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 into 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 date 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
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 adds 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:

\[ \text{Cost } A_1 = \text{All actual expenses in cash and kind incurred in production by the producer.} \]

Cost \( A_1 \) = Cost \( A_i \) + Rent paid for leased-in land

Cost \( A_i \) = Cost \( A_i \) + 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 \( C_3 = \text{Cost} \ C_2^* + 10 \text{ per cent of Cost} \ C_2^* \) 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 \( C_1 = \text{Gross income} - \text{Cost} \ C_1 \)
Net Income over Cost \( C_2 = \text{Gross income} - \text{Cost} \ C_2 \)
Net Income over Cost \( C_3 = \text{Gross income} - \text{Cost} \ C_3 \)

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 (CACP) 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 hect.                          | per HH per hect.                        | per HH per hect.                        | per HH per hect.                       |
| **Area (k)**     | 4.48                                     | 20                                     | 0.28                                   | 4.31                                  |
| **Land preparation** | Hl(days)                                 | ML(Rs)                                 | Hl(days)                               | ML(Rs)                                |
|                  | 1.33                                     | 6.30                                   | 0.08                                   | 1.25                                  |
| **Manures**      | M(Rs)                                    | 2333.33                                | 11032.31                              | 12053.57                              |
|                  | 0.66                                     | 3.15                                   | 0.03                                   | 0.62                                  |
| **Fertilizers**  | M(Rs)                                    | 720                                    | 3404.25                                | 3125                                  |
|                  | 0.166667                                 | 0.786667                               | 0                                      | 0.15625                               |
| **Seed**         | Qty.(kg)                                 | 13.33                                  | 63.04                                  | 0                                      |
|                  | 0.33                                     | 1.57                                   | 0                                      | 0.31                                  |
| **Transplanting**| ML(Rs)                                   | 200                                    | 945.62                                 | 0                                      |
| **Plant**        | HL(days)                                 | 5.33                                   | 25.22                                  | 5                                      |
| **Protection**   | Value                                     | 104.16                                 | 492.51                                 | 7.81                                   |
|                  | Harvesting                               | 11.33                                  | 53.58                                  | 0.85                                   |
| **Production**   | Qty.(qts)                                | 14                                     | 66.19                                  | 0.83                                   |
|                  | Value(Rs)                                | 21000                                  | 99290.8                                | 1250                                  |
| **Straw(Bundles)** | Value(Rs)                               | 410                                    | 1938.53                                | 20.83                                 |
|                  |                                           | 10250                                  | 48463.4                                | 520.83                                |
| **Gross Returns**| 31250                                    | 147754                                 | 1770.83                                | 126488.1                              |
| **Total labour** | 19.25                                    | 91.01                                  | 1.70                                   | 1.07                                   |
| **Total Labour costs** | 5775                                    | 27304.97                               | 511                                    | 36500                                 |
| **Total input costs** | 4060.83                                | 19200.16                               | 311.66                                 | 22261.91                             |
| **Working Capital** | 9835.83                                | 46505.12                               | 822.66                                 | 58761.91                            |
| **Interest on Working capital** | 1180.3                                 | 5580.61                                | 98.72                                  | 7051.42                              |
| **Land Revenue& Taxes** | 5.64                                   | 26.66                                  | 0.37                                   | 26.66                                 |
| **Depreciation on farm assets** | 1742.45                                | 8238.55                                | 20                                     | 1428.57                              |
| **Rental Value of Land** | 3016.66                                 | 14263.2                                | 208.33                                 | 14880.95                             |
| **Cost (A1)**    | 6989.22                                  | 33045.99                               | 429.44                                 | 30674.29                             |
| **Cost (A2)**    | 10005.89                                 | 47309.19                               | 637.77                                 | 45555.24                             |
| **Cost (B1)**    | 8731.893                                 | 41285.55                               | 449.44                                 | 32102.86                             |
| **Cost (B2)**    | 11754.2                                  | 55575.41                               | 658.14                                 | 47010.47                             |
| **Cost(C1)**     | 14506.89                                 | 68590.51                               | 960.44                                 | 68602.86                             |
| **Cost(C2)**     | 17529.2                                  | 82880.38                               | 1169.14                                | 83510.47                             |

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### Table 2. Cost and production of apple in district Shopian

| Age (yrs) | 1st (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 | 0.33 | 0 | 0 | 0 | 0.33 | 0.74 |
| Manures (ML(Hrs)) | 0.33 | 0.33 | 1 | 1.333 | 3 | 6.66 |
| Fertilizers (ML(Hrs)) | 0.083 | 0.33 | 1.6 | 2 | 4.01 | 8.92 |
| Seed/Planting material (ML(Hrs)) | 300 | 0 | 0 | 0 | 0.33 | 0.74 |
| Irrigation (ML(Hrs)) | 0 | 0 | 0 | 0 | 0 | 0 |
| Plant Protection (ML(Hrs)) | 133.33 | 500 | 9004 | 11666.7 | 21304 | 47342.2 |
| Harvesting (ML(Hrs)) | 0 | 0 | 0 | 0 | 0 | 0 |
| Production (ML(Hrs)) | 0 | 0 | 0 | 0 | 0 | 0 |
| Value(Rs) | 0 | 0 | 10400 | 110000 | 214000 | 475556 |
| Gross Returns plus rental value of land (ML(Hrs)) | 1.41 | 1.66 | 12.53 | 15.66 | 31.28 | 69.51 |
| Total Labour Days | 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 |
Table 3. Cost and production of livestock in district Pulwama

| Age (yrs) | 1st (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 | 68820.00 | 152933.5 |
| Managerial Cost@10 ofC2 | 289.80 | 407.63 | 2625.58 | 3558.97 | 6882.00 | 15293.35 |
| Cost(C3) | 3187.84 | 4483.97 | 28881.48 | 39148.73 | 75702.00 | 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 | -2014.90 | 74062.14 | 71331.24 | 142134.9 | 320953.5 |
| Net returns over cost C2 | -2898.04 | -4076.33 | 77544.11 | 74410.27 | 145179.9 | 322622.1 |
| Net returns over cost C3 | -3187.84 | -4483.97 | 75118.52 | 70851.30 | 138297.9 | 307328.7 |

Note: HH = Household, HL = Human labour, M = Material, K = Kanal and ML = Machine Labour
|                | 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 there 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 system are topographically rich in agricultural products and nature has bestowed mountains with special 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 reveal 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 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

| Vegetable | Tomato | Sag | K.K | Brinjal | Cauliflower | Cabbage | Cucumber | Chill | Bottle guard | Radish | Carrot | Beans | Others (onion) | Total (ha) |
|-----------|--------|-----|-----|--------|-------------|---------|----------|------|-------------|--------|--------|-------|----------------|------------|
| Area      | 0.2    | 0.48| 1.23| 0.47   | 1.2         | 1.23    | 0.24     | 0.39 | 0.18        | 0.7    | 0.48   | 0.76  | 0.04           | 7.58       |
| Land      | 0.4    | 0.4  | 0.4 | 0.4    | 0.4         | 0.4     | 1.17     | 0.36 | 0.36        | 0.7    | 0.48   | 0.48 | 0.04           | 20         |
| prep.:    | 0.4    | 0.4  | 0.4 | 0.4    | 0.4         | 0.4     | 1.17     | 0.36 | 0.36        | 0.7    | 0.48   | 0.48 | 0.04           | 7.58       |
| ML(Rs)    | 100    | 230  | 615 | 235    | 600         | 615     | 196      | 90   | 350         | 240    | 380    | 20   | 3790          | 10000      |

| Manures   | M      | M    | ML  | ML     | ML         | ML      | ML       | ML   | ML          | ML     | ML     | ML    | ML             | ML         |
|-----------|--------|------|-----|-------|-----------|---------|---------|------|-------------|--------|--------|-------|----------------|------------|
| Tomato    | 6      | 57.5 | 98  | 15.6   | 15.6      | 15.6    | 15.6    | 15.6 | 15.6        | 15.6   | 15.6   | 15.6  | 15.6           | 15.6       |
| ML(Days)  | 0.01   | 0.15 | 0.2 | 0.01   | 0.01      | 0.01    | 0.01    | 0.01 | 0.01        | 0.01   | 0.01   | 0.01  | 0.01           | 0.01       |
| Fertilisers ML(Rs) | 80    | 161  | 492 | 235    | 540       | 492     | 486     | 36   | 280         | 192    | 190    | 16   | 2918          | 7699.208   |
| Interculture | 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      |
| Plant Protection Qty. (Rs) | 40    | 46   | 123 | 141    | 420       | 615     | 96      | 234  | 36          | 70     | 48     | 152  | 12            | 2033       |
| ML(Days)  | 0.1    | 0.23 | 0.615| 0.235  | 0.6       | 0.615   | 0.12    | 0.195| 0.09        | 0.175  | 0.12   | 0.12 | 0.01          | 3.295      |
| ML(Days)  | 0.01   | 0.15 | 0.2 | 0.01   | 0.01      | 0.01    | 0.01    | 0.01 | 0.01        | 0.01   | 0.01   | 0.01 | 0.01           | 3.295      |
| Harvesting ML(Days) | 0.4    | 1.36 | 3.69| 0.94   | 2.4       | 2.4     | 0.24    | 0.17 | 0.18        | 2.1    | 0.92   | 2.28 | 0.12          | 19.28      |
| Production Qty. (gts) | 3570  | 5750 | 15375| 6345   | 22500     | 15375   | 4800    | 3510 | 2160        | 8750   | 9000   | 9120 | 480           | 106915     |
| Value(Rs) | 180    | 575  | 922.5| 493.5  | 1080      | 1291.5  | 300     | 117  | 189         | 840    | 480    | 171  | 48            | 6687.5     |
| Seed/Planting material Value(Rs) | 600    | 1380 | 2460| 940    | 3000      | 1968    | 720     | 780  | 360         | 1400   | 1152   | 1520 | 96            | 16976      |
| Labour Costs(Rs) | 696    | 1076.4| 4723.2| 1558.05| 2448    | 4815.45 | 651.6   | 1643.85| 487.8 | 2058   | 1627.2 | 2234.4 | 165.6       | 24186.45   |
| 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   |
| 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    |
| Land Revenue & Taxes | 0.4    | 0.92 | 2.46| 0.94   | 2.4       | 2.4     | 0.48    | 0.78 | 0.36        | 1.4    | 0.96   | 1.52 | 0.08          | 15.16      |

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

| Area                  | 1st-Year | 2nd-Year | 3rd-Year | 4th-Year | 5th-Year | 6th-Year | 7th-Year | 8th-Year | 9th-Year |
|-----------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| **Land preparation**  |          |          |          |          |          |          |          |          |          |
| HL(Days)              | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        |
| ML/BL(Rs)             | 2250     | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        |
| Manures               |          |          |          |          |          |          |          |          |          |
| M(Rs)                 | 2647.62  | 335.22   | 376.18   | 304.22   | 387.04   | 224.64   | 150.3    | 144.82   | 181.14   |
| HL(Days)              | 2.06     | 0.16     | 0.18     | 0.14     | 0.2      | 0.12     | 0.08     | 0.06     | 0.1      |
| Fertilizers           |          |          |          |          |          |          |          |          |          |
| M(Rs)                 | 146.18   | 208.1    | 225.3    | 183.32   | 217.0    | 128.96   | 89.44    | 108.76   | 1398.52  |
| HL(Days)              | 0.06     | 0.04     | 0.04     | 0.04     | 0.04     | 0.04     | 0.02     | 0.02     | 0.32     |
| Interculture          |          |          |          |          |          |          |          |          |          |
| HL(Days)              | 0        | 4.2      | 4.68     | 3.6      | 4.68     | 2.64     | 1.8      | 1.8      | 2.16     |
| ML(Hrs)               | 25.56    | 109.37   | 107.39   | 109.37   | 107.39   | 109.37   | 107.39   | 107.39   | 0        |
| Plant Protection      |          |          |          |          |          |          |          |          |          |
| Qty(Rs)               | 103      | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        |
| HL(Days)              | 0.125    | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0.125    |
| Harvesting            |          |          |          |          |          |          |          |          |          |
| HL(Days)              | 3.15     | 4.41     | 4.91     | 3.78     | 4.91     | 2.772    | 1.89     | 1.89     | 2.268    |
| Production            |          |          |          |          |          |          |          |          |          |
| Qty.(gms)             | 10.56    | 32.26    | 52.12    | 43.86    | 60.1     | 36.28    | 26.64    | 26.64    | 36.28    |
| Value(Rs)             | 1056     | 3226     | 5212     | 4386     | 6010     | 3628     | 2664     | 2664     | 3628     |
| Seed Production       |          |          |          |          |          |          |          |          |          |
| 0                     | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        | 0        |
| Gross Returns plus rental value of land | 1056 | 3226 | 5212 | 4386 | 6010 | 3628 | 2664 | 2664 | 50510 |

Note: HH=Household, HL= Human labour, M = Material, K = Kanal and ML= Machine Labour
| Area | 1st-Year | 2nd-Year | 3rd-Year | 4th-Year | 5th-Year | 6th-Year | 7th-Year | 8th-Year | 9th-Year | Average/HH | Average/ha |
|------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------|------------|
| Labour Costs(Rs) | 2969.1 | 2643 | 2944.2 | 2268 | 2950.2 | 1671.6 | 1137 | 1131 | 1364.4 | 19078.5 | 20161.76 |
| Interest on Working capital | 1697.61 | 65.19 | 72.17 | 58.50 | 72.59 | 42.42 | 28.76 | 28.25 | 34.78 | 2100.32 | 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 | 946.81 | 1050.39 | 835.84 | 1054.27 | 528.3 | 528.3 | 633.96 | 8382.36 | 35220 |
| 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 | 936.93 | 1132.52 | 30284.46 | 127245.6 |
| Cost (B1) | 16326.42 | 283.31 | 2482.73 | 1893.64 | 2491.88 | 1694.70 | 1683.93 | 2036.12 | 43270.16 | 181807.4 |
| Cost(B2) | 16967.42 | 2180.71 | 2425.53 | 1893.64 | 2491.88 | 1694.70 | 1683.93 | 2036.12 | 43270.16 | 181807.4 |
| Cost(C1) | 19265.52 | 3326.31 | 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 | 4516.64 | 5379.61 | 3055.30 | 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 | 493.724 | 207447.4 |
| 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 | -654.71 | -151.80 | 92.42 | 268.66 | 376.76 | 370.60 | 19534.59 | -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 SADGP. 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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