



VEGETABLE BASED FARMING SYSTEMS TO AUGMENT FARM INCOME AND NUTRITION IN KOLAR DISTRICT, KARNATAKA

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ABSTRACT

The study was undertaken in Kolar district of Karnataka state. Four major cropping systems *viz.* Vegetable Based Small Cropping systems (VSC), Vegetable Based Large Cropping systems (VLC), Cereal Based small Cropping systems (CSC) and Cereal Based Large Cropping systems (CLC) were identified based on preliminary survey and previous studies in the area. The study based on the primary data obtained from 60 vegetable based cropping system (30 Vegetable Based Small Cropping systems (VSC) and 30 Vegetable Based Large Cropping systems (VLC)) and 60 Cereal Based Cropping systems (CC)(30 Cereal Based small Cropping systems (CSC) and 30 Cereal Based Large Cropping systems (CLC)) of 120 farmers covering equal samples under major cropping systems elicited through survey for 2011-12. The cropping income highest in VLC system (RS 371729/ha) and lowest in (Rs 33075/ha). The productivity is higher in VC system compare to CC system Input use pattern higher *i.e.* human labour (197 days) and FYM (10.94 t/ha) in VSC system. The Costs of cropping systems highest in VSC system (Rs. 2,19,179/ha) and lowest in CLC (Rs. 61,922.8/ha).

KEY WORDS: cropping system, input use, labour use, nutrient use.

INTRODUCTION

The ultimate goal of sustainable agriculture is to develop farming systems that are productive and profitable, conserve the natural resource base, protect the environment and enhance health and safety. To meet the objectives of poverty reduction, nutrition and food security, competitiveness and sustainability, several researchers have suggested farming system approach including the vegetable based farming system (IIVR, 2011 and IIVR Vision 2030). In the farming system as a whole, different cropping systems compete for the scarce resources such as land, labour and capital on the farm and also they exhibit interdependence due to supplementary or complementary relationship. Thus, it is necessary to deal with whole farm approach to minimize risk and increase the production and profit. Vegetable based farming system involves the allocation of available resources of a farm to the production enterprises in the manner that helps the attainment of the goals of maximization of farm income and employment. To put this concept effectively into practice it is necessary to understand the different vegetable based cropping systems in various farming systems.

METHODOLOGY

The study was undertaken in Kolar district of Karnataka state. In order to evaluate the objectives of the study, data was collected from both primary and secondary sources. Primary data required on the socio- economic characteristics, land holdings, inventory of implements and machinery, cost and returns of principal crops, non farm income was collected from the randomly selected farmers through personal interview using pre-tested structured schedule. The data was collected under four different categories as mentioned in the previous section

and it pertains to 2011-12 period of agricultural production of the district. The secondary data regarding cropping pattern, land utilization and general information of district were collected from Statistical Department, Kolar. For evaluating the objectives of the current investigation, the analytical techniques used are summarized as below. The procedure and method of costing of various inputs and that of outputs included in the study are detailed below.

Variable costs

The variable costs include cost on seeds, manure, fertilizers, wages of labour- human, machine and bullock labour, plant protection chemicals, irrigation etc. and interest on operational capital and repair and maintenance charges. The actual quantity of inputs used in production and amount paid to these inputs were taken as it for the following inputs. Seed/Seedling, chemical fertilizers, FYM, plant protection chemicals, hired labour- human, bullock and machine, Costs incurred by the farmers in marketing of crop produce were also included as the cost of production. These marketing costs include cost of packing, loading charges at the field, unloading charges at the market, transportation costs, market access and other incidental charges. For the own inputs which are available at farmers dispose imputed values were estimated as per the following procedure.

Own Labour: The wages paid to different hired labour components *viz.*, human, bullock, and machine, is taken as the value for the own labour input.

Seeds: The prevailing market price for the price is imputed for the own seeds of the farmers.

Farm yard manure: The prevailing price per tonne was used to impute the value of farmyard manure produced on the farm.

For calculating the cost of the input items as given below, the following procedure is followed.

Irrigation cost: The per hectare irrigation cost is estimated in two steps. In the first step, the annual value of the irrigation structure is estimated by dividing the total irrigation cost *viz.*, digging and bore well cost by its life span. To this annual cost, the cost of repair and maintenance is added and the sum is divided by the size of holding of the farms to get the per hectare irrigation cost.

Interest on operational capital: This cost is calculated at the rate of 12 per cent per annum based on the rate at which commercial banks advance crop loans and was apportioned to the crop based on its duration.

Fixed costs: These include depreciation on farm implements and machinery, interest on fixed capital, and land revenue. The measurement and definitions of fixed cost components are as follows.

Depreciation value of the implement: Per hectare depreciation of implements is estimated in two steps. In the first step, the depreciation value of implement used in the production is estimated by straight line method. To this annual cost, the cost of repair and maintenance is added and the sum is divided by the size of holding of the farm to get per hectare cost of implement including its annual repair and maintenance cost. The implements and equipments used in the production by the farms are wooden plough, iron plough, harrow, tractor, cultivator, disc plough and spade *etc.*

Interest on fixed capital: Interest charges on fixed capital were calculated at the rate of 11 per cent, as the fixed deposits in commercial banks would fetch this rate of interest. The items considered under fixed capital are implements and machinery. Interest was considered on the

value of these assets after deducting the depreciation for the year.

Land revenue: Actual land revenue paid by the farmers was considered.

Rental value of land: The practice of leasing-in or leasing-out is not exist in the study area. The average value for willingness to pay for either leased-in or lease-out in the present study area is taken as the opportunity cost for the land.

Output and returns: In most of the crops, the output included the main yield of the crop only and in some cases it included by-product also as in the case of ragi, maize, paddy, *etc.*

RESULTS & DISCUSION

Total cropping income and income of other activities

The details on the farm income –both from cropping income, other farm income and off-farm activities, are calculated as it enables to understand the status of dependency of farm activities. The income from farm activities for the study year were calculated by adding gross income realised by the farmers from the different agriculture crops in all three seasons. The annual off-farm income was by taking into account all the allied & other activities during the year of study. The results of annual total farm income of the respondents under different cropping systems are presented in Table I. It is clear that major portion of the on-farm income for the vegetable based cropping systems comes from the vegetables crops and in case of cereal based cropping system the major portion of the income comes from the cereal crops only. Therefore, the grouping is justified in the present study.

TABLE I. Farm gross income from respondent farmers in the study region (Rs. per farm)

Sl No	Particulars	Cropping income from				Allied & other activities	Total farm income
		Cereals	Vegetables	Others	Total		
1	VC system	15952	1375639	13233	1404824	182300	1587124
2	CC system	340186	37016	5292	382494	136000	518494
	F ratio	303.19*	56.22*	1.789 ^{NS}	32.73*	0.719 ^{NS}	33.985*
	CD (5%)	37069	355375	11818	355727	108680	364913
3	SF system	145392	433583	3042	582016	82100	664116
4	LF system	210746	979073	15484	1205302	236200	1441502
	F ratio	12.317*	9.337*	4.391*	12.166*	7.967*	17.958*
	CD (5%)	37069	355375	11818	355727	108680	364913
5	VSC system	10828	848028	4833	863690	69400	933090
6	VLC system	21075	1903250	21633	1945958	295200	2241159
7	CSC system	279956	19137	1250	300343	94800	395143
8	CLC system	400417	54895	9333	464645	177200	641845
	F ratio	8.758*	8.153*	0.538 ^{NS}	6.597*	1.724**	8.381 ^{NS}
	CD (5%)	52423	502576	16714	503075	153697	516065

Notes:

1. NS: Non Significant; * (Significance at 5%); ** (Significance at 1%)
2. Cereals (paddy, ragi and maize)
3. Vegetables (tomato, cabbage, cauliflower, potato *etc.*)
4. Others (sericulture)
5. Allied & Other activities (dairy, sheep rearing, off farm *etc.*)

Perusal of results in the table suggested that annual on-farm income is directly proportion to the size of holding and hence, the per hectare farm income from different cropping systems was estimated as it provides “Productivity of different farming systems” and also better platform for comparison and also eliminates variations in

size of holding in different farms. The result of this analysis is presented in Table II. However, incomes from allied & other activities were retained as it is since it is independent of size of holding.

TABLE II. Gross cropping income from respondent farmers in Kolar district, Karnataka

Sl No	Particulars	Productivity of different farming systems (Rs/ha)			
		Cereals	Vegetables	Others	Gross income
1	VC system	38718	323528	24325	269743
2	CC system	92542	101692	33075	91070
3	SF system	89307	241955	50700	167246
4	LF system	85669	346697	24043	203324
5	VSC system	62953	250599	92942	239382
6	VLC system	32324	371729	20801	285666
7	CSC system	90777	95685	19531	89708
8	CLC system	93906	103186	37036	92045

Notes:

1. Cereals (paddy, ragi and maize)
2. Vegetables (tomato, cabbage, cauliflower, potato etc..)
3. Others (sericulture)
4. Allied & Other activities (dairy, sheep rearing, off farm etc.)

The per hectare annual on-farm income from cereals comprising ragi, paddy, etc. was examined in three different broader groups. It was observed that the on-farm income was higher in CC system (Rs 92542) over VC system (Rs 38718), SF system (Rs 89307) over LF system (Rs 85669) and CLC system (Rs 93906) over CSC (Rs 90777), VSC (Rs 62953) and VLC (Rs 32324) systems. On the other hand per hectare on-farm income from vegetable crops comprising of tomato, beans, cabbage, etc was higher in VC system (Rs 323528/ha) over CC system (Rs 101692), LF system (Rs 346697) over SF system (Rs 241955) and VLC system (Rs 371729) over VSC (RS 250599), CLC (Rs 103186) and CSC (Rs 95685) systems. As regards on-farm income from other crops such as sericulture etc., CC system (Rs 33075) , SF system (Rs 50700) and VLC systems (20801/ha) had higher income over their respective groups in the cropping system. Similar result obtained by Singh (2006) and Sandeep (2002) that the net income from the cropping system.

Input use pattern of major inputs in various cropping systems

Farm resources are the major limited factors in production and need to be applied judiciously. This not only optimises the resource use but also reduce the cost of production. In the present study, per farm input use analysis is employed instead of per crop analysis as the entire cropping system

was considered in the study. This calls for summing up of inputs used in different crops during individual seasons. Labour input and nutrient inputs were only amenable for aggregation and hence only these two variables were examined for input use pattern among different cropping systems. Further, due to time constraint the analysis is restricted to only one major season *i.e.* kharif season. Thus, results from this point onwards on costs, returns, profitability, efficiency, etc. are examined for kharif season only.

Labour use pattern

The various types of labour viz., human (men and women), bullock and tractor labours used in the cultivation of different crops during kharif season and also nature of employment (hired or own) were analysed and presented in Table III.

The VC system had employed on an average more human labour (169.41 days) comprising of 46.74 man days and 122.67 woman days than the CC system (76.51 days) comprising of 21.48 men days and 55.03 woman days. In both systems, hired labour is a substantial share both in men and women labour and infact in women labour, the entire component is hired. Bullock labour and machine labour too was employed more in VC system than the CC system.

TABLE III. Labour use pattern of various cropping systems during kharif season, 2011-12 in Kolar district, Karnataka (per ha)

Particulars	Cropping-based		Size-based		Cropping-size based				Pooled
	VC	CC	SF	LF	VSC	VLC	CSC	CLC	
Men Labour (Men days)									
Own	9.63	3.98	7.41	6.33	11.55	7.97	3.26	4.70	6.87
Hired	37.11	17.50	29.97	24.63	39.07	35.12	20.86	14.14	27.30
Sub total	46.74	21.48	37.37	30.96	50.62	43.08	24.12	18.84	34.17
Women Labour (Women days)									
Own	0.14	0.06	0.10	0.10	0.12	0.18	0.09	0.03	0.10
Hired	122.53	54.97	106.77	71.20	146.69	99.31	66.85	43.08	88.98
Sub total	122.67	55.03	106.87	71.30	146.81	99.49	66.94	43.11	89.09
Total human	169.41	76.51	144.25	102.26	197.43	142.57	91.06	61.95	123.25
Bullock Labour (Bullock pair days)									
Own	0.74	0.90	0.94	0.71	0.88	0.62	1.00	0.80	0.83
Hired	4.59	2.61	4.40	2.75	5.34	3.74	3.46	1.75	3.57
Sub total	5.32	3.51	5.34	3.46	6.22	4.36	4.47	2.56	4.40
Tractor Labour (hrs)									
Own	1.96	0.45	1.06	1.39	1.71	2.28	0.40	0.49	1.22
Hired	2.05	1.87	2.70	1.17	3.07	0.93	2.33	1.41	1.94
Sub total	4.01	2.32	3.76	2.56	4.77	3.21	2.74	1.91	3.16

A comparison between SF and LF systems revealed that the labour employment was higher (144.25 days) in SF system with 37.37 man days and 106.87 woman days of labour than the LF system (102.26 days) which comprises of 30.96 man days and 71.30 woman days. Here also the hired component is nearly 95% in both systems. The Bullock labour and machine labour was employed more in SF system than in the LF system with higher hired component.

VSC systems employed higher human labour (197 days) than the VLC (142.57 days) CSC (91.06 days) and CLC (61.95 days) systems. The major portion of this employment (>65 %) was mainly from the woman labour category in all four cases. The hired labour component was again the predominant in both men and women labour in all four cropping systems. The bullock and machine labour too was employed more in VC system than the CC system.

TABLE IV. Input use pattern of various cropping systems during kharif season, 2011-12 in Kolar district, Karnataka (per ha)

Inputs	Cropping-based		Size-based		Cropping system-size based				Pooled
	VC	CC	SF	LF	VSC	VLC	CSC	CLC	
FYM (t)	9.20	3.18	7.33	5.04	10.94	7.46	3.73	2.63	9.20
N (kgs)	344.25	285.07	330.93	298.39	331.02	357.49	330.84	239.30	344.25
P (kgs)	379.09	160.84	257.75	282.19	352.53	405.66	162.96	158.73	379.09
K (kgs)	261.93	19.09	123.90	157.13	244.23	279.63	3.56	34.63	261.93

Nutrient use pattern

The major source of nutrient to the cropping systems comes from organic and inorganic sources. These sources will have significant influence on the crop productivity and hence, the profitability of the farms. The farmers in the study regions have applied the major N, P and K nutrients in two forms *viz.*, FYM as an organic source and chemical fertilizers as inorganic sources. In the present analysis, the results are presented on FYM as organic source and N, P and K nutrients of chemical fertilisers (Table IV). Chemical fertilizers were applied in different brands in the present study and the individual nutrient was estimated by summing up the active ingredients in it.

The organic nutrient FYM application was higher in VC system (9.2 t/ha) over CC system (3.18 t/ha), SF system (7.33/ha) over LF system (5.04 t/ha) and VSC system (10.94 t/ha) over VLC (7.46 t/ha), CSC (3.73 t/ha) and CLC (2.63 t/ha) systems. The inorganic application of N, P and K was higher in CC system (344.25kg of N 379.09 kg of P and 261.93 kg of K per ha) than the VC system (285.07 kg of N, 160.84 kg of P and 19.09 kg of P). Comparison between SF and LF systems revealed that the N application was higher in SF system (330.93 kg/ha) than LF system (298.39 kg/ha) while P and K application was higher in LF system (257.75 kg of P and 123.90 kg of K per ha) than SF system (282.19 kg of P and 157.13 kg of K).

Among four individual cropping systems, VLC system had applied higher quantities of all three nutrients compared to other three categories of the cropping systems. The lowest application of N (239.3 kg/ha) and P (158.73) was seen in the CLC system, while K application was lowest in the CSC system.

Costs of cropping systems

The variable and fixed costs incurred by the farmers in different crops in kharif season were added to arrive at per hectare cost for the various cropping systems. The total costs were broadly calculated under three broader headings *viz.*, i) working capital comprising of all costs involved in production including own inputs, ii) Cost on capital inputs such as the depreciation on implements and annualised costs on irrigation structure, rental value of land, and finally iii) marketing costs incurred by the farmers in facilitating the dispose of produce. The result of this analysis is presented in Table 4.13. As regards comparison between two cropping systems *viz.*, VC and CC systems, the results indicated that, the average per hectare cost of cultivation was significantly higher in the VC system (Rs. 2,09,198) over the CC system (Rs 68,039). SF system (Rs. 14, 9167.3) over LF system (Rs. 1,30,570) and VSC system (Rs. 2,19,179) compared to VLC (Rs. 1,99,217.6), CSC (Rs. 79,155.4) and CLC (Rs. 61,922.8), systems.

The per hectare working expenses were higher in VC system (Rs 1, 34,263.9) than in CC system (Rs 52,980.8). In case of SF system, the working expenses were higher at Rs 1, 04,540.2 than that of Rs 82,704.5 in LF system. These costs were Rs 1,47,853.7, Rs 1,20,674.0, Rs 6,12,26.7 and Rs 44,735.0 in VSC, VLC, CSC and CLC systems, respectively. The major component of cost in both vegetable based systems (VC, VSC and VLC systems) and cereal based systems (CC, CSC and CLC systems) was the cost incurred by the farmers on the nutrient costs which were followed by cost incurred on the nutrient inputs. The details on the cost on capital inputs and farmers' marketing cost are presented in Table -V. Similar result obtained from Grover (1992) and Govardhan (1998) that there is no difference in cost involved in production.

TABLE V. Cost structure of different cropping systems (Kharif) in Kolar district, Karnataka (Rs per ha)

Particulars	Cropping-based systems		Size-based systems			Cropping-size based systems		
	VC	CC	SF	LF	VSC	VL.C	CSC	CLC
Human labour cost								
<i>Men labour</i>								
Own	287	1160	2166	1866	3363	2379	969	1352
Hired	11343	5212	9103	7452	11824	10862	6382	4042
Sub total	14214	6372	11268	9318	15187	13241	7350	5394
	(43.43)	(42.66)	(40.48)	(46.99)	(40.14)	(47.94)	(41.21)	(44.82)
<i>Women labour</i>								
Own	23	9	16	16	19	27	14	5
Hired	18490	8555	16549	10496	22625	14354	10473	6637
Sub total	18513	8564	16566	10511	22645	14381	10487	6642
	(56.57)	(57.33)	(59.52)	(53.01)	(59.86)	(52.06)	(58.79)	(55.18)
	32727	14937	27834	19829	37831	27622	17837	12036
	[[75.13]]	[[69.50]]	[[72.13]]	[[74.93]]	[[74.53]]	[[75.97]]	[[67.53]]	[[72.65]]
Total human labour								
Bullock Labour Cost								
Own	620	780	773	627	641	599	905	656
Hired	3810	2327	3905	2233	4584	3035	3225	1430
Sub total	4429	3108	4677	2860	5225	3634	4129	2086
	[[10.17]]	[[14.46]]	[[12.12]]	[[10.81]]	[[10.29]]	[[9.99]]	[[15.63]]	[[12.59]]
Tractor Labour cost								
Own	2964	652	1464	2151	2251	3677	678	626
Hired	3391	2795	4612	1574	5453	1329	3771	1819
Sub total	6405	3447	6076	3775	7704	5106	4449	2445
	[[14.70]]	[[16.04]]	[[15.75]]	[[14.26]]	[[15.18]]	[[14.04]]	[[16.84]]	[[14.76]]
	43561	21491	38588	26464	50760	36361	26415	16567
	[[20.82]]	[[30.47]]	[[25.87]]	[[20.27]]	[[23.16]]	[[18.25]]	[[33.37]]	[[26.75]]

Note : () Figures in parentheses represents the individual percentage of total human labour cost.

[[]] Figures in parentheses represents the individual percentage of total labour cost. [] indicates the percentage of total cost.

Farming systems to augment farm income and nutrition

TABLE V. Cost Structure (Rs per ha) of different cropping systems (Kharif) in Kolar district, Karnataka (contd.)

Particulars	Cropping-based			Size-based			Cropping-size based		
	VC	CC	SF	LF	VSC	VLC	CSC	CLC	
Seeds	8862 [4.24]	1886 [2.67]	5610 [3.76]	5137 [3.93]	9422 [4.30]	8302 [4.17]	1799 [2.27]	1972 [3.18]	
Nutrient Costs									
FYM	15883	5998	13390	8491	19186	12580	7595	4401	
Other manures	4848	170	2790	2227	5538	4157	42	298	
NPK	42101	22179	32658	31621	40537	43665	24779	19578	
Other Chemical fertilizer	3870	104	2113	1861	4143	3598	83	124	
Sub total	66702 [31.88]	28450 [40.33]	50952 [34.16]	44200 [33.85]	69404 [31.67]	63999 [32.13]	32499 [41.06]	24401 [39.41]	
Plant protection chemicals									
	15140	1154	9391	6903	18268	12011	514	1795	
	[7.24]	[1.64]	[6.30]	[5.29]	[8.33]	[6.03]	[0.65]	[2.90]	
	134264	52981	104540	82705	147854	120674	61227	44735	
	[64.18]	[75.11]	[70.08]	[63.34]	[67.46]	[60.57]	[77.35]	[72.24]	
Variable cost	5371 [2.57]	2119 [3.00]	4182 [2.80]	3308 [2.53]	5914 [2.70]	4827 [2.42]	2449 [3.09]	1789 [2.89]	
Interest on working capital @ 12%									
Fixed capital									
Dripping cost	9656	326	4836	5146	9672	9640	0	653	
Irrigation cost	5731	4116	4138	5709	5057	6405	3219	5013	
Depreciation- implements	3574	1713	2493	2794	3185	3963	1802	1624	
Rental value of land	2500	2500	2500	2500	2500	2500	2500	2500	
Sub total	21461 [10.26]	8655 [12.27]	13967 [9.36]	16149 [12.37]	20414 [9.31]	22508 [11.30]	7520 [9.50]	9789 [15.81]	
Marketing costs of farmers									
Transportation cost	24678	4813	14862	14630	23458	25898	6265	3361	
Packing cost	5313	1068	3069	3313	5188	5437	949	1188	
Marketing charges	18112	903	8548	10466	16351	19873	746	1060	
Sub total	48103 [22.99]	6784 [9.62]	26479 [17.75]	28409 [21.76]	44998 [20.53]	51208 [25.70]	7959 [10.05]	5609 [9.06]	
Total cost	209198	70539	149167	130570	219179	199218	79155	61923	

CONCLUSION

Vegetable based cropping system had realised 70 per cent higher annual on-farm income than the cereal based cropping systems and the major portion (84 %) of this income came from the vegetable crops like tomato, cabbage, cauliflower, etc., and income from cereals like ragi, paddy, etc., constitutes hardly 10 per cent. In case of cereal based cropping system, the major portion of the income comes from cereal crops like ragi, paddy, maize, etc.

Analysis of costs structure revealed that the vegetable based cropping systems are both labour and capital intensive than the cereal based farming systems as reflected in the higher share of input costs. It is also concluded that the small farmers based cropping systems are also found to have labour and capital intensive cultivation.

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