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Farming systems characterization of southern transitional zone of Karnataka, India

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Abstract
The study was conducted in Davangere district coming under Southern transitional zone (Zone-7), Karnataka. The data were collected from 180 farm house holds through questionnaire survey; three predominant farming systems were identified with different sources of income and resource base. F_1- Cropping system alone, F_2- (Cropping system + livestock) and F_3- (Cropping system + livestock + Horticulture). The survey results indicated that, in F_3 farming system marginal and small farmers who adopted Cropping system + livestock received more profit and it is well suited for varied agro- ecological and socio- economic condition of the farmers. Similarly, medium and large farmers prefer to adopt additionally horticulture component for getting better income. As per characterization survey, active participation of women was found more in purchase, sale of animals and hiring of agriculture labourers. It is concluded from the survey results; integration with different farming situations which are interdependent each other, economically feasible and provides means of production through resource recycling and employment generation and solving fuel crisis with ecological balance.

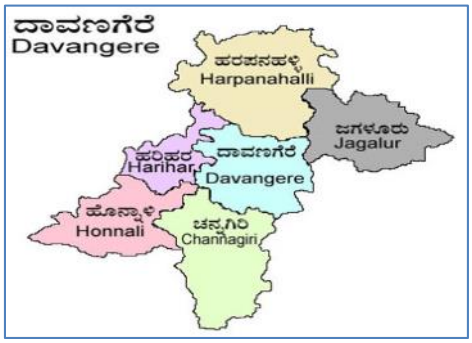
Keywords: integrated farming system, characterization, socio-economic condition, resource recycling

Introduction
Indian farming system is heterogeneous in terms of varied agro-ecology and resource availability. However green revolution has brought self-sufficiency but much of its technological progress that transformed agriculture was found in irrigated areas while, it has failed to register a significant growth in rain-fed and dry land areas. Rain-fed agriculture eco-system usually have irregular and scanty rainfall pattern with low productive potential soil type which is more prone to high level of land degradation thus leading to reduced level of productivity and livelihood opportunities of farming communities. In a view of this, Integrated farming system is being recognised as a suitable alternative intervention in managing natural resources and to increase the farmers income in rain-fed agriculture ecosystem. Gradual shrinking of land holding and growing demand for food has made necessary to integrate land based enterprises like crop, dairy, fishery, poultry, horticultural crops, agro-forestry, etc. within the bio-physical and socio-economic environment of the farmers to make farming more commercial, profitable and sustainable. Therefore, technological and socio-economic interventions can be effectively combined to improve the productivity of rain-fed agriculture, allied agriculture enterprises and natural resource base. Employment generation resulted from adoption of intensive cultivation of crops and vegetables round the year under rainfed conditions provides a lot of employment opportunities and keeps farmers and their family members engaged for more time and helps in improving the economic condition of marginal and small farmers. Strengthening agricultural production systems for greater sustainability and higher economic returns, employment generation, food and nutrition security in the country, helps in retention of farming communities in agriculture occupation itself and avoids rural youths migration to cities in search of jobs which in turn reduces burden on providing urban amenities to the fast growing cities.

Materials and Methods
The present study was undertaken to identify the predominant farming system in Davangere district of Karnataka (Southern transitional zone-7) and to characterize them by important socio-economic indicators.

Area of the study
District is located in the mid-eastern region of the Karnataka state, and geographic coordinates

lies between the 14°27'14.58" N latitude and 75°55' 07.99" E longitude. Major part of the district is covered by red sandy soil and followed by black soil. The district enjoys semi-arid climate, dryness and hot summer in the major part of the year. In the last decade (1996-2005) the district received an average annual rainfall of the 607.57 mm. Sulekere Halla is a major stream that flows through Davangere and Harihara taluks. The district has a literacy rate of 75.74 in 2011 compared to 67.43 of 2001. There was change of 8.63 percent in the population compared to 2001 censes and with regards to sex ratio district stood at 972 per 1000 male compared to 2001 census figure of 952.



Sampling and data analysis

Survey of 180 households was conducted with a focus on socio-economic information and income of the farmers from different farm enterprises. This data was used for identification of predominant farm types for the region and farm management related information. Apart from socio-economic parameters of the households, farm size, infrastructural facilities, information on cost of cultivation and yield of different crops, and price received by the farmers were included in the data collection instrument. Taluks and villages are purposively selected and 12 Marginal, 8 Small, 5 Medium, 5 large farmers from each village are randomly selected.

Taluk	Name of the Village	No. of sample households
Channagiri	Marabanahalli	30
	Nilogal	30
	Hosalli	30
Honnali	Singatagere	30
	Neralagundi	30
	Taraganahalli	30
	Total	180

Budgeting technique

Complete farm budgeting technique has been employed in order to determine the optimum utilization of available resources within the farm and to examine whether the farmer is in profit or not under various combinations of enterprises. Microsoft excel work sheet has been employed for data analysis technique.

- Cost of Cultivation: Cost of all inputs used, for all enterprises of the farming system including the cost of family labour
- Gross Return: Total revenue earned from all the components of the farming system
- Net Return: Gross Return – Total Cost of Cultivation

Constraint analysis

Henry Garrett Ranking Method is employed to rank different constraints faced by farmer respondents is followed different farming system.

Percentage position = $100\ (R_{ij} - 0.5)/\ N_j$

Results and Discussion

Socio-economic characterization

Table: 1 represents general information of sample respondents regarding education, age, land holding, family type, caste and occupation.

Table 1: Socio-economic characteristics of sample households

Particulars	Frequency	Particulars	Frequency
Education		**Average holding size (ha.)**	
Illiterate	34	Marginal (<1.00)	0.8
Primary	46	Small (1.00-1.99)	1.6
Upto 10th	56	Medium (2.00-3.99)	2.9
PUC	23	Large (>4.00 ha.)	8.4
Degree and Higher	21		
Age		**Family type**	
Less than 35	16	Joint	125
35 to 55	90	Nucleus	55
More than 55	74		
Caste		**Agriculture as occupation**	
General	69		
OBC	44	Main	153
SC/ST	57	Subsidiary	27
Minorities	10		

Identification of Farming Systems

Based on the survey conducted for the southern-transitional zone of Karnataka, Six major Farming Systems have been identified:

1. Cereal based farming system (27.22%)
2. Plantation crop farming system (28.89%)
3. Fruits and Vegetables based farming system (8.89%)
4. Livestock based farming system (23.33%)
5. Pulses and Oilseed based farming system (6.67%)
6. Sugarcane based farming system (5.56%)

The major identified farming system which were followed by 180 sample respondents taken 90 each from Channagiri and Honnali taluk are represented in the Table-2. The study found that the highest percentage of sample respondents are following plantation based farming system as which contributes 28.89 percent and followed by Cereal based farming system (27.22%) and Livestock based farming system (23.33%). Other farming enterprises such as, Fruits and Vegetables (8.89%), Pulses and Oilseed (6.67%) and Sugar cane based farming systems (5.56%) contribute very less.

Particularly in Channagiritaluk, 23 farmers (32.22%) practice are canut based plantation farming system, as it is predominant plantation crop of the region under irrigated and rainfed situation. Honnali taluk which comes under rain fed and dry land situation and predominant crops of the taluk are maize, groundnut, onion, pulses and finger millet. The sample of 29 farmers (32.22%) are practicing cereal based cropping system. Similarly, livestock based farming system is a dominant enterprise in both the taluks as it provides rural women employment and household nutrition which contributes 24.44 and 22.22 percent in Channagiri and Honnali taluk respectively. The study area is also suitable for growing sugarcane, vegetables (such as, Gerkin, Tomato, Chilli, Brinjal, Bendi, etc) and fruits such as papaya, banana, etc.

Table 2: Categorization of farmers based on farming system and land holding in Southern-transitional zone

Farming Systems	Marginal		Small		Medium		Large		Total	
	No	%	No	%	No	%	No	%	No	%
Channagiri taluk - Productive Block										
Cereal based	9	25.00	5	20.8	3	20.00	3	20.00	20	22.22
Fruits & Vegetables based	4	11.11	2	8.33	1	6.67	1	6.67	8	8.89
Live-stock based	8	22.22	6	25	4	26.67	4	26.67	22	24.44
Pulses & Oil seeds based	3	8.33	1	4.17	1	6.67	1	6.67	6	6.67
Plantation crops based/ Spices based	10	27.78	9	37.5	5	33.33	5	33.33	29	32.22
Sugarcane based	2	5.56	1	4.17	1	6.67	1	6.67	5	5.56
Sub total	36	100	24	100	15	100	15	100	90	100
Honnali taluk - Under Developed Block										
Cereal based	12	33.33	7	29.2	5	33.33	5	33.33	29	32.22
Fruits & Vegetables based	3	8.33	2	8.33	2	13.33	1	6.67	8	8.89
Live-stock based	8	22.22	4	16.7	4	26.67	4	26.67	20	22.22
Pulses & Oil seeds based	3	8.33	1	4.17	0	0.00	1	6.67	5	5.56
Plantation crops based/ Spices based	8	22.22	9	37.5	3	20.00	3	20.00	23	25.56
Sugarcane based	2	5.56	1	4.17	1	6.67	1	6.67	5	5.56
Sub total	36	100	24	100	15	100	15	100	90	100
Total	72	100	48	100	30	100	30	100	180	100

Existing predominant farming systems

Among identified pre-dominant farming system that exists in the study area. It (Table: 3) clearly indicates that, the F_3 model (Crops+ Livestock+ Horticulture) has been adopted by highest number of farmers 65 with per cent share of 36.11 and it is found more profitable farming system over others. As F_3 model is an interdependent farming system approach for easy recycling of crop residue. Similarly, in F_1 model comprising majorly small (55.56%) and medium farmers (34.92%) and their choice is cereal (Paddy) based farming system since land is the limiting factor for production. Majority of the medium and large land holding farmers prefer to adopt horticulture based farming system (such as Arecanut, Black pepper, etc) as they are of commercially important.

Table 3: Different category of farmers practicing various farming system in Davangere district (N=180)

Category	Category of holding				
	Marginal	Small	Medium	Large	Overall
Crops (F_1)	35	22	4	2	63
% Share	55.56	34.92	6.35	3.17	35.00
Crops+ Livestock (F_2)	24	17	5	6	52
% Share	46.15	32.69	9.62	11.54	28.89
Crops+ Livestock+ Horticulture (F_3)	13	9	21	22	65
% Share	20.00	13.85	32.31	33.85	36.11

Livestock based farming system

In the rural areas, livestock based farming system is considered as a source of rural household employment and nutrition. Livestock component comprising dairy animals like milch cow, buffaloes are significantly contributing to the household income (Table-4). The main source of income of marginal and small farmers households was from livestock. The average net income from livestock per household per annum was Rs.30,667 for marginal, Rs.35,667 for small farmers and highest income was obtained by medium Rs.38,000 and Large Rs.63,300 farmers from livestock and they are maintaining highest number of animals. Hence to enhance the productivity, economic returns, nutritional values and employment, integration of dairy component is advisable [1].

Table 4: Average dairy population and milk production among different category of farmers practicing integrated farming at Davangere district

Category	Average number of Cows (No.)	Average number of Buffaloes (No.)	Milk production/ Animal / Annum (lt.)		Net income from livestock (Rs/annum)
			Cow	Buffalo	
Marginal	2-3	1-2	1020	617	30667
Small	2-3	1-2	1370	645	35667
Medium	3	2-3	1632	659	38000
Large	3-4	2-3	2065	711	63300
Total Average	3.15	2.16	1522	658	43399

Table 5: Economics of different Enterprises (Rs.)

Category	Crop			Horticulture			Livestock			Others
	TR	TC	NR	TR	TC	NR	TR	TC	NR	
Marginal	65500	25000	40500	58000	20000	38000	50000	19333	30667	27417
Small	90000	21000	69000	75000	32889	42111	65000	29333	35667	21000
Medium	120000	39167	80833	165000	60800	104200	78000	40000	38000	37333
Large	145000	48666	96334	512167	98000	414167	90000	26700	63300	71767
Total Average	105125	33458	71667	202541	52922	149620	70750	28842	41909	39379

*****TR-Total Returns, TC- Total Cost and NR-Net Returns

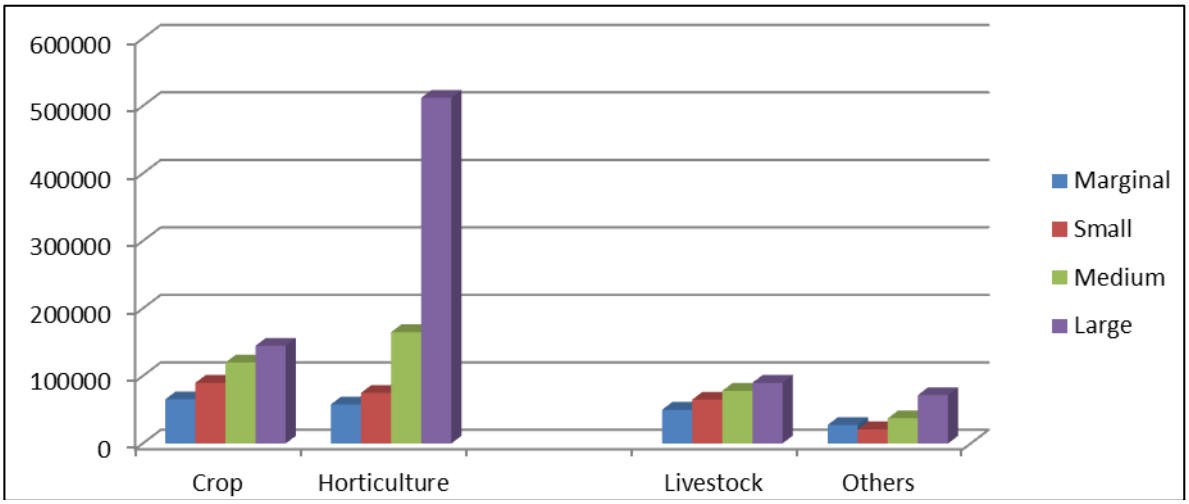


Fig 1: Share of total returns from different enterprises among categorized farmer respondents.

The survey clearly indicates that marginal and small farmers highest income contributed by livestock and crop component. Similarly, medium and large farmers income was contributed by horticulture based farming system approach (Fig.1) and these farmers are having high risk bearing ability compared to small and marginal farmers. Therefore it is clear from the study that farmers income is highest in F_3 (Crop+ Horticulture+ Livestock) model in the study area [2].

Employment generation from different farming systems

As per the survey data indicated that the employment generation from F_2 and F_3 models were more (517 and 761 mandays per year respectively) due to involvement of more number of components, whereas F_1 model has generated very less mandays (210 per year) (Fig.2). Thus Crop+ Horticulture+ Livestock component provides maximum employment generation compared to F_1 and F_2 models of farming systems [3].

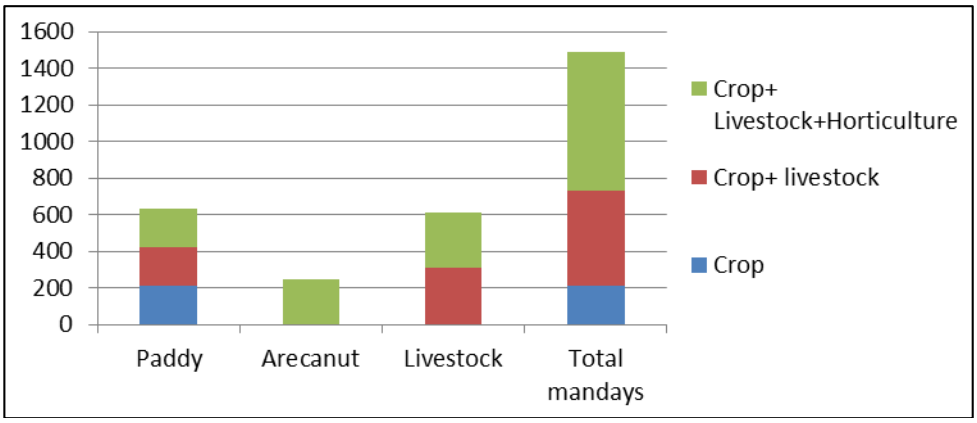


Fig 2: Employment availability existing in identified predominant farming system throughout the year.

Table 6: Employment generation in practicing in pre-dominant farming system in the study area (Mandays/per acre)

Components	Crop	Arecanut	Livestock	Total mandays
Crop (Paddy, Maize, Ragi)	210	-	-	210
Crop+ livestock	210	-	307	517
Crop+ Livestock+Horticulture	210	244	307	761

Table 7: Women's participation in decision making

Extent of women participation	Crop to be sown				Agricultural operations				Purchase and sale of farm animals				Borrowing and repayment of farm loan				Labour to be hired			
Land holdings of farmers (in ha.)	<1	1-2	2-4	>4	<1	1-2	2-4	>4	<1	1-2	2-4	>4	<1	1-2	2-4	>4	<1	1-2	2-4	>4
Nil	38	28	20	13	19	11	11	6	34	25	17	11	46	32	22	16	9	3	8	1
Only consulted	31	17	6	15	40	24	14	20	26	10	5	10	20	10	4	11	29	20	8	13
Opinion considered	3	1	2	0	11	11	3	4	5	6	3	5	4	3	0	0	27	17	11	14
Final decision	0	2	2	2	2	2	2	0	7	7	5	4	2	3	4	3	7	8	3	2

Nil=0, only consulted=1, Opinion considered=2, Final decision=3

The survey results indicated that role of women in decision making in various farming activities is found higher in marginal and small farming communities compared to large and medium farming communities.

Table 8: Major constraints prevailing in farming systems in the study area

Constraints	Marginal	Small	Medium	Large	Overall	Rank
Bio-physical constraints						
1. Lack of irrigation water	83.54	74.63	80.16	76.47	87.72	I
2. Scarcity of Labour	46.24	51.86	71.63	70.38	77.18	II
3. Lack of improved variety	14.9	41.42	10.6	15.45	71.77	III
4. Unpredictable weather	35.4	23.78	30.29	31.6	70.82	V
Socio-economic constraints						
1. Inadequate supply of electricity	70.11	60.4	72.3	78.23	69.83	VI
2. High input cost	40.88	39.22	34.89	10	71.16	IV
3. Non-availability of Farm credit	13.87	15.69	5.56	10	69.48	VII
4. Lack of technical advice	5.68	4.92	2.2	1.4	49.8	IX
5. Price fluctuation	22.4	23.6	25.78	30.88	53.2	VIII

The major Bio-physical constraint is non-availability of sufficient water sources which is to the extent of 87.72 per cent. The availability of water either from rainfall or ground water which is affects the agriculture activities significantly. Similarly, the non-availability of agricultural labourers at the right time of agricultural operations to the extent of 77.18 per cent. For Small and marginal farmers purchasing inputs (71.16 %) is one of the major constraint as it fetches one third of the total cost of cultivation. Unpredictable weather condition such as prolonged sunshine and un-even distribution of rainfall will destruct the standing crop and deteriorate the quality and quantity of the produce. Price fluctuation (53.2%) is also one of the most important constraints as it is noticed by all categories of farmers, higher price risk is noticed in case of large farmers as they mainly produce Arecanut as a sole or intercrop with Black pepper and Banana [4] and [5].

Table 9: Accessibility of Farmers' to credit facilities

Source	Marginal	Small	Medium	Large	Overall	% Share
RRB's	36	22	10	4	72	48.98
PAC's	19	8	2	3	34	23.13
Commercial banks	5	1	4	7	17	11.56
Friends	1	2	2	0	5	3.40
Land lords/Money lenders	4	2	0	0	6	4.08
Relatives	2	3	0	0	5	3.40
Informal sources	5	3	0	0	8	5.44

The survey results indicated that, maximum credit facilities was it was fulfilled by Regional Rural bank (48.98 %) followed by Primary Agriculture co-operatives (23.13%) and Commercial banks (11.56%). Marginal and small farmers borrowing credit is very high for both crop production and household consumption purpose whereas medium and large farmers requirement is for investing on security assets. This clearly indicates that farmers have better knowledge about banks and they are avoiding the exploitation from private money lenders as they charge higher rate of interest. In spite of these financial institutions, very few marginal and small farmers are still habituated to borrow from friends, relatives and informal sources (micro-finance such as Dharmastala, Grameen kuta, etc) whenever there is financial need.

Conclusion

The characterization survey conducted in the two taluks of semi-arid region of Southern transitional zone of Karnataka. The F_3 model (Crop + Horticulture + Livestock) has found to be the best farming system of integration, for getting higher farm income and stable employment all around the year. Thus, Integrated Farming System (IFS) provides better platform in generation of employment throughout the year, increased farm income, nutritional security and effective re-cycling of farm waste which improves standard of living of farm families. Dissemination of such farming system approach models will help in promoting sustainability in agriculture and its allied sectors and also establishment of Farmers' Producer Organization (FPO) will help small and marginal farmers in getting better price of their produce. The result from the study clearly indicates that integrated farming system approach is the best choice for sustainable production and effective management of natural resources.

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