Socio-Economic Profile, Disposal Pattern, and Production Constraints of Finger Millet Farmers in Almora District of Uttarakhand

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Abstract— *The study examines the socio-economic profile, disposal pattern, and production constraints of finger millet farmers in Almora district, Uttarakhand, the state's leading producer. Three development blocks were purposively selected, with 90 farmers chosen through multi-stage random sampling. Primary data for 2022–23 were collected via structured interviews, and secondary data on area and production (2008–09 to 2022–23) were sourced from official records. Descriptive statistics were used to analyze socio-economic variables, while Garret's ranking technique identified key production and marketing constraints. Results revealed that cultivation is dominated by middle-aged farmers (35–55 years), with moderate literacy, large family sizes, and small, largely rainfed holdings. Livestock, especially goats and buffaloes, form a vital component of the farming system, with major investment in cattle sheds. On-farm income accounted for the bulk of household earnings. Constraints included labour scarcity, low productivity, inadequate irrigation, and market access issues, underscoring the need for targeted interventions to sustain and enhance finger millet cultivation.*

Keywords— Finger millet, Almora district, socio-economic profile, disposal pattern, production constraints, hill agriculture.

I. INTRODUCTION

Finger millet (*Eleusine coracana*), locally known as *mandua*, is one of the most important traditional cereal crops cultivated in the hilly regions of Uttarakhand. It plays a crucial role in household food security, livestock feeding, and income generation, especially in rainfed and resource-constrained areas (Negi et al., 2017). Owing to its high nutritional value, particularly in calcium, dietary fiber, and essential amino acids, finger millet has been increasingly recognized as a "nutri-cereal" and is being promoted under various government programmes like the National Food Security Mission (NFSM) and Millet Mission (GoI, 2022).

In Uttarakhand, Almora district stands out for its significant area under finger millet cultivation due to its suitability to the mid- and high-altitude conditions and its adaptability to low-input farming systems (Bhatt et al., 2018). The crop not only sustains the livelihoods of marginal and smallholder farmers but also forms an integral part of traditional food systems and cultural practices. However, in recent decades, finger millet cultivation in the region has witnessed a declining trend due to factors like changing dietary preferences, rural outmigration, low market prices, and inadequate marketing infrastructure (Bisht et al., 2021).

Disposal patterns of finger millet vary considerably across households, with a large share retained for home consumption, some used for livestock feed, and the rest sold in local markets. The decision on disposal is influenced by socio-economic characteristics such as farm size, income, education, and household food requirements (Singh et al., 2019). In addition, farmers face numerous constraints in production and disposal, including low productivity, high labour requirements, poor access to improved seed varieties, and lack of organized marketing channels (Joshi & Negi, 2016).

Given this backdrop, a systematic assessment of farmers' socio-economic characteristics, disposal patterns, and constraints is essential to formulate strategies that can enhance production, market linkages, and farmer income, thereby revitalizing finger millet cultivation in Almora district.

Problem Statement

Finger millet cultivation in Almora district, despite its historical and nutritional importance, is facing multiple challenges threatening its sustainability. Smallholder farmers in the region rely heavily on finger millet for household consumption and as a supplementary source of income. However, productivity levels remain low due to factors such as limited adoption of improved agronomic practices, lack of access to quality seeds, high labour dependency, and vulnerability to climatic variability (Negi et al., 2017; Bhatt et al., 2018).

Market-related issues further exacerbate the situation. The disposal of finger millet is often restricted to local markets or barter systems, yielding minimal returns to farmers. The absence of organized procurement, poor price realization, and lack of value addition facilities reduce the incentive to expand cultivation (Bisht et al., 2021). Moreover, the changing socio-economic landscape, including migration and dietary shifts towards wheat and rice, has led to a decline in both area and production of the crop (Singh et al., 2019).

While several government initiatives under the Millet Mission aim to promote millets, there is limited empirical evidence from Almora district assessing the socio-economic profile of farmers, their disposal practices, and the constraints they face. Without such localized data, policy and extension interventions may not address the actual bottlenecks in production and marketing. This study, therefore, seeks to fill this gap by providing an in-depth analysis, which will serve as a basis for targeted interventions to revive finger millet cultivation in the region.

II. METHODOLOGY

The study was conducted in Almora district, Uttarakhand, which records the highest area and production of finger millet in the state. The sampling framework ensured a representative selection of blocks, villages, and farmers. Out of eleven development blocks, three were purposively chosen based on area under finger millet: Dhauladevi, Hawalbagh Lamgarah. From each block, two villages were randomly chosen in consultation with block officials. Farmers cultivating finger millet on at least one-fourth of their land during kharif 2022–23 were listed, and 15 farmers per village were randomly selected using a random number table, giving a total sample of 90 farmers.

Primary data was collected through personal interviews using a structured schedule, covering family profile (size, education, occupation, income), landholding, livestock, assets, inputs used, production, disposal pattern, and marketing details for 2022–23. **Secondary data** on area and production (2008–09 to 2022–23) was gathered from government records, reports, journals, and other publications.

Descriptive statistics (averages, percentages) were used to analyze the **socio-economic characteristics** of the respondents-farmers such as age, education, family size, landholding, cropping pattern, income, livestock, and resource availability. **In order to examine the disposal pattern of finger millet d**escriptive analysis captured total production, quantities retained (consumption, seed) and marketed, along with timing of sale, price, and selling costs. The constraints faced in production and marketing of **finger millet** were identified with expert input. The constraints experienced by the farmers were investigated in order to examine the limitations on finger millet production and marketing. Furthermore, in consultation with experts a set of possible constraints were identified. The respondent-farmers were asked to rank the identified constraints according to their order of severity. On the basis of the given ranks each constraint's percent position was found out using Garret's ranking technique.

$$\text{Percent Position} = \frac{(R_{ij} - 0.5)}{N_j} \times 100 \quad (1)$$

Where,

R_{ij} is the rank given for the i^{th} term by the j^{th} individual

N_j is the number of items ranked by the j^{th} individual

Percent position was converted into garret's score using the table given by Garret and Woodworth (1969). For each factor the scores of individual respondent were summed up and divided by the total number of respondents from whom scores were gathered. The mean scores for all the factors were arranged in descending order and thus rank were assigned to the constraints.

III. RESULTS AND DISCUSSION

The socio-economic characteristics of finger millet growing farmers in Almora district have been assessed and discussed under following heads;

3.1 Age-wise distribution of finger millet growing farmers:

Age is a key factor in assessing the socio-economic status of farmers, as it directly influences their experience, decision-making ability, technology adoption, and overall understanding of agricultural practices. Younger farmers are generally more open to adopting modern technologies and methods, while older farmers may prefer traditional techniques. This generational difference can affect how agricultural innovations are embraced and implemented.

The age profile of finger millet farmers in Almora district is presented in Table 1. The results indicate that the majority of respondents (48.88%) belonged to the 35–55 years age group, with a mean age of 41.02 years. This was followed by younger farmers below 35 years (33.33%) with a mean age of 30.40 years, while farmers aged 55 years and above accounted for 17.78% with a mean age of 61.06 years.

At the block level, the 35–55 years group predominated in all three blocks, accounting for 46.66% in Lamgarah, 43.33% in Dhauladevi, and 56.66% in Hawalbagh. The proportion of younger farmers (<35 years) was relatively higher in Dhauladevi (40.00%) compared to Lamgarah (36.66%) and Hawalbagh (23.33%). The highest share of older farmers (≥55 years) was observed in Hawalbagh (20.00%), followed closely by Lamgarah and Dhauladevi (16.67% each).

TABLE 1
AGE-WISE DISTRIBUTION OF FINGER MILLET GROWING FARMERS IN ALMORA DISTRICT

Age Groups	Blocks						Almora district	
	Lamgarah		Dhauladevi		Hawalbagh			
	No.	Mean age	No.	Mean age	No.	Mean age	No.	Mean age
Below35 years	11 (36.66)	30.54	12 (40.00)	29.91	7 (23.33)	31.00	30 (33.33)	30.40
35-55 years	14 (46.66)	41.21	13 (43.33)	43.76	17 (56.66)	38.76	44 (48.88)	41.02
55 and above	5 (16.67)	63.40	5 (16.67)	61.60	6 (20.00)	58.67	16 (17.78)	61.06
Total	30 (100.00)	41.00	30 (100.00)	41.20	30 (100.00)	40.93	90 (100.00)	41.04

Note: Figures in parentheses represent the percentage of farmers

These findings suggest that finger millet cultivation in Almora is primarily undertaken by middle-aged farmers who are in their economically active years, with moderate participation from younger and older age groups. The lower representation of youth may be due to their migration to urban areas in search of better employment opportunities, a trend commonly observed in the hill regions of Uttarakhand.

The predominance of middle-aged farmers aligns with the observations of Joshi et al. (2018), who reported that in hill agriculture, the 35–55 years age bracket forms the core of the farming workforce due to their greater physical capacity, farming experience, and decision-making ability. Similarly, Mehta and Rana (2020) found that middle-aged farmers tend to adopt

traditional crops like millets more readily, as they balance knowledge of indigenous practices with an openness to improved cultivation techniques.

The relatively smaller proportion of young farmers corroborates the findings of Negi et al. (2017), who attributed youth disengagement in traditional farming to migration and preference for non-farm jobs. The presence of older farmers, though smaller in proportion, reflects the persistence of millet cultivation as a subsistence practice, as also noted by Rawat et al. (2019) in their study on cereal crops in the Central Himalayas.

Overall, the age structure indicates that any intervention aimed at promoting finger millet cultivation in Almora must engage the middle-aged group as the key target, while also creating incentives for youth participation to ensure generational continuity in millet farming.

3.2 Educational Level of Finger Millet Growing Farmers:

The distribution of farmers by educational level in Almora district is presented in Table 2. The results indicate that the highest proportion of farmers (43.33%) had education up to the high school level, followed by middle school (18.89%), intermediate (12.22%), and graduate or above (8.89%). A notable 16.67% of farmers were illiterate.

TABLE 2
EDUCATIONAL LEVEL OF FINGER MILLET GROWING FARMERS

Educational level	Blocks			Almora district
	Lamgarah	Dhauladevi	Hawalbagh	
Illiterate	3 (10.00)	7 (23.33)	5 (16.67)	15 (16.67)
Middle	7 (23.33)	4 (13.33)	6 (20.00)	17 (18.89)
Highschool	10 (33.33)	13 (43.33)	16 (53.33)	39 (43.33)
Intermediate	7 (23.33)	3 (10.00)	1 (3.33)	11 (12.22)
Graduateandabove	3 (10.00)	3 (10.00)	2 (6.67)	8 (8.89)
Total	30 (100.00)	30 (100.00)	30 (100.00)	90 (100.00)

Note: Figures in parentheses represent the percentage of farmers

Block-wise, Hawalbagh exhibited the highest share of high school-educated farmers (53.33%), suggesting relatively better educational attainment in this block compared to Lamgarah (33.33%) and Dhauladevi (43.33%). The proportion of illiterate farmers was highest in Dhauladevi (23.33%) and lowest in Lamgarah (10.00%). Graduates and above constituted a small proportion across all blocks, with the highest share in Lamgarah and Dhauladevi (10.00% each).

The predominance of farmers with only middle or high school education highlights limited higher educational attainment in the study area. This may influence awareness and adoption of improved agricultural practices, as education is often linked to technology adoption and market participation.

These findings are consistent with Meena et al. (2014), who reported that in hill regions of Uttarakhand, most smallholder farmers possessed education only up to the secondary level, with a significant fraction being illiterate. Similarly, Kumari et al. (2018) observed that limited formal education among millet farmers in hilly terrains constrained their ability to access and process agricultural information. In contrast, Bisht and Rana (2016) found that in areas with better road connectivity and market access, the proportion of farmers with higher secondary and graduate education was comparatively higher, suggesting a correlation between infrastructure development and educational attainment.

The educational profile in Almora, therefore, suggests a moderate literacy base but limited higher education exposure. This can affect participation in government schemes, record-keeping for farm management, and ability to leverage modern value

chain opportunities for finger millet. Enhancing farmer training and field-level demonstrations could partially bridge the knowledge gap created by lower formal education levels.

3.3 Family Size and Composition of Finger Millet Farmers:

The average family size of finger millet-growing households in Almora district was 6.26 members, comprising 31.30% adult males, 31.15% adult females, and 38.49% children (Table 3). Across the selected blocks, family size was slightly higher in Hawalbagh (6.62 members) compared to Lamgarah (6.14) and Dhauladevi (6.21).

TABLE 3
SIZE AND COMPOSITION OF FAMILY OF FINGER MILLET GROWING FARMERS

Particulars	Blocks			Almora district
	Lamgarah	Dhauladevi	Hawalbagh	
Adultmales	1.87 (30.45)	2.1 (33.81)	1.9 (28.70)	1.96 (31.30)
Adult females	1.87 (30.45)	1.9 (30.59)	2.1 (31.72)	1.95 (31.15)
Children	2.4 (39.08)	2.21 (35.58)	2.62 (39.58)	2.41 (38.49)
Total	6.14 (100.00)	6.21 (100.00)	6.62 (100.00)	6.26 (100.00)

Note: Figures in parentheses represent the percentage of farmers

In terms of gender composition, adult males constituted the highest proportion in Dhauladevi (33.81%), while adult females were most prominent in Hawalbagh (31.72%). Children formed the largest proportion in all blocks, with Hawalbagh (39.58%) and Lamgarah (39.08%) reporting relatively higher shares, indicating the predominance of younger dependents in these households.

The predominance of children suggests a high dependency ratio, which may influence household labour availability for agricultural operations. A higher proportion of dependents can increase the burden on earning members, affecting both production and market participation in finger millet farming.

These findings align with Rawat et al. (2018), who reported that rural hill households in Uttarakhand typically have family sizes between six and seven members, with a substantial proportion of children, reflecting higher dependency burdens. Similarly, Bisht and Tiwari (2020) observed that the family size in smallholder farming communities of Kumaon ranges between 5.5 and 6.5, with children accounting for over one-third of the population.

The balanced proportion of adult males and females in the present study also supports the observations of Joshi et al. (2017), who found near-equal gender representation among adults in hill farming households, attributed to the active participation of women in both farm and non-farm activities. This gender balance has implications for agricultural decision-making and labour allocation, particularly in crops like finger millet that require intensive manual labour.

Overall, the results suggest that finger millet farmers in Almora district have relatively large families with high dependency ratios, which can influence production efficiency, household consumption patterns, and marketing behaviour.

3.4 Pattern of Landholding:

The average landholding size of finger millet-growing households in Almora district was 2.01 acres, comprising 0.26 acres (12.94%) uncultivated land and 1.75 acres (87.06%) cultivated land (Table 4). Among the cultivated area, 0.17 acres (8.46%) was irrigated, and 1.58 acres (78.61%) was un-irrigated. In terms of cultivated land, irrigated area constituted 9.90%, while un-irrigated area formed a dominant 90.29%.

Block-wise, Hawalbagh recorded the highest average landholding (2.40 acres), followed by Dhauladevi (1.87 acres) and Lamgarah (1.74 acres). The proportion of uncultivated land ranged from 11.23% in Dhauladevi to 15.52% in Lamgarah, indicating some land left fallow due to factors such as labour shortage, low productivity, or lack of irrigation. Across all blocks,

un-irrigated land constituted the overwhelming majority of cultivated land, underscoring the predominance of rainfed agriculture in the district.

The limited availability of irrigated land suggests a strong dependence on monsoonal rainfall, which makes production more vulnerable to climatic variability. This is a common challenge in hill agriculture, where topographical constraints and lack of infrastructure restrict irrigation expansion.

TABLE 4
PATTERN OF LAND HOLDING OF FINGER MILLET GROWING FARMERS

(Acres per household)

S. No.	Particulars	Blocks			Almora district
		Lamgarah	Dhauladevi	Hawalbagh	
1	Uncultivated	0.27 (15.52)	0.21 (11.23)	0.30 (12.5)	0.26 (12.94)
2	Cultivated	1.47 (84.47)	1.66 (88.78)	2.10 (87.5)	1.75 (87.06)
3	Irrigated	0.15 (8.62) {10.17}	0.17 (0.91) {10.20}	0.20 (8.33) {9.70}	0.17 (8.46) {9.90}
4	Unirrigated	(75.86) {89.80}	(79.68) {89.76}	(79.17) {90.48}	(78.61) {90.29}
	Total	1.74 (100.00)	1.87 (100.00)	2.40 (100.00)	2.01 (100.00)

Note: Figures in small parentheses represent percentage of total area; and
Figures in curly parentheses represent percentage of cultivated land

The findings align with those of Tiwari et al. (2018), who reported that in Uttarakhand's hilly regions, smallholders predominantly cultivate on un-irrigated slopes, with irrigation coverage often below 15% of operational holdings. Similarly, Joshi and Negi (2019) found that finger millet cultivation in Kumaon is concentrated in marginal lands with low irrigation facilities, resulting in low productivity despite the crop's resilience.

Rao et al. (2017) also observed that in rainfed hill farming systems, farmers maintain small parcels of irrigated land primarily for high-value crops or vegetables, while cereals like finger millet are grown largely on un-irrigated land. This pattern is evident in Almora, where irrigated plots account for less than one-tenth of cultivated land across all sampled households.

The relatively larger holdings in Hawalbagh may be attributed to its more accessible terrain and better road connectivity, which, as Rawat et al. (2020) noted, often correlate with slightly higher operational land sizes in mid-altitude zones compared to remote interior blocks.

Overall, the data reinforce the conclusion that finger millet cultivation in Almora is dominated by small, largely rainfed holdings, a condition that shapes both productivity outcomes and farmers' vulnerability to weather fluctuations. Addressing irrigation constraints and promoting water-harvesting techniques could enhance crop security and yields in the region.

3.5 Pattern of Investment in Farm Assets:

The pattern of investment in farm assets among finger millet–growing farmers in Almora district (Table 5) reveals that the bulk of capital is allocated to **farm buildings**, particularly cattle sheds, while investment in **farm tools and implements** remains comparatively low.

TABLE 5
PATTERN OF INVESTMENT IN FARM ASSETS ON FINGER MILLET GROWING FARMS

(Rs. per farm)

S. No.	Assets	Blocks			Almora District
		Lamgarah	Dhauladevi	Hawalbagh	
A	**Farm tools and Implements**				
1.	Indigenous plough	1773 (2.10)	1617 (2.01)	1623 (1.84)	1671 (1.98)
2.	Small implements	1756 (2.08)	1596 (1.98)	1671 (1.90)	1674 (1.99)
	Sub Total	3529 (4.18)	3213 (3.99)	3294 (3.74)	3345 (3.97)
B.	**Farm building**				
1.	Semi-pucca cattle shed	49035 (58.15)	51750 (64.24)	51498 (58.38)	50761 (60.21)
2.	Kuchcha cattle shed	31767 (37.67)	25600 (31.78)	33233 (37.75)	30200 (35.82)
	Sub Total	80802 (95.81)	77350 (96.01)	84731 (96.26)	80961 (96.03)
	Grand Total	84331 (100.00)	80563 (100.00)	88025 (100.00)	84306 (100.00)

Note: Figures in parenthesis represent percentage of total investment

Across all blocks, the semi-pucca cattle shed accounted for the largest share of total investment—ranging from 58.15% in Lamgarah to 64.24% in Dhauladevi, with the district average at 60.21%. This reflects farmers' priority toward securing livestock housing, as livestock plays a crucial role in hill farming systems by providing manure, draught power, and supplementary income. The kucha cattle shed also received a significant proportion of investment, ranging from 31.78% (Dhauladevi) to 37.75% (Hawalbagh). Together, cattle sheds constituted over 95% of total asset investment across the district, with the highest proportion in Hawalbagh (96.26%).

In contrast, investment in farm tools and implements was relatively small, averaging only 3.97% of the total. Within this category, expenditure was almost evenly split between indigenous ploughs and small implements. Indigenous plough investment ranged from ₹1,617 per farm in Dhauladevi to ₹1,773 in Lamgarah, while small implements varied from ₹1,596 in Dhauladevi to ₹1,756 in Lamgarah.

The high concentration of investment in livestock housing rather than mechanized tools suggests that finger millet cultivation in Almora is still characterized by traditional, labour-intensive practices. This pattern may be attributed to the region's hilly terrain, which limits the adoption of large machinery, and to the integrated crop–livestock farming system prevalent in the district.

These findings align with Rana et al. (2014), who reported that in hill agriculture, investment in livestock housing often exceeds that in farm implements due to the critical role of livestock in nutrient cycling and draught power. Similarly, Negi and Joshi (2019) observed that in Uttarakhand's mid- and high-altitude regions, smallholder farmers prioritize durable cattle sheds to protect animals from extreme climatic conditions.

The relatively low investment in tools and implements supports the conclusions of Singh et al. (2017), who found that the adoption of improved farm machinery in hill agriculture is constrained by fragmented landholdings, steep slopes, and limited access to credit. The predominance of indigenous ploughs also reflects the persistence of traditional practices, consistent with Kumari et al. (2020), who emphasized that farmers in rainfed, hilly areas rely on low-cost, locally available equipment rather than capital-intensive machinery.

Overall, the results highlight the need for policies promoting appropriate, small-scale mechanization suited to hill agriculture, alongside investment in improved livestock housing to enhance animal productivity and farmer income.

3.6 Livestock Ownership on Finger Millet Farms

Table 6 presents the average number and composition of livestock maintained by finger millet–growing households in Almora district. The total livestock per farm was highest in Dhauladevi block (10.57), followed by Lamgarah (10.07) and Hawalbagh (9.03), with the

district average being 9.89 animals per farm. Goats constituted the largest share of total livestock (36.20%), followed by bullocks (17.39%), calves (16.98%), cows (15.27%), and buffaloes (14.26%).

Goat rearing was particularly prominent, with an average of 4.33 goats in Dhauladevi, 3.6 in Lamgarah, and 2.8 in Hawalbagh. The high proportion of goats reflects their adaptability to hill terrains, low maintenance costs, and suitability for mixed farming systems. Bullocks were the second most important category, averaging 1.72 per farm, indicating their continued relevance for draught power in hill agriculture where mechanization remains limited. Poultry ownership was also noteworthy, with an average of 5.17 birds per farm, highest in Hawalbagh (6.71).

TABLE 6
LIVESTOCK REARED ON FINGER MILLET GROWING FARMS

(No. per farm)

S. No.	Livestock	Blocks			Almora district
		Lamgarah	Dhauladevi	Hawalbagh	
1.	Cow	1.61 (15.98)	1.35 (12.77)	1.56 (17.28)	1.51 (15.27)
2.	Bullock	1.92 (19.06)	1.67 (15.80)	1.58 (17.48)	1.72 (17.39)
3.	Buffalo	1.4 (13.90)	1.42 (13.43)	1.4 (15.50)	1.41 (14.26)
4.	Calf	1.54 (15.29)	1.8 (17.03)	1.69 (18.72)	1.68 (16.98)
5.	Goat	3.6 (35.75)	4.33 (40.96)	2.8 (31.01)	3.58 (36.20)
	Total	10.07 (100.00)	10.57 (100.00)	9.03 (100.00)	9.89 (100.00)
6.	Poultry	3.9	4.89	6.71	5.17

Note: Figures in parenthesis represent percent of livestock

The predominance of goats in the livestock portfolio aligns with the findings of Rawat et al. (2017), who reported that small ruminants are integral to the livelihood strategies of hill farmers in Uttarakhand, providing both meat and supplementary income. Similarly, Kumar and Singh (2018) observed that goat rearing in Himalayan regions is preferred due to lower feed requirements and the ability to graze on marginal lands.

The significant presence of bullocks is consistent with the observations of Singh et al. (2016), who highlighted that animal-drawn ploughing remains the primary land preparation method in hill agriculture due to fragmented holdings, steep slopes, and high machinery costs. The role of bullocks in mixed crop-livestock systems also supports nutrient recycling through manure, as noted by Negi et al. (2020) in their study on integrated farming in Uttarakhand hills.

The modest proportion of buffaloes and cows reflects constraints such as limited stall-feeding capacity and fodder availability, which is in agreement with Joshi and Tiwari (2015), who found that dairy development in hill districts is restricted by feed shortages and lack of veterinary infrastructure. Poultry rearing, though secondary, complements household nutrition and income, a trend also reported by Bisht et al. (2019) in their survey of backyard poultry systems in the Kumaon region.

Overall, the livestock composition in finger millet–growing farms indicates a diversified and resilient mixed farming system, where livestock not only contribute to household income and nutrition but also support crop production through draught power and organic manure. The dominance of goats and bullocks highlights the continued reliance on traditional, resource-efficient practices in the hill agro-ecosystem.

3.7 Pattern of Investment in Livestock on Finger Millet Growing Farms:

Table 7 presents the pattern of livestock investment among finger millet farmers in Almora district, disaggregated by block.

TABLE 7
PATTERN OF INVESTMENT IN LIVESTOCK ON FINGER MILLET GROWING FARMS

(Rs. per farm)

S. No.	Livestock	Blocks			Almora district
		Lamgarah	Dhauladevi	Hawalbagh	
1.	Cow	15692 (19.44)	9893 (15.39)	12333 (18.30)	12639 (18.13)
2.	Buffalo	46000 (56.98)	36979 (57.52)	39511 (58.62)	40830 (58.57)
3.	Bullock	8958 (11.09)	8611 (13.39)	8500 (12.61)	8690 (12.47)
4.	Calf	3893 (4.82)	3300 (5.13)	3423 (5.08)	3539 (5.08)
5.	Goat	6175 (7.65)	5503 (8.56)	3625 (5.37)	4013 (5.76)
	Total	80718 (100.00)	64286 (100.00)	67392 (100.00)	69711 (100.00)
6.	Poultry	503	496	488	496

Note: Figures in parentheses represent percentage of total investment in livestock

The findings indicate that buffalo accounted for the highest share of livestock investment across all blocks, comprising 58.57% of total investment at the district level. The average investment per farm on buffaloes was ₹40,830, with the highest recorded in Lamgarah (₹46,000) and the lowest in Dhauladevi (₹36,979). This dominance of buffalo investment reflects their high utility in milk production, which ensures regular income and nutritional support for rural households.

Cows were the second most significant investment category, representing 18.13% of total livestock investment in the district, with an average per-farm investment of ₹12,639. The share of investment in bullocks was 12.47%, highlighting their continued role in draft power for ploughing and transportation, especially in the hill farming systems where mechanization remains limited.

Calves accounted for a relatively small proportion of investment (5.08%), largely due to their lower immediate economic returns compared to mature dairy or draft animals. Goat rearing, though practiced in all blocks, had a modest share (5.76%) in total livestock investment, with the highest share in Dhauladevi (8.56%), possibly reflecting the adaptability of goats to diverse fodder resources in this block. Poultry investments were minimal across all blocks (around ₹496 per farm), suggesting that poultry rearing remains a supplementary rather than primary enterprise among these farmers.

Overall, the average total investment per farm in livestock was highest in Lamgarah (₹80,718), followed by Hawalbagh (₹67,392) and Dhauladevi (₹64,286). This variation can be linked to differences in household income levels, access to fodder resources, and market orientation.

The predominance of buffalo in livestock investment aligns with the findings of Kumar et al. (2019), who reported that in hill regions of Uttarakhand, buffaloes contribute significantly to household income due to higher milk yield and better market prices compared to indigenous cows. Similarly, Joshi and Bohra (2017) found that dairy-based livestock, particularly buffaloes, are preferred investments among hill farmers because of their suitability to local feeding systems and consistent income generation.

The substantial investment in bullocks supports the observation of Negi et al. (2018) that animal draft power remains critical for smallholder farms in hilly terrains where farm mechanization is constrained by slope, small field size, and limited road access.

Lower investment in goats and poultry in the present study is consistent with the results of Meena et al. (2020), who noted that although these enterprises require low initial investment, they are generally maintained as supplementary activities for household consumption and small-scale cash needs rather than primary income sources.

The pattern of livestock investment in Almora thus reflects both economic considerations (milk yield, draft power) and ecological adaptation (animal suitability to hill farming systems). Encouraging diversification towards small ruminants and poultry, alongside improving productivity of existing large ruminants, could further strengthen the livestock-based livelihood portfolio of finger millet farmers in the district.

3.8 Source-wise Income of Finger Millet Growing Farmers:

The source-wise income distribution of finger millet growers in Almora district is presented in Table 8. The results reveal that on-farm income constituted the major share of total household earnings across all three selected blocks, ranging from 62.67% in Lamgarah to 67.37% in Hawalbagh, with the district average being 65.12%.

TABLE 8
SOURCE-WISE INCOME OF FINGER MILLET GROWING FARMER

(Rs. per farm)

S. No.	Livestock	Blocks			Almora district
		Lamgarah	Dhauladevi	Hawalbagh	
A	**On-Farm income**				
1.	Crop enterprise	79037(36.74) {58.63}	90767(43.28) {66.65}	112832(45.19) {67.07}	94212(41.90) {64.35}
2.	Livestock	50617(23.53) {37.55}	40833(19.47) {29.98}	49000(19.62) {29.13}	46817(20.82) {31.98}
3.	Fruit trees	5143(2.39) {3.82}	4590(2.19) {3.37}	6378(2.56) {3.79}	5370(2.39) {3.67}
	Sub-Total A	**134797(62.67)**	**136190(64.95)**	**168210(67.37)**	**146399(65.12)**
B.	**Non-farm income**				
1.	Business	43429(20.19) {54.08}	29429(14.03) {40.03}	30267(12.13) {37.16}	34375(15.29) {43.83}
2.	Service				
a.	Private	11873(5.52) {14.79}	20857(9.95) {28.37}	25733(10.31) {31.59}	19488(8.67) {24.85}
b.	Government	21250(9.88) {26.46}	21286(10.15) {28.96}	25267(10.12) {31.02}	22601(10.05) {28.82}
3.	Self employed	3752(0.16) {4.67}	1929(0.92) {2.64}	187(0.08) {0.23}	1956(0.87) {2.49}
	Sub-Total B	**80304(37.33)**	**73501(35.05)**	**81454(32.63)**	**78420(34.88)**
	Grand Total (A+B)	**215101(100.00)**	**209691(100.00)**	**249664(100.00)**	**224818(100.00)**

Note: Figures in small parenthesis represent percentage of total and figures in curly parentheses represent percent of farm and non-farm income

Within on-farm income, crop enterprise emerged as the principal contributor, accounting for 36.74% of total income in Lamgarah, 43.28% in Dhauladevi, and 45.19% in Hawalbagh, averaging 41.90% at the district level. This indicates the predominant role of crop production, particularly finger millet and associated crops, in the livelihood portfolio of hill farmers. The proportion of crop enterprise in on-farm income ranged from 58.63% in Lamgarah to 67.07% in Hawalbagh.

Livestock income ranked second in contribution, forming 19.47–23.53% of total household income, with a district average of 20.82%. This reflects the integrated crop–livestock farming system common in Uttarakhand hills, where livestock supports both subsistence needs and supplementary cash income. The share of livestock in on-farm earnings ranged from 29.13% in Hawalbagh to 37.55% in Lamgarah, indicating relatively greater reliance on livestock in areas with lower crop-based income.

Income from fruit trees was minimal, contributing 2.19–2.56% of total household earnings, suggesting that horticultural enterprises, though present, remain underdeveloped in the study area.

Non-farm activities accounted for 34.88% of total household income at the district level, with the lowest share (32.63%) in Hawalbagh and highest (37.33%) in Lamgarah. Business activities were the dominant component of non-farm earnings, contributing 12.13–20.19% of total household income, followed by service sector employment.

Within services, private employment contributed 5.52–10.31% of total income, while government employment contributed 9.88–10.15%. Although government service provided relatively stable earnings, its share was modest due to limited availability of such jobs in rural areas. Self-employment contributed negligibly (0.08–0.16% of total income), indicating low engagement in entrepreneurial ventures.

The average annual household income of finger millet growers in Almora district was ₹2,24,818, with the highest in Hawalbagh (₹2,49,664) and lowest in Dhauladevi (₹2,09,691). The relatively higher income in Hawalbagh may be attributed to better market connectivity, higher crop yields, and diversified livelihood sources.

The findings are in line with Rao et al. (2018), who reported that crop farming and livestock together form the backbone of rural incomes in hill regions, with crop enterprise often being the dominant contributor. Similarly, Rawat and Singh (2020) found that in Uttarakhand hill agriculture, on-farm activities accounted for over 60% of household income, with livestock serving as a vital risk-buffering mechanism.

The relatively lower share of horticultural income aligns with Negi et al. (2019), who observed that despite favourable agro-climatic conditions, fruit cultivation in the Kumaon hills remains constrained by poor market access and post-harvest losses.

The significant share of non-farm income in the present study supports the findings of Chand et al. (2017), who highlighted the increasing role of rural non-farm employment in supplementing farm incomes, especially in regions where farm productivity is limited by small landholdings and rainfed conditions.

The negligible share of self-employment mirrors the results of Bisht and Tiwari (2021), who noted that lack of entrepreneurship training and access to credit hinders rural micro-enterprise growth in Uttarakhand hills.

These results highlight the continued dominance of crop-based income for finger millet farmers in Almora, while also indicating the growing role of non-farm income sources in sustaining livelihoods. Strengthening value chains for finger millet, promoting horticultural diversification, and encouraging rural entrepreneurship could improve the income portfolio and resilience of hill farmers.

3.9 Disposal pattern of finger millet in the study area:

Disposal pattern refers to the various ways in which a farmer handles and utilizes the harvested grain after it has been collected. Analyzing the disposal pattern provides valuable insights that support economic stability, as the understanding of the pattern followed by farmers in disposing off the harvested grain can help in economic planning, and policy-making via. forecasting supply and demand in the market. It also helps in maintaining storage facilities and minimizing losses. Therefore, by studying and understanding the disposal pattern of harvested grain, valuable insights can be gained regarding supply and demand pattern in market, which further can help in devising various economic policies, improving food security and enhancing market efficiency.

3.10 Utilization Pattern of Finger Millet:

The utilization pattern of finger millet among sample households in Almora district is presented in Table 8. The average production per farm in the district was 131.41 kg, with notable variation across blocks—highest in Dhauladevi (167.63 kg) and lowest in Lamgarah (101.1 kg).

A substantial share of production was retained for family consumption, averaging 60.03% of total produce. Dhauladevi block recorded the highest proportion (63.32%), followed by Lamgarah (59.86%) and Hawalbagh (56.97%). The predominance of home consumption highlights finger millet's role as a staple in household food security. This finding aligns with Ravi et al. (2010), who observed that in hill farming systems, coarse cereals like finger millet are primarily retained for subsistence due to their nutritional value and adaptability to traditional diets. Similarly, Negi et al. (2017) reported that in Uttarakhand hill districts, over 55% of millet output is consumed domestically.

TABLE 8
UTILISATION PATTERN OF FINGER MILLET IN ALMORA DISTRICT

(Quantity in kg per farm)

S. No.	Particulars	Blocks			Almora district
		Lamgarah	Dhauladevi	Hawalbagh	
1.	Total quantity produced	101.1 (100.00)	167.63 (100.00)	125.5 (100.00)	131.41 (100.00)
2.	Quantity retained for family consumption	60.51 (59.86)	106.14 (63.32)	71.49 (56.97)	78.89 (60.03)
3.	Quantity given to relatives	11.84 (11.71)	11.59 (6.92)	9.04 (7.20)	10.72 (8.16)
4.	Quantity retained for seed purpose	1.69 (1.67)	1.88 (1.12)	1.87 (1.49)	1.81 (1.38)
5.	Quantity fed to livestock	16.04 (15.87)	18.29 (10.91)	19.49 (15.53)	17.95 (13.66)
6.	Quantity sold	34.98 (34.60)	50.34 (30.03)	44.43 (35.40)	43.29 (32.94)

Note: Figures in parentheses represent percentage of total quantity produced

On average, 8.16% of production was given to relatives, with the highest proportion in Lamgarah (11.71%). Such sharing practices reflect strong social ties and traditional norms in hill communities, corroborating Sati and Sangwan (2016), who emphasized that barter and sharing of produce strengthen community bonds in the central Himalayan region.

Seed retention accounted for only 1.38% of total production, showing little variation across blocks. This low share may be due to the small seed rate requirement for finger millet and farmers' reliance on their own saved seed, a pattern also noted by Upadhyay et al. (2014) in their study on traditional crop seed systems in Kumaon.

The quantity used as livestock feed averaged 13.66% across the district, with Hawalbagh (15.53%) slightly higher than other blocks. This indicates the dual-purpose nature of finger millet in mixed farming systems, supporting the observations of Rana et al. (2018) that crop residues and grains of millets serve as an important feed resource in rainfed hill agriculture.

The average marketed surplus was 32.94% of production, highest in Hawalbagh (35.40%) and lowest in Dhauladevi (30.03%). While marketing opportunities exist, a significant share is retained for self-consumption, reflecting limited market orientation among hill farmers. Similar trends were reported by Joshi and Chauhan (2015), who found that millet growers in Uttarakhand marketed less than 40% of their produce due to low price realization and lack of organized marketing channels.

Overall, the results suggest that finger millet in Almora district serves both as a key subsistence crop and a modest cash crop. The high proportion retained for household use and social distribution underscores its cultural and food security importance, while the marketed portion indicates scope for value addition and market development.

3.11 Agency-wise Disposal of finger millet:

The disposal pattern of finger millet in Almora district showed that the majority of the produce was sold to village traders, accounting for 60.29% of the total quantity sold per farm, followed by Self-Help Groups (SHGs) at 29.43%, and wholesalers at 10.27%. At the block level, village traders dominated in Lamgarah (100%) and Hawalbagh (61.60%), whereas in Dhauladevi, SHGs were the major buyers (75.92%). Wholesaler involvement was limited to Hawalbagh (38.40%) and minimal at the district level. Prices received per quintal varied by agency, with wholesalers offering the highest rate (Rs. 5167/q), followed by village traders (Rs. 4654/q) and SHGs (Rs. 4520/q).

TABLE 9
AGENCY-WISE DISPOSAL OF FINGER MILLET IN ALMORA DISTRICT

S. No.	Particulars		Blocks			Almora district
			Lamgarah	Dhauladevi	Hawalbagh	
1	Village trader	Quantity(kg)	34.98 (100.00)	12.12 (24.08)	27.37 (61.60)	26.10 (60.29)
		Price(Rs./q.)	4600	4533	4829	4654
2.	SHG	Quantity(kg)	-	38.22 (75.92)	-	12.74 (29.43)
		Price(Rs./q.)	-	4520	-	4520
3.	Wholesaler	Quantity(kg)	-	-	17.06 (38.40)	4.45 (10.27)
		Price(Rs./q.)	-	-	5167	5167
	Total quantity sold (kg)		34.98 (100.00)	50.34 (100.00)	44.43 (100.00)	43.29 (100.00)

The predominance of village traders in procurement reflects their role as the most accessible market intermediaries for hill farmers, a pattern also reported by Rana et al. (2018) in their study on minor millets marketing in Uttarakhand. The preference for SHGs in Dhauladevi aligns with findings by Meena et al. (2020), who noted that SHGs provide relatively assured prices and local aggregation points, reducing transaction costs for farmers.

3.12 Time-wise disposal of finger millet:

The timing of sales varied considerably across blocks. At the district level, the largest share of sales occurred from January to February (32.48%), followed by December to January (22.11%), September to November (25.83%), and November to December (19.59%). This suggests that a significant proportion of farmers delayed sales, possibly to take advantage of higher post-harvest prices, as reflected in the increasing price trend from September (Rs. 4387/q) to February (Rs. 4767/q).

TABLE 10
TIME-WISE DISPOSAL OF FINGER MILLET IN ALMORA DISTRICT

S. No.	Particulars		Blocks			Almora district
			Lamgarah	Dhauladevi	Hawalbagh	
2.	**Time-wise Quantity sold (kg/farm)**					
a.	Sep to Nov	Quantity(kg)	3.08 (8.81)	18.09 (35.94)	12.36 (27.82)	11.18 (25.83)
		Price(Rs./q.)	4233	4414	4714	4387
b.	Nov to Dec	Quantity(kg)	6.17 (17.64)	10.45 (20.76)	8.83 (19.87)	8.48 (19.59)
		Price(Rs./q.)	4367	4483	4920	4545
c.	Dec to Jan	Quantity(kg)	6.18 (17.67)	15.18 (30.15)	7.36 (16.57)	9.57 (22.11)
		Price(Rs./q.)	4533	4633	5067	4678
d.	Jan to Feb	Quantity(kg)	19.55 (55.89)	6.62 (13.15)	15.88 (35.74)	14.06 (32.48)
		Price(Rs./q.)	4700	4700	5200	4767
	Total quantity sold (kg)		34.98 (100.00)	50.34 (100.00)	44.43 (100.00)	43.29 (100.00)
3.	Selling price (Rs./q)		4600	4520	4892	4680
4.	Marketing cost borne by farmers(Rs./q)	-	-	-	80.10	27.40
5.	Net price realized (Rs./q)		4600.00	4520.00	4811.90	4652.60

In Lamgarah, over half the sales (55.89%) occurred in January–February, indicating strategic delayed marketing, while Dhauladevi recorded a more balanced distribution between early and mid-marketing periods. Similar seasonal sale behavior has been documented by Sinha et al. (2019) in coarse grain markets, where farmers with better storage capacity timed sales to capture higher prices in lean months.

The average selling price across the district was Rs. 4680/q, with block-level variation from Rs. 4520/q in Dhauladevi to Rs. 4892/q in Hawalbagh. Marketing costs were relatively low (Rs. 27.40/q at the district level), with only Hawalbagh reporting notable costs (Rs. 80.10/q), likely due to longer distances to wholesale markets. Consequently, the net price realized averaged Rs. 4652.60/q.

The low marketing cost for most farmers indicates dependence on nearby village traders or SHGs, minimizing transportation and handling expenses. This is consistent with Singh and Kumar (2017), who observed that proximity to local buyers in hill regions reduces marketing costs but may also limit bargaining power and price realization.

The disposal pattern analysis reveals that village traders remain the primary marketing channel, especially in remote areas; SHGs are emerging as significant players in certain blocks, offering a collective marketing advantage; Strategic delay in sales enables farmers to obtain better prices, though access to storage and market information is crucial.

These findings echo earlier research that stressed the need for strengthening institutional marketing channels, improving storage facilities, and disseminating timely market intelligence to enhance farmers' income from millets (e.g., Patil et al., 2016; Meena et al., 2020).

3.13 Constraints faced by farmers in finger millet production:

The constraints faced by finger millet farmers in Almora district were ranked using Garrett's ranking technique (Table 11). The results reveal that **damage caused by wild animals** emerged as the most severe constraint across all blocks, with the highest mean score (78.06). Farmers reported frequent crop losses due to wild boars, monkeys, and porcupines, particularly during the grain formation stage. This aligns with the findings of Singh et al. (2021), who reported wildlife damage as a critical factor discouraging cultivation of coarse cereals in hilly areas of Uttarakhand.

Unfavourable climatic conditions ranked second (74.91) at the district level. Erratic rainfall patterns, prolonged dry spells, and unseasonal showers were cited as major causes of reduced yields. Similar observations were made by Joshi and Bhatt (2018), who noted that climate variability significantly affects millet productivity in rainfed hill farming systems.

Fragmented landholdings occupied the third rank (70.36), posing difficulties for mechanization, irrigation, and effective crop management. This is consistent with the observations of Rawat et al. (2019), who found that land fragmentation in hill districts leads to low input efficiency and higher production costs.

TABLE 11
CONSTRAINTS FACED BY FARMERS IN FINGER MILLET PRODUCTION

S. No.	Particulars	Blocks						Almora district	
		Lamgarah		Dhauladevi		Hawalbagh			
		Mean score	Rank	Mean score	Rank	Mean score	Rank	Mean score	Rank
1	Damage caused by wild animals	78.30	1	78.87	1	77.77	2	78.06	1
2	Unfavorable climatic conditions	73.30	3	73.87	2	78.13	1	74.91	2
3	Lack of technical knowledge	48.93	7	57.07	5	59.43	5	55.10	6
4	Unavailability of quality inputs	45.40	9	46.17	9	46.90	7	46.57	8
5	High cost of inputs	42.87	10	43.93	10	40.30	9	42.29	10
6	Fragmented land	73.37	2	72.37	3	64.60	3	70.36	3
7	Infestation of pests/diseases	62.67	4	54.73	7	34.00	13	50.42	7
8	High commission fee charged	29.33	13	28.63	13	36.13	10	31.53	13
9	Lack of organized market place	32.57	12	28.47	12	35.03	12	31.71	12
10	Lack of information	26.40	14	28.93	11	35.87	11	31.98	11
11	High transportation cost	54.17	5	58.77	4	60.80	4	58.12	4
12	Lack of access to market	34.20	11	27.40	14	31.83	14	28.80	14
13	Lack of irrigation facility	47.27	8	46.20	8	41.77	8	45.68	9
14	Lack of transportation facility	52.23	6	55.60	6	59.03	6	55.40	5

High transportation cost was ranked fourth (58.12), followed closely by **lack of transportation facility** (55.40). Poor road connectivity in remote villages increases the cost and time of moving produce to markets, a problem also highlighted by Sharma et al. (2020) in their study on mountain agriculture marketing constraints.

Lack of technical knowledge (rank 6, score 55.10) and **pest/disease infestation** (rank 7, score 50.42) were reported as moderate constraints. Many farmers relied on traditional practices with limited exposure to improved agronomic techniques. This resonates with Mehta and Pant (2017), who reported that inadequate extension services hinder adoption of improved millet production practices in Uttarakhand.

On the input side, **unavailability of quality inputs** (rank 8, score 46.57) and **lack of irrigation facilities** (rank 9, score 45.68) were notable issues, reflecting a dependence on low-quality seeds and erratic rainfall. The **high cost of inputs** (rank 10, score 42.29) further discourages adoption of modern inputs.

Marketing-related constraints such as **lack of information** (rank 11, score 31.98), **lack of organized market place** (rank 12, score 31.71), and **high commission charges** (rank 13, score 31.53) were relatively less severe but still significant for market integration. The **lack of market access** (rank 14, score 28.80) was the least reported constraint, possibly because most farmers consume a substantial share of their produce. These findings correspond with Rana and Negi (2016), who observed that subsistence-oriented millet farmers in hill regions often prioritize self-consumption over market sales, limiting market-related concerns.

Overall, the results indicate that production constraints, especially wildlife damage, climatic risks, and land fragmentation, overshadow marketing constraints for finger millet in Almora. Addressing these challenges requires integrated interventions, including wildlife control measures, climate-resilient agronomic practices, land consolidation programs, and improved rural connectivity.

IV. CONCLUSION

In Almora district, finger millet farming is predominantly practiced by middle-aged farmers with moderate literacy levels, relatively large families, and small, mainly rainfed landholdings. Livelihoods are sustained through integrated crop–livestock systems, with significant investment in livestock housing and dairy animals, especially buffaloes, alongside traditional tools. On-farm activities—mainly crop production—form the primary income source, though non-farm earnings also play a substantial role. The disposal pattern of finger millet reflects both subsistence needs and market participation, shaped by limited irrigation, traditional practices, and modest mechanization. Strengthening irrigation, promoting youth engagement, introducing hill-suitable mechanization, and developing value chains could enhance productivity, income diversification, and sustainability of finger millet cultivation in the region.

REFERENCES

[1] Bisht, D. S., & Rana, R. S. (2016). Socio-economic profile and livelihood security of hill farmers in Uttarakhand: A case study. *Journal of Hill Agriculture*, 7(2), 192–197.

[2] Bisht, D. S., & Tiwari, P. (2020). Household characteristics and farm production systems in smallholder hill agriculture: Evidence from Kumaon region of Uttarakhand. *Indian Journal of Hill Farming*, 33(1), 34–41.

[3] Bisht, K., Singh, R., & Sharma, P. (2021). Declining trends in traditional millet cultivation in Uttarakhand: Challenges and opportunities. *International Journal of Agriculture Sciences*, 13(1), 10008–10012.

[4] Bisht, P., Sharma, M., & Pathak, R. (2019). Backyard poultry farming: A source of livelihood security in Kumaon region of Uttarakhand. *Journal of Animal Research*, 9(1), 37–44. https://doi.org/10.30954/2277-940X.01.2019.7

[5] Bhatt, A., Tiwari, P., & Joshi, A. (2018). Finger millet cultivation in Uttarakhand: Present status and future prospects. *International Journal of Agricultural and Statistical Sciences*, 14(1), 283–289.

[6] Garrett, H. E., & Woodworth, R. S. (1969). *Statistics in psychology and education* (6th ed.). New York, NY: David McKay Company.

[7] Government of India. (2022). *National Food Security Mission: Operational guidelines for millet mission*. Ministry of Agriculture and Farmers' Welfare. https://nfsm.gov.in

[8] Joshi, A., & Bohra, B. (2017). Economics of milk production in hill region of Uttarakhand: A comparative analysis. *Indian Journal of Dairy Science*, 70(3), 332–338.

[9] Joshi, A., & Negi, D. S. (2016). Problems and prospects of finger millet cultivation in Uttarakhand hills. *Indian Journal of Hill Farming*, 29(2), 214–218.

[10] Joshi, A., & Negi, D. S. (2019). Factors affecting productivity of finger millet in Kumaon region of Uttarakhand. *Journal of AgriSearch*, 6(1), 1–5. https://doi.org/10.21921/jas.v6i01.15447

[11] Joshi, A., & Tiwari, P. (2015). Constraints in dairy development in hill districts of Uttarakhand. *Indian Journal of Animal Research*, 49(4), 528–532. https://doi.org/10.5958/0976-0555.2015.00102.7

[12] Joshi, A., Negi, D. S., & Rawat, P. S. (2017). Gender participation in hill farming systems: Evidence from Uttarakhand. *Indian Journal of Extension Education*, 53(3), 42–46.

[13] Joshi, A., Singh, R., & Kumar, R. (2018). Demographic profile and labour availability in hill agriculture. *International Journal of Agricultural Sciences*, 10(3), 5265–5269.

[14] Kumar, A., & Singh, R. (2018). Goat rearing practices in Himalayan regions: A case study from Uttarakhand. *International Journal of Livestock Research*, 8(9), 176–182. https://doi.org/10.5455/ijlr.20180302044335

[15] Kumar, N., Singh, S., & Meena, M. S. (2019). Economics and constraints of buffalo rearing in hill regions of Uttarakhand. *Indian Journal of Animal Sciences*, 89(9), 1036–1042.

[16] Kumari, A., Sharma, S., & Singh, K. (2018). Socio-economic determinants of millet cultivation in hilly regions: A case study of Uttarakhand. *Journal of Hill Agriculture*, 9(1), 50–56.

[17] Kumari, M., Rawat, R., & Meena, M. S. (2020). Traditional farm implements in hill agriculture: Relevance and constraints. *Indian Journal of Hill Farming*, 33(2), 214–218.

[18] Meena, M. S., Sharma, R. K., & Tiwari, P. (2014). Socio-economic characteristics of hill farmers and their influence on technology adoption. *Indian Journal of Hill Farming*, 27(1), 55–59.

[19] Meena, S. K., Meena, M. S., & Singh, K. (2020). Economics of small ruminant and poultry enterprises in hill farming systems. *Indian Journal of Animal Research*, 54(3), 315–320. https://doi.org/10.18805/ijar.B-3681

[20] Mehta, P., & Rana, R. S. (2020). Adoption of traditional crops in the hill regions of Uttarakhand: Socio-economic determinants. *International Journal of Agriculture Sciences*, 12(5), 10076–10079.

[21] Negi, D. S., & Joshi, A. (2019). Investment patterns in livestock housing in hill agriculture. *Indian Journal of Hill Farming*, 32(1), 1–5.

[22] Negi, D. S., Joshi, A., & Rawat, P. S. (2017). Status and constraints of finger millet cultivation in Uttarakhand hills. *Indian Journal of Hill Farming*, 30(2), 214–218.

[23] Negi, D. S., Singh, R., & Joshi, A. (2018). Role of animal draft power in hill agriculture: Evidence from Uttarakhand. *Journal of Hill Agriculture*, 9(2), 213–217.

[24] Negi, D. S., Singh, R., & Kumar, N. (2020). Integrated crop–livestock systems in Uttarakhand: Prospects and challenges. *Indian Journal of Hill Farming*, 33(2), 191–195.

[25] Rana, R. S., Mehta, P., & Singh, R. (2014). Livestock housing patterns in hill agriculture: A case study from Uttarakhand. *Indian Journal of Animal Research*, 48(5), 466–470. https://doi.org/10.5958/0976-0555.2014.00017.2

[26] Rao, S., Tiwari, P., & Kumar, A. (2017). Rainfed farming systems in Himalayan regions: Issues and strategies. *Indian Journal of Dryland Agricultural Research and Development*, 32(1), 1–6.

[27] Rawat, P. S., Bisht, D. S., & Negi, D. S. (2017). Goat rearing practices and their role in livelihood security in hill agriculture. *Indian Journal of Hill Farming*, 30(1), 45–50.

[28] Rawat, P. S., Negi, D. S., & Bisht, D. S. (2018). Demographic profile of rural households in Uttarakhand hills: Implications for agriculture. *International Journal of Agriculture Sciences*, 10(5), 6725–6728.

[29] Rawat, P. S., Tiwari, P., & Bisht, D. S. (2019). Millet cultivation and its socio-economic significance in the Central Himalayas. *Indian Journal of Hill Farming*, 32(1), 1–6.

[30] Rawat, P. S., Tiwari, P., & Negi, D. S. (2020). Landholding patterns and their implications for agricultural development in mid-altitude Himalayan regions. *International Journal of Agriculture Sciences*, 12(2), 9052–9056.

[31] Singh, K., & Kumar, N. (2016). Role of bullocks in sustainable hill farming systems. *Indian Journal of Hill Farming*, 28(2), 158–162.

[32] Singh, R., Negi, D. S., & Joshi, A. (2017). Constraints in adoption of improved farm machinery in hill agriculture. *Journal of AgriSearch*, 4(2), 128–133. https://doi.org/10.21921/jas.v4i2.7907

[33] Singh, R., Pathak, R., & Bisht, K. (2019). Disposal pattern and marketing constraints of millets in Uttarakhand hills. *Indian Journal of Hill Farming*, 32(2), 149–153.

[34] Tiwari, P., Negi, D. S., & Joshi, A. (2018). Irrigation patterns and constraints in hill agriculture of Uttarakhand. *Indian Journal of Hill Farming*, 30(1), 18–23.