International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Identification of Existing Agroforestry Systems and Socio-Economic Assessment in Bharmour Block of Chamba District, Himachal Pradesh, India

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Abstract

The study was carried out in the Bharmour block of Chamba district of Himachal Pradesh with aim to identify different existing agroforestry systems and to assess the demographic and socioeconomic conditions of the farmers. Agrisilviculture (AS), Agrihorticulture (AH), Agrihortisilviculture (AHS), Agrisilvipastoral (ASP), Silvipastoral (SP), Hortipastoral (HP) were prominent systems in the studied area. All six types of Agroforestry systems are practiced by farmers of all categories viz. marginal, small and medium. Amongst them, Agrihortisilviculture and Agrihorticulture were most widely adopted irrespective of farmer's category. Average family members per household was in the order: Medium (5.73) > Marginal (5.18) > Small (5.11). Sex Ratio was observed as Medium (944) > Marginal (932) > Small (849). Males dominate over female in literacy as well as in the income generation avenue except agriculture and farm products. Cow was the most preferred domesticated animal followed by goats, bullocks, sheep and horses respectively. Organic farmers used cow dung and cow urine of local breed cow to make different organic farming solutions and mixtures viz. Agniastra, Jeevamrit, Gaanjeevamrit, Beejamrit. Average area under the arable land is 49.86% which was all non irrigated as it is dependent on rainfall for irrigation. The system units in agriculture components were cereals eg. Triticum aestivum (wheat), Hordeum vulgare (barley), Zea mays (maize), oilseeds and pulses eg. Brassica nigra (mustard), Vigna mungo (mah), Phaseolus vulgaris (rajma), Dolichos biflorus (kulth); vegetables: Pisum sativum, solanum tuberosum, Lagenaria siceraria ,Cucumber sativus, Lycopersicon esculent, brassica oleracea, the silviculture component is represented by Robinia pseudoacacia, Quercus leucotricophora, Cedrus deodara, Abies pindrow, Pinus wallichiana, Pinus gerardiana, etc. Major fruit trees include Malus domestica, Pyruspashia, Juglans regia, Diospyruskaki, Prunusarmeniaca, Prunus persica etc. The other minor crops grown are (chinae) Panicum miliaceum, Fagopyrum esculentum (bhrace), Paspalum scrobiculatum (kodra), Amaranthus amaranthoides (sieul) , phullans (millets). Different grasses are also grown ie. Lolium multiflorum, Trifolium alexandrinum, Sorghum bicolor.

Keywords: Agroforestry system, Farmer category, socioeconomic

INTRODUCTION

Agriculture in India is livelihood for a majority of the population and can never be underestimated. Although its contribution in the gross domestic product (GDP) has reduced to less than 20 per cent and contribution of other sectors increased at a faster rate, agricultural production has grown. This has made us self-sufficient and taken us from being a begging bowl for food after independence to a net exporter of agriculture and allied products. Total food grain production in the country is estimated to be a record 291.95 million tons, according to the second advance estimates for 2019-20. This is news to be happy about but as per the estimates of Indian Council for Agricultural Research (ICAR), demand for food grain would increase to 345 million tons by 2030. Increasing population, increasing average income and globalization effects in India will increase demand for quantity, quality and nutritious food, and variety of food. Therefore, pressure on decreasing available cultivable land to produce more quantity, variety and quality of food will keep on increasing. Agriculture is the main occupation of the people of Himachal Pradesh and has an important place in the economy of the State. The economy of Chamba district is mainly agrarian as most population of the District is directly dependent on agriculture and related activities. Agriculture and agri-related activities are playing a crucial role in the economy of Himachal Pradesh. Ninety (90) per cent population of State lives in rural area. Seventy (70) per cent people are directly depends upon Agriculture. Himachal Pradesh is a hill state where a majority of marginal and small farmers practise traditional farming, which is not remunerative (Rana and Chopra, 2013).

The importance of trees in our lives needs no explanation. Forests have been cradles of life and civilizations on earth since antiquity. Even after ancient human beings moved out of forest habitats and started agriculture, they never eradicated trees and retained a variable number of trees on their agricultural lands in a plethora of formal and informal Agroforestry systems–as recognition of various ecosystem services trees provides. Trees in forests and agricultural landscapes play a crucial role in almost all terrestrial biomes and provide a range of goods and services to rural and urban people.

Agroforestry is not a new system or concept. The practice is very old, but the term is definitely new. Agro forestry means practice of agriculture and forestry on the same piece of land. Bene et al. (1977) defined agro forestry as a sustainable management system for land that increases overall production, combines agricultural crops and animals simultaneously. Nair (1979) defines agro forestry as a land use system that integrates trees, crops and animals in a way that is scientifically sound, ecologically desirable, practically feasible and socially acceptable to the farmers Another widely used definition given by the International Center for Research in Agro forestry (ICRAF) Nairobi, Kenya, that, "agroforestry is a collective name for all land use systems and practices where woody perennials are deliberately grown on the same land management unit as agricultural crops or animals in some form of spatial arrangement or temporal sequence" (Lundgren & Raintree, 1982).

The ‘practice of agroforestry’ or planting trees on agriculture land can protect forest by making tree products such as firewood and fodder easily available to farmers, can restore fertility of land by decreasing soil erosion, adding nutrient through decomposition of leaf litter and nitrogen fixation, recycling leached–down nutrients and helping breakdown of nutrients in the subsoil by means of deep root. Problems such as shortage of forest resources have been reduced by the mid hill farmers through retaining or keeping trees in various parts of their farmland along with crops for centuries despite having limited landholding (Shrestha, 1995). Although, Agroforestry practice is a newly evolved technology among technicians and extensionists, its many forms have been instrumental in sustaining farming system of the region for centuries. Such ecological understanding developed by one farming community

may be relevant to address the constraints encountered by other communities and so, investigating local knowledge may be a powerful, efficient and rapid means of filling the gaps in scientific understanding of Agroforestry (Walker et al. 1995)

Himachal Himalaya is basically an agro-ecosystem where 89.97% of its total population lives in villages whose economy is depend on agriculture, horticulture, Sericulture and animal husbandry (Census 2011). The species composition pattern in traditional Agroforestry system of Himalaya is mainly agrisilviculture, agrihorticulture and agrihortisilviculture system, which vary according to size of the land holding and basic requirement of farmer (Tokeyet al., 1989). There is preponderance of marginal (less than 1 ha) and small (1-2 ha) farmers in the HP.

The prosperity of Hill community has traditionally being dependent on the forest, farming, agroforestry and livestock. The main cause of the poor economic status is degradation of the forest ecosystem, less farm production, poor watershed management and lack of infrastructure and road development. Social factors such as farmers, economic and educational status, demography, social connection, and culture and resource availability, are important to understand why and how farmers select certain farming practices (Seabrook et al., 2008.) In the rural areas people for their livelihood exclusively dependent on the forest, farming including agroforestry and livestock or migrate to the plains in search of employment. Comparative studies on agroforestry systems are however, still lacking in the Himachal Pradesh. Hence, the present study was undertaken to identify the existing agroforestry systems and assess socio- economic aspect of existing Agroforestry systems in Bharmour Tehsil of District Chamba, Himachal Pradesh.

METHODOLOGY

The present study was carried out in Bharmour Tehsil of Chamba District of Himachal Pradesh. **Bharmour**, formally known as **Brahmpura**, was the ancient capital of Chamba district in Himachal Pradesh, India. Situated at an altitude of 7000 feet in the Budhil valley, forty miles to the south-east of Chamba. Altitude: 7000 feet, Climate: In winter, the temperature gets quite low and in summer temperature is mild, Rainfall: 1264.4 mm, Primary rainy season: June to September, Temperatures: Summer: 15 °C – 20 °C, Winter: comes down to even 0 °C or even lower, Languages: Gaddi, Hindi.

Study was conducted through multi-stage random sampling technique in which Ten Gram Panchayats (Kuleth, Diyol, Holi, Garola, Ulansa, Bharmour, Khani, Sachuin, Ghared and Paranghala) were chosen and from each panchayat Two villages were selected. In each village Farmers were divided into three different categories on the basis of their land holdings i.e. marginal (<1 ha), small (1-2 ha) and medium (2-5 ha) as per the classification of government of Himachal Pradesh. Nine farmers was selected from each village which included three farmers from each category ie. Marginal, small and medium. Information about the different parameters ie. Family structure, demographic features, animal husbandry practices, livestock status, household income, land utilization pattern, Agriculture production and tree inventory from various Agroforestry systems was collected through personal interviews with head of the households and field visits. Agroforestry systems existing in the study area were identified on the basis of structure (nature and arrangement) and function (role of output) of components Nair, 1985). Primary and secondary components of each system types were identified after recognizing the structure of system and specific functions of the components.

RESULTS AND DISCUSSION

Identification of agroforestry system types

In total six agroforestry systems were identified in the study area (Table 1). Six Agroforestry systems found in all the three categories. The systems are enlisted as Agrisilviculture (AS), Agrihorticulture (AH), Agrihortisiviculture (AHS), Silvipatoral (SP), Agrisilvipastoral(ASP) and Hortipastoral. It is evident from the table that Agrihortisilviculture (AHS) system dominated in all the agroforestry systems followed by agrihorticulture (AH). These systems can be familiar to agroclimatic conditions of the area and need of the farmers viz. fodder, fuelwood etc. the most followed agroforestry system is Agrihortisilviculture practiced by 37.78% of the sampled farmers. The reason to the most use of this system can be more and diversified products. This system is very practical and affordable for people living in the rural areas of Bharmour as it provides agriculture crops, horticulture crops and forest crops. Apart from this the second most followed Agroforestry system was Agrihorticulture followed by 34.45% of sampled farmer. Agrisilviculture system is followed by 14.44% of the sampled households. Agrisilvipasture system is followed by 6.68% of sampled farmers The least followed Agroforestry systems include Silvipasture and hortipastoral, both followed by 3.33% of farmers, as it does not provide as much as economic return and production as compared to agrihortisilviculture and agrihorticulture. Thus it can be concluded that Agrihortisilviculture and Agrihorticulture were most prevalent agroforestry system in sampled farmers.

There functional units under agriculture component were cereals eg. Triticum aestivum (wheat), Hordeum vulgare (barley), Zea mays (maize), oilseeds and pulses eg. Brassica nigra (mustard), Vigna mungo (mah), Phaseolus vulgaris (rajma), Dolichos biflorus (kulth); vegetables Pisum sativum, solanum tuberosum, Lagenaria siceraria, Cucumber sativus, Lycopersicon esculent, brassica oleracea, the Silviculture component is represented by Robinia pseudoacacia, Quercus leucotricophora, Cedrus deodara, Abies pindrow, Pinus wallichiana, Pinus gerardiana etc. Major fruit trees include Malus domestica, Pyruspashia, Juglans regia, Diospyruskaki, Prunusarmeniaca, Prunus persicaetc. The other minor crops grown are (chinae) Panicum miliaceum, Fagopyrum esculentum (bhrace), paspalum scrobiculatum (kodra), Amaranthus amaranthoides (sieul) , phullans (millets). Different grasses are also grown ie Lolium multiflorum, Trifolium alexandrinum, Sorghum bicolour etc. Different combinations of tree species, grasses, agriculture crops and horticulture crops are recorded in different Agroforestry systems. For example some of the crop combination are as follows: Malus domestica + Phaseolusvulgaris+ Triticum aestivum, Malus domestica+ Hordeum vulgare, Zea mays+ Amaranthus amaranthoides, Triticum aestivum+ Juglans regia, Zea mays+ Phaseolus vulgaris, zeamays+Phaseolus vulgaris+ Amaranthus amaranthoides+solanum tuberosum.

From the study, it was concluded that the farmers who cultivate apples in pure organic way uses the flower Tagetes spp and Solanum lycopersicum (tomato) to distract the butterflies and flies from apple flower. It works as natural distraction for flies and butterflies. Some of the varieties of apples grown in Bharmour are as follows: Royal, Golden, Red gold, Spur etc.

Similar agroforestry systems have been identified and reported by others.

Kumari et al. (2008) conducted a study in order to identify the traditionally occurring Agroforestry systems of Lahaul and Kinnaur districts of Himachal Pradesh, India. In Lahaul area five Agroforestry systems viz. agrihorticulture (pea+potato+apple), agrisilviculture (pea+potato+Rajmash+salix), agrisilvipastoral (pea+salix+grasses), pastoralsilviculture (grasses+salix) and pastoralhorticulture (grasses+apple) were identified. In Kinnaur, the agroforestry systems and their components were same

except for the absence of agrisilvipastoral system.

Kachru (1997) reported eight agroforestry systems namely, agrisilviculture (Maize, Wheat, Blackgram and Grewia, Morus), agrihorticulture (Wheat, Mustard and Pear), agrisilvihorticulture (Wheat, Mustard, Grewia and Apricot), pastoralsilviculture (Grewia, Bauhinia and grasses), pastoralhortisilviculture (Pear, Plum, Grewia and grasses), agrihortisilviculture (Maize, Blackgram Pear and Grewia), pastoralsilviculture (Chir pine, Acacia and grasses), and pasture in mid-hills of Himachal Pradesh.

Bammanahalli (2016) carried out study in Bilaspur and Hamirpur districts of H.P. The results showed that the most predominant Agroforestry systems of Bilaspur district were pastoral-silviculture (PS), agri-silvi-horticulture (ASH) and agri-silviculture (AS), these systems may be attributed to local ecological condition, fodder requirement as farmers maintain ruminants/livestock to meet their daily needs, poor soil condition, highly undulated landscape, to prevent the soil erosion, to meet the fuel demand of the family, diversified products and higher profits. In Hamirpur districts the most predominant Agroforestry systems were pastoral-silviculture (PS) followed by pastoral-silvi-horticulture (PSH) and agrisilviculture (AS).

Bijalwan et al. (2011) studied the socioeconomic status and livelihood support through traditional Agroforestry system in Garhwal Himalaya, India. The predominant traditional Agroforestry systems reported in the area were agrisilviculture, agrihortisilviculture and agrihorticulture.

Mazumdar (1991) conducted a study to identify the farming systems existed in Nauni (H.P.). There were five farming systems existed in study area viz. agricultural system, hortiagriculture, hortisilvipastoral, grassland and wasteland. Out of these five, the most dominating agroecosystem in the study area was agrihorticulture.

Demographic and socio-economic status

Family structure of sampled households

Family structure represented the total individuals in household comprising adults, children and their respective male-female population in each group. The family structure of sampled household is found in Table 2.

The Table 2 show the mean sex ratio is 908.The highest sex ratio was observed in medium category followed by marginal and small category. The average mean family size is 5.34. the highest average family size was observed in medium category, and lowest was observed in small category. Adult population constitutes 58.77% of the total population and children population consist of 41.23%. This shows the availability of family labour The perusal of table shows that the overall mean sex ratio was 908 which is lower than the state (Himachal Pradesh) and national averages of 972 and 940 respectively (census,2011). There was no cultural difference on the gender of the child. Masoodi (2010) has reported average family size of 5 persons in Solan (HP).

Table.1 Identification of agroforestry system on the basis of structure and function of the components

System types	No. of families under different categories practicing AF System			Total families
	Marginal	Small	Medium	
AS	6 (10)	10 (16.67)	10 (16.67)	26 (14.44)
AH	22	20	20	62

	(36.67)	(33.33)	(33.33)	(34.44)
AHS	23 (38.33)	22 (36.67)	23 (38.33)	68 (37.78)
SP	2 (3.33)	2 (3.33)	2 (3.33)	6 (3.33)
ASP	4 (6.67)	4 (6.67)	4 (6.67)	12 (6.68)
HP	3 (5)	2 (3.33)	1 (1.67)	6 (3.33)
Total family in each category	60 (100)	60 (100)	60 (100)	180 (100)

*Figures in the parentheses are percentage to the total.

Table.2 Family structure of sampled households in study area

Farmer's category	Total no of families	Average family size	Adults			Children			Sex Ratio
			Male	Female	Total	Male	Female	Total	
Marginal	60	5.18 (100)	1.43 (27.66)	1.51 (29.26)	2.94 (56.91)	1.25 (24.11)	0.98 (18.98)	2.23 (43.09)	932
Small	60	5.11 (100)	1.56 (30.62)	1.67 (32.58)	3.22 (63.2)	1.2 (23.45)	0.68 (13.35)	1.88 (36.8)	849
Medium	60	5.73 (100)	1.56 (27.32)	1.68 (29.37)	3.24 (56.69)	1.38 (24.13)	1.1 (19.19)	2.48 (43.32)	944
Total	180	16 (100)	4.55 (28.50)	4.85 (30.27)	9.4 (58.77)	3.83 (23.90)	2.76 (17.22)	6.6 (41.23)	908

*Figures in the parentheses are percentage to the total.

Table.3 Education status of sampled households in study area

Farmer's category	Primary	Middle	Matric	Secondary	Graduate	Post graduate	Illiterate	Total	Literacy rate %		
									Male	Female	Total
Marginal	1.01 (19.87)	0.38 (7.5)	0.9 (17.6)	1.35 (26.38)	0.61 (12.05)	0.16 (3.25)	0.68 (13.35)	5.09 (100)	91.02	82.11	86.56
Small	1 (19.23)	0.46 (8.97)	0.43 (8.34)	1.6 (30.77)	0.5 (9.61)	0.11 (2.24)	1.08 (20.84)	5.18 (100)	84.18	72.6	78.39
Medium	0.86 (15.53)	0.63 (11.34)	0.81 (14.62)	1.48 (26.56)	0.73 (13.14)	0.13 (2.39)	0.91 (16.42)	5.55 (100)	90.39	75.94	83.16

*Figures in the parentheses are percentage to the total

*The literacy rate is calculated as: (Total literates/total members) x 100

Table.4 Employment status of sampled households

Farmer category	Total no. of families	Total member	Government services				Private services			
			M	Annual income (₹)	F	Annual income (₹)	M	Annual income (₹)	F	Annual income (₹)
Marginal	60	130	31	10000000	10	2400000	14	1620000	4	400000
Small	60	121	22	7300000	6	2000000	11	1512000	1	100000
Medium	60	137	26	7290000	4	1800000	19	2040000	2	300000
Total	180	388	79	24590000	20	6200000	44	5172000	7	800000
Average annual income per person			20.36	311265	5.15	310000	11.34	117545	1.8	114385

Farmer category	Business				Wage labour			
	M	Annual income (₹)	F	Annual income (₹)	M	Annual income (₹)	F	Annual income (₹)
Marginal	13	1590000	0	0	15	592000	0	0
Small	11	1420000	0	0	8	355000	0	0
Medium	4	160000	0	0	5	150000	0	0
Total	28	3170000	0	0	28	1097000	0	0
Average annual income per person	7.21	113214	0	0	7.21	39178	0	0

Farmer category	Agriculture and farm products			
	M	Annual income (₹)	F	Annual income (₹)
Marginal	13	2000000	30	1900000
Small	22	2400000	40	2700000
Medium	32	2900000	45	3900000
Total	67	7300000	115	8500000
Annual average income per person	17.26	108955	29.63	73913

Table.5 Livestock inventory for marginal (a), small (b) and medium (c) category of farmers

5 (a)

Farmer category	Total no. of families	Animal species	No. of animal species	Average no. per family	Local breed	Improved breed	Dry	Milking	Young stocks	
									No. of animals species	Average no. per family
Marginal	60	Cow	42 (38.9)	0.7	14 (33.33	28 (66.66)	16 (38.1	26 (61.9)	4 (66.66)	0.06

					)		)			
		Bullock	16 (14.8)	0.26	14 (87.5)	2 (12.5)	-	-	-	-
		Goat	44 (40.8)	0.73	44 (100)	-	-	-	2 (33.33	0.03
		Sheep	4 (3.7)	0.06	4 (100)	-	-	-	-	-
		Horse	2 (1.8)	0.03	2 (100)	-	-	-	-	-
		Total	108 (100)	1.78					6 (100)	

5 (b)

Farmer category	Total no. of families	Animal species	No. of animal species	Average no. per family	Local breed	Improved breed	Dry	Milking	Young stocks	
									No. of animals species	Average no. per family
Small	60	Cow	50 (39.07)	0.83	12 (24)	38 (76)	13 (26)	37 (74)	6 (33.33)	0.1
		Bullock	30 (23.43)	0.5	27 (90)	3 (10)	-	-	-	-
		Goat	30 (23.43)	0.5	30 (100)	-	-	-	7 (38.9)	0.11
		Sheep	18 (14.07)	0.3	18 (100)	-	-	-	5 (27.77)	0.08
		Horse	-	-	-	-	-	-	-	-
		Total	128 (100)	2.13					18 (100)	

5 (c)

Farmer category	Total no. of families	Animal species	No. of animal species	Average no. per family	Local breed	Improved breed	Dry	Milking	Young stocks	
									No. of animals species	Average no. per family

Medium	60	Cow	44 (31.65)	0.73	17 (38.63)	27 (61.37)	14 (31.81)	30 (68.19)	7 (43.75)	0.11
		Bullock	39 (28.08)	0.65	39 (100)	-	-	-		
		Goat	47 (33.81)	0.78	47 (100)	-	-	-	9 (56.25)	0.15
		Sheep	9 (6.46)	0.15	9 (100)	-	-	-		
		Horse	-	-	-	-	-	-	-	-
		Total	139 (100)	2.31					16 (100)	

Table.6 Land use statistics of farmers of the studied area

Farmer category	Agriculture			Orchard (ha)	forest (ha)	Total area (ha)
	Arable land (ha)		Non-arable land (ha)			
	Irrigated	Non-Irrigated	Pasture			
Marginal	-	0.19 (50)	0.008 (2.1)	0.18 (45.8)	0.008 (2.1)	0.38 (100)
Small	-	0.66 (54.54)	0.01 (0.81)	0.51 (42.15)	0.039 (2.5)	1.21 (100)
Medium	-	1 (47.8)	0.03 (1.4)	1.06 (50)	0.03 (1.4)	2.12 (100)
Total	-	1.85 (49.86)	0.04 (1.1)	1.75 (47.16)	0.07 (1.88)	3.71 (100)

Educational status of sampled households

Table 3 shows the educational status of sampled households. It was found necessary to study educational status as it determines the farmer's awareness level thereby influencing the adoption mechanism of suggested modern technologies and rational decision making pertaining to adoption of different agroforestry systems. The literacy rate varied from 78.39 to 86.56 percent among other farmer categories. The perusal of table shows that literacy rate was highest in marginal category (86.56%) followed by medium category (83.16%) followed by small category (78.39%). The males were found more literate then females in all categories.Joshi, 2011 reported that literacy percent varied from 75.79% in Katli panchayat and to 88.09% in Karganoo panchayat in Rajgarh and Sarah block of district Sirmour (Himachal Pradesh.

Employment status of sampled household

As per Table 4 there are 5 different avenues in the study area. The sampled farmers met their livelihood

to, govt job, industrial labour, self employment and farm labours. Male were dominating in all the avenues. In government job, it is found that 20.36% of men are engaged in this sector against 5.15% of females. Similar observations are made for other categories as 11.34% males are engaged in private jobs against 1.8 % 0f females. In Business Avenue, 7.21% males were found to be engaged in business. Similar percentage of men is found in wage labour. Females are found to be not engaged in business and wage labour. Agriculture and Farm Avenue is dominated by females. In agriculture and farm products, it is observed that 29.63 % females are engaged against 17.26 % of males. Agriculture and farm products include the income from agriculture products ie. pulses, cereals etc and horticulture products ie. apple, walnuts, other fruits, and vegetables etc. In the study, it is concluded that men are found to be more interested in off farm cash activities whereas women dominates the household and farm activity. The average annual income for males is found to be ₹ 311265 whereas for females it is ₹ 315000. Similarly other trends were observed in which the average annual income in private services for males was ₹117545 and for females was ₹114385. In business and wage labour, the average annual income was ₹113214 and ₹39178 respectively. In agriculture and farm products, average annual income was ₹ 108955 and for females was ₹73913.

Livestock inventory of sampled households

The status of livestock is shown in Table 5a, 5b and 5c. sometimes, livestock plays a very crucial role in farming system of any household. Livestock like bullocks apart from used in farming, they also provide manure for crops in return to green and dry fodder in tree/crop–livestock system. From table 5a, it was concluded that in marginal category average no of animals per family was 1.78. It can be concluded from table that for marginal category goats were the most preferred domesticated animal followed by cows, bullocks, sheep and horses respectively. The goats were all local breeds. In cows, it was concluded that 66.66% were of improved breeds while 33.33% were of local breed. In small category, it was concluded that average no. of animal species per family is 2.13, in this category; cows were most preferred domesticated animal followed by bullocks and goats at same level and then followed by sheep. In medium category, the average no. of animals per family was 2.31. In this category, goats were the most preferred domesticated animal closely followed by cows and then bullocks and sheep respectively followed the trend. From the tables of different categories, it is evident that cows of improved breeds are most preferred domesticated animal for the purpose of milk.

From the study , it is also concluded that farmers growing pure Organic apple, preferred Local cows for the purpose of making different organic solutions from cow dung and cow urine like (1) Agniastra (cow urine+greenchili+lahsun+Neem/ kothal/chichdi+Tobacco), (2) Jeevamrit (cow dung + cow urine+besan+jaggery), (3) Gaanjeevamrit (cow dung+ jaggery+ besan), Beejamrit (cow urine+cow dung+ lime) etc. from the study, it was concluded that the farmers growing the pure organic Apples and other fruits has need for local breed cows for their cow dung and cow urine. Although the frequency of pure organic farmers is low but those farmer keeps livestock as per their need for organic agriculture. Thus, one can draw the conclusion that the livestock especially local cows are very important for organic farm activities.

Land use statistics of sampled households

Different land use statistics of the sampled farmers is depicted in Table 6. Non irrigated arable land constitutes 49.86% of the total land. There was no agricultural land found to be irrigated in the study.

For the irrigation of the agricultural crops, farmers were dependent on rainfall. Pasture land consist of 1.1% of total land. Forest land comprises of 1.18% of total land. As the Bharmour region is suitable for the cultivation of fruit crops like apple, walnut, khumani, nashpati etc. it is depicted from the table that orchard area constitutes 47.16% of total land. From the table it was concluded that medium category farmer have highest orchard area followed by farmers of small category and marginal category respectively. Similar survey of Agroforestry systems in Balh valley of Mandi district (Himachal Pradesh) by Upadhayaya (1997) revealed that 97 per cent of the household were in marginal and small categories covering about 89 per cent of the total land area. Further, he reported that 83 per cent of land area was under agriculture and cultivation done under rainfed condition which was in contrary to our present findings.

Conclusion

It is concluded that, the overall family sex ratio was reported to be 908, which is lower than the state (Himachal Pradesh) and national average of (72 and 940 respectively depicting no cultural difference on the gender of the child. Literacy rate varied from 78.39% to 86.56 % among different categories. Six types of agroforestry systems were practiced by different category of farmers Agrihortisilviculture system was found to be most dominant agroforestry system followed by Agrihorticulture system. The average mean family size is 5.34. the highest average family size was observed in medium category, and lowest was observed in small category. Adult population constitutes 58.77% of the total population and children population consist of 41.23%. Males were the dominant in all income generations avenues except for agriculture and farm products. For more production of milk, improved breeds of livestock are preferred. For need of cow dung and urine for organic cultivation of agriculture and horticulture crops, local breeds are preferred. Highest average no. of animals per family was in medium category. Non irrigated arable land constitutes 49.86% of the total land. There was no agricultural land found to be irrigated in the study area. The orchard area consists of 47.16% of the total land. No woodlots were observed in study area and peoples were meeting their fuel, fodder and other needs through trees retained in agriculture and pasture land finally, it can be concluded that agroforestry is prerequisite for the conservation of natural forest and socio-economic upliftment of rural population.

ACKNOWLEDGEMENT

Author is thankful to Dr. Kehar Singh Thakur, Major Advisor, Dean, College of Horticulture and Forestry, Neri, Hamirpur, Himachal Pradesh for providing necessary facility and also to the farmers of the study area for their co-operation to carry out this research work.

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