A COMPARATIVE ANALYSIS OF SOCIO-ECONOMIC VIABILITY OF AGROFORESTRY IN PULWAMA DISTRICT OF JAMMU & KASHMIR

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ABSTRACT

Agroforestry is an inter disciplinary, multi-sector approach of land use. Its prime objective is overall optimization and to protect the environment and maintain the ecological integrity. Agroforestry is primarily the technology of using perennial vegetation in combination with seasonal or perennial field crop, fodder or other crops of economic value in agriculture. In the developed agroforestry systems, there are three components i.e, the woody perennials, the agricultural crops and the animals. However in all the agroforestry systems the presence of tree component is must and it plays the dominant roles-the trees have two major roles-the productive role (fuel, fodder, food, fruit and fertilizer) and the service roles (soil and moisture conservation, wind break, shelter belts, shade etc.)

The present work assumes much significance because of the fact that agroforestry although much recognized as economically viable enterprise at the national and international level has not received much attention in our state. Kashmir, being a mountainous vale has tremendous potential for agroforestry. This study analyzed the socio-economic viability of agroforestry in Pulwama district of Jammu & Kashmir. It has been long experienced in Pulwama that land use/ land cover change is taking place at a tremendous pace, since last two or three decades. This change is not everywhere ecologically, economically and environmentally viable. This study

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holistically analyzed the socio-economic implication of agroforestry in Pulwama district of Jammu & Kashmir.

The comparative cost and benefit analysis of agroforestry practice in the district revealed that the integrated agriculture-forestry system is more profitable than the exclusive agriculture system on account of lower input costs adjusted on agricultural plantation. Integrated agriculture-forestry farming is an economically viable, environmentally sustainable and socially acceptable farming system in the study area.

Key words: Agroforestry, Perennial, Integrated, Socio-economic, Profitable

1. Introduction:

Agroforestry has a high potential to simultaneously satisfy three important objectives viz., protecting and stabilizing the ecosystems, producing a high level of output of economic goods, providing stable employment, improve income and basic materials to rural population. Besides that, agroforestry is capable to conserve natural resources through various systems under different agro-climatic regions.

Agroforestry is a dynamic, ecologically based natural resource management practice that through the integration of trees on farms and in the agricultural landscape diversifies and sustains production for increased social, economic and environment benefit. Incorporating trees into farming systems leads to greater prosperity at the farm level. Trees provide farmer's with marketable products such as timber, building poles, firewood, animal fodder, fruit and medicines all of which earn extra income.

Agroforestry is an age old practice followed in some form or the other in different parts of the world. Intensification and commercialization of agroforestry picked up momentum around the same time with the initiatives of corporate firms and NABARD. Intensive agroforestry has certainly created investment and employment opportunities to supplement the on-farm income (Kareemulla et al., 2003; Saigal et al., 2002). Besides the intensive/ commercial agroforestry, the traditional agroforestry systems also provide ample avenues for entrepreneurship, especially for the rural youth both in the farm and nonfarm agroforestry sector. There has always been close association in trees and human being throughout the world. The presence of trees, outside the

forest has more significance in satisfying the daily domestic needs of the people. The presence of trees around field borders and homesteads intended to increase the magnitude of production

The state of Jammu & Kashmir is bestowed with rich floral diversity. The area located in the North of the Indian Republic is a mountainous zone in the North-West Himalayas. It is physiographically the most complex and diverse. The great diversity in its climate and altitude has resulted in an ideal environment for the development of agroforestry. Agroforestry being the planet's most important terrestrial ecosystem are linked with economic and physical welfare of mankind. However, with ever increasing population of the state, forests have been placed under tremendous pressure arising out of increasing demand for fuel wood, fodder, timber and other forest products. The increase in population and inadequate management practices has resulted in acute degradation of our forest resources, the issue therefore is to arrest the deterioration of our forest resources and to maintain the ecological balance and simultaneously meet the ever increasing demands of the people.

This goal can be achieved by undertaking plantation programme on all possible types of land of the state outside the natural forests with particular emphasis on fast growing trees which if identified and propagated by adopting propagation technique promise the uninterrupted supply of fuel wood, fodder and other forest products,

Traditionally, in Pulwama district a large number of multipurpose trees are deliberately introduced and maintained by the farmers in the cropping system. More than 80 percent of the population is dependent on agriculture in which combining trees, crop and livestock is a common phenomenon, which has resulted in various kinds of agroforestry systems. Agroforestry is an integral land use system being followed in district Pulwama, combining trees, crops and animals for sustained production of grains, fodder, fruit, fuel wood, timber and other economic productions. It offers multiple alternatives and opportunities to the farmers to enhance farm production and income, while protecting the agricultural environment. The local inhabitants of Pulwama district of Jammu & Kashmir have their traditional agroforestry systems which play an important role in meeting diverse subsistence needs at the time of emergency. The detailed work has been carried out with the following

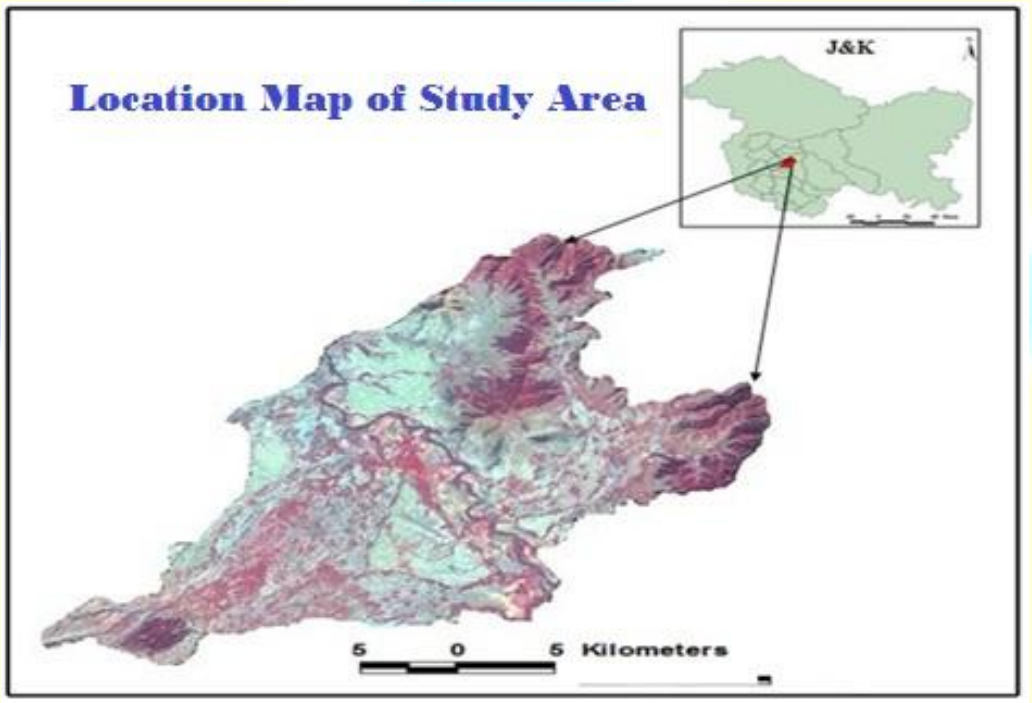
objectives:

(i) To observe the socio-economic and demographic profile of the study area.

(ii) To workout the economic viability of agroforestry in different geo-ecological regions of the study area.

2. Study Area

The study area is the Pulwama district of Kashmir valley. It came into being in 1979 when it was carved out of Anantnag district. It is centrally located in the valley of Kashmir, situated between the geographical coordinates of 33°37′-34°06′ N latitude and 74°33′-75°14′ E longitude.



Source: IRS P6 LISS III (2010)

Fig. 1.1

3. DATA BASE AND METHODOLOGY

A detailed account of the techniques followed and materials used during the conduct of research work is presented below.

Primary data was collected through a multi-structured questionnaire, through the sampling of a set of 300 questionnaires; information was collected regarding social status and

economic viability of agroforestry. These collected sets of information were then classified, tabulated and refined. Finally the results were obtained and interpreted comprehensively.

Secondary data was obtained from various sources like government records, journals, magazines, published and unpublished reports, newspapers, etc.

4. Methodology

The whole study area was altitudinally divided into three regions comprising of Flood plains ((Up to 1700 meters amsl), Karewas (1700-2000 meters amsl) and Kandi/Hill (Above 2000 meters amsl).The survey was conducted in 30 villages selected through stratified random sampling technique, and from each village 10 households were selected. The cost benefit analysis between agriculture and agricultural plantations in various regions was done in order to work out the overall scenario of the "Socio-economic viability of agroforestry". The costs referred were worked out by assessing total costs on labour, seeds, fertilizers, irrigation etc. Similarly the output referred includes agricultural products, bi-products of fuel; fodder and commercial timber etc were converted in to monetary terms to evaluate the economic efficiency of agriculture and agricultural plantation in different geo-ecological regions. In this way the variation in cost benefit ratio for various types of regions was done.

5. SOCIO-ECONOMIC STATUS OF SAMPLE HOUSEHOLDS

The socio-economic survey was conducted in such a manner that the overall depiction of socio-economic viability of agroforestry at village level could be studied. The objective of the socio-economic survey was to gain information about the resource use patterns by the inhabitants of the area. A common questionnaire containing all the information was drawn in close consultation with each household, mostly head or the elder person of the family. During the interview, families representing all economic classes were selected. Both educated as well as uneducated persons were interviewed from such households. At the time of interview of households, the information pertaining to their family life, number of family members, sex, age, religion, land use pattern, cropping pattern, magnitude of energy consumption, the number of fruit trees and multipurpose trees within agricultural fields, existing agroforestry systems, livestock population, nature of employment etc were discussed.

The results on the socio-economic status of the people of three different regions are presented in Table 1.1. A total of 300 households surveyed during the survey including 2197 members in different groups. The average family size was reported to be 7.49 members per family in Flood plain, 7.28 members per family in Karewa and 6.78 members per family in Kandi. The selected villages in different regions were typical in geographical situation falling between 1600 to 2000m amsl. The agricultural practices in Flood plain and Karewa regions were carried out mainly on flat lands while as in Kandi region the agricultural practices were carried out on terraces. The houses of the villages were made up of mainly stone, soil and bricks. During the survey it was found that families having lower income and literacy had more number of children. Economic prosperity was found to have intimate and positive relation with the literacy. It was also found that the average monthly family income in Flood plain ranges between Rs 20,000-25,000, in Karewa it was between Rs 15,000-20,000 and in Kandi the average monthly family income was found to be Rs 5,000-10,000.

Table 1.1: Socio-economic and Demographic Profile of Sample households

Parameter	Region			Total
	Flood plain	Karewa	Kandi	
Total agricultural land (ha)	152	47	19	218
Irrigated land (ha)	71	13	05	89
Unirrigated (ha)	81	34	14	129
Total households surveyed	200	50	50	300
Human population	1494	364	339	2197
Human population (i) male	828	195	185	1208
(ii) Female	666	169	154	989
Literate male	650	120	110	880
Literate female	280	90	50	420
Employment status				
(i) Primary	190	50	80	320
(ii) Secondary	126	13	26	155
(iii) Tertiary	94	20	22	136
Average monthly Family Income (Rs)	20,000-25,000	15,000-20,000	5,000-10,000	

Source: Field Survey (2011)

6. Cropping Pattern of sample households

Cropping pattern means the proportion of area under various crops at a point of time. Cropping pattern is however, a dynamic concept as it changes over space and time. Cropping structure in a region is the direct outcome of the physical, socio-cultural and historical factors. Characterized with mountainous undulating terrain and micro level variation in temperature, precipitation and soils, the district Pulwama of Jammu and Kashmir has a high degree of variation in its cropping pattern, crop combination and crop diversification. The district Pulwama has a high concentration of paddy, orchards, maize, and fodder, vegetables and saffron cultivation. The area in percentage of the total cropped area in sample households of district Pulwama have been given in Table 1.2.

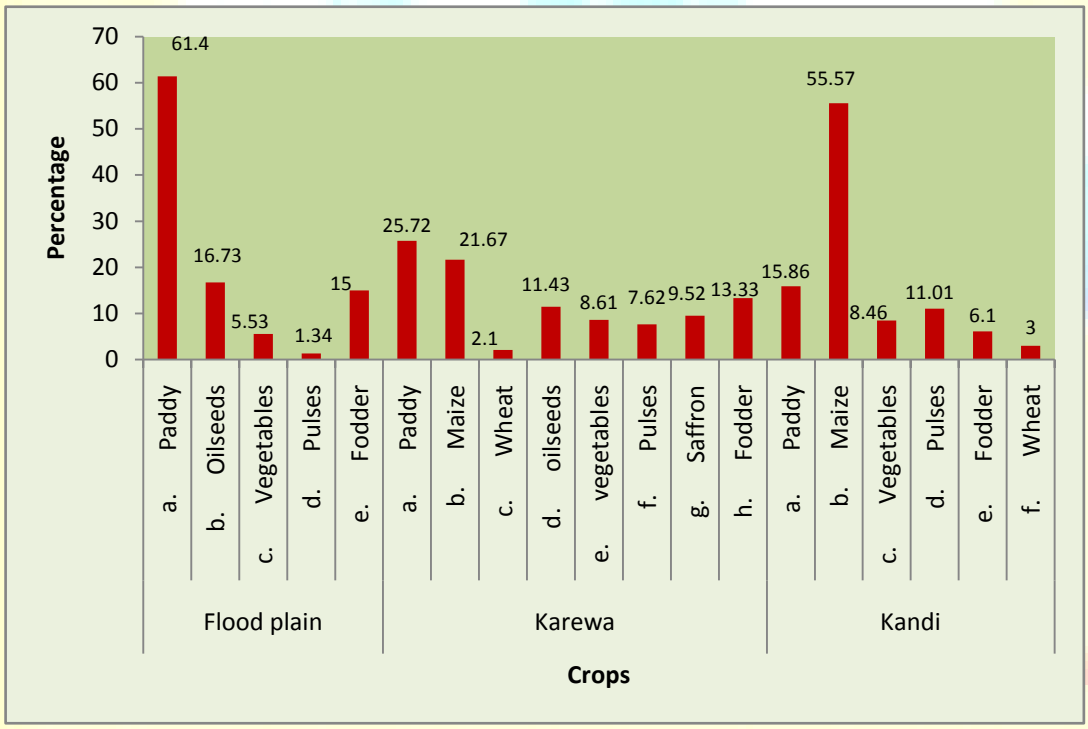
Table 1.2: Region wise Cropping pattern of sample households

Region	Crops	Area (%) of the total
Flood plain	a. Paddy	61.40
	b. Oilseeds	16.73
	c. Vegetables	5.53
	d. Pulses	1.34
	e. Fodder	15.00
Total	-	**100**
Karewa	a. Paddy	25.72
	b. Maize	21.67
	c. Wheat	2.10
	d. Oilseeds	11.43
	e. Vegetables	8.61
	f. Pulses	7.62
	g. Saffron	9.52
	h. Fodder	13.33
Total	-	**100**
Kandi	a. Paddy	15.86
	b. Maize	55.57
	c. Vegetables	8.46
	d. Pulses	11.01
	e. Fodder	6.10
	f. Wheat	3.00
Total	-	**100**

Source: Field Survey (2011)

The Table 1.2 and Fig.1.2 depicts a diverse cropping pattern in all the three regions of the study area. In flood plain highest percentage is under paddy cultivation i.e. 61.40 percent, followed by oilseeds 16.73 percent, fodder 15.00 percent, vegetables 5.53 percent and lowest percentage is under pulses i.e. 1.34 percent. The total area under paddy cultivation in Karewa region is 25.72 percent, followed by maize 23.77 percent, fodder 13.33 percent, oilseeds 11.43 percent, saffron 9.52 percent, vegetables 8.6 percent, pulses 7.62 percent, and wheat 2.10 percent. In Kandi region the dominant crop is maize, occupies an area of about 55.57 percent followed by paddy 15.86 percent, pulses 11.01 percent, fodder crops 9.10 percent, vegetables 8.46 percent and wheat 3.00 percent.

Region wise Cropping pattern of sample households



Source: Field Survey (2011)

Fig. 1.2

7. LAND USE PATTERN OF SAMPLE HOUSEHOLDS

Land use is a more complicated term. Social scientists and land managers define land use more broadly to include the social and economic purposes and contexts for and within which lands are managed (or left unmanaged), such as subsistence versus commercial agriculture, rented versus owned, or private versus public land. While land cover may be observed directly in

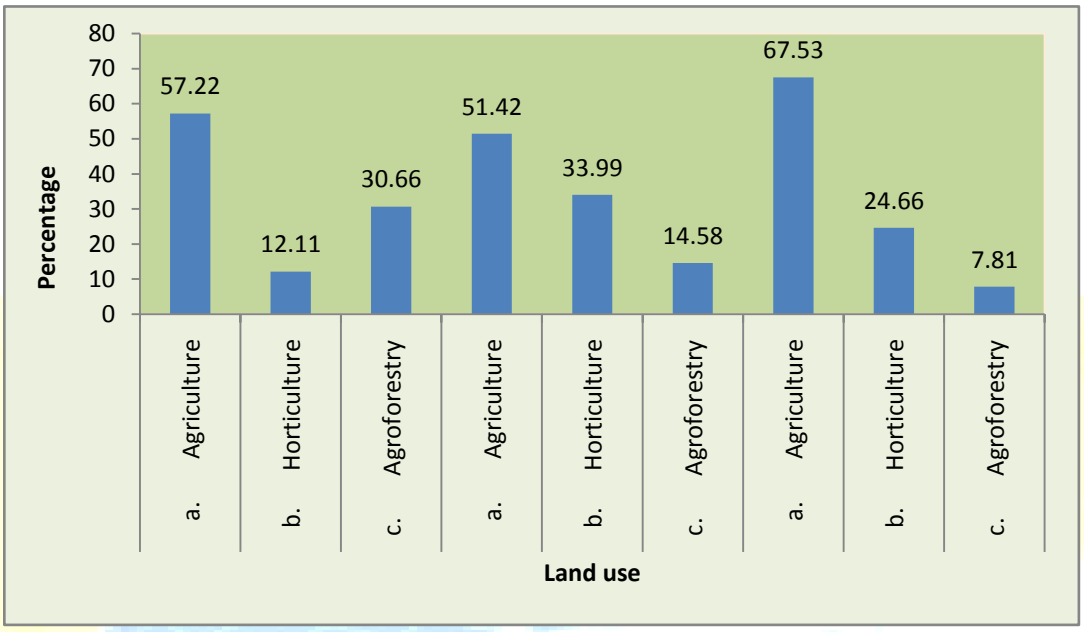
the field or by remote sensing, observations of land use and its changes generally require the integration of natural and social scientific methods (expert knowledge, interviews with land managers) to determine which human activities are occurring in different parts of the landscape, even when land cover appears to be the same. The land use pattern of the sample household is depicted in Table 1.3.

Table 1.3: Region wise land use pattern of sample households

Region	Land Use	Area (%) of the total
Flood plain	a. Agriculture	57.22
	b. Horticulture	12.11
	c. Agroforestry	30.66
Total	-	**100**
Karewa	a. Agriculture	51.42
	b. Horticulture	33.99
	c. Agroforestry	14.58
Total	-	**100**
Kandi	a. Agriculture	67.53
	b. Horticulture	24.66
	c. Agroforestry	7.81
Total	-	**100**

Source: Field Survey (2011)

Region wise land use pattern of sample households



Source: Field Survey (2011)

Fig. 1.3

The Table 1.3 and Fig. 1.3 reveals that the land use pattern of sample households in district Pulwama. It highlights that maximum portion is under agriculture in all the three regions followed by horticulture and agroforestry in Karewa and Kandi region where as in Flood plain the situation is different, agriculture is followed by agroforestry and horticulture.

8. Magnitude of fuel wood and fodder Consumption

The fuel wood was used by all the three regions besides the other alternatives. The fuel wood was mainly used for cooking, heating room and water during winter. However, the families with better economic condition were also using kerosene, LPG and biogas. The fuel wood scarcity has been obviously felt in areas where forests are absent. Therefore, in such areas agroforestry has played its role to fulfill the firewood demand. Further, as the scope for extraction of firewood from the forests is decreasing gradually, the only alternative left for the people is to patronize agroforestry on farm and community lands. The average annual consumption of fuelwood varies from region to region.

Table 1.4: Average fuel wood consumption per household per year

Region	Average household size	Yearly fuel wood consumption (qtls.)
Flood Plain	7.49	12
Karewa	7.28	24
Kandi	6.78	30

Source: Field Survey (2011)

The Table 1.4 reflects that in Flood plain, the average consumption of fuelwood per household was 12 qtls.yr^{-1}, in Karewa it was 24 qtls.yr^{-1} and in Kandi belt the average consumption of fuelwood per household was 30 qtls.yr-1. The minimum consumption of fuel wood was recorded in Flood plain area in both summer and winter seasons due to easy availability of kerosene oil and LPG and comparatively higher economic status. It was also found that the consumption of fuel wood was higher in winter as compared to summer season. The higher consumption rate during winter was partly due to prevalence of lower temperature.

The fodder used by the sample households was supplied from tree leaves mostly taken from trees existing in agroforestry systems. The demand of green fodder was met from agricultural fields while dry fodder was supplied from preserved grasses and agricultural straw in the form of hay.

Table 1.5: Average Fodder consumption pattern in sample households

Region	Tree fodder	
	Kg/day/livestock head	
	Summer	Winter
Flood Plain	3.02	5.28
Karewa	3.8	5.5
Kandi	4.44	6.2

Source: Field Survey (2011)

The Table 1.5 reflects that the average tree fodder requirement varied from 3.02 kg/day/livestock head to 4.44 kg/day/livestock head in summer and 5.28 kg/day/livestock head to 6.2 kg/day/livestock head in winter season. Fodder production is one of the major objectives for maintaining agroforestry systems. Hence, the trees in or around the agricultural fields supplement the fodder requirement substantially.

9. LIVESTOCK POPULATION

The animal husbandry sector constitutes one of the vital allied activities of the primary sector of a rural economy. The prosperity of the rural economy largely hinges on the availability of land resources and the abundance of livestock population. Both of them are considered vital assets for the rural population because these determine social and economic prosperity.

Table 1.6: Livestock Population in sample households of Pulwama District

Region	Cattle Population (%)	Sheep/Goat Population (%)	Poultry Population (%)	Total Livestock Population (%)
Flood plain	220 (4.30)	1590 (30.97)	3323 (64.73)	5133 (100)
Karewa	150 (3.76)	2050 (51.45)	1785 (44.79)	3985 (100)
Kandi	196 (10.11)	687 (35.48)	1054 (54.41)	1937 (100)
Total	566 (5.13)	4327 (39.14)	6162 (55.73)	11055 (100)

Source: Field Survey (2011)

The Table 1.6 reflects that the total livestock population in sample households is 11055 units out of which cattle population comprises 566, sheep/Goat population is 4327 and the Poultry population is 6162. The highest livestock population is found in Flood plain followed by Karewa and Kandi belts.

10. SOCIO-ECONOMIC VIABILITY OF AGROFORESTRY

Agroforestry practices in the study area seems to be showing significant contribution in the overall agricultural system. This is clearly being depicted by the table 1.7 as almost all the three regions devote some area for miscellaneous tree cultivation such as Populus, Willow and Kikar. However, Flood plain region leads in this system followed by Karewas and Kandi belts. The reason for bringing more area not conducive for agriculture practices into miscellaneous tree cultivation seems to have had pronounced effect on the socio-economic conditions of these three regions particularly of Flood plain and Karewas. However, sample villages of Kandi though devoting some area for miscellaneous tree cultivation did not register significant changes in development of Agroforestry systems. This could be related to a large extent to the close proximity of forests near to this Kandi region. People of this region naturally collect fuel wood, and timber free of cost. From the present study, it is quite obvious that some areas in district Pulwama are not practising Agroforestry systems in proper way

11. COST AND RETURNS OF AGRICULTURE AND AGRICULTURE PLANTATION

Economic analysis of an activity in a given situation is very essential for the proper assessment of its economic feasibility and viability. This may help the producers, extension workers, scientists and planners alike in making rational decisions on various matters. Therefore an attempt has been made to analyze the economic aspect of agriculture and different agriculture plantation such as Populus, Willow and Kikar in different geo-ecological environments of Pulwama district.

Table 1.7: Cost Benefit Analysis of agroforestry

Geo-ecological Region	Name of the Product	Total Cost(Rs)/ Hectare	Total Income(Rs)/ Hectare	Net Profit(Rs)/ Hectare
Flood Plain	Agriculture	1,08940	2,05180	96,240
	Poplar	6,360	5,07993	5,01633
	Willow	1,174	4,26000	4,24826
	Kikar	693	90,000	89,307

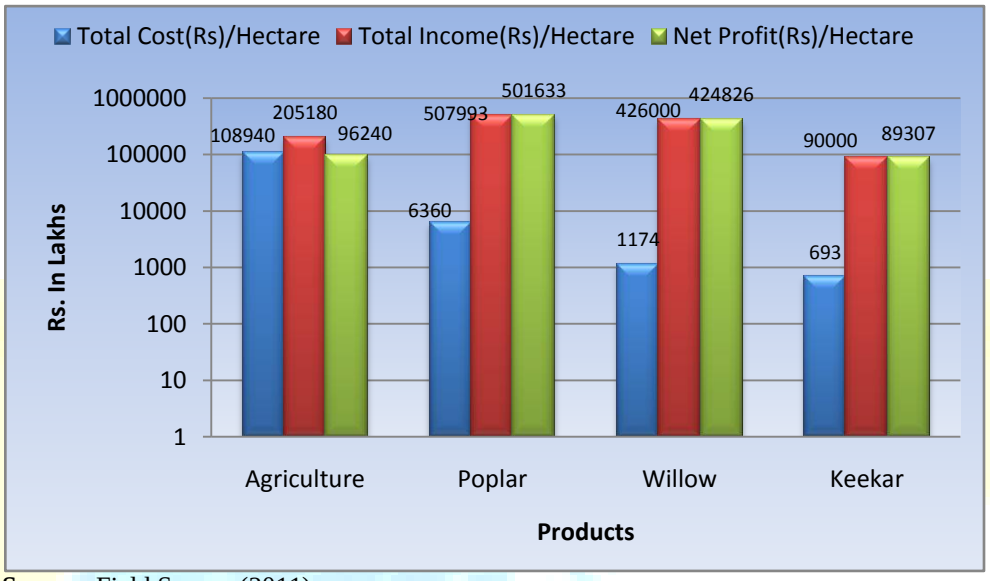
Karewa	Agriculture	82,100	1,49600	67,500
	Poplar	4,920	5,02666	4,97746
	Willow	1,107	1,12933	1,11826
	Kikar	767	1,05000	1,04233
Kandi	Agriculture	94,800	1,34800	40,000
	Poplar	4,947	3,22173	3,17226
	Willow	720	80,400	79,680
	Kikar	753	1,31600	1,30847
Average	**Agriculture**	**95,280**	**1,63193**	**67,913**
	Poplar	**5,409**	**4,44277**	**4,38868**
	Willow	**1000**	**2,06444**	**2,05444**
	Kikar	**738**	**1,08866**	**1,08129**

Source: Field Survey (2011)

An analysis was also worked out to find out the economic viability for the purpose of developing agroforestry systems in the study area. The total cost in Rupees Per hectare was calculated from sample households to acertain the total cost being spend for agricultural crops, miscellaneous trees separately. This was done to identify the economic viability of all these above systems of agriculture. The costs referred were worked out assessing total costs on labour, seeds, pesticides/ fertilizers, irrigation etc. Similarly out puts in terms of money per hectare for these types of agroforestry was done in order to work out cost benefit ratio. The output referred includes agricultural products, bi-products of fuel, fodder and commercial timber. All the above analysis was done separately for all the three regions of the sample villages. By this way, the variation in cost benefit ratio for different types of regions was done.

Flood Plain: - The table 1.7 and Fig. 1.4 clearly shows that in flood plains, area the total expenditure on agriculture is Rs 1,08940 per hectare and the farmer gets an annual income of about Rs 2,05180 per hectare gaining a net profit of about Rs 96,240 per hectare. In comparison to this the cost on agriculture plantation such as Poplar, Willow and Kikar is Rs 6,360, Rs 1,174 and Rs 693 per hectare and the average income obtained by the farmer per hectare is Rs 5,07993, Rs 4,26000 and Rs 90,000, after fifteen years gaining a net profit of about Rs 5,01633,Rs 4,24826 and Rs 89,307 per hectare.

Cost Benefit Analysis of Flood plain

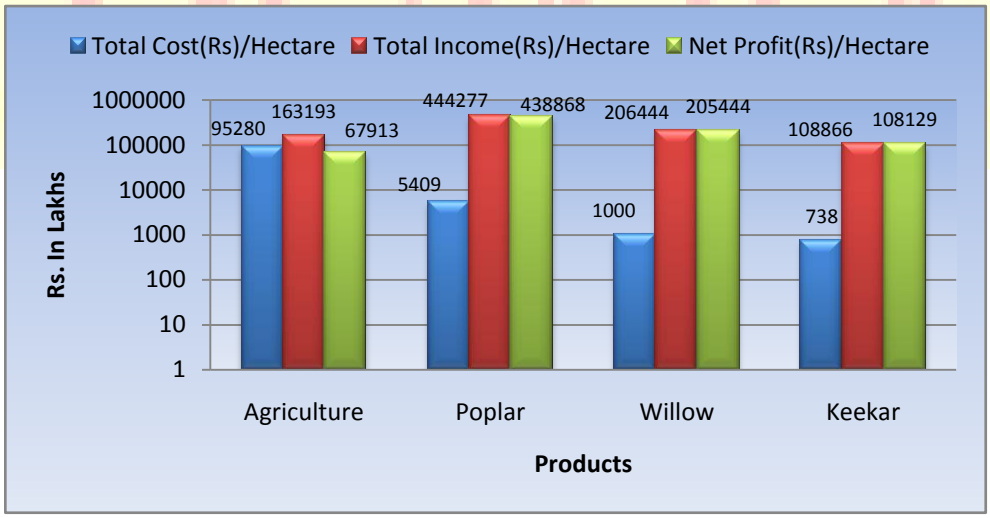


Source: Field Survey (2011)

Fig. 1.4

Karewa: The Table 1.7 and Fig.1.5 shows that the cost on agriculture in Karewa is Rs 82100 and the annual income generated from agriculture is Rs 149600 per hectare, gaining a net profit of about Rs 67500 .In relation to this the total expenditure on different plant species such as Populus, Willow and Kikar is Rs 4920, Rs 1107 and Rs 767 per hectare and the average income obtained from the above species is Rs 5,02666, Rs 1,12933 and Rs 1,05000 per hectare after fifteen years, showing a net profit of about Rs 4,97746, Rs 1,11826 and Rs 1,04233 per hectare.

Cost Benefit Analysis of Karewa

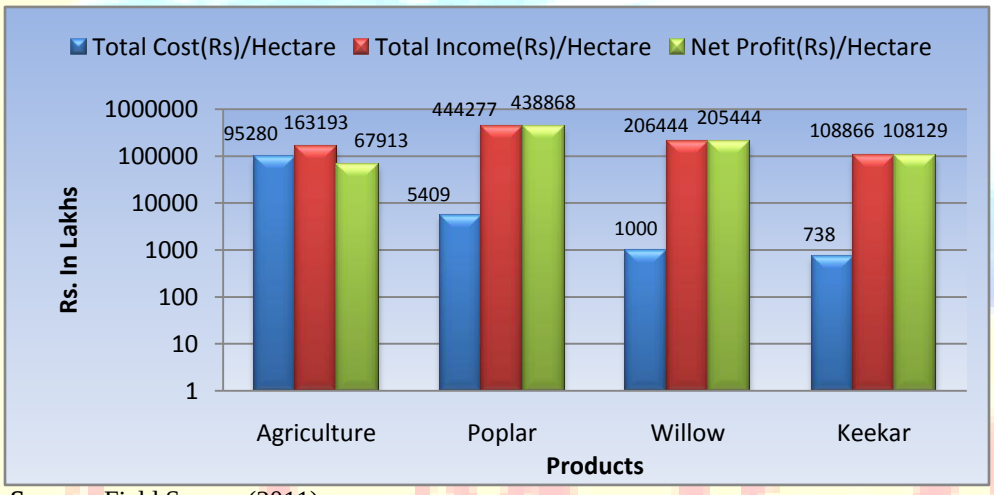


Source: Field Survey (2011)

Fig. 1.5

Kandi: In Kandi zone the table 1.7 and Fig 1.5 reflects that the cost on agriculture is Rs 94800 per hectare and the annual income obtained from per hectare of agriculture land is Rs 134800 gaining a net profit of Rs 40,000 per hectare. While as in agriculture plantation such as Poplar, Willow and Kikar the farmer invests a little amount i.e., Rs 4947, Rs 720 and Rs 753 per hectare and obtaining an average income of about Rs 3, 22173, Rs 80,400 and Rs 1, 31600 per hectare after fifteen years. The net profit gained by farmer from Poplar, Willow and Kikar is Rs 3, 17226, Rs 79,680 and Rs 1, 30846 per hectare of land.

Cost Benefit Analysis of Kandi

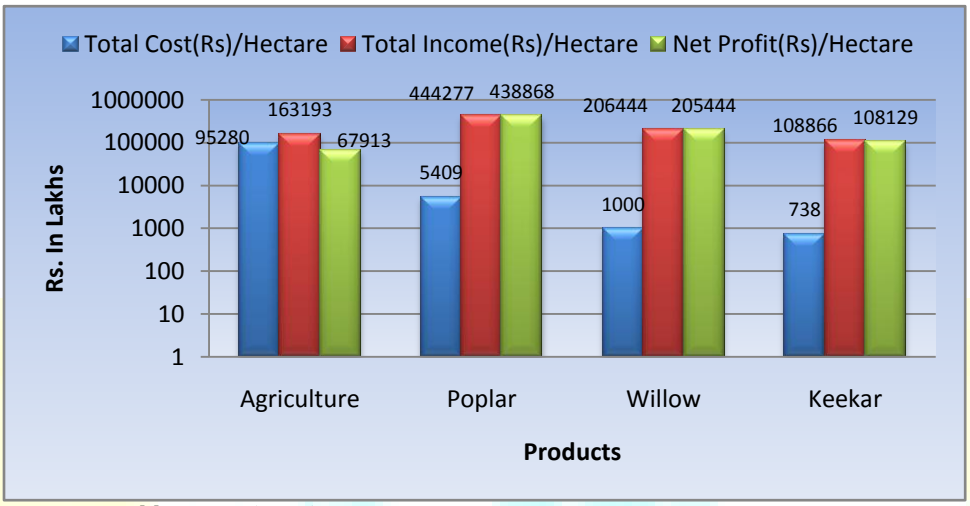


Source: Field Survey (2011)

Fig. 1.6

The Table 1.7 and Fig. 1.6 shows that the annual average cost on agriculture per hectare that comes out Rs 95280 and the annual income obtained from per hectare of agriculture land is Rs 163193, showing a net profit of about Rs 67913 per hectare. In comparison to this the average cost on agriculture plantation such as Poplar, Willow and Kikar is Rs 5409, Rs 1000 and Rs 798 rupees per hectare after fifteen years. The income obtained from these tree species is Rs 4,44277, Rs 2,06444 and Rs 1,08866 per hectare showing a net profit of about Rs 4,38868, Rs 2,05444 and Rs 1,08129 per hectare.

Average Cost Benefit Analysis of Agroforestry



Source: Field Survey (2011)

Fig. 1.7

The Table 1.7 clearly indicates that the cost benefit ratio is more favourable for agriculture plantation such as Poplar, Willow and Kikar than pure agriculture. So from this analysis it is clear to conclude that the plantation is much more profitable than agriculture produce and it also requires less efforts and human labour.

12. Conclusion:

The farmer's willingness to grow trees on their farms was found as a function of their sociological, cultural and economic characteristics. Survey analysis of farmers' perception has showed a strong concern for the positive outcome of tree plantation. Planting of trees was perceived by the large number of the farmers either for fuel wood, timber, and fodder or income enhancement. The educated farmer's have allocated more size of the farms for trees as compared to illiterate farmers. This could be associated due to the higher level of awareness for the importance of tree cultivation. The bigger family size was reported to have more forested area. This may be greater availability of labour for growing woody perennials and more requirements of woody perennials for, fuel wood, fodder, timber and fruits for household utilization and to generate extra income to sustain their livelihood. It was found that most of the agroforestry systems prevailed in the study area were need based and essentially required by the local people to cater to their daily domestic needs of food, fodder, fuelwood and timber. It was found that agroforestry provides year round employment for rural work force. Associated activities like harvesting, transport, processing and marketing etc. open up new avenues for employment generation. It was also found that on maturity of tree components after their felling fetches a good amount to fulfill their basic needs than agriculture crops. The comparative cost and benefit

analysis of agroforestry practice in the district revealed that the integrated agriculture-forestry system is more profitable than the exclusive agriculture system on account of lower input costs adjusted on agricultural plantation. Integrated agriculture-forestry farming is an economically viable, environmentally sustainable and socially acceptable farming system in the study area.

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