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ASSESSING FARM INVENTORIES AND LAND UTILIZATION FOR ORGANIC CROP CULTIVATION IN THE LOW HILL REGION OF HIMACHAL PRADESH INDIA

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ABSTRACT

Organic agriculture is increasingly promoted in the Himalayan region as a strategy for enhancing ecological sustainability and livelihood security. This study investigates the structure of farm inventories and land utilisation patterns among marginal and small organic farming households in the low hill zone of Himachal Pradesh. Using primary survey data, the analysis examines household-level investments in buildings, machinery, livestock, and land resources, and evaluates their implications for organic crop cultivation. The results indicate that ass*et al*location is heavily skewed toward residential buildings and livestock, underscoring the centrality of mixed farming and manure-based nutrient management in organic systems. Mechanisation levels remain limited, with farmers predominantly relying on manually operated implements due to high acquisition costs and the constraints posed by small, fragmented holdings. Land-use analysis reveals that cultivated land constitutes the highest share of total holdings, complemented by pastures, orchards, and ecological spaces that support fodder availability and soil fertility. The overall findings suggest that organic farming in the low hills is characterised by resource-constrained yet ecologically integrated production systems. Policy measures aimed at improving access to shared mechanisation services, strengthening livestock support, promoting local organic input production, and enhancing market integration are essential for improving the economic viability and long-term sustainability of organic agriculture in the region.

Keywords: Sustainable agriculture, organic farming, Himachal Pradesh, Crop cultivation, Farm Inventory

Introduction

Sustainable agriculture has emerged as a central priority for both policymakers and farming communities in India, particularly in the Himalayan region where fragile ecosystems, declining soil fertility, and climate variability pose persistent challenges (Jodha, 2000; Negi & Joshi, 2002). The low hill zone of Himachal Pradesh represents a unique socio-ecological landscape where smallholder farmers increasingly rely on organic cultivation as a strategy to conserve natural resources, enhance soil health, and reduce dependence on external inputs. Organic agriculture in mountain regions has been shown to strengthen ecological resilience while supporting livelihood diversification through integrated crop–livestock systems (Pimentel *et al*., 2005; Rao *et al*., 2015).

Within these systems, the structure of farm inventories including land, livestock, machinery, and buildings plays a vital role in shaping production decisions and long-term sustainability. Farm assets are widely regarded as core indicators of economic strength, technological capability, and adaptive capacity among rural households (Binswanger & Deininger, 1997; Rao & Chotigeat, 1981). In the Himalayan context, where landholdings are typically

small and fragmented, asset structure strongly influences the scale of farming operations, labour allocation, and the adoption of organic management practices (Sharma & Sharma, 2014). Capital formation in agriculture, especially through investments in durable assets such as buildings, machinery, and livestock, contributes significantly to enhancing farm productivity and reducing vulnerability (Fan *et al*., 2000).

Organic farming systems in the low hills are characterised by labour-intensive practices, diversified cropping patterns, and the close integration of livestock with crop production. Livestock provides essential inputs such as farmyard manure (FYM), and their presence is central to nutrient cycling in organic systems (Rangnekar, 2006; Tiwari *et al*., 2004). Land utilisation decisions including the allocation of land to cultivated crops, pastures, orchards, and ecological buffers further shape the sustainability of farm households. Land-use heterogeneity has been shown to support ecological stability and enhance both food and fodder security in mountainous agriculture (Negi & Joshi, 2002; Bhatt & Bhandari, 2014). Despite the growing relevance of organic agriculture in Himachal Pradesh, empirical studies examining how farm inventories and land-use patterns influence the functioning and economic viability of organic farms remain limited. Existing literature largely focuses on productivity comparisons, agro-ecological benefits, or adoption determinants, whereas analyses of asset distribution and resource utilisation among organic growers in the low hill zone are relatively scarce (Chand *et al*., 2015; FAO, 2018).

Recognising these gaps, this study investigates the asset structure and land-use patterns of organic farming households in the low hills of Himachal Pradesh. Understanding how farmers invest in buildings, machinery, livestock, and land resources is essential for identifying the constraints and opportunities for strengthening organic agriculture in the region. The insights generated contribute to ongoing discussions on sustainable agricultural transitions in mountain environments and offer evidence-based recommendations for policy support, infrastructure development, and targeted interventions.

The overarching aim of this study is to assess how farm inventories and land utilisation patterns shape the functioning and sustainability of organic crop cultivation in the low hill zone of Himachal Pradesh. To achieve this aim, the study pursues the following two objectives:

1. To analyse the investment patterns in key farm assets including buildings, machinery, livestock, and landholdings among marginal and small organic farming households.
2. To examine the land utilisation structure and evaluate how resource allocation across cultivated land, pastures, orchards, and other land-use components influences organic farming practices in the region.

Materials and Methods

Study Area

The study is being conducted in the state of Himachal Pradesh, where CSKHPKV played a role in promoting sustainable farming practices through regular training on natural and organic farming in various districts of Himachal Pradesh. Most training has been organised with the Japan International Cooperation Agency (JICA). The Kangra and Hamirpur districts were purposefully selected for this study based on the maximum number of trainings conducted. In these districts, farmers were found mainly to be marginal (<1 hectare) and small (>1 hectare), which represents the farming population of the state.

Sampling design

The number of trainings conducted by CSK HPKV University was highest in the Kangra and Hamirpur districts. A list of villages in the two districts where the trainings were conducted was prepared. From this list, six villages, three from each district, were randomly chosen. Using the proportional allocation method, 120 beneficiary farmers were randomly selected from these villages. The farmers were classified into two groups based on their land holdings: marginal and small farmers. Finally, a cohort of 120 farmers was selected proportionately, comprising both categories across the selected villages, resulting in 70 marginal and 50 small farmers. The distribution of farmers in different categories is depicted in Table 1.

Table 1: Distribution of the sample amongst different categories of farmers

Sr. No.	Category	Size of holding (ha)	Number of farmers	Percentage of farmers
1.	Marginal	<1	70	58.33
2.	Small	>1	50	41.67
Total			120	100.00

Data collection

Data was gathered from both primary and secondary sources. Primary data was collected using pre-tested schedules through personal interviews with selected sample farmers. Secondary data from various published and unpublished sources were used for the study.

Result and Discussion

Farm inventories and land utilisation

Capital formation is recognised as one of the most critical determinants of agricultural growth, productivity enhancement, and resilience among farm households (Binswanger & Deininger, 1997; Fan *et al*., 2000). The structure of farm assets including land, buildings, machinery, and livestock acts as a key indicator of economic status and technological adoption (Rao & Chotigeat, 1981). Given the centrality of these assets in shaping household-level production decisions, the farm inventories of the sample households were systematically analysed.

Investment pattern in farm buildings

The analysis in Table 2 shows that residential buildings constituted the major share of investment (84.18%), consistent with findings that rural households prioritise housing as a primary capital asset (Vaidyanathan, 1986). Cattle sheds (13%) formed the second major component, reflecting the strong integration of livestock with crop production in mountain farming systems particularly under organic regimes (Rangnekar, 2006).

Small farmers invested more in buildings (Rs. 20,10,704) compared to marginal farmers (Rs. 15,44,571), indicating a stronger capital base. Similar asset-investment gradients across farm sizes have been documented in Himalayan agriculture (Sharma & Sharma, 2014).

Table 2: Investment pattern on buildings on sample farms (Rs. /farm)

Sr. No.	Particulars	Marginal	Small	Overall
1	Residential buildings	1306000	1686000	1464000
		(84.55)	(83.85)	(84.18)
2	Cattle shed	197000	266000	226000
		(12.75)	(13.23)	(13.00)
3	Store house	14000	13000	14000
		(0.92)	(0.65)	(0.81)
4	Vermi-compost shed	7000	8504	7627
		(0.45)	(0.42)	(0.43)
5	Any other	20571	37200	27500
		(1.33)	(1.85)	(1.58)
	Total investment	1544571	2010704	1739127
		(100.00)	(100.00)	(100.00)

Note: Figures in parentheses indicate percentages of the total in each category.

Investment in farm machinery

Mechanisation has been acknowledged globally as a driver of higher labour productivity and reduced drudgery (Pingali, 2007). However, in organic and smallholder systems, the dominance of manually operated tools persists, owing to the scale of operations and cost constraints (Chand *et al*., 2015).

Table 3 indicates that:

- **Major machinery** accounted for ~85% of total investment.
- Power tillers represented the largest share (51.91%), followed by tractors (16.38%).
- Investments were higher on small farms (Rs. 34,757) relative to marginal farms (Rs. 17,913), consistent with typical farm-scale patterns (FAO, 2018).

Organic farmers' reliance on hand tools for frequent operations such as weeding aligns with research showing that labour-intensive tasks remain prominent in organic systems (Pimentel *et al*., 2005).

The limited number of power-operated implements in the sample aligns with earlier studies indicating that high initial investment costs and low utilisation rates discourage machinery ownership among hill farmers (Bhatt & Bhandari, 2014). Hiring services, therefore, become a rational economic choice.

As indicated earlier, most of the sample farms were associated with organic farming, for which the minor tools were reported to be more important for day-to-day routine operations. It was reported by most respondents that intercultural operations like weeding/hoeing, insect-pest management are more

important in organic farming compared to inorganic farming.

Table 3 reveals that among the minor implements, the share of sickle and hoe was found to be higher than compared of other implements. During the survey, it was found that generally the sample farms had mostly manually operated farm implements; however, they were also found to use the services of power-operated tools on a payment basis. The majority of the respondents had the view that these implements are quite useful in the existing system of crop production, i.e. natural/ organic crop production practices.

The total investment in implements/machinery by sample farms was estimated to the tune of Rs. 17,913, Rs. 34,757and Rs. 24,960on marginal, small and overall farms, respectively. About 85 per cent of the total investment was made in major farm machinery, while the proportion of minor farm implements was just about 10 per cent of the total investment on an overall farm situation. Among the major farm machinery, the highest investment was made on power tiller, followed by tractor, i.e. about 51 and 16 per cent, respectively, of the total investment.

Table 3: Investment on farm machinery and tools (Per household)

Sr. No	Particulars	Marginal			Small			Overall		
		Number	Value (Rs.)	Per cent	Number	Value (Rs.)	Per cent	Number	Value (Rs.)	Per cent
A	Major farm machinery									
1.	Tractor	0.06	1500	8.37	0.12	11436	32.90	0.08	4089	16.38
2.	Power tiller	0.14	8632	48.19	0.20	14600	42.01	0.17	12956	51.91
3.	Chaff cutter	0.54	1864	10.41	0.72	2620	7.54	0.62	2064	8.27
4.	Thresher	0.09	1503	8.39	0.04	680	1.96	0.07	1150	4.61
5.	Water lifting pump	0.14	257	1.43	0.72	786	2.26	0.38	431	1.73
6.	Sprayers/duster	0.83	465	2.60	1.00	606	1.74	0.90	523	2.10
	Sub-total	1.80	14221	79.39	2.80	30728	88.41	2.22	21213	85.00
B	Minor farm implements									
1.	Plough									
i.	Wooden	0.20	104	0.58	0.24	131	0.38	0.22	116	0.46
ii.	Iron	0.69	886	4.95	0.68	818	2.35	0.68	858	3.44
2.	Spade	1.71	283	1.58	2.48	576	1.66	2.03	317	1.27
3.	Hoe	3.83	368	2.05	4.04	315	0.91	3.92	346	1.39
4.	Rake	1.31	246	1.37	1.72	279	0.80	1.48	260	1.04
5.	Sickle									
i.	Local	3.60	195	1.09	4.23	214	0.62	3.77	203	0.81
ii.	Cerated	3.49	133	0.74	4.65	150	0.43	3.82	140	0.56
6.	Axe	1.77	710	3.96	1.84	740	2.12	1.80	722	2.89
7.	Planker	0.66	342	1.91	0.68	321	0.92	0.67	334	1.34
	Sub-total	17.26	3267	18.23	20.56	3544	10.20	18.39	3296	13.20
C.	Tools/implements for organic inputs									
1.	Tanks	1.14	306	1.71	1.24	365	1.05	1.18	331	1.33
2.	Pitcher	1.77	119	0.66	1.72	120	0.35	1.75	120	0.47
	Sub-total	2.91	425	2.38	2.96	485	1.40	2.93	451	1.81
	Total		24960	100.00		34757	100.00		24960	100.00

The table further reveals that other manually operated tools and implements constituted the meagre portion in the total investment on sample farms because they were relatively cheaper than power-operated tools/implements. On the other hand, the number of power-operated tools and implements on sample farms was quite low compared to the total machinery, mainly on account of their high initial cost and occasional use in the crop production operations. This indicates that respondents opted to hire the services of these implements rather than purchasing them for their own farm use. It is clear from the above discussions that farmers have the tendency to purchase the farm implements/machinery that are of frequent use on the farm and at the same time require relatively less initial investment as well as less maintenance cost. Higher levels of investment in farm implements on small farms, especially in major implements, were due to the size of their holding.

Livestock inventory and investment

Livestock rearing is an integral part of agriculture and holds a complementary relationship with crop production. Livestock and crop components have a

symbiotic relationship with each other, as by-products of crop components are used as fodder for livestock and livestock in turn supply valuable FYM for crop production. Cow dung, urine are the major constituents of livestock components, which are used for the preparation of different organic inputs on an organic farm. Therefore, it was important to know the existing status of livestock inventory on sample farms. Generally, the farming community used to maintain livestock in order to meet their household needs for milk, milk products, meat, eggs, wool, draught power and farm yard manure (FYM). The size of the unit depends on the availability of fodder, household and farm needs. This component of farming also provides the yearly income and employment opportunities to farm families.

The investment pattern given in Table 4 shows that the investment in livestock was remarkably higher on small farms. And the total investment was Rs. 10,6774/farm as compared to Rs. 68,153/farm on marginal farms. This clearly shows that small farmers have better breeds of animals. The major investment was on local cow (29.68%), followed by crossbred cow (25.01%) and buffalo (21.59%) out of the total investment of Rs. 88,686/farm on the overall farm situation. The investment in small ruminants, i.e. sheep and goats, accounted for about 9 per cent of the total investment. The investment proportion for goats was higher on marginal farms (2.15%) than the small farms (0.60%).

Table 4: Investment on livestock (Per household)

Sr. No.	Particulars	Marginal			Small			Overall		
		Number	Value (Rs.)	Per cent	Number	Value (Rs.)	Per cent	Number	Value (Rs.)	Per cent
A.	Cow local									
1	Milking	1.11	24092	35.35	0.96	19280	18.06	1.05	22654	25.54
2	Dry	0.29	3357	4.93	0.32	4880	4.57	0.30	3675	4.14
	Sub-total	1.40	27449.00	40.28	1.28	24160.00	22.63	1.35	26329.00	29.68
B.	Cow crossbred									
1	Milking	0.26	8914	13.08	0.72	22432	21.01	0.45	16436	18.53
2	Dry	0.09	2686	3.94	0.28	10040	9.40	0.17	5750	6.48
	Sub-total	0.35	11600.00	17.02	1.00	24380	30.41	0.62	14092	25.01
C.	Buffalo									
1	Milking	0.26	9029	13.25	0.56	21650	20.28	0.38	16967	19.13
2	Dry	0.11	2429	3.56	0.08	1920	1.80	0.10	2186	2.46
	Sub-total	0.37	11458	16.81	0.64	23570	22.08	0.48	19153	21.59
D.	Bullock	0.34	523	0.77	0.08	132	0.12	0.23	360	0.41
E.	Heifer									
1	Local cow	0.11	2171	3.19	0.24	4880	4.57	0.17	3300	3.72
2	Crossbred cow	0.14	2743	4.02	0.12	2230	2.09	0.13	2517	3.49
3	Buffalo	0.09	2657	3.90	0.24	4046	3.79	0.15	2900	3.27
F.	Calves	0.23	2514	3.69	0.28	3600	3.37	0.25	2968	3.35
G.	Sheep	1.09	5571	8.17	1.64	11040	10.34	1.32	7850	7.80
H.	Goat	1.06	1466	2.15	0.44	644	0.60	0.80	1123	1.27
	Total		68153	100.00		106774	100.00		88686	100.00

Land inventory and utilisation pattern

Agriculture is land land-based avocation, and as such, land resources are the basic requirements for farming around which the economy of farmers revolves. The size of land holding determines the nature and scale of farming with respect to different farm enterprises in a given situation. Thus, the size of land holding is an important factor for the adoption of different farm enterprises, their scale of operation, technology to be adopted and ultimately an indicator of economic security and welfare of a particular farm family. The farmers having relatively large-sized land holdings have more opportunities for increasing the scale of production as compared to the farmers who have relatively small-sized holdings. Keeping this factor into consideration, the land inventory and its utilisation on sample farms have been examined and are presented in Table 5.

The table reveals that the average size of land holding on sample farms was 0.54, 1.23 and 0.83 ha on marginal, small and overall farm categories, respectively. It can be seen from the table that the

available land was allocated for the cultivation of field crops, orchards, trees/forests and used as permanent pastures/grasslands. Among the different land uses, the proportion of total land holding put under cultivation of crops was found to be highest, i.e. about 68 per cent on the overall farm category. It was comparatively more among marginal farms (83%) as compared to small farms (58%). The interaction with the respondents revealed that the existing allocation of land for the cultivation of crops was sufficient to meet the household requirements on marginal farms for cereals, vegetables, pulses and oilseeds. A higher proportion of area was found under permanent pastures, viz, 8.40, 15 and 12.50 per cent on marginal, small and overall categories, respectively. The area put under residential buildings, cattle sheds, etc., was estimated at 3.72, 5.78 and 5 per cent on marginal, small and overall farm categories, respectively.

Table 5 : Land utilization pattern on sample households (Per cent)

Sr. No.	Particulars	Marginal			Small			Overall		
		IR	UIR	Total	IR	UIR	Total	IR	UIR	Total
1	Owned land (ha)	0.44	0.09	0.53	0.76	0.56	1.32	0.57	0.29	0.86
2	Leased-in (ha)	0.02	-	0.02	-	-	-	0.01	-	0.01
3	Leased-out (ha)	-	0.01	0.01	-	0.09	0.09	-	0.04	0.04
4	Total land holding (ha)	0.46	0.08	0.54	0.76	0.47	1.23	0.58	0.24	0.83
		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
i	Cultivated land	98.00	-	83.41	93.89	-	57.92	95.78	-	67.58
ii	Orchard	0.50	4.25	1.06	5.06	3.06	4.28	2.97	3.29	3.06
iii	Fallow land	-	5.75	0.85	-	3.73	1.43	-	4.11	1.22
iv	Cultivated wasteland	1.50	-	1.28	1.05	2.37	1.56	1.25	1.93	1.45
v	Land under misc. trees/grasses	-	8.63	1.28	-	36.61	14.03	-	31.24	9.19
vi	Permanent pastures	-	56.37	8.40	-	39.15	15.00	-	42.46	12.50
vii	Area under buildings	-	25.00	3.72	-	15.08	5.78	-	16.97	5.00

IR- Irrigated UIR- Un-irrigated

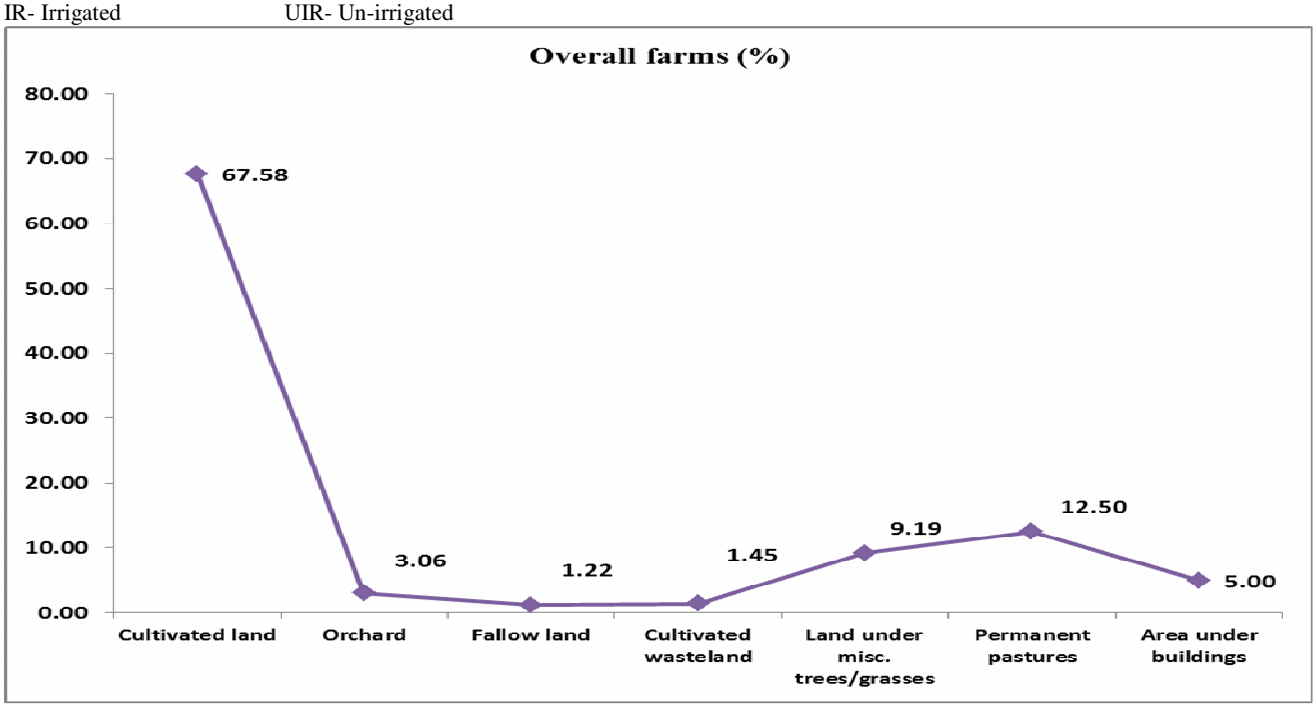

Fig. 1: Land utilization pattern of sample households

Conclusion

This study assessed the farm inventories and land utilisation patterns of organic farming households in the low hill region of Himachal Pradesh, providing valuable insights into the structural and resource-based factors shaping sustainable agriculture in the area. The analysis showed that marginal and small farmers allocate the largest share of their investments to residential buildings and livestock, reaffirming the strong crop–livestock integration that underpins organic soil fertility, nutrient cycling, and household nutrition in mountain ecosystems. Investments in major farm machinery were relatively limited, reflecting the high cost of mechanisation, small and fragmented landholdings, and the continued reliance on labour-intensive production techniques inherent to organic farming. Land-use patterns further revealed a balanced mosaic of cultivated fields, pastures, fallow land, and ecological spaces, demonstrating farmers' efforts to simultaneously meet household food, fodder, and environmental needs.

These findings underscore that organic agriculture in the low hills is sustained through careful resource management, diversified enterprises, and traditional ecological knowledge. However, the constraints of limited land, low mechanisation, and modest asset bases also restrict productivity growth and livelihood enhancement. Strengthening farmers' resilience and improving livelihood outcomes, therefore, requires supportive institutional and policy interventions tailored to the specific needs of hill agriculture.

Policy Suggestions for Strengthening Farmers' Livelihoods

1. Expand access to shared mechanisation services (e.g., Custom Hiring Centres) to reduce costs and improve the timeliness of operations.
2. Strengthen livestock support systems including breed improvement, fodder development, and veterinary care to enhance nutrient recycling and household income.
3. Promote local production of organic inputs through training and community-level composting and bio-input units.
4. Encourage diversified land-use practices, such as agroforestry and silvi-pasture, to improve ecological resilience and income stability.
5. Improve market access and value addition for organic produce through certification clusters and local processing support.
6. Facilitate affordable credit and risk protection tailored to small organic farmers to stimulate productive investments.

Overall, the study highlights that sustainable organic farming in the low hill regions largely depends on balanced resource utilisation, strong livestock integration, and diversification within limited landholdings. With well-designed policy support, improved institutional frameworks, and enhanced market integration, organic agriculture in Himachal Pradesh can evolve into a robust pathway for livelihood improvement, environmental conservation, and long-term rural sustainability.

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