as the various resources, inputs and farm operations are managed in an efficient manner which improves the productivity and efficiency of the system. So, there is an important role for formulation of policies and regulations to promote and enhance DFS. Further, public and private investment in the development of low-cost, practical technologies should be encouraged.

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