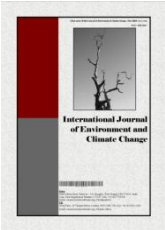

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Characterization of Organic, Inorganic and Integrated Farming Practices for Livelihood Assessment in Jammu Region – A Case Study of Sambha District

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This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aim: Organic farming is considered as a solution to environmental ills associated with modern agriculture. Survey covered crop, livestock, homestead, agro forestry systems with data pertaining to 120 farmers from 06 villages of Sambha district in Jammu division. Data refer to the input output details and other socio-economic characteristics of farm households in the crop year 2019-2020.
Study Design: Descriptive statistics like sum, average, percentage and ratio were calculated to examine the socioeconomic characteristics of the sample farmers.
Place and Duration of Study: Survey covered crop, livestock, homestead, agro forestry systems with data pertaining to 120 farmers from 06 villages of Sambha district in Jammu division.

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Methodology: Random sampling technique has been used for collecting data. A combination of descriptive statistics, mathematical and statistical techniques was used to analyse the data collected.

Results: Out of 120 sample farmers, the highest percentage of farmers was in small farm category followed by marginal, landless, medium and large. Average farm size for landless, marginal, small, medium and large were 0.02 ha, 0.71 ha, 1.43 ha, 2.65 ha and 4.80 ha, respectively. All the five categories of farmers showed little variation in terms of the age of households of the farmer. Farmer's age, literacy and farm size are factors having impact on decision making processes in farming. Own cultivated land for marginal, small, medium and large were 0.53 ha, 1.21 ha, 2.23 ha and 4.21 ha, respectively whereas using above formula total cultivated land for marginal, small, medium and large were 0.71ha, 1.43ha, 2.65ha, and 4.80 ha respectively. Among the six major farming systems, the highest number of farmers practiced Crop+Livestock+Poultry (C-L-P) system. C-L-P was followed by Crop+Livestock+Poultry+Agroforestry (C-L-P-A), Crop+Livestock+Kitchen gardening (C-L-K), Crop +Vegetables (C-V), Crops+Horticulture (C-H) and Vegetable+Horticulture (V-H) systems. Cereals were major crops of the region followed by pulses in high land areas and horticultural crops. Out of five cropping patterns, net returns was the highest in Rice-maize-vegetable cultivation (Rs.120344 ha-1) followed by Maize-Potato-Wheat (Rs.103380 ha-1), Pulse-Mustard-Wheat (Rs.101100ha-1), Rice-Pulses-Wheat (Rs. 98000 ha-1) and Rice-Wheat system (Rs.88950 ha-1). The overall food security index in case of integrated farming practicing households was 1.13. However, food security indices of food secure households and food insecure households were 1.37 and 0.87, respectively. From the index it can be seen that even though the farmers are practicing integrated farming

Conclusion: The study reveals that crop–livestock–poultry–homestead farming system was the most popular in integrated farming systems. Integrated farming has the potential of increasing farmers' income and employment creation over the mixed and traditional farming practices in the study areas. The extent of food security situation was much better among the integrated farm households when compared to others. Farm households practicing organic in integrated farming were more economically self-sustainable having different modules comprising of livestock, horticulture, poultry and crop. In UT of Jammu where land is scarce, effort should be taken to increase production through integration of various production components in agriculture for efficient utilization of resources. It would result in production of diversified products from minimum area and help in increasing the income of the farmers

Keywords: Organic farming; inorganic cultivation; integrated farming; baseline survey; livelihood of farmer; livestock; employment; income; etc.

1. INTRODUCTION

Agriculture is the predominant economic sector of Union Territory of Jammu and Kashmir as it supports about 65 per cent of its population. Jammu division of this UT is located 32.73°N and 74.87°E with elevation of 327 meters from mean sea level. The main crops of region are paddy, wheat, maize and barley. Paddy, maize and wheat contribute to major portion of the food grains in the (Union Territory) UT and account for 70 percent of the total cropped area [1]. Jammu has varied agro-climatic conditions ranging from flat land to hill topography modifying crop growth factors and hence expresses a wide variety of agricultural & horticultural produces ranging from common cereals like rice-wheat to high quality basmati, rajma etc. some of which are unique to the region. The (Union Territory) UTs of Jammu, Kashmir and Ladakh are home to high quality Basmati, Rajma in Jammu region; high quality Saffron, Zeera, fresh and dry temperate fruits and commercial floriculture in Kashmir region and high-quality apricots and sea-buck thorn berry in Ladakh region. However, productivity of major cereal crops is much less than that of other parts of the country. Dairying and livestock sector is predominant in the region and there is a need for further development of dairy sector in the (Union Territory) UT for catering to the demand of dairy products and for augmenting the subsidiary income of the farming community. Like national situation per capita arable land availability is very low in Jammu and of the 17 million households, about 80% are small farmers and landless farmers involved in farming activities through tenant farming or practicing dairying. Due to its subsistence nature,

agriculture in Jammu is characterized by diversified farming to meet the household requirements and to minimize the risk and uncertainty [2]. Small farmers try to develop as many enterprises as their farming situations allow within the present socioeconomic and agro-climatic condition, and in accordance with household goals, preference and resources. Land topography, soil type and availability of different inputs all influence the farmers in choosing different enterprises along with the environmental factors. Hence considering environmental and socio-economic factors, initiatives like dissemination of suitable modern technologies and improved package of practices would help to increase productivity, production and help in improving economic status of farmers and agro-climatic conations [3].

Organic farming is considered as a solution to environmental ills associated with modern agriculture. While organic cultivation integrates sustainable farming methods–like the exclusion of synthetic pesticides and fertilizers–it also requires considerably more knowledge and resource management for bringing the yield at par with conventional chemical agriculture. Organic farming is mainly based upon traditional methods/techniques derived on sound ecological principles which favors maximum use of organic material (crops residues, livestock excreta, legumes/green manuring, on and off farm organic wastes, growth regulators, bio-fertilizer, bio-pesticides etc) and discourages the synthetically produced agro-inputs for maintaining soil productivity and fertility and pest management under conditions of sustainable natural resources use and healthy environment. The pesticides/weedicides adverse effects on environment, their residues in food chain and their endangering action on biodiversity causing imbalance of ecosystem have been well understood and hence use of pesticides is being discouraged slowly. Apart from pesticides even chemical fertilizers have jeopardized the environment through carbon mineralization, nitrate poisoning, phosphate runoff to water bodies, reduction of beneficial soil micro-flora and micro-fauna by adversely altering the chemical and physical properties of soil. These yield associated negative effects of chemical fertilizers are also economically expensive increasing cost of cultivation to farmer Mamun et al. [4]. For example if conventional chemical farming incurs Rs. 11,250 towards cost of cultivation per hectare of rice, an organic farm spends around Rs. 9000 which can be further reduced if farmer uses his own resources as manure inputs. In terms of the energy budget too modern system of farming is expensive as it consumes 31000MJ of energy while ecological organic farming accounts for only 23400MJ. These statistics emphasize the need of organic farming in the country. However, there is declining trend of total production of rural compost and farm yard manure building the supply-demand gap which causes price of these organic inputs to go high making farmers adhere to cheap chemical fertilizers. Shrinking of green manure area is another aspect of present farming practices which do not show better prospects for sustaining soil health and implementing organic farming on large scale in the country Khan et al. [5]. Since the production of these organic inputs reduced and practicing green manuring is very less, the benefits of ecological farming can be explored in regions where sufficient organic material is available and use of chemical fertilizer is either restricted or its supply is scarce Anowar et al. [6]. Keeping these facts in view, the present study is conducted to know the status of organic farming in the Himalayan regions of Jammu.

2. MATERIALS AND METHODS

Study Area: The present study was conducted on organic and inorganic farming system status of Sambha district in Jammu division. In Sambha district, two blocks practicing different cropping systems and varied with different topography were selected. In each block three villages were selected randomly.

Sample Size: A total 120 farmers were interviewed for the study for the two districts of Sambha. 60 farmers from each block comprising of 30 farmers practicing farming under organic conditions and 30 farmers practicing farming under inorganic conditions were taken for the study. A total of 20 farmers from each selected village were chosen randomly and data was collected respectively. All possible efforts were made to ensure the collection of reasonably accurate data from the selected farmers through face-to-face interview on recall basis and also focus group discussions (FGD) were conducted in every selected village. The primary data on farming operations as well as other farm enterprises such as, livestock, poultry rearing, goat rearing, fruit crops, kitchen garden and agro forestry along with non-farm activities were collected. Secondary information sources in the form of handouts, reports, publications,

notifications, etc. having relevance with this study were also collected consulting the relevant departments. Apart from these additional basic information on age distribution, literacy level and farm categories of villages for interpreting socio-economic-literacy status of selected villages. A combination of descriptive statistics, mathematical and statistical techniques was used to analyse the data collected. Descriptive statistics like sum, average, percentage and ratio were calculated to examine the socioeconomic characteristics of the sample farmers Yang [7].

Impact Evaluation: To evaluate the impact of organic/inorganic farming on farmers' employment creation and income generation, technique of propensity score matching (PSM) was applied with Kernel and Radius matching methods.

Poverty Measurement: For understanding the level of poverty, food security was used as criteria and mathematical representation followed was:

$$\mathrm{Zi} = \frac{Yi}{\mathrm{R}}$$

Here, Z_i = Food security index for i^{th} household which takes the value of 1 for food secure and that of 0 for food insecure household. For example, Z_i = 1 if Yi is greater than or equal to R; and Z_i = 0 if Yi less than R;

Y_i is daily per capita calorie intake of i^{th} household; and
R is daily per capita calorie required for i^{th} household and i = 1, 2, 3……., 30.

Based on the household food security index (Z), food insecurity gap/surplus index (P) and the head count ratio (H) were calculated. Food insecurity gap measures the extent to which households are food insecure and surplus index measures the extent by which food secure households exceeded food security line. This index is given as:

$$\mathrm{p} = \sum_{M}^{1} \binom{\mathrm{m}}{i} = Gi$$

Where,

P = Food insecurity gap or surplus index;
M = Number of households that are food secure (for surplus index) or food insecure (for food insecurity gap); and
G_i = Per capita calorie intake deficiency (or surplus) faced by i^{th} household.

$$Gi = \left(\frac{Yi - R}{R}\right)$$

The head count ratio (H) measures the percentage of the population of households that are food secure or insecure. This is represented mathematically as:

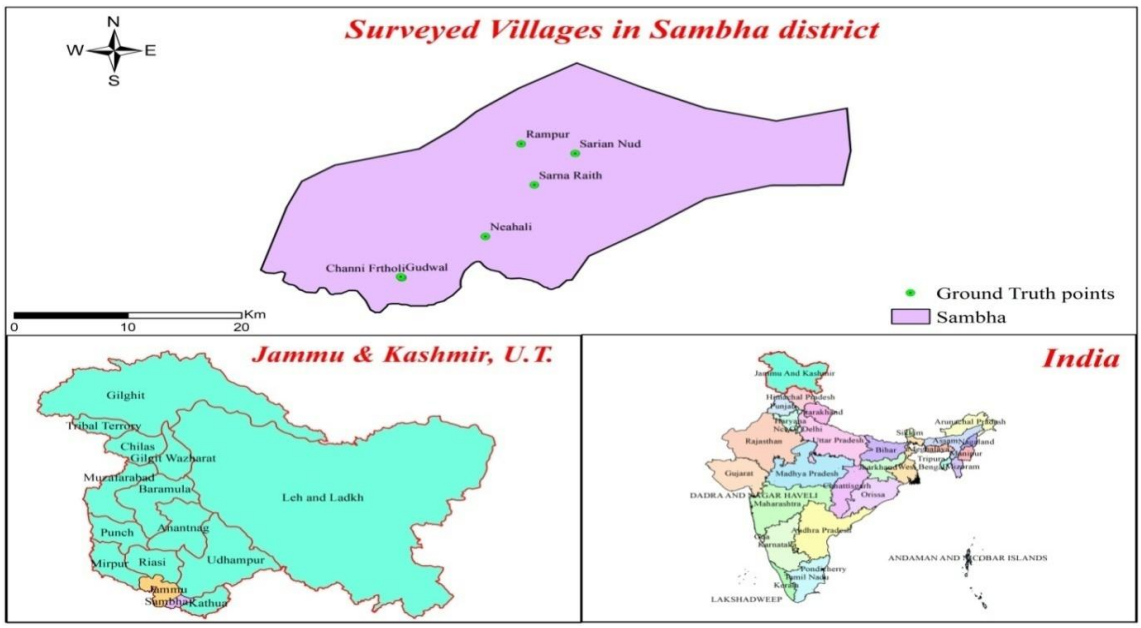

Fig. 1. Survey villages in Sambha district

$$H = \frac{M}{N}$$

Where,

H = head count ratio;
M = Number of households that are food secure (for surplus index) or food insecure (for food insecurity gap); and
N = Number of households in the sample.

Constraint Facing Index: Overall constraints score in organic and conventional chemical farming was computed for each farmer by adding their constraint scores in all 12 constraint items. The possible range of constraints facing score for each constraint could be 0 to 3 and possible range of overall constraints facing score for 12 constraints could range from 0 to 36. A constraint facing index (CIF) for each 12 selected constraints was computed by using the following formula:

$$CFI = (C_h \times 3) + (C_m \times 2) + (C_l \times 1) + (C_n \text{ X } 0)$$

Where,

C_h= Number of responses indicating high constraint;
C_m= Number of responses indicating medium constraint;
C_l = Number of responses indicating low constraint; and
C_n= Number of responses indicating no constraint.

Constraint facing index (CFI) for any of the selected constraint could range from 0 to 240 for organic farming, where, 0 indicated no constraint facing and 240 indicated highest constraint facing.

3. RESULTS

3.1 Farmers' Categories, Farm Size and Average Family Size

According to Ministry of Agriculture & Farmers Welfare, farmers are categorized based on operational holdings into five classes: marginal (below 1.00 hectare), small (1.00-2.00 hectare), semi- medium (2.00-4.00 hectare), medium (4.00-10.00 hectare) and large (10.00 hectare and above). Since there were no farmers with operational holdings of 10 ha or more than 10 ha in our selected villages, the operational holdings categorization was modified to include landless agricultural labourers as we found significant number of landless farmers actively involved in agriculture and contributing to farming. Hence, the five categories of operational holdings are landless, marginal, small, medium and large farmers (Table 1).Out of 120 sample farmers, the highest percentage of farmers was in small farm category followed by marginal, landless, medium and large. Average farm size for landless, marginal, small, medium and large were 0.02 ha, 0.71 ha, 1.43 ha, 2.65 ha and 4.80 ha, respectively. Number of persons in a family (family size) is an important parameter in order to understand socio economic aspects, capability of farm holding to support family food security and nutritional security, additional labour availability and etc. The average family sizes of landless, marginal, small, medium and large farmers were 6.3, 4.9, 5.6, 6.5 and 4 persons, respectively.

3.2 Age Distribution and Literacy Level of Selected Farmers

All the five categories of farmers showed little variation in terms of the age of households of the farmer. Farmer's age, literacy and farm size are factors having impact on decision making processes in farming. Generally, technical efficiency and tendency to try new technologies are more in younger farmers than the older farmers (Battese & Coelli, 1995). In terms of age groups, marginal farmers were younger as the average age of marginal farmers in surveyed villages was 39 years. Reason behind such young population with marginal land holdings (0.02 to 1 ha)might be due to decreasing operational holdings from one generation to next; the same trend is observed in national level too leaving average land holdings of entire population to 0.14 ha and more than 62% of the population in the working age group (15-59 years). The range of age groups of our survey was from 39 to 43 years indicating that age was not a factor controlling farming decisions and there is more possibility of introduction of innovative practices to these farmers. This leaves us to focus on literacy level and capital/infrastructure availability of farmers for practicing organic cultivation or integrated farming. Education level of the sample farmers have been divided into five groups: illiterate, PSC (primary school certificate), JSC (junior school certificate), SSC (secondary school certificate), HSC (higher secondary school certificate and above). Among the five levels, highest percentage of the farmers was in PSC level where as lowest in HSC and above HSC level

(Table02). As observed, as farm holding size decreased the education level also decreased. Large and medium farmers were highly educated as indicated by their literacy level and small and landless laborers were more illiterate. The low level of literacy was attributed to lack of economic resources in some cases while in others lack of education itself was reason behind their present poor economic status [8].

3.3 Land Ownership Pattern of Different Farm Categories

In Sambha district of Jammu, three types of land holding systems were observed: (i) Rented land holding system (ii) leased land holding system (iii) mortgage land holding system. In the first system, tenants provide one third of their produces to the owner of the land. In the second system, tenants cultivate land paying certain prefixed amount of money to the owner of the land. In the third system, tenants cultivate land providing certain amount of money (returnable) to the owner of the land. The formula for computing total cultivable land with the concerned farmer is: own cultivated land + rented in land–rented out land+leased in land–leased out land+mortgaged in land–mortgaged out land +homestead land (kitchen garden). Own cultivated land for marginal, small, medium and large were 0.53 ha, 1.21 ha, 2.23 ha and 4.21 ha, respectively whereas using above formula total cultivated land for marginal, small, medium and large were 0.71ha, 1.43ha, 2.65ha, and 4.80 ha respectively (Table 3).

Table 1. Average family size, farm size and land holdings of the sample farmers

Farm Categories	Mean family size	Farm size (no)	% of sample farmer
Landless (0.02 ha)	6.3	0.02	14
Marginal (0.021- 1 ha)	4.9	0.71	19
Small (1-2 ha)	5.6	1.43	46
Medium (2- 4 ha)	6.5	2.65	13
Large (4-10 ha)	4	4.8	8

Table 2. Mean age and educational level of different categories of farmers

Farmer category	Age (years)	Educational level (%)					
		Illiterate (%)	Literate (%)	PSC	JSC	SSC	HSC & Above
Landless (0.02 ha)	43	35	65	19	30	15	1
Marginal (0.021- 1 ha)	39	30	70	21	34	10	5
Small (1-2 ha)	42	26	74	29	24	13	8
Medium (2- 4 ha)	47	5	95	23	32	28	12
Large (4-10 ha)	46	-	100	-	69	16	15

Table 3. Land ownership pattern of different farm categories in Sambha district

Farm category	Own cultivated land*	Rented out land	Rented in land	Leased out land	Leased in land	Mortgage out land	Mortgage in land	Kitchen Garden	Fallow land	Total cultivated land
Landless	-	-	-	-	-	-	-	0.02	-	0.02
Marginal	0.53	0	0.02	-	0.11	0.02	0.02	0.03	-	0.71
Small	1.21	0.04	0.11	0.10	0.05	0.03	0.01	0.05	0.01	1.43
Medium	2.23	0.05	0.32	0.43	0.02	0.02	0.02	0.06	0.03	2.65
Large	4.21	0.13	0.42	0.96	-	0.18	0.11	0.06	0.05	4.80

**All land area in hectare*

3.4 Land and Soil Type of the Sample Farmers

Four land configuration and soil types were found in the studied district. The four land types observed are: high lands, medium high lands, medium lands and low lands. The highlands are of slopy terrain in comparatively high altitude and these lands cannot hold water during monsoon. Medium highlands are relatively lower altitude than high land and less slope which made them comparatively more fertile than high land. Medium lands are of uniformly flat topography with water holding capacity higher than high land and medium high land. In the monsoon, normally no water retaining is seen in these lands but water can be easily retained by raising "bandh" around the field. Medium low lands are also uniformly flat faced with main characteristics of submergence of these lands in 1 or 2 feet water for 2-3 months. However water movement in these low lands could be controlled by building bunds and other barrier structures. There is fifth category of low lands also present with year round submerging condition but the area is very less. The highest amounts of agricultural land existed under medium high land topography. There were four soil types associated with each of four land configurations which are listed in Table 4 and maximum area of the district was covered by sandy loamy soil type.

3.5 Major Farming Systems of the Region

Variety of farming and cropping systems were being practiced by sample farmers and among them six farming systems were found to be major in Sambha district (Table 5). Among the six major farming systems, the highest number of farmers practiced Crop+Livestock+Poultry (C-L-P) system. C-L-P was followed by Crop+Livestock+Poultry+Agroforestry (C-L-P-A), Crop+Livestock+Kitchen gardening (C-L-K), Crop +Vegetables (C-V), Crops+Horticulture (C-H) and Vegetable+Horticulture (V-H) systems. On the other hand, percentage of agricultural landwas the highest under Crop+Livestock+Poultry+Agroforestry (C-L-P-A) system and lowest under Crop+Horticulture systems.

3.6 Major Crops in the Sambha District

Cereals were major crops of the region followed by pulses in high land areas and horticultural crops. Both HYV and local varieties of crop were used in case of rice, wheat, maize, mustard, vegetables and horticultural crops. About 73 percent of district's land was under HYV crop varieties where as only 27 percent land was under local varieties. In terms of percentage acreage of land under HYV crops, the highest area was under Basmati rice followed by non-basmati rice, wheat, maize, mustard, pulses and vegetables and banana, mango, guava, jackfruit in case of fruit crops. Average yield of the crops were lower compared to their potential yield due to crop variety and management practices (Table 6).

3.7 Time of Sowing and Harvesting the Major Crops

Sowing / Planting time and harvesting time differ in different agro-ecological zones. Normal sowing / planting time and harvesting time followed a cross Sambha district in Jammu division are shown in the Table 7.

3.8 Cropping Patterns Practiced in Sambha District

Cropping patterns differ due to climate, types of land, farm size (marginal, small, medium and large) and soil type. Major cropping patterns observed in the district were rice-wheat, maize-potato-wheat, maize-bajra-wheat. The varieties of the different crops in the region are shown in the Table 8.

Table 4. Land and soil type of Sambha district

Land Type	Area (ha)	Soil Type	Area (ha)
High land	19.23	Loamy	22.13
Medium high land	47.29	Sandy loamy	12.02
Medium land	16.22	Sandy loamy	48.31
Medium low land	8.39	Clay loamy	11.07
Lowland	2.4		
Total	93.53	Total	93.53

Table 5. Major farming systems of the sample farmers of Sambha district

Major Farming Systems	Number of households	Percentage of arable land
Crop +Livestock+Poultry (C-L-P)	13	10.83
Crop+ Livestock +Poultry+Agroforestry (C-L-P-A)	67	55.83
Crop+Livestock+Kitchen gardening (C-L-H)	16	13.33
Crop+Vegetables (C-V)	9	7.50
Crops+Horticulture (C-H)	8	6.67
Vegetable+Horticulture (V-H)	7	5.83
Total	120	100.00

Table 6. Major crops grown by sample farmers of Sambha district

Crops	HYV		LOCAL	
	% Area	Yield(t ha^{-1})	% Area	Yield(t ha^{-1})
Rice (Basmati)	15.26	3.1	5.26	2.7
Rice (Non-basmati)	13.21	2.7	-	-
Wheat	15.26	3.3	2.8	2.8
Maize	12.36	3.1	1.9	2.7
Mustard	8.9	1.5	2.23	0.9
Pulses	5.8	1.3	1.2	85
Potato	6.3	18.5	2.1	13.1
Onion	2.4	15.5	-	-
Mango	5.69	2.5	-	-
Guava	4.3	9	0.9	7
Jackfruit	3.3	65	-	-
Others	7.22	-	0.21	-
Total	100	-	16.6	-

Table 7. Sowing and harvesting time of major crops

Crops	Sowing/Planting months	Harvesting time
Rice	July to August	October to November
Wheat	November to December	April
Maize (Summer)	February to March	May to June
Mustard	November	January to February
Pulses	March	May-June
Potato	November to December	January to February
Vegetables	Kharif, Rabi	Kharif, Rabi
Horticulture	Kharif, Rabi	Kharif, Rabi

3.9 Farm Inputs Used by the Sample Farmers Practicing Organic Cultivation

Among the crops, the highest input cost was in the potato followed by rice, maize, wheat, pulse and vegetable (Table 9).

3.10 Per Farm Input Used by the Sample Farmers Practicing Inorganic Cultivation

For inorganic cultivation (conventional farming practice of the region), the main inputs adding to farmers cost of cultivation are seed, urea, phosphatic fertilizers (TSP), potassic fertilizers (MOP), irrigation and labour charges. Among the crops, the highest input cost was in case of potato followed by rice, maize, wheat, pulse and vegetable (Table 10).

3.11 Vegetable Production by Kitchen Gardening

Homestead vegetables production increases family consumption of vegetables per person per day. Farmers utilize spaces available to them for kitchen gardening like open sunny places, roofs,

marshy lands, slightly marshy areas, backyard, etc. in the homestead area. Among the sample farmers, average per farm vegetables production was 17 kilogram in summer season and around 25 kilogram in winter season. The produce from kitchen gardening was consumed by family itself.

Table 8. Major cropping patterns practiced and varieties sown by the farmers of Sambha district

Cropping pattern	Kharif		Rabi	
	Crop	Variety	Crop	Variety
Rice – Wheat	Rice	B-370, Jhelum, Basmati, Shalimar rice	Wheat	1531, 2967, HD-3226 and Shalimar Wheat-1
Maize-Potato+Wheat	Maize	P-3501, NK-6240	Potato Wheat	Kufri, Chipsona-21531,2967, HD-3226
Maize+Bajra-Wheat	Maize Bajra	P-3501, NK-6240 Local, MPKV, Giant Bajra	Wheat	1531,2967, HD-3226
Rice- Pulse+Berseem	Rice	B-370, Jhelum	Pulse Berseem	Ultra, PBG5BL 1, BL 22, BL 42
Pulse-Mustard+Wheat	Pulse	Pant 031, Red kidney beans	Mustard Wheat	RS 01, RS05, Pusa mustard 26, 1531,2967, HD-3226

Table 9. Farm inputs used inorganic cultivation by the farmers of Sambha district

Crop	Input use						Tillage Cost (Rsha^{-1})	Total cost (Rsha^{-1})
	Labor (Male+ Female)	Seed (kg)	$ZnSO_4$ (kg)	Gypsum (kg)	Cow dung (kg)	Irrigation cost (Rs.)		
Rice	130	30	3	40	400	8100	5500	13600
Wheat	90	120	-	80	500	3000	4500	7500
Maize	100	10	-	-	500	7500	6800	14300
Mustard	55	8	10	75	600	1500	6500	8000
Potato	215	1800	18	90	900	4500	6200	10700
Banana	250	-	12	150	9500	5000	6000	11000
Pulses	80	35	6	60	500	1500	5500	7000
Vegetables	200	-	10	100	10000	5600	6500	12100

Table 10. Farm inputs used for inorganic crop production by the farmers of Sambha district

Crop	Input use							Tillage (Rs. ha^{-1})	Total cost (Rs. ha^{-1})
	Labor (Male+ Female)	Seed (kg)	Urea (kg)	TSP (kg)	MP (kg)	Pesticide (ltr.)	Irrigation (Rs.)		
Rice	115	30	130	40	40	1800	8000	5000	13000
Basmati rice	135	25	180	120	60	4500	10000	5000	15000
Wheat	90	130	150	120	80	-	3500	4000	7500
Maize	105	12	200	-	80	1800	7000	5000	12000
Mustard	60	10	150	100	130	3500	1500	4500	6000
Pulses	85	40	80	100	80	3500	1500	4500	6000
Potato	200	1850	220	200	240	6000	5000	5000	10000
Vegetables	220	-	200	140	120	5500	8000	6000	14000

Table 11. Kitchen garden vegetables production and utilization pattern

Crops	Vegetables produced (kg)	Vegetables consumed (kg)	Vegetables distributed to others (kg)	Vegetables sold (kg)	Market price at harvest (Rs.kg^{-1})
Summer vegetables					
Cucurbits	08	06	02	-	25
Brinjal, leafy vegetables	09	08	01	-	20
Total	17	14	03	-	
Winter vegetables					
Potato	07	05	02	-	20
Cauliflower	06	04	02	-	18
Radish	05	04	01	-	10
Bean	02	02	00	-	15
Bottle gourd	05	04	01	-	12
Total	25	19	06	-	

3.12 Farm Fruit Production and Disposal

In most of the farm holdings in Sambha district, three to four fruit trees were present either in main farm area or on border/bund areas. The farmers were very much interested in integrating fruit crops in their farm fields. However, availability of quality root stocks and varieties were main constraints. The fruit crops were mainly used for nutritional security of farm family rather than selling in open market (Table 12).The main fruit trees of the region were mango, jackfruit, banana, papaya and guava. Average per farm mango, jackfruit, banana, papaya and guava were 10kg, 60kg, 30kg, 5 kg and 8kg respectively.

3.13 Farm management practices by the sample farmers

The agronomic management includes variety selection, seed rate, seeding date, transplanting fertilizer application date, organic manures addition, weed control, water management, pesticide application and harvesting. Agronomic managements of the cultivated crops have been indicated in the Table 13.

3.14 Sources of Inputs Used by Sample Farmers

Sources of inputs used by sample farmers described in the Table 14. On an average, 28 percent farmers used the previous season seeds for next season sowing, 45 percent farmers purchased fresh seeds from market, 8 percent farmer's procured quality seeds from cooperatives like IFFCO, 15 percent farmers used seeds borrowed from other farmers and around 4 percent farmer's procured seeds from other sources. In contrast to seed procurement, all the fertilizer and pesticide used were purchased from the market. In case of organic manures and farm yard manure usage, on average 85 percent farmers used farm yard manures from their own livestock/dairying component and around 15 percent farmers purchased compost/ vermin compost from market. For farm operations the machinery were used on hiring for their small holdings on per hour basis and only 6-7% farmers owned farm implements like tractors, cultivators etc. and thus farm mechanization was almost outsourced. In terms of labour, farm family labour was utilized mainly and hired labour was used for some special farm operations like rice transplanting, weeding, etc.

3.15 Household Livestock and Poultry Assets and Economics of Sample Farmers

Average household livestock and poultry assets (no.) under different categories of farm holdings of sample farmers have been shown in the Table 15. In Jammu region it has been observed that almost farmers kept livestock on their farm and their family milk requirements were met by these livestock. It was type of subsistence dairying rather than commercial dairying. Only very few farmers involved in commercial dairying with more than 5 to 6 animals. In Jammu and

surrounding region it has been observed that some landless farmers are exclusively involved in dairying with more than 10 animals and they purchase feed in the form of berseem, wheat straw from other farmers of the surrounding areas. Farmers involved in dairying mainly kept cows, bullocks, goat and sheep as their main animal components. More than 25% of the farmers practiced poultry and very few famers kept pigs also. The average number of animals, mean expenditure on them in the form of feed or medicines and profits originating from animal component is showed in Table 16.

3.16 Per Farm Credit Received and Purpose of Credit

For their day to day farm operations farmers mainly relied on various credit sources in Sambha district of Jammu. Some of the sources of farm credit were local cooperatives, NGOs (Van Sampda & Bharitya Social Vision Trust etc), banks (J&K Bank, Ellaquai Dehati Bank, Grameen Bank etc), money lenders and other sources (relatives, friends, etc). Some farm credit sources along with the purpose of farm loans are listed in Table 17.

3.17 Cost and Returns of Major Cropping Systems of Sambha District

Among the existing cropping systems of Sambha district (Table 8), five major cropping systems are taken for calculating cost benefit ratio *viz* Rice-Wheat, Maize-Potato-Wheat, Rice-Pulses+Wheat, Rice-Maize-Vegatable and Pulse-Mustard-Wheat. Total cost, gross returns, net returns and BC ratio have been shown in the Table 18. Out of five cropping patterns, net returns was the highest in Rice-maize-vegetable cultivation (Rs.120344 ha-1) followed by Maize-Potato-Wheat (Rs.103380 ha-1), Pulse-Mustard-Wheat (Rs.101100ha-1), Rice-Pulses-Wheat (Rs. 98000 ha-1) and Rice-Wheat system (Rs.88950 ha-1). However in terms of cost: benefit ratio, Pulse-Mustard-Wheat was profitable yielding Rs.2 for every rupee invested. Rice-Maize-Vegetable was next profitable cropping system in terms of returns for money invested with B:C ratio of 1.89 and Rice-Pulses + Wheat system had B:C ratio of 1.81.

3.18 Farm Income of the Sample Farmers

For calculating farm income of selected farmers, money received from sale of farm produce or its equivalent received during in exchange for labor or services, income generated from sale of animal products like milk, compost, wool etc have been considered. Farm income (Rs.) of the sample farmers have been shown in the Table 19. The items of income were categorized as crop, livestock, poultry, kitchen gardening, agro forestry, off farm and nonfarm. In case of land less and marginal farmers, non-farm income were higher compared to income from other sources.

3.19 Farm Expenditure of the Sample Farmers

Payment of cash for inputs used and for services utilized in the form of farm mechanized operations or other farm operations like sowing, harvesting, transportation etc. are considered for calculating farm expenditure. Apart from expenditure on cultivation, in order to understand profitability or loss situation of farm family the other household expenditures like food, cloth, residential (like water charges, electricity charges, rent in case of rented house etc.), education, medicine, etc. have also been taken in to consideration to know economic status of farmers. Mean household expenditure (Rs.) of the sample farmers have been shown in the Table 20. All the items of expenditure were the highest in case of large farmer followed by medium, small, marginal and landless.

Table 12. Fruit production for additional income and family nutritional security

Fruit crop	Fruits harvested(kg)	Fruits consumed (kg)	Fruits distributed to others (kg)	Market price of fruit at harvest (kg-1)	Total value of fruits (kg)
Mango	10	5	5	40	400
Jackfruit	60	30	30	30	1800
Banana	30	18	12	20	600
Papaya	5	3	2	20	1000
Guava	8	4	4	25	200

Table 13. Agronomic management practices of different crops by sample farmers

	Rice	Wheat	Maize	Potato	Mustard	Banana	Moong	Vegetables	
								Summer	Winter
Variety	BasmatiB-370	1531, 2967	Hybrid		Tori- 7	Sagor	Bari mung	HYV, Local	HYV, Local
Seed rate (Kg/ha)	25-30	40-50	20	1.5-2 ton			25-30	-	-
Sowing time	June	Nov/ Dec	Feb/ Mar	Nov/ Dec	Nov	Sep/Oct		Feb/ Mar	Oct/Nov
Transplanting time	July	-	-	-	-	-	-	May-Apr	-
Urea (Kg/ha)	100	100-150	100	150-200	80-100	200-300	70-80	-	-
TSP (Kg/ha)	40	30-40	60 -70	200-250	30-40	100-150	-	-	-
MP (Kg/ha)	-	20-40	40-50	250-300	30-40	100-150	-	-	-
Cow dung (ton/ha)	-	4-6	4-6	-	5-8	4-6	6-8	-	-
Weeding (no.)	2	1	2-3	2-3	1	1-2	2-3	1-2	-
Irrigation (no.)	-	2-3	5-6	-	3-4	1-2	4-5	1	-
Insecticide application (no.)	1/2	-	-	-	6-8	1-2	4-5	1	-
Harvesting date	Nov- Dec	April	May- June	Feb- Mar	Jan	Jul -Aug	May	Jul-Aug	Nov-May

Table 14. Sources of inputs used by sample farmers

Inputs	Source of input used (in %)				
	Own	Market	IFFCO	Other	SAUs
Seeds/ Seedlings	28	45	08	15	04
Fertilizers	-	100	-	-	-
Pesticides	-	100	-	-	-
Organic / Farm Yard Manure	85	15	-	-	-
Mechanical power	07	-	-	93	-
Labour	41	-	-	59	-

Table 15. Average per household livestock and poultry assets (no.) of sample farmers

Assets	Marginal	Small	Semi medium	Medium	Large	Average
Cow	0.92	1.06	1.15	1.00	0.95	1.02
Calf	1.00	0.85	0.93	1.00	1.00	0.96
Buffalo	0.95	1.03	1.05	1.00	0.90	0.99
Bullocks	0.50	0.43	0.30	0.00	0.00	0.25
Goat	2.30	2.00	1.40	1.60	0.00	1.46
Sheep	1.80	1.30	1.00	0.00	0.00	0.82
Poultry	2.33	4.67	5.45	3.20	3.00	3.73
Pig	0.35	0.00	0.00	0.00	0.00	0.07

Table 16. Cost and returns of livestock and poultry enterprises of the sample farmers

Livestock	Number of animals (Avg.)	Original value	Feed & medicine cost per animal	Present value	Total cost	Net returns
		1	2	3	4 (=1+2)	4-3
Cow	2.02	31000	14000	39000	25000	14000
Buffalo	1.00	39000	16000	49000	33000	16000
Bullocks	0.25	19000	12000	28000	16000	12000
Goat	1.46	2900	1500	4800	3300	1500
Sheep	0.82	1750	1200	3600	2950	650
Poultry	3.73	12	120	900	132	768
Pig	0.7	6600	1800	9600	8400	1200

Table 17. Farm credits availed and purpose of the credit

Name of Organizations	Purpose of Credit
Local Samitee	Household service
NGO (Van Sampda & Bharitya Social Vision Trust)	Crop Cultivation
Bank (J&K Bank, Ellaquai Dehati Bank, Grameen Bank)	Crop Cultivation
Money lenders	Household service
Others	Household service

Table 18. Cost and returns of major cropping patterns of Sambha district

Cropping Patterns	Total cost (Rs. ha.1)	Gross Return (Rs. ha^{-1})	Net Return (Rs. ha^{-1})	B:CRatio
Rice-Wheat	112550	201500	88950	1.79
Maize-Potato-Wheat	132120	235500	103380	1.78
Rice-Pulses+wheat	121500	219500	98000	1.80
Rice- Maize-Vegetable	135256	255600	120344	1.88
Pulse-Mustard-Wheat	98100	199200	101100	2.03

Table 19. Farm income (Rs.) of the sample farmers

Item	Landless	Marginal	Small	Medium	Large
Crop	0	21345	36450	46520	96500
Livestock	7526	9510	11254	15260	19250
Poultry	560	800	960	1250	0
Kitchen garden	600	760	800	1000	0
Agro-Forestry	230	590	700	900	3200
Total Farm	8916	33005	50164	64930	118950
Off-farm	32650	46512	0	0	0
Non-farm	15000	23500	32560	26500	20000
Total	65482	136022	132888	156360	257900

Table 20. Average per farm expenditure (Rs.) of the sample farmers

Item	Landless	Marginal	Small	Medium	Large
Food	41250	43560	44230	60000	70000
Cloth	3200	3950	3500	3950	5250
Residential	1550	1890	2100	2320	5500
Education	0	6500	6000	7000	10000
Medicine	2200	3200	3000	2000	3000
Others	7200	8000	9200	10000	15000
Total	55400	67100	68030	85270	108750

3.20 Agricultural Services from Different Organizations

In the sambha district mainly four types of agricultural services (Table 21) which were utilized by farmers were observed, viz, consultancy services which included suggestion sab out crop production, pest, diseases, etc. that were mainly provided by state agricultural departments, KVK and SAU. Suggestions about new technology were mainly provided by SAU and state agricultural department. Farm credit and crop insurance services were provided by Department of Agricultural Extension, Indian Council Agriculture Research (ICAR), J&K Bank, Ellaquai Dehati Bank, Grameen Bank, other local cooperative banks and few non-government organizations (NGO).

3.21 Food Security Index of the Households Practicing Integrated Farming

To know economic sufficiency and poverty situation of selected integrated farming practicing farmers, indices like food security index and calorie intake are used. The overall food security index in case of integrated farming practicing households was 1.13. However, food security indices of food secure households and food insecure households were 1.37 and 0.87, respectively. From the index it can be seen that even though the farmers are practicing integrated farming, there is still gap in terms of food security and more interventions in terms of resource utilization, recycling and income generation are helpful to increase food security index of these farmers. The reason for food insecure situation is unscientific management of farm resources and thus scientific approach for resource management can uplift the status. Nevertheless, integrated farm households were food secure given the fact that 89.0 percent integrated farms were able to meet the required calorie intake of 2,122 kcal per capita per day while 11.0 percent of households consumed only 1853 kcal per capita, which is below recommended calorie intake and thus fell under food insecure households (Table 22). The food insecurity gap/surplus index shows that the food secure households exceeded the food poverty line by 6.0 percent while food insecure households fell short of required calorie intake by 8.0 percent, respectively.

3.22 Constraint Facing Index (CFI)

The computed CFI for 12 common constraints taken into consideration ranged from 208 to 240. Majority of the farmers mentioned that low price of outputs, non-availability and/or high price of HYV seeds and scarcity of concentrate feed and fodder are the serious problems in the study areas and CFI for these three problems faced by farmers were 240, 231 and 227, respectively.

Table 21. Services provided by different organizations

Kind of services	Service provider (name)	Farmers
Suggestions about crop production, input, pest, diseases, etc.	Department of Agricultural Extension, KVK, ICAR and NGOs	54
Information on new technology	Indian Council Agriculture Research (ICAR) and State Agriculture University	39
Credit for crop production	J&K Bank, Ellaquai Dehati Bank, Grameen Bank, Department of agricultural extension	18
Other farming services	Non-Government Organizations (NGO's)	09

Table 22. Food security index for integrated farming

Type of farming	Food security indices	Food secure households	Food insecure households	Average
Integrated farming system	Food security index	1.33	0.87	1.12
	Per capita daily calorie intake (kcal)	2823.83	1853.1	2290.99
	Food insecurity gap/Surplus index	0.06	-0.08	-

Table 23. Selected constraints (12) along with constraints facing index and rank order

Constraints faced by farmers	Extent of constraints (N=120)				CFI	Rank order
	High (3)	Medium (2)	Low (1)	Not at all (0)		
Low price of outputs	39	49	25	7	240	1
Lack of adequate extension services	42	36	33	9	231	2
Non-availability and high price of HYV seed	37	42	32	9	227	3
Scarcity of labour	41	35	33	11	226	4
Lack of storage and processing facilities	31	50	29	10	222	5
Lack of education and training facilities	35	41	34	10	221	6
High price of fertilizers and pesticides	38	37	32	13	220	7
Transportation problem	36	39	33	12	219	8
High price of vaccine and medicine	35	41	31	13	218	9
High price of irrigation	40	33	31	16	217	10
Outbreak of diseases	33	38	35	14	210	11
Non-availability of grazing land	32	38	36	14	208	12

High cost of fertilizers and pesticides and lack of irrigation facilities are also more remarkable problems. Low literacy level and lack of knowledge about trainings related to agricultural skill improvement and modern technologies were forcing farmers to stick to traditional method of cultivation in order to make subsistence living and thus were getting lower yield. Irrigation facilities and electricity charges of using bore wells etc. were also some of the constraints faced by farmers in upland areas where water table was very low. Labourers in study area migrated from agriculture to non-farm employment creating scarcity of labour (Table 23).

4. DISCUSSION

The categorization based on the data of Ministry of Agriculture & Farmers Welfare, farmers into five classes: marginal (below 1.00 hectare), small (1.00-2.00 hectare), semi- medium (2.00-4.00 hectare), medium (4.00-10.00 hectare) and large (10.00 hectare and above) was the basis of characterizing the collected data from the two districts of Sambha. The average land holding of more than 10 hectare was not observed and this category was excluded from the analysed data. The observation is in conformity with national data and the farmers having a mean sixe family of 6.3 to 4 for all the categories was observed.

However the parameters of socio economic aspects, capability of farm holding for viable support of farm family meeting its nutritional requirements, food security and excess produce for sale were also a factor and in the study ware correlated. The maximum number of farmers belonged to small or marginal farmers which are comparable to the national average. The educational level and age of farmers are also a contributing factor in the wellbeing of a farm family. More literate farmers are prone to adapt new and proven techniques than illiterate farmers. This is also evident from risk taking ability of the farmers. Small and marginal farmers are more effected by small changes rather that large farm holding farmers. In the conducted study the mean age of marginal and small farmers shows that they are more adaptive to the changing scenario and are able to increase their farm income by exposing themselves to new information, new high yielding varieties. The level of literacy is directly proportional to adaptation of new technologies. Farmer's age, literacy and farm size are factors having impact on decision making processes in farming. Generally, technical efficiency and tendency to try new technologies are more in younger farmers than the older farmers. As observed, as farm holding size decreased the education level also decreased. Large and medium farmers were highly educated as indicated by their literacy level and small and landless labourers were more illiterate. The low level of literacy was attributed to lack of economic resources in some cases while in others lack of education itself was reason behind their present poor economic status. Land ownership is another important factor for farm economy. Leased land farmer is less prone to adopt new technologies and he has to pay the rent or produce in addition to meet his family requirement. This is an important factor in the present agriculture system in India. Own land owner or farmer with small or marginal land holding is generally more self-reliant. Soil type and land type also affect the quality as well as quantity produced from the same area. In the study area it was observed that the typography and soil type composition was more towards sandy loamy and the output of the farmers field was commensurate with the type of soil. However high yielding proven varieties are able to produce more in the same conditions and it is advisable for the farmers of this region to undertake better varieties for higher economic returns. Farming system is a central focal point for a farmers family for nutritional security and socio economic conditions of a farmer. The prevailing system with highest recorded system of crop+livestock+poultry+agroforestry was dominant in the region. A clubbing of different nodules for round the year production and productivity is the backbone of farming community. The prevailing system ensured the nutritional and socioeconomic stability of the farmers of the study area. Different regions de[pending on agro climatic zones and area have different farming systems but the most common is of crop+livestock+horticulture which results in economic stability. The major crops in the crop component differs from region to region but in the present study it was observed that rice wheat or maize were the dominant crops in the farming system which is again comparable to Indian agrarian system where wheat or rice is the predominant crop in a farming system. Farm inputs is a major factor for economic viability of a farm household and in the present study it was observed that major inputs were in the form of seed cost and fertilizers. This is a common scenario in the Indian farming system and the results obtained are comparable with the study findings. Vegetables and fruits form an important part of nutritional security of a farm household. In the present study backyard kitchen garden and horticulture produce provided important inputs for maintaining the nutritional security and excess produce as additional income for the farm family. Dairy, poultry, livestock etc unit is also an important factor in a farming system which yields milk, meat, eggs, cotton along with manure for the farm as well as vermicomposting unit. This is an integral part and all the activities of a farm household revolves around it. The present study also reveal that the animal component results in stable income throughout the year and is being practiced my all the categories of the farm household. Indices like food security index and calorie intake are used to know economic sufficiency and poverty situation of selected integrated farming practicing farmers. The overall food security index in case of integrated farming practicing households was 1.13. However, food security indices of food secure households and food insecure households were 1.37 and 0.87, respectively. From the index it can be seen that even though the farmers are practicing integrated farming, there is still gap in terms of food security and more interventions in terms of resource utilization, recycling and income generation are helpful to increase food security index of these farmers

5. CONCLUSION

The study reveals that crop–livestock–poultry–homestead farming system was the most popular in integrated farming systems. The study also concludes that integrated farming has the potential of increasing farmers' income and employment creation over the mixed and traditional farming practices in the study areas. The study also reveals that the extent of food security situation was much better among the integrated farm households. Worth mentioning improvements were found based on different capitals (namely, human capital, social capital, natural capital, physical capital and financial capital) of farm households practicing in integrated farming. Considering the findings of the study, some important policy recommendations have been arisen which are: special incentives from Department of Agricultural Extension (DAE) on irrigation and fertilizer for small and marginal farmers are necessary to enhance the productivity and profitability. Veterinary services for dairy cattle and poultry birds should be ensured by Department of Livestock Services (DLS) timely at village level. Training program on production technologies, harvesting, processing, storage and transportation should be offered by different institutes for increasing skill of the farmers so that they can obtain and apply knowledge for field crops, livestock production and fish culture as well.

6. RECOMMENDATION

In UT of Jammu where land is scarce, effort should be taken to increase production through integration of various production components in agriculture for efficient utilization of resources. It would result in production of diversified products from minimum area and help in increasing the income of the farmers. In conclusion it can be said that the integrated farming system is not only technically feasible but also economically viable in Jammu. Extensive efforts should be made to transfer this technology among the farmers.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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