



A Micro Level Investigation of Costs & Returns of Different Agro-ecosystems in Kashmir Region of Jammu and Kashmir: India

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Authors' contributions

This work was carried out in collaboration among all authors. Author SAG designed the study. Author AB wrote the protocol, performed the statistical analysis and managed the data interpretation. Authors AQ and IQ collected the data in the field. All authors read and approved the final manuscript.

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ABSTRACT

The basic objectives of the study were to enquire in to the involvement of various types of costs, the returns per rupee invested and the benefit thereof in different agro-ecosystems in the state of Jammu and Kashmir in general and valley of Kashmir in particular, especially the sampled districts. This study was based upon primary and secondary data. A multi-stage random sampling was utilised for collection of data from 432 respondents of four different agro-ecological zones. For major crops, the cost of cultivation were estimated by concept utilised by Commission on Agricultural Costs and Prices (CACP), Government of India. The results revealed that fruit crop agro-ecosystem is highly remunerative than field crop and crop agro-ecosystems, though the fruit crop involve huge of investment in terms of different costs. The livestock based agro-ecosystem is

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also dominant in some parts of the Kashmir region with declining trend. The results revealed that the gross returns of paddy and apple, livestock and cash crop were Rs. 23250, Rs. 321000, Rs. 108920 and 106915 respectively. This study had its applicability in the daily routine life of any household dwelling in the sampled agro-ecosystems. The study could be of utmost importance in selecting the crop in which the region/agro-ecosystem had specialisation or absolute advantage.

Keywords: Livelihood; interdependence; costs; returns; agro-ecosystem.

1. INTRODUCTION

An agro-ecosystem, defined as an articulate unit of agricultural activity, comprises of both living and non-living components and their interactions [1]. The agro-ecosystem provides an interactive mechanism and framework to analyze food production systems in totality [2]. Ecosystem and the interplay of its components may vary across regions consistent upon number of factors. The mountains, owing to various specificities, may have different setting that allowed its performance different from that of plains [3] Indian mountainous regions are fragile zone though it is bestowed with natural components (biotic and abiotic) that adds to the value of its ecosystem and agro-ecosystem in particular [4]. Ecosystem and the interplay of its components may vary across regions consistent upon number of factors. The mountains, owing to various specificities, may have different setting that allowed its performance different from that of plains. Indian mountainous regions are fragile zone though it is bestowed with natural components (biotic and abiotic) that add to the value of its ecosystem and agro-ecosystem in particular [5]. Different studies opines that the per hectare expenditure on all the inputs except the seed was more on the rice-rice system over rice-pulse system in Andhra Pradesh and wheat in Punjab, coconut in Karnataka [6,7,8]. The valley has a distinction in terms of its diversity, which made it to provide biotic or abiotic environment to the number of agro-ecosystems [9,10]. Only few studies, examining few ecosystems or part of ecosystem is available in literatures which directed us towards a necessity of a comprehensive study for holistic approach towards sustainable ecosystem management.

2. METHODOLOGY

The study was carried out in four different agro-ecosystems of Kashmir valley. The four Agro-ecosystems were selected from four different districts of the valley based on their predominance and efficient resource use and proper specialisation and suitable agro-climates

for the particular crops or agro-ecosystems. The random sampling techniques was utilised for the selection of two community development blocks from each district and from each community development block 4 villages were selected randomly at the last stage of sampling 10 per cent of the households were selected for data collection. Different techniques like averages, percentages, etc. were utilised. In addition, the costs of cultivation of major crops were estimated using the cost concept defined by Commission on Agricultural Costs and Prices (CACP), GOI, which are as given below:

Cost A_1 = All actual expenses in cash and kind incurred in production by the producer. The items covered in cost A_1 are costs on: (i) hired human labour (ii) hired bullock labour (iii) owned bullock labour (iv) home produced/purchased seed (v) plant protection chemicals (vi) home produced/purchased manure (vii) fertilizers (viii) insecticides and pesticides (ix) depreciation on farm machinery, equipment and farm building (x) irrigation (xi) land revenue, land development tax and other taxes (xii) interest on working capital (xiii) interest on crop loan and (xiv) miscellaneous expenses.

Cost A_2 = Cost A_1 + Rent paid for leased-in land

Cost A_1 = Cost A_1 + Interest on value of owned capital assets (excluding land)

Cost B_2 = Cost B_1 + Rental value of owned land (net of land revenue) and rent paid for leased-in land

Cost C_1 = Cost B_1 + Imputed value of family labour

Cost C_2 = Cost B_2 + Imputed value of family labour

Cost C_2^* = Cost C_2 estimated by taking into account statutory or actual wage rate whichever is higher

Cost C_3 = Cost C_2^* + 10 per cent of Cost C_2^* to
(on account of managerial functions
performed by farmer)

The profitability of the farmers was calculated as follows as given by Sankhayan [11]:

Farm business income = Gross income-Cost A_2
Family labour income = Gross income-Cost B_2
Net Income over Cost C_1 = Gross income-Cost C_1
Net Income over Cost C_2 = Gross income-Cost C_2
Net Income over Cost C_3 = Gross income-Cost C_3

2.1 Cost Structure

The unit wise estimates regarding costs in the sampled area of selected districts viz, Anantnag, Shopian, Pulwama and Budgam all the cost A_1 , A_2 , B_1 , B_2 , C_1 , C_2 and C_3 came out to be highest in fruit crop based agro-ecosystems and lowest in field crop based agro-ecosystems. Owing to the higher cost structure, the returns per unit of area are highest in fruit crop based ecosystems and lower in field crop based ecosystems.

2.2 Costs and Returns of Different Agro-ecosystems

The data and information pertaining to various variable costs were collected from the base level in the sampled area and accordingly the suitable technique of Commission on Agricultural Costs and Prices (CACPC) and non-use value by willingness to pay were employed to get the logical results. Study of costs and returns under various agro-ecosystems is important to understand the viability of these agro-ecosystems. The results with respect to the cost concepts used to work out the economy of various systems is discussed below.

3. RESULTS AND DISCUSSION

3.1 Crop Based Agro-ecosystem: Field Crop Ecosystem (FLCES)

The highest investment under crop based agro-ecosystem was estimated in district Pulwama followed by Anantnag which were almost at par. However, it is of great interest that despite district Anantnag identified for cereal based farming system, its investment was little less than district Pulwama which probably indicates that district Pulwama has a very strong forward and backward linkage vis-à-vis crop and livestock. The figures reveal that the field crop based agro eco system was least important in

Shopian district which is evidenced by lesser area under cereal production. In case of cereal based farming systems, all the costs were higher in district Anantnag which uses more of advanced technologies and possess more size of land holdings. The lowest costs were observed in district Shopian where the farmers do not grow cereals being a hilly district owing to its climatic and topography that suits cultivation of horticultural crops. This could further be substantiated by the fact that per hectare expenditure on cereals in district Shopian accounted for less than horticulture based farming system (Table 1). This could be attributed to the share of more family labour required and used for cultivating cereal crops in cereal based farming systems. The farmers spent more time towards cereals under cereal based farming systems being a dominant and option for livelihood to them, resulting in more costs. The farmers also spent more on cereals in cereal based farming systems so as to increase their productivity in turn resulting in higher returns.

3.2 Fruit Crop Based Agro-ecosystem

District Shopian (hill district) in the Kashmir valley is considered to be the main producer of horticultural crops and fruit crop based ecosystem is dominant in this district. Owing to its topography and other climatic features and also its highest apple production and productivity, Table 2 reveals that the district is using huge average investment in this trade and activity followed by Pulwama and the minimum average investment was estimated in district Anantnag. The figures indicate that Shopian district best suited for fruit crops.

3.3 Livestock Based Agro-ecosystem

Livestock based agro-ecosystem is dominant in district Pulwama and is highest milk producing areas in the state. Rearing of livestock per household is highest in district Pulwama compared to other districts of the valley. Thus per unit of rearing of animals result in the highest variable as well as fixed costs and hence resulting in the variation in total costs in farms. The households having both livestock and crops on their farms had higher costs while as the households which grow crops only on their farms had low costs. Therefore the difference in the costs in the livestock based farming systems may be attributed to different breeds such as cross bred, local breeds etc. and type of livestock being in other agro-ecologically

Table 1. Average cost and production of field crop (Paddy) of sampled districts per household and per hectare

	Anantnag field crop based farming system		Shopian fruit crop based farming system		Pulwama livestock based agro ecosystem		Budgam cash crop based agro-ecosystem		
	per HH	Per hec.	per HH	Per hec.	per HH	Per hec.	per HH	Per hec.	
Area (k)	4.48	20	0.28	20	4.31	20	4.23	20	
Land preparation	HL(days)	1.33	6.30	0.08	5.58	1.25	5.8	1.25	5.58
	ML(Rs)	703.33	3325.45	43.75	3125	671.87	3117.75	625	2790.18
Manures	M(Rs)	2333.33	11032.31	168.75	12053.57	2500	11600.93	2750	12276.79
	HL(days)	0.66	3.15	0.03	2.68	0.62	2.9	0.62	2.78
Fertilizers	M(Rs)	720	3404.25	43.75	3125	687.5	3190.25	718.75	3208.70
	HL(days)	0.166667	0.786667	0	0	0.15625	0.725	0.15625	0.7
Seed	Qty.(kg)	13.33	63.04	1.875	133.93	13.75	63.80	15.62	69.75
	HL(days)	0.33	1.57	0	0	0.31	1.45	0.31	1.39
	Value	200	945.62	28.12	2008.93	206.25	957.07	234.37	1046.31
Transplanting	ML(Rs)	5.33	25.22	0.62	44.64	5	23.2	5.62	25.11
Plant	HL(days)	0.08	0.39	0	0	0.08	0.36	0.08	0.35
Protection	Value	104.16	492.51	7.81	558.03	101.56	471.28	109.37	488.28
Harvesting	HL(days)	11.33	53.58	0.85	61.16	10.62	49.30	10.62	47.43
Production	Qty.(qtls)	14	66.19	0.83	59.52	13.63	63.28	12.91	57.66
	Value(Rs)	21000	99290.8	1250	89285.72	20454.55	94916.68	19375	86495.53
	Straw(Bundles)	410	1938.53	20.83	1488.09	381.81	1771.78	366.66	1636.90
	Value(Rs)	10250	48463.4	520.83	37202.38	9545.45	44294.45	9166.66	40922.62
Gross Returns		31250	147754	1770.83	126488.1	30000	139211.1	28541.67	127418.2
Total labour		19.25	91.01	1.70	121.66	19.25	89.32	19.92	88.91
Total Labour costs		5775	27304.97	511	36500	5775	26798.15	5975	26674.11
Total input costs		4060.83	19200.16	311.66	22261.91	4445	20626.45	4733.33	21130.95
Working Capital		9835.83	46505.12	822.66	58761.91	10220	47424.59	10708.33	47805.06
Interest on Working capital		1180.3	5580.61	98.72	7051.42	1226.4	5690.95	1285	5736.60
Land Revenue& Taxes		5.64	26.66	0.37	26.66	5.74	26.66	5.97	26.66
Depreciation on farm assets		1742.45	8238.55	20	1428.57	1714.42	7955.57	1489.76	6650.71
Rental Value of Land		3016.66	14263.2	208.33	14880.95	3200	14849.19	3316.66	14806.55
Cost (A1)		6989.22	33045.99	429.44	30674.29	7415.57	34411.01	7514.06	33544.94
Cost (A2)		10005.89	47309.19	637.77	45555.24	10615.57	49260.2	10830.73	48351.49
Cost (B1)		8731.893	41285.55	449.44	32102.86	9130.24	42367.7	9003.4	40193.75
Cost(B2)		11754.2	55575.41	658.14	47010.47	12335.99	57243.56	12326.04	55026.97
Cost(C1)		14506.89	68590.51	960.44	68602.86	14905.24	69165.85	14978.4	66867.86
Cost(C2)		17529.2	82880.38	1169.14	83510.47	18110.99	84041.7	18301.04	81701.07

	Anantnag field crop based farming system		Shopian fruit crop based farming system		Pulwama livestock based agro ecosystem		Budgam cash crop based agro-ecosystem	
	per HH	Per hec.	per HH	Per hec.	per HH	Per hec.	per HH	Per hec.
Managerial Cost@10 ofC2	1752.92	8288.04	116.9133	8351.047	1811.1	8404.17	1830.10	8170.10
Cost(C3)	19282.12	91168.41	1286.06	91861.53	19922.09	92445.87	20131.15	89871.18
Farm Business Income	21244.11	100445	1133.06	80932.85	19384.43	89950.94	17710.93	79066.67
Family Labour Income	19495.8	92178.73	1112.68	79477.62	17664.01	81967.58	16215.63	72391.19
Net returns over cost C1	16743.11	79163.63	810.39	57885.23	15094.76	70045.29	13563.27	60550.3
Net returns over cost C2	13720.8	64873.76	601.68	42977.62	11889.01	55169.44	10240.63	45717.09
Net returns over cost C3	11967.88	56585.73	484.77	34626.57	10077.91	46765.26	8410.52	37546.98

Note: HH = Household, HL = Human labour, M = Material, K = Kanal and ML = Machine Labour

Table 2. Cost and production of apple in district Shopian

Age (yrs)		1 st (Year)	2 to 7	8 to 34	Above 34	Average/HH	Average/ha
Area	(K)	0.7	1.04	3.12	4.14	9	20
Land preparation	HL(Days)	0.33	0	0	0	0.33	0.74
	ML(Hrs)	0	0	0	0	0	0
Manures	M(Rs)	133.33	200	1760	2760	4853.33	10785.2
	HL(Days)	0.33	0.33	1	1.333	3	6.66
Fertilizers	M(Rs)	13.33	56.66	2932	4000	7002	15560
	HL(Days)	0.083	0.33	1.6	2	4.01	8.92
Seed/Planting material	Qty.(Rs)	300	0	0	0	300	666.667
	HL(Days)	0.33	0	0	0	0.33	0.74
Irrigation	HL(Days)	0	0	0	0	0	0
	Pruning(Days)	0	0.33	1.66	2	4	8.88
Plant Protection	M(Rs)	133.33	500	9004	11666.7	21304	47342.2
	HL(Days)	0.33	0.66	1.6	2	4.6	10.22
	ML(Days)	133.33	266.66	2400	4000	6800	15111.1
Harvesting	HL(Days)	0	0	6.66	8.33	15	33.33
Production	Qty. Boxes)	0	0	208	220	428	951.11
Value(Rs)		0	0	104000	110000	214000	475556
Gross Returns plus rental value of land		0	0	104000	110000	214000	475556
Total Labour Days		1.41	1.66	12.53	15.66	31.28	69.51
Total Labour Costs		425	500	3760	4700	9385	20855.56
Total Input Costs		700	966.66	13164	18426.67	33257.33	73905.2
Gross Costs		1125	1466.66	16924	23126.67	42642.33	94760.73
Interest on Working capital		135	176	2030.88	2775.2	5117.08	11371.29
Land Revenue& Taxes		0.46	0.69	2.08	2.76	6	13.33

Age (yrs)	1 st (Year)	2 to 7	8 to 34	Above 34	Average/HH	Average/ha
Depreciation on farm assets	125.03	185.77	557.31	739.51	1607.66	3572.59
Costs(A1)	960.50	1329.13	15754.28	21944.14	39988.07	88862.4
Rental Value of Land	1387.03	2060.73	6182.21	8203.32	17833.31	39629.6
Cost (A2)	2347.53	3389.87	21936.49	30147.47	57821.4	128492
Cost (B1)	1085.54	1514.90	16311.59	22683.66	41595.73	92435
Cost(B2)	2473.04	3576.33	22495.89	30889.74	59435.07	132077.9
Cost(C1)	1510.54	2014.90	20071.59	27383.66	50980.73	113290.5
Cost(C2)	2898.04	4076.33	26255.89	35589.73	68820.07	152933.5
Managerial Cost@10 ofC2	289.80	407.63	2625.58	3558.97	6882.00	15293.35
Cost(C3)	3187.84	4483.96	28881.48	39148.7	75702.07	168226.8
Farm Business Income	-2347.54	-3389.87	82063.51	79852.53	156178.6	347063.5
Family Labour Income	-2473.04	-3576.33	81504.11	79110.26	154564.9	343477.6
Net returns over cost C1	-1510.54	-2014.9	83928.41	82616.34	163019.3	362265
Net returns over cost C2	-2898.04	-4076.33	77744.11	74410.27	145179.9	322622.1
Net returns over cost C3	-3187.85	-4483.97	75118.52	70851.3	138297.9	307328.7

Note: HH = Household, HL = Human labour, M = Material, K = Kanal and ML = Machine Labour

Table 3. Cost and production of livestock in district Pulwama

	Cow (Milch)	Young stock	Sheep	Goat	Horse	Total/Day	Total/ Year
No.	1.26	1.34	1.5	0.15	0.031	4.281	
P- Value(Rs)	37828	6654.67	4285.71	450	775	49993.4	
Fodder							
Dry(kg)	5.07	2.24	0.86	0.1	0.10	8.37	3058.61
Value(Rs)	12.67	5.60	2.16	0.25	0.25	20.94	7646.53
Fresh(kg)	5.23	3.31	1.02	0.1	0.15	9.82	3587.87
Value(Rs)	10.46	6.63	2.05	0.2	0.31	19.65	7175.74
Concentrate							
Quantity(kg)	0.84	0	0.25	0.02	0.02	1.13	414.51
Value	16.8	0	5	0.5	0.41	22.71	8290.36
Medicine(Rs)/Day	0.34	0.18	0.45	0.02	0.00	1.00	368.35
Labour(days)	0.02	0.02	0.06	0.00	0.00	0.11	43.76
Labour(Rs)	7.56	8.04	9.28	0.9	0.18	25.97	9479.67
Working Capital=Total Cost/Day(Rs)	47.85	20.45	18.95	1.87	1.17	90.30	32960.68
Milk(kg/day)	3.78	0	0	0.075	0	3.855	1407.07
Meat(kg/year)	0	28.87	19.01	2.1	0	49.99	18248.97
Other (dung-kg/day)	6.31	3.36	0.22	0.02	0.15	10.08	3680.27
Dung(Rs)	12.6	6.72	0.90	0.09	0.31	20.63	7530.44
Milk(Rs)	94.5	0	0	1.87	0	96.37	35176.88

	Cow (Milch)	Young stock	Sheep	Goat	Horse	Total/Day	Total/ Year
Meat + other/Work/Day(Rs)	0	11.86	16.07	1.72	2.32	31.98	11674.55
Total Returns/Day(Rs)	107.1	18.58	17.16	3.72	2.63	149.20	54460.2
Interest on Working capital	0.01	0.00	0.00	0.00	0.00	0.02	10.54
Depreciation on farm assets	1.52	1.61	1.81	0.18	0.03	5.16	1885.49
Gross Costs(Cost A1)	40.29	12.41	9.66	0.97	0.98	64.33	23481.01
Cost (A2)	40.29	12.41	9.66	0.97	0.98	64.33	23481.01
Cost (B1)	41.81	14.03	11.47	1.15	1.02	69.49	25366.5
Cost(B2)	41.81	14.03	11.47	1.15	1.02	69.49	25366.5
Cost(C1)	49.37	22.07	20.76	2.05	1.20	95.46	34846.17
Cost(C2)	49.37	22.07	20.76	2.05	1.20	95.46	34846.17
Managerial Cost@10 of C2	4.93	2.20	2.07	0.20	0.12	9.54	3484.61
Cost(C3)	54.31	24.28	22.83	2.25	1.32	105.01	38330.8
Farm Business Income	66.80	6.16	7.49	2.74	1.65	84.87	30979.19
Family Labour Income	65.28	4.55	5.68	2.56	1.61	79.70	29093.7
Net returns over cost C1	57.72	-3.48	-3.59	1.66	1.42	53.73	19614.03
Net returns over cost C2	57.72	-3.48	-3.59	1.66	1.42	53.73	19614.03
Net returns over cost C3	52.78	-5.69	-5.67	1.46	1.30	44.19	16129.4

Note: HH = Household, HL = Human labour, M = Material, K = Kanal and ML = Machine Labour

different regions of the valley, such as cows, draught animals and buffaloes (Table 3). The different breeds have different feeding habits resulting in the variation of the costs.

The milch animals are highly sensitive and involve huge cost in their upkeep, therefore involve huge costs compared to other animals which. The large variation in the total costs in cereal based farming systems was mainly due to absence of livestock in various farming systems. The difference in the cost C_2 and C_2^* indicated that the opportunity cost of the family labour was more in all the farming systems. In general, livestock based farming systems were found utilizing more cost than the cereal based farming systems and the results are in conformity with, [7], thus confirming that the more the commercial enterprises, more will be the returns. The reason behind the higher returns in livestock based agro-ecosystems were the additional income generated through the more number of animals in livestock based farming systems.

3.4 Niche Crop Based Farming System

Mountain farming systems are topographically rich in agricultural products and nature has bestowed mountains with specialized advantage in respect of growing niche crops. It is due to these specialised and niche crops that mountains are leading in some agricultural products ahead than growth at national level (Table 4). The most prominent niche crops of the state are saffron and off season vegetables. Both these crops are commercially grown in district Budgam. The analysis of Table 4 reveals that maximum average investment was made on vegetables. It is pertinent to note here that the vegetables from this district are supplied to all the three regions of the state and are exported to the neighbouring states. The household cost utilisation pattern among different agro-ecosystems were found highest under livestock ecosystem (LSES) compared to cash crop ecosystem (CCES) which incurred the lowest cost (Table 5). The highest cost utilisation in LSES could be due to more requirement of investment per unit of cultivated land and number of animals. The less number of animals along with low land holding was also the main reason for the low per household costs. The cost structure of various agro-ecosystems and associated enterprises in Kashmir valley also indicated that per household costs as well as per unit costs were found higher in livestock based farming systems as compared to the cereal based farming systems. The reason being

that rearing of livestock requires more investment as compared to cereals. Moreover, these days, good breeds of livestock require more rearing costs as compared to local breeds. Some of the cereal based farming system holders did not possess any livestock, so on an average the costs involved were less. The costs of cereals viz. rice, wheat and maize were higher under of cereal based farming system as compared to livestock based farming system. This could be attributed to the share of more family labour required and used for cultivating cereal crops than other farming systems. The other enterprises or farming systems were much costlier in livestock based farming systems as compared to cereal based farming systems. The farmers use their time and resources efficiently to cereal crops in cereal based farming systems and towards livestock in livestock based farming systems being their dominant activity. The farmers also spent more time on cereals in cereal based farming systems to increase their productivity and returns per rupee invested. The various income determinants like gross returns; farm business income, farm labour income and net income over cost C_1 , C_2 and C_3 were used to study the economics of different agro-ecosystems. The data revealed that in case of cereal based agro-ecosystems, all the income determinants were higher in district Anantnag owing to the fact that the land holding in these agro-ecosystems was the highest resulting in the high income due to larger production. The lowest income determinants were observed in district Shopian in the cereal based farming systems. In this district the farmers were not rearing animals and poultry on their fields, which was the main reason for the low income in this farming system. There was a greater variation in the income determinants of different farming systems. The households having both livestock and crops on their farms had high gross returns while as the households which grew crops only on their farms had low gross returns. Hence more the enterprises more will be the returns, therefore right time for farmers to adopt Integrated Farming System. The cost C_1 , C_2 and C_3 were found highest fruit crop ecosystem for farm business income, farm labour income and net income in district Shopian and lowest in district Budgam in livestock agro-ecosystems. The difference in livestock based farming and the determinants involved could be attributed to the different breeds and type of livestock being reared. In general the returns livestock was found much more remunerative than rice based agro-ecosystem. The economics of various

Table 4. Cost and production of cash crop (Vegetables) in district Budgam

		Tomato	Sag	KK	Brinjal	Cauliflower	Cabbage	Cucumber	Chili	Bottle guard	Radish	Carrot	Beans	Others (onion)	Total	Total (ha)
Area Land preparation	K	0.2	0.46	1.23	0.47	1.2	1.23	0.24	0.39	0.18	0.7	0.48	0.76	0.04	7.58	20
	HL (DAYS)	0.4	1.38	3.69	0.94	3.6	3.69	0.48	1.17	0.36	2.1	1.44	2.28	0.12	21.65	57.12401
	ML(Rs)	100	230	615	235	600	615	120	195	90	350	240	380	20	3790	10000
Manures	M (Qtls)	3	6.9	12.3	4.7	18	9.84	3.6	3.9	1.8	7	5.76	7.6	0.48	84.88	223.9578
	HL (DAYS)	0.2	0.46	1.23	0.47	1.2	1.23	0.24	0.39	0.18	0.7	0.48	0.76	0.04	7.58	20
Fertilisers	M(Rs)	80	161	492	235	540	492	48	156	36	280	192	190	16	2918	7699.208
	HL (DAYS)	0.01	0.023	0.0615	0.0235	0.06	0.0615	0.012	0.0195	0.009	0.035	0.48	0.038	0.002	0.835	2.203166
Seed/ Planting material	Qty. (gms)	6	57.5	92.25	16.45	36	43.05	30	39	63	280	120	1140	16	1939.25	5116.755
	HL(DAYS)	0.01	0.115	0.3075	0.235	0.3	0.615	0.12	0.195	0.09	0.35	0.024	0.38	0.02	2.7615	7.28628
Transplanting	HL (DAYS)	0.4	0	2.46	0.47	0	2.46	0.24	0.78	0.18	0	0	0	0.08	7.07	18.65435
Interculture	HL (DAYS)	0.8	0	3.69	1.88	0	4.92	0.72	1.56	0.54	1.4	0.96	1.52	0.16	18.15	47.88918
Plant Protection	Qty. (Rs)	40	46	123	141	420	615	96	234	36	70	48	152	12	2033	5364.116
	HL (DAYS)	0.1	0.23	0.615	0.235	0.6	0.615	0.12	0.195	0.09	0.175	0.12	0.19	0.01	3.295	8.693931
	ML(Rs)	80	92	492	188	480	492	96	156	72	140	96	152	0.8	2536.8	6693.404
Harvesting	HL (DAYS)	0.4	1.38	3.69	0.94	2.4	2.46	0.24	1.17	0.18	2.1	1.92	2.28	0.12	19.28	50.87071
Production	Qty. (qtls)	2.5	5.75	15.375	4.23	15	15.375	4.8	3.51	2.16	8.75	6	4.56	0.48	88.49	233.4828
	Value (Rs)	3750	5750	15375	6345	22500	15375	4800	3510	2160	8750	9000	9120	480	106915	282097.6
Seed/Planting material	Value(Rs)	180	575	922.5	493.5	1080	1291.5	300	117	189	840	480	171	48	6687.5	17645.12
Manures	Value(Rs)	600	1380	2460	940	3600	1968	720	780	360	1400	1152	1520	96	16976	44791.56
Labour Costs(Rs)		696	1076.4	4723.2	1558.05	2448	4815.45	651.6	1643.85	488.7	2058	1627.2	2234.4	165.6	24186.45	63816.49
Working Capital		1776	3560.4	9827.7	3790.55	9168	10288.95	2031.6	3281.85	1271.7	5138	3835.2	4799.4	358.4	59127.75	156009.9
Interest on Working capital		213.12	427.248	1179.324	454.866	1100.16	1234.674	243.792	393.822	152.604	616.56	460.224	575.928	43.008	7095.33	18721.19
Land Revenue& Taxes		0.4	0.92	2.46	0.94	2.4	2.46	0.48	0.78	0.36	1.4	0.96	1.52	0.08	15.16	40

	Tomato	Sag	KK	Brinjal	Cauliflower	Cabbage	Cucumber	Chili	Bottle guard	Radish	Carrot	Beans	Others (onion)	Total	Total (ha)
Depreciation on farm assets	36.8	84.64	226.32	86.48	220.8	226.32	44.16	71.76	33.12	128.8	88.32	139.84	7.36	1394.72	3680
Gross Costs(Cost A1)	1330.32	2996.808	6512.604	2774.786	8043.36	6936.954	1668.432	2104.362	969.084	3826.76	2757.504	3282.288	243.248	43446.51	76423.33
Excluding rental value of land															
Rental Value of Land	450	690	1845	761.4	1800	1845	576	421.2	259.2	1050	1080	1094.4	57.6	11929.8	31477.04
Cost (A2)	1780.32	3686.808	8357.604	3536.186	9843.36	8781.954	2244.432	2525.562	1228.284	4876.76	3837.504	4376.688	300.848	55376.31	97408
Cost (B1)	1367.12	3081.448	6738.924	2861.266	8264.16	7163.274	1712.592	2176.122	1002.204	3955.56	2845.824	3422.128	250.608	44841.23	78876.67
Cost(B2)	1817.52	3772.368	8586.384	3623.606	10066.56	9010.734	2289.072	2598.102	1261.764	5006.96	3926.784	4518.048	308.288	56786.19	99888
Cost(C1)	2063.12	4157.848	11462.12	4419.316	10712.16	11978.72	2364.192	3819.972	1490.904	6013.56	4473.024	5656.528	416.208	69027.68	121420.7
Cost(C2)	2513.52	4848.768	13309.58	5181.656	12514.56	13826.18	2940.672	4241.952	1750.464	7064.96	5553.984	6752.448	473.888	80972.64	142432
Managerial Cost@10 of C2	251.352	484.8768	1330.958	518.1656	1251.456	1382.618	294.0672	424.1952	175.0464	706.496	555.3984	675.2448	47.3888	8097.264	14243.2
Cost (C3)	2764.872	5333.645	14640.54	5699.822	13766.02	15208.8	3234.739	4666.147	1925.51	7771.456	6109.382	7427.693	521.2768	89069.9	156675.3
Farm Business Income	1969.68	2063.192	7017.396	2808.814	12656.64	6593.046	2555.568	984.438	931.716	3873.24	5162.496	4743.312	179.152	51538.69	184690
Family Labour Income	1932.48	1977.632	6788.616	2721.394	12433.44	6364.266	2510.928	911.898	898.236	3743.04	5073.216	4601.952	171.712	50128.81	182210
Net returns over cost C1	1686.88	1592.152	3912.876	1925.684	11787.84	3396.276	2435.808	-309.972	669.096	2736.44	4526.976	3463.472	63.792	37887.32	160677.3
Net returns over cost C2	1236.48	901.232	2065.416	1163.344	9985.44	1548.816	1859.328	-731.952	409.536	1685.04	3446.016	2367.552	6.112	25942.36	139666
Net returns over cost C3	985.128	416.3552	734.4576	645.1784	8733.984	166.1976	1565.261	-1156.15	234.4896	978.544	2890.618	1692.307	-41.2768	17845.1	125422.7

Note: HH=Household, HL= Human labour, M = Material, K = Kanal and ML= Machine Labour

Table 5. Cost and production of cash crop (Saffron) in district Budgam

Area	(k)	1 st -Year	2 nd -Year	3 rd -Year	4 th -Year	5 th -Year	6 th -Year	7 th -Year	8 th -Year	9 th -Year	Average/HH	Average/ha
Land preparation	HL(Days)	0	0	0	0	0	0	0	0	0	0	0
	ML/BL(Rs)	2250	0	0	0	0	0	0	0	0	2250	9453.78
Manures	M(Rs)	2647.62	335.22	376.18	304.22	387.04	224.64	150.3	144.82	181.14	4751.18	19962.94
	HL(Days)	2.06	0.16	0.18	0.14	0.2	0.12	0.08	0.06	0.1	3.1	13.02
Fertilizers	M(Rs)	146.18	208.1	225.3	183.32	217.9	128.86	89.44	90.66	108.76	1398.52	5876.13
	HL(Days)	0.06	0.04	0.04	0.04	0.04	0.04	0.02	0.02	0.02	0.322	1.35
Seed	Qty(Rs)	9000	0	0	0	0	0	0	0	0	9000	37815.13
	HL(Days)	4.5	0	0	0	0	0	0	0	0	4.5	18.90
Interculture	HL(Days)	0	4.2	4.68	3.6	4.68	2.64	1.8	1.8	2.16	25.56	107.39
	ML(Hrs)	0	0	0	0	0	0	0	0	0	0	0
Plant Protection	Qty.(Rs)	103	0	0	0	0	0	0	0	0	103	432.77
	HL(Days)	0.125	0	0	0	0	0	0	0	0	0.125	0.52
	ML(Hrs)	0	0	0	0	0	0	0	0	0	0	0
Harvesting	HL(Days)	3.15	4.41	4.91	3.78	4.914	2.772	1.89	1.89	2.268	29.988	126
Production	Qty.(gms)	10.56	32.26	52.12	43.86	60.1	36.28	26.64	26.46	36.82	325.1	1365.96
	Value(Rs)	1056	3226	5212	4386	6010	3628	2664	2646	3682	32510	136596.6
Seed Production	Value(Rs)	0	0	0	0	0	0	0	0	18000	18000	75630.25
Gross Returns plus rental value of land		1056	3226	5212	4386	6010	3628	2664	2646	21682	50510	212226.9

Area	1 st -Year	2 nd -Year	3 rd -Year	4 th -Year	5 th -Year	6 th -Year	7 th -Year	8 th -Year	9 th -Year	Average/HH	Average/ha
(k)	0.5	0.7	0.78	0.6	0.78	0.44	0.3	0.3	0.36	4.76	
Labour Costs(Rs)	2969.1	2643	2944.2	2268	2950.2	1671.6	1137	1131	1364.4	19078.5	80161.76
Interest on Working capital	1697.61	65.19	72.17	58.50	72.59	42.42	28.76	28.25	34.78	2100.324	8824.89
Land Revenue& Taxes	1	1.4	1.56	1.2	1.56	0.88	0.6	0.6	0.72	9.52	40
Depreciation on farm assets	240.5	336.7	375.18	288.6	375.18	211.64	144.3	144.3	173.16	2289.56	9620
Total Costs(Cost A) Excluding Labour	16085.92	946.61	1050.39	835.84	1054.27	608.44	413.40	408.63	498.56	21902.1	92025.65
Rental Value of Land	880.5	1232.7	1373.58	1056.6	1373.58	774.84	528.3	528.3	633.96	8382.36	35220
Cost (A2)	16966.42	2179.31	2423.97	1892.44	2427.85	1383.28	941.70	936.93	1132.52	30284.46	127245.6
Cost (B1)	16326.42	1283.31	1425.57	1124.44	1429.45	820.08	557.70	552.93	671.72	24191.66	101645.6
Cost(B2)	16967.42	2180.71	2425.53	1893.64	2429.41	1384.16	942.30	937.53	1133.24	30293.98	127285.6
Cost(C1)	19295.52	3926.31	4369.77	3392.44	4379.65	2491.68	1694.70	1683.93	2036.12	43270.16	181807.4
Cost(C2)	19936.52	4823.71	5369.73	4161.64	5379.61	3055.76	2079.30	2068.53	2497.64	49372.48	207447.4
Managerial Cost@10 ofC2	1993.652	482.371	536.97	416.164	537.961	305.57	207.93	206.85	249.76	4937.248	20744.74
Cost(C3)	21930.17	5306.09	5906.71	4577.80	5917.57	3361.33	2287.24	2275.39	2747.41	54309.73	228192.2
Farm Business Income	-15910.4	1046.68	2788.02	2493.55	3582.14	2244.72	1722.29	1709.06	20549.47	20225.54	84981.24
Family Labour Income	-15911.4	1045.28	2786.46	2492.35	3580.58	2243.84	1721.69	1708.46	20548.75	20216.02	84941.24
Net returns over cost C1	-18239.5	-700.31	842.22	993.55	1630.34	1136.32	969.29	962.06	19645.87	7239.836	30419.48
Net returns over cost C2	-18880.5	-1597.72	-157.73	224.35	630.38	572.24	584.69	577.46	19184.35	1137.516	4779.47
Net returns over cost C3	-20874.2	-2080.09	-694.71	-191.80	92.42	266.66	376.76	370.60	18934.59	-3799.73	-15965.3

Note: HH = Household, HL = Human labour, M = Material, K = Kanal and ML= Machine Labour

agro-ecosystems and associated enterprises in Kashmir valley also indicated that the per household returns as well as per unit returns were higher in case of livestock based agro-ecosystems were more as compared to the rice agro-ecosystems. The people in livestock based agro-ecosystems earn additional income due to possession of more number of animals. The livestock based agro-ecosystems earn more returns as compared to cereal based agro-ecosystems. The livestock based agro-ecosystems were also rearing high milk yielding breeds, thus generating more income through such breeds [8] also observed an annual income of Rs. 24,843/- annum at the rate of Rs. 13 per liter of milk from livestock which when transformed to the present prices is similar to that of the present study. The perusal of data revealed that the per hectare benefit cost ratio over cost C_1 , C_2 and C_3 was favourable for cereal crops than fruit crops. The main reason behind this could be attributed to the highest returns and lowest costs respectively in each agro ecosystem. The higher benefit cost ratio of fruit crop based farming systems could be attributed to the high yielding of fruits in fruit crop farming systems. In this way, the comparison of different agro-ecosystems reveals that revenue in fruit agro-ecosystem was highest and contributed more than half of gross or net revenue generated by all agro-ecosystems together, thus, leading a shift in the economy from cereals to fruit agro-ecosystem (Torane et al, 2011) also worked out that benefit cost ratios in different farming systems which are in accordance to results of the present study.

4. CONCLUSION

In conclusion, rice cultivation in the field crop based agro-ecosystem has been found with low cost of production, field crops are having higher marketable surplus and it provides employment to both unskilled and semi-skilled human labour compared to other agro-ecosystem. The fruit crop based agro-ecosystem, approximately employs 25-30 lakh people directly or indirectly, and contributing around 6,000 corers towards SAGDP. So far as economic contribution of livestock is concerned, states with higher livestock share are having lower level of poverty index ration. Livestock less prone to global warming and climate change compared to the rain-fed agriculture, therefore has more acceptability as an important contributor. The livestock sector has turned more productive by way of its potential to push returns 36 per cent if

scientific system of management is followed. Vegetables were grown in all agro-ecosystems in Kashmir. Except district Budgam vegetable cultivation is limited to family consumption only and the district is the dominant and major supplier to all the three regions of the state including few neighbouring states like Delhi and Haryana. District Budgam is cultivating vegetables on the maximum area/land available to them, the cultivate vegetables because of assured and available irrigation facilities and favourable agro-climatic conditions, therefore, all the respondents cultivated vegetables both in the kharif and rabi seasons, as such the cropping intensity was more than 200 in the vegetable growing areas. Returns per rupee invested were higher from vegetables compared to other crops in the agro-ecosystem, because, of better market accessibility. Yield can be increased up to 33 per cent in the case of CCES by adopting better management practices used by the best performers.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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