AGROFORESTRY – A GATEWAY TO REDUCE THE FARMER POVERTY

CONTRIBUTIONS OF AGROFORESTRY ON SOCIO-ECONOMIC CONDITIONS OF FARMERS IN CENTRAL PUNJAB, PAKISTAN – A CASE STUDY

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ABSTRACT. Agroforerstry (AF) in the farmlands of Punjab (Pakistan) is a tradition, but it was practiced without any proper methodology. From last few years, AF practices have become popular in Punjab. Especially in the rural areas woody biomass is being used as a major source of energy. The study was designed to examine the contributions of AF on the socio-economic conditions of the farmers in the central Punjab of Pakistan. District Chiniot was selected as the universe of study and a detailed survey was conducted in the three tehsiles by interviewing 150 randomly selected farmers with the use of a well-structured questionnaire. In addition, secondary data was also collected from district agriculture offices. Chi-Square test was used for quantitative data analysis. Results showed that farmer's annual income and household status was improved after practicing AF. Reasonably less poor farmers have more income increase than the poor farmers due to an extra investment, but income generation helped poor farmers to maintain the minimal living standards. Farmers perceived the advantage of trees immensely and the large scale farmers taking this as a genuine source of income. In adoption of AF, attitude of the farmers was independent of family size and settlement period, but was dependent on the occupation and number of livestock holding. The study suggested that, in the present financial scenario of the poor farmers, planting of suitable tree species with multiple benefits is an escape way to come out of the vicious circle of poverty. Along with that agroforestry can play a vital role in increasing the vegetation cover in forest deficient countries. Extension services and awareness programs should be arranged in

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the areas where people have negative attitude about AF practices, because the cultivated fields are the best places to grow the tree with crops. Moreover, subsidies and income generating project should be launched to motivate people towards AF.

Keywords: afforestation; farmland; income status; attitude; extension services; Chiniot.

INTRODUCTION

Pakistan has made considerable progress in lot of spheres after independence and the significant achievement among them is the self-sufficiency in agriculture and in food grain production. After 1950, production has increased, primarily, due to increment in productivity per unit land area (Reisner *et al.,* 2007).

Pakistan is at 110th position on the basis of its forest resources in the world, as announced by United Nations General Assembly in 2011 (Chaudhry, 2011) and facing timber and firewood shortage (GOP, 2013). The reality is clear by fact that Pakistan has suffered a lot from its forest cover since 1990, due to increased deforestation activities (FAO, 2011). The Government of Pakistan is attempting to make up the deficiency and has brought 2% of farming land under tree cover (Qureshi, 2005; Mari *et al.,* 2011). In a study, Lambin *et al.* (2006) mentioned that 90% energy requirement of poor farmers are met by trees growing on farm lands. There is a need to expand the territory under tree blanket, not just to help the developing population, but also to improve the ecological and natural services being provided by the forests (Swallow *et al.,* 2002).

Farmer willingness to grow trees on their farmlands is a function of their attitudes, mainly towards the advantages and disadvantages of growing trees. The objective of the current study is to investigate the farmer's attitude and perception about the contribution of AF on socio-economic conditions of farmers in Central Punjab, Pakistan.

MATERIALS AND METHODS

Study area
District Chiniot was selected as the universe of study. Chiniot comprises of three tehsiles: Chiniot, Lalian and Bhowana. It is a newly built district of Punjab province, Pakistan. It was separated from district Jhang in 2009. Now, Chiniot is a separate district under division Faisalabad. This area is famous due to its furniture articles. Land of district Chiniot is very fertile and productive because of a well-managed irrigation system. The climate of the area is equipped by hot summer and short severe winter. It rises to the height of 192 m above sea level. Average annual temperature is 24°C and average annual precipitation is 336 mm.

Data collection
It is very difficult, rather impossible and extremely expensive to collect data related to problem under investigation from the entire population. Thus, sampling appears to be the only way to overcome this problem to get representative information from large population. Therefore, a questionnaire was developed through a consultative process, keeping in view the goals and

objective of study. A data from 150 households, 50 from each tehsil was collected from different villages, according to available financial resources. Secondary data was also collected from various resources, such as District agriculture offices, tehsil's agriculture offices and community mobilizers.

Although the interview schedule was constructed in English, yet the questions were administered in Punjabi (local) language, for the convenience of interviewees to get required information with maximum accuracy. Due to illiteracy and suspicious nature of farmers a great deal of time had to be spent in explaining the propose of study and assuring them that the information collected from them would be kept secret and only conclusions would be published for educational purpose.

Data analysis

Chi-Square test and MS excel package was used for quantitative data analysis. Farmer attitude and behavior towards adoption of AF practices were divided into three categories: strongly in favor, moderately favorable and negative/opposite based on the percentage of the farmers. If more than 75% of the farmers adopting a particular AF practice it was rated as strongly favorable, 50-75% as moderately favorable and below 50% considered as negative/opposite. Our hypothesis was that the farmers' adoption of AF management practice was independent from family size, settlement period, occupation, and livestock land holding. Different other indicators, like farmer income status, farmer's household assets status and perceptions about importance of trees were also taken in study.

RESULTS

Average annual income

Average annual income of the respondents was divided into three categories. Data in *Table 1* showed that 66% of the farmers having average annual income (>200000 rupees) before doing AF increased their income up to 11.42% after doing some years of AF, while farmers having average annual income <400000 rupees (11.3%) of farmers increased their income up to 15.34%. The average annual change in income after doing AF was 13.87%.

Table 1 - Average income change in the annual income the farmers

A.I.	N.R.P	P.R.T	A.I.B.AF	A.I.A.AF	A.I.C
>2,00000	99	66.0	1,50000	1,62905	11.42%
2,00000-4,00000	34	22.6	2,65000	2,82070	14.86%
<4,00000	17	11.3	4,38000	4,62550	15.34%
Total/avg.	150	100	2,84333.3	3,02509	13.87%

Note: Income is in Pakistani currency (rupee).
A.I. = annual income (PK rupees); N.R.P. = number of respondents farmers; P.R.T. = percentage of respondents farmers; A.I.B.AF = average annual income before practicing AF; A.I.A.AF = average annual income after practicing AF; A.I.C. = average income change (%)

Percentage of the average income change was calculated according to the data provided by the respondents, because majority of the farmers don't have any proper documentation of their income change. They gave their idea about the change in income after doing AF.

Change in household assets status

Farmers were interviewed about their household assets change after practicing the AF practices. Results in the *Fig. 1* indicted that farmer's household assets increased after practicing AF. Farmers bought motorbike and television (60-70% more than before doing AF). Motorbike being a source of conveyance and television recreational tool were the indicators of improved living conditions. With that farmers bought 40% more tube well, 60% more pump and 20% more cow and buffalo for fresh milk and meat production.
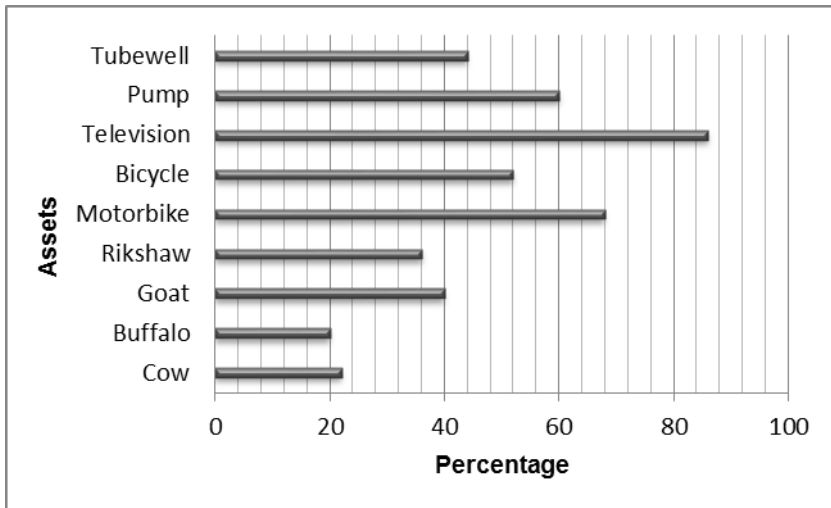

Figure 1 - Changes in household assets of the respondents after doing agroforestry

Family size

On the basis of the responses, farmers were classified into five family size categories. Data in the *Table 2* showed the average family size of the respondents of different villages. Average male size (3.20) was higher than the average female size (2.87) in the same study area. Average family size of the farmers in district Chiniot was 6.07 members per household, whereas average family size in Punjab province was 6.16 members per household. Average family size of Pakistan was 6.38 members per household (PBS, 2011). So, the average family size of the study area was slightly lower than the national family size.

Table 2 - Average size of the families of the respondents

Age	Male (M)	Female (F)	Total (M+F)
Up to 20	0.92	0.87	1.79
20-35	0.83	0.79	1.66
35-50	0.66	0.63	1.29
50-65	0.48	0.44	0.92
65+	0.4	0.5	0.9
Total	3.20	2.87	6.07
Avg. family size		**6.07***	

Farmer's attitude towards agroforestry by (family size, occupation and settlement period, livestock unit)

In the *Tables 3, 4, 5* and *6* farmer's attitude towards AF based on their family size, occupation, settlement period and number of livestock units were shown. Data from the *Table 3* revealed that 38% of the farmers having family size 5-8 people were strongly in favor of AF and 37% of the farmers were moderately in favor. From the farmers having family size more or equal to 8, 16% were strongly in favor of promoting AF, 14% were moderately in favor, while only 9% of the farmers having family size more than eight people were against the AF.

Table 3 - Farmers attitude towards adoption of agroforestry practices by family size (frequency)

Category wise distribution	Family size (members)			
	<5	5-8	>8	Total
Strongly in favor	8	6	3	17
Moderate favor	38	37	19	94
Opposite	16	14	9	39
Total	62	57	31	150
X^2 Calculated	1.84			
X^2 Tabulated	9.49			

Note: [X^2 tab. (P>0.05) > X^2 cal. (P>0.05), hypothesis is accepted]

Data from the *Table 4* revealed that only 8% of farmers having agriculture + services as an occupation were strongly in favor of adopting AF. From the farmers having agriculture + livestock as a main occupation, 34% of the farmers were strongly in favor of adopting and promoting AF, while it was interesting to know that 21% of the farmers have negative attitude towards AF, while 54% are moderately in favor. A proportion of 14% of the farmers having business other than agriculture were strongly in favor of AF. Data from the *Table 5* showed that more than one third, *i.e.* 38% of the farmers, settled more than

25 years ago, have positive attitude and were strongly in favor of AF, while from the farmers settle between 15-25 years, 21% of the farmers were also strongly in favor of promoting AF.

Data in the *Table 6* showed that 19% of the farmers having less than three animals are strongly in favor of promoting AF and 27% are moderately in favor, while 16% showed unfavorable attitude.

Table 4 - **Farmers attitude towards adoption of agroforestry practices by occupation (frequency)**

Category wise distribution	Occupation				
	Agri+LS	Agri+Service	Bussiness	Other	Total
Strongly in favor	34	8	14	4	59
Moderate favor	54	5	3	3	65
Opposite	21	3	1	4	28
Total	109	16	14	11	150
X^2 Calculated	26.33**				
X^2 Tabulated	12.59				

Note: [X^2 tab. (P>0.05) > X^2 cal. (P>0.05), hypothesis is rejected]

Table 5 - **Farmers attitude towards adoption of agroforestry practices by settlement period (frequency)**

Category wise distribution	Settlement period (years)			
	<15	15-25	>25	Total
Strongly in favor	5	21	38	64
Moderate favor	7	18	31	56
Opposite	2	5	23	30
Total	14	44	92	150
X^2 Calculated	5.45			
X^2 Tabulated	9.49			

Note: [X^2 tab. (P>0.05) > X^2 cal. (P>0.05), hypothesis is accepted]

Table 6 - **Farmers Attitude towards adoption of agroforestry practices by number of livestock holding**

Category wise distribution	Number of livestock unit (animals)			
	<3	3-5	>5	Total
Strongly in favor	19	22	16	57
Moderate favor	27	26	9	62
Opposite	16	15	1	32
Total	62	63	25	150
X^2 Calculated	11.69**			
X^2 Tabulated	9.49			

Note: [X^2 tab. (P>0.05) > X^2 cal. (P>0.05), hypothesis is rejected]

From the farmers having 3-5 animals units, 22% of the farmers were strongly in favor, while 15% were against that.

DISCUSSION

The introduction of AF in agriculture has many short and long run implication for the economy. One of the short run effects is an increase in the income of those farmers who adopt new production techniques (Essa, 2004). Annual income is the total income earned by the respondents from all the sources to which they are engaged at the end of each year (Irtwange, 2006). Our study showed that AF practice has increased the average annual income of the farmers. For example, 66% of the farmers increased their income up to 11.42% after doing some years of AF. Farmers having average annual income <400000 rupees increased their income up to 15.34%, mainly due to extra investment in AF than poor farmers. In a study about AF in south China, Hogarth *et al.* (2013) mentioned that AF had a significant impact on improving livelihood and forest related income of farmers. His results showed that AF has 31.5 % of share in income of farmers. Household assets change were also considered and assets like (cow, buffalo, goat, rickshaw, motorbike, bicycle, television, pump and tube well) were taken as indicators. Results showed that farmer's household assets increased after practicing AF and

farmers find it easy to buy tube well, water pump, cow and buffalo. These household assets change due to AF were important in betterment of lifestyle and reducing poverty.

In his study, Islam *et al.* (2013) mentioned that AF had a positive impact on the household status of farmers, their household improved after practicing AF. It is evident from studies the family size of respondents played a pivotal role in determining their attitude towards adoption of a new innovations or ideas. Keeping in view the importance of this factor data about family size was also analyzed. Average family size of the farmers in district Chiniot was 6.07 members per household, while average family size of Pakistan was 6.38 members per household (PBS, 2011). So, the average family size of study area was slightly lower than the national family size. Hypothesis was taken that: farmer's attitude towards AF was independent of family size, settlement period, occupation and number of livestock holding. From the conducted research we analyzed that, among the farmers having family size between 5-8 person per household, 38% of the farmers were strongly in favor of promoting AF, while 37% of the farmers were moderately in favor. While the farmers having agriculture + livestock as a main occupation, 34% of the farmers were strongly in favor of adopting AF and only 8% of farmers having agriculture + services as an occupation were in strong favor of adopting AF. Only 14% of the farmers having business other than

agriculture were strongly in favor of AF.

Statistically, the hypothesis that attitude of farmers to adopt AF was independent from family size was accepted, while hypothesis that attitude of farmers to adopt AF was independent from occupation was rejected. Educational level of the household leader is also an important factor in adoption of agroforestry (Tian & Shi, 2017). One third of the farmers who settled more than 25 years ago have positive attitude towards AF and 21% of the farmers who settled between 15-25 years were in strong favor of promoting AF, while very less percentage (5%) of farmers were against that. Statistically, this showed that adoption of AF was independent from settlement period. Therefore, the hypothesis was accepted. Among the farmers having more than five animals units only 1% have negative attitude towards adopting AF and farmers having less than three animals, 27% were in moderate favor of AF. On the other hand, farmers having 3-5 animals units, 22% of the farmers were strongly in favor, while 15% were against that. Thus, the hypothesis that a farmer's attitude towards AF was independent from livestock holding was rejected. Farmers have different priorities according to their mindset, current living condition and investment (Mukadasi *et al.,* 2007). Our results revealed that farmer's adoption of AF neither dependent on family size, nor on settlement period, but it was dependent on farmer's occupation and livestock holding.

In this growing age, where certain things are becoming expensive day by day, farmers adopt AF practices to fulfill the daily requirements of their families. AF might not change their overall condition but certainly helping in improving their lifestyle (White *et al.*, 2005; Wibawa *et al.*, 2006). Farmers are getting different tangible (financial) and intangible (environmental, soil and wind erosion, climate change mitigation) benefits from AF. Fruit and medicinal trees along with milk, meat and dairy products from cow and buffalo are helping to improve food security. Slowly, but gradually, they are improving their life style by adding things like motorbike, water pump, television and animals.

Our results were supported by Nawaz *et al.* (2016) and Farooq *et al.* (2017), who stated that farmers were concerned about the diversified benefits of trees on their farmlands. Growing woody trees in the farmlands of Punjab was a tradition, but practiced without any appropriate information and proper methodology (Saralch *et al.,* 2007). In recent years, forestry production increased from timer to non-timber production because timber production is labor and time intensive; therefore, the non-timber production become the main source of income for farmers (Tian & Shi, 2017). Even having existing forestry production technologies there is still a room for improvement

thorough effective policy measures and law making. Moderate allocation of resources among farmers can play a vital role in enhancing forestry production (Tian & Shi, 2017). Under current circumstances, besides agriculture and livestock, AF is the best option to improve the living condition of the farmers and rural people (Zubair & Garforth, 2006).

It can significantly increase food production by maximizing land use (Franzel *et al.,* 2011). From last some year's, AF was being poplar in district Chiniot and farmers are using different trees according to their priorities in combination with crops on their farmlands to promote AF. Abundant trees grown on their farmlands are shown in *Table 7.*

Table 7 - Abundance of tress on farmer's farmland in study area

Local name	Scientific name	Local name	Scientific name
Shisham	*Dalbergia sissoo*	Beri	*Ziziphus mauritiana*
Kikar	*Acacia nilotica*	Neem	*Azadirachta indica*
Bakain	*Melia azedarach*	Bohar	*Ficus benghalensis*
Shatoot	*Morus alba*	Amrood	*Psidium guajava*
Poplar	*Populus deltoides*	Malta	*Citrus sinensis*
Sumbal	*Bombax ceiba*	Mango	*Mangifera indica*
Sufaidah	*Eucalyptus camaldulensis*	Jaman	*Syzygium cumini*

CONCLUSIONS

Our study clearly indicated that AF helped farmers in changing their socio-economic conditions. Farmer's income and household status was improved after practicing some years of AF. Farmers were very positive about the benefits of AF and they perceived the advantage of trees immensely. Attitude of the farmers towards AF was independent of the family size and settlement period, but depends on the occupation and livestock holdings. Still, there were a big number of farmers who were having unfavorable attitude towards AF. The possible reason behind that was less knowledge and financial issues.

The important recommendations are that extension services and awareness programs about the AF should be arranged in the areas where farmers have unfavorable and negative attitude towards AF. Practice of AF on scientific basis is very essential. A productive AF system requires proper planning and proper administration of agricultural land to assess the suitability for tree production. This practice includes an evaluation of the limit of the area and the determination of growing tree species for particular areas. Moreover, subsidies and income generating projects should be launched to motivate people towards AF. Obviously, in order to fulfill the needs of ever growing population, country have to produce more from shrinking

lands. AF can be a gateway to reduce poverty if practiced properly.

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