

IMPACT ASSESSMENT OF EUCALYPTUS PLANTING ON BARANI FARMLANDS

Babar Sohail¹ and Kanwar Muhammad Suleman²

Abstract

A sample size of 70 resource persons (farmers) was fixed, who were selected randomly from one Tehsil district Attock under stratified random sampling technique to assess the impact of Eucalyptus planting on farmlands. The information collected through the questionnaire was analyzed statistically.

Economic comparison between Eucalyptus tree raising and agriculture crop production has shown that the former is a profitable practice having high benefit cost ratio than the later. Moreover, out of total sample population, 45 percent of the farmers have sold 66,300 Eucalyptus trees earning 13.2 million rupees which is a handsome amount generated from about 55 acres during the last 8 years.

More than 74 percent farmers reported negative effects of shade of Eucalyptus trees on wheat production while only 6% farmers who belonged to waterlogged areas reported positive effects of Eucalyptus on wheat production. Although Eucalyptus have allelopathic effects on agriculture crops but economic losses due to raising of Eucalyptus were proved baseless.

According to this study, most of the farmers (67%) are not willing to plant Eucalyptus on their farmlands anymore. This negative trend in majority of farmers is accounted for two major problems i.e., poor marketing and low returns as 66 percent farmers indicated marketing problems and 75 percent reported low returns from the Eucalyptus woods. Farmers (20 percent) who have high income saving, alternate profession and large landholdings are still willing to grow more Eucalyptus on their farmland.

Farmers perception was fairly positive about the climatic changes in the area due to Eucalyptus planting i.e., reduction in wind velocity and storms (74%

¹ M.Sc. Forestry (1996-98), Forest Education Division, Pakistan Forest Institute, Peshawar.

² Senior Pulp and Paper Officer, Pakistan Forest Institute, Peshawar.

farmers), increase in rain (20% farmers), decrease in temperature (14% farmers) and increase in humidity (61% farmers) and lowering water table by about 15-20 ft (73% farmers). However, these changes are based on farmer's perception and need detailed study before confirmation.

Introduction

Forestry Planning and Development Project (FPDP) was the first project which was launched on large scale all over the country in 1985 to motivate and teach farmers to become tree growers, and eventually market producers of wood products. Under this project, participatory approach was used to raise the multipurpose tree species on the private farmlands through extensive motivation. As a result nearly 140,000 farmers had planted almost 129 million trees (Suleman and Hakeem, 1995).

Among other hardwood species like simal, poplar, mulberry and shisham, eucalyptus was the most favourite species of the project. Out of total Eucalyptus trees planted in Punjab, about 50 percent trees were planted in district Attock, which is a semi dry area having harsh climatic conditions e.g., low water table i.e., about 100-150 ft deep. Eucalyptus being adopted to harsh climatic conditions of the area, had got good success under the project and farmers were highly attracted to the Eucalyptus planting campaigns due to less care needed during the establishment of plantations, short rotation of the species was another major attractiveness in Eucalyptus planting. Most of the farmers in Attock district planted Eucalyptus trees over the barren/waste lands and as shelter belts on the boundary of their agricultural fields. Although the project had succeeded in motivating people to grow Eucalyptus on their farmlands but the actual success of this project lies in the impact of Eucalyptus planting by the farmers, their perception and trend.

The main purpose of this study conducted in 1998 was to assess the impact of Eucalyptus planting under Forestry Planning and Development Project (USAID) in the district Attock.

The main objectives of this study are:

Determination of socio-economic impact of Eucalyptus planting on farmers.

- ▶ Verification of effects of Eucalyptus upon agriculture production.
- ▶ Determination of farmers' trend towards further planting of Eucalyptus on their farmlands.
- ▶ Identification of farmers' perception about climatic changes in the area due to Eucalyptus planting.

A brief description of the study area is given below:

The Total area of District Attock is 6916 km². The forest area is 9.5 percent of the total area i.e. 160896 acres. District Attock lies between 33°-7' and 34° North latitude, 71°-45' and 73°0 East longitude. It is bounded on the North and West by the River Indus and in the East by Haripur and Rawalpindi districts while in its South lies the Chakwal district (Anon, 1981). Climatically Attock falls in semi-arid region having low rainfall (406 mm annually) with severe temperature during summer (48°C) and winter (3°C) and early spring frost.

Topographically the tract lies in the Punjab Sub-Himalayas varying in elevation from 305 to 1067 m. Climatically it falls in the sub-tropical zone, whilst ecologically it belongs to the Phulai (*Acacia modesta*) forest zone of the north-west dry region.

The predominating species on the Northern slope of Kalachitta, North of the main ridge, is olive (*Olea cuspidata*) with Phulai (*Acacia modesta*), sanatha (*Dodonaea viscosa*), gurgur (*Monothea buxifolia*), pataki (*Gymnosporia royleana*) and Reptonia as the chief auxiliaries. Along the ravines small groups and isolated specimens of *Grewia oppositifolia*, *Flacourtia ramontachi*, *Pistacia intergerrima*, *Albizzia lebbek*, *Rhamnus persica*, *Phonix sylvestris*, *Ficus* spp, *Dalbergia sissoo*, *Morus alba*, *Bombax ciba* etc. are found occasionally (Rabani, 1990).

Review of Literature

Suleman and Rice, (1993) compared the capabilities of Eucalyptus pulp in Brazil, Portugal, Thailand and Pakistan. Strategic advantages of each country was evaluated on the basis of raw material resources, economy of scale, the level of technology, wood cost, the level of integration, geographical specialization and market share. Brazil and Portugal have clear advantages over the less

industrialized countries like Thailand and Pakistan in hardwood pulping. However, increasing demand for Eucalyptus market pulp on the world market will help to develop the industries of the four countries.

Suleman and Hakeem (1995) carried out a study in Forestry Planning and Development Project (FPDP) areas to identify the major marketing constraints of Eucalyptus wood grown on farms and to assess their impacts on national economy. The study used two survey instruments, one for the Eucalyptus growers (supply) and other for the industrial users (demand). On supply side, the major questions were focused on information about the respondent, knowledge about the industrial uses of Eucalyptus wood, apparent constraints, adopted market channels, contact person to sell, preference of Eucalyptus in the local markets and incentive package expected from government for the promotion of Eucalyptus wood. Question on demand of Eucalyptus as industrial wood included information about type of markets, source of supply, demand pattern, problem in direct marketing and utilization, suitability of Eucalyptus for their products, expected government role in the processing of Eucalyptus wood, supply situation of their existing raw materials and role of industrial users in the promotion of benefits to the farmers. The raw data was analyzed using simple descriptive statistics such as frequency and percentage tables. Major marketing constraints which had hampered the industrial utilization of Eucalyptus wood were inferred from the survey results.

It was concluded that marketing of Eucalyptus wood was the major burning problem of those farmers which were actively engaged in Eucalyptus planting programme. Absence of marketing system was manifested in terms of low farm prices, higher marketing costs and dependence on middlemen. It was further conclude that Eucalyptus marketing problem was a direct result of poor industrial demand of Eucalyptus grown in the project areas. It was further pointed out that marketing constraints of Eucalyptus wood in Pakistan were the result of gap between the objectives of growers and planners, limited Eucalyptus processing facilities, undeveloped markets, poor flow of information, non-competitive markets and poor linkages between the growers and users. Marketing constraints had already started influencing the farmer's decision to manage their crops, resulting into reduced growth and affecting quality and quantity of yields.

Rafique and Hafeez, (1994) studied the allelopathic effects of different parts of *Eucalyptus camaldulensis*. Wheat variety Faisalabad 83 and Faisalabad 85 were irrigated with 5% solution of fresh leaves, dry leaves, fresh bark, dry bark, fruits and flowers of *Eucalyptus camaldulensis* whereas pure water was used

for woodlot soil treatment and control. Effects of 5 % solution of different parts of *Eucalyptus camaldulensis* on the pH of soil, germination percentage, number of tillers per plant, height of crop and yield, (straw and grains) of wheat crop were studied which were statistically insignificant.

Ashraf, (1994) conducted a study in Attock district to find out the perception of tree farmers about tree planting. 54 four household heads were randomly selected and data collected by a structured interview schedule. The study revealed that the farmers' attitude towards tree planting was positive. More than 77 percent of farmers were willing to plant more trees on their land. Farmers were neither willing to purchase nor wanted to continue tree growing business if the government incentives were withdrawn. Main problem perceived by the tree farmers was marketing of their produce. Education had no significant effect on the farmers' views regarding effect of trees on their agricultural crops.

Rafique, (1995) studied the allelopathic effects of different parts of *Eucalyptus camaldulensis* on wheat variety "Inqalab-91". Plants were irrigated with aqueous extract of thoroughly chopped fresh leaves, dry leaves, fresh bark, dry bark, fruits and floral buds of *Eucalyptus camaldulensis* whereas ordinary water was used for control. Fertilizer was also applied to the wheat crop. Effects of different parts of *Eucalyptus camaldulensis* on germination percentage, number of tillers per plant, height of crop and yield of wheat crop were studied which were statistically insignificant.

Methods and Procedures

Primary and secondary information were used to assess the impact of FPD project on tree farmers and study area in terms of economical, social and meteorological effects. A demographic survey was conducted in the study area to collect primary information by developing a survey instrument (Annex-1). Resource persons (tree farmers) were interviewed using structure method combined with telephonic and direct contacts. The major questions were focused on information about the respondents, family details, farm descriptions covering information about landholdings, ownership pattern, farm operations, irrigation pattern, agriculture crop production, annual income from agriculture production, tree planted area, tree age, utility of trees, prices of trees, income from trees, expenditures on raising trees, savings, effects on agricultural production, willingness to more planting, observed and perceived climatic changes in the area. Secondary data was collected from the relevant literature, annual reports, bulletins, etc.

To conduct demographic survey of the project area, stratified random sampling was done. i.e. Out of four Tehsils of district Attock, one Tehsil (Attock) was selected randomly in the first stage. In the second stage of sampling, sample size of 70 respondents was fixed and resource persons (farmers) to be interviewed were selected randomly, not more than two persons from same village. Information collected through the survey were compiled and analyzed by using simple descriptive statistical techniques like frequency and percentage table etc. Economic comparison of agricultural crop (wheat production) with Eucalyptus tree crop was carried by determining the benefit cost ratio.

Results and Discussion

From the analysis of primary and secondary information, the following impacts of Eucalyptus planting in the study area can be inferred:

Respondents' Age

Age is considered a measuring scale for the maturity and experience of the respondents participating in a survey. The average age of the respondents was 45 years. If we segment the age groups into two groups, more than 30 years and less than 30 years then 94.29 percent of the total respondent are above 30 years and only 5.71% respondents are below 30 years. From these findings we may conclude that survey results are authentic because 95% of the information were based on a vast past experience.

Education

Education is a major factor which effects the decision and practices adopted by the farmers. It also refers to the living standard and thinking of the respondent. Mean education level of the sample population is found to be matric. More than 71.14 percent of the sample population has matric education level and above, while 17.43 percent respondents are under matric education level and only 11.43 percent of sample population are illiterate.

Moreover, out of total family members of the sample population, 70.65% members are educated out of which 58.20% are males and 41.80% are females. While literacy rate of Pakistan is 37.9% of which 50% are males & 25.3% are females. The higher education level among respondents and the high percentage of educated family members indicates that mostly the educated farmers participated in the tree planting under the FPDP social forestry campaign. It also indicates their high living standard.

Family Details

Survey results reveals that average family size of the sample population of this survey is 16 persons per family, of which 52 percent are male and 48 percent are females. Out of total males and females, 80 percent and 61 percent are found educated respectively. The reason for high average family size is that most of the families i.e., about 70 percent families are living under joint family system. Moreover, 57 percent of the total respondents are also involved in the professions other than farming e.g. Govt. services, Business, etc. These findings confirm that those respondent tree farmers which have other professions are more acquainted with the activities of the project in the study area. These observations provides the opportunities to identify the target groups for future extension activities in similar areas.

Family Income, Expenditure and Saving

The per capita annual income is found to be Rs.28524 which is much more than our National per capita income of Rs.23700 per annum (Budget 1998). The survey results also revealed an average family expenditure of Rs.25707 per months against an average family income of Rs.33271 which indicated 23% saving of total income i.e., Rs.7564 per family per month. This high percentage of saving also indicates the ability of farmers to take risk in long term forestry investments.

Landholdings

Average landholding of the sample population is found to be 840 kanals or 105 acres out of which 70.72% area is used for agriculture production while 17.73 percent area for farm forestry practices and rest of 12 percent area constitutes orchards and barren land. The farmers having large landholdings have planted more area under Eucalyptus plantation than those having small landholdings. Out of total respondents who have planted trees, 28 percent have raised trees in compact blocks, 22 percent in linear and 50 percent in both linear and block patterns.

Number of Trees

More than 36.8 million trees were planted in District Attock under FPD Project (USAID) from 1985 to February, 1995. While in the sample population area, about 2 million trees were planted over an area of 1300 acres under the

same Project. Out of these, 88 percent are Eucalyptus trees planted at an average spacing of 5.5×5.5 ft and having an average age of 5.5 years.

Willingness to Plant Eucalyptus

According to the survey findings, 67 percent tree growers are not willing to plant more Eucalyptus on their farmlands and only 20 percent are interested to participate in Eucalyptus planting programmes. These findings are totally different from the previous studies carried out by Suleman and Hakeem (1995). In 1995 more than 50 percent farmers showed their willingness to grow more Eucalyptus on their lands while 30 percent respondents were against the idea of planting Eucalyptus under any programme while 20 percent did not show any response in this regard (Table 1).

Table 1. Willingness of Farmers to plant more Eucalyptus.

Response	1995*	1998	
	Percentage	Number of respondents	Percentage
Willing to plant trees	50	14	20
Not willing to plant trees	30	47	67
No response	20	9	13
Total	100	70	100

* Source Suleman & Hakeem (1995).

Now it is clear that just after 4 years, opinion of the farmers have changed a lot. Now more than 67% of farmers are not willing to plant more Eucalyptus while only 20% farmers are still ready to plant Eucalyptus trees.

Reasons for not planting more Eucalyptus

Initially most of the farmers had appreciated and participated in the Eucalyptus planting campaign under FPDP (USAID), but now they are showing negative response. According to this study, major reasons of this negative response are:

Reasons	No. of Respondents	Percentage
Marketing problems	46	66
Low return	52	75
Negative impact on Agri production	35	50
Land restrictions	15	21

Farmers are seeking high return within 6-7 years which is not possible under present conditions due to small market demand and over supply of Eucalyptus wood in the area.

Impact on Agriculture Production

More than 74 percent farmers stated that shade of Eucalyptus trees have negative impacts on agriculture production, while 6 percent respondents think positive impact of Eucalyptus trees on agricultural crops. Remaining 20 percent have no idea of negative or positive impacts of Eucalyptus trees on agricultural crops (Table 2). The negative impact is based on the average wastage of 10 ft strip along Eucalyptus rows which don't produce wheat crop. It was found that barley and millet are least effected. The positive impact is based on the lowering of water table in waterlogged areas where lands have become productive or agriculture production has increased.

Table 2. Impact of Eucalyptus Trees on Agriculture Crop Production (Farmers' Perception).

Impact	No. of Respondents	Percentage
Negative	52	74
Positive	4	6
No Response	14	20
Total	70	100

Monoclimatic Effects of Eucalyptus plantations in the Area

Table 3. Tree farmer's response about climatic changes in the area due to Eucalyptus planting.

Parameters	Farmers Percentage		
	No change(%)	Change(%)	No Response(%)
Rain	66	Increased 20	14
Wind Velocity and Storm	14	Decreased 74	12
Temperature	68	Decreased 14	18
Humidity	26	Increased 61	14
Water table	16	Lowered 73	11

Majority of the farmers reported no change in temperature and rainfall while significant changes in wind velocity (decrease), frequency of storms (decrease), humidity (increase) and water table (decrease). They have reported positive changes in wind storms and humidity and negative change in water table.

Comparison between willing & non-willing Farmers to plant more Eucalyptus on their farm lands

Sample size of 14 farmers was fixed for both population of willing and non-willing farmers and t-test was applied to check the role of education, additional income, landholdings and saving on decision making to participate or not willing to participate in further Eucalyptus planting programmes. It was found that education had no role in decision making. However there is strong role of additional income, landholdings and saving on decision making to participate in further planting of Eucalyptus on farmland. Those farmers who have additional income, big landholdings and bigger savings are more vulnerable to the Eucalyptus planting programmes in the area. It is suggested that the big farmers relatively well established and having high income, saving, landholding or alternate sources of income should be targeted first for future social forestry, agro-forestry and commercial forestry projects and planting campaigns. Small farmers are totally dependent on agriculture production, and can't spare their land for long term forestry investments.

Economic comparison of wheat production & Eucalyptus trees

The economic comparison of wheat and Eucalyptus trees was done by discounting the future average incomes to present worth. The results indicated that the agriculture crop with one sided shelter belt of Eucalyptus trees have reasonably high benefit cost ratio (2.3) than that of agriculture production alone (1.7). Thus the Eucalyptus raising along with agriculture crops is highly economical as compared to the wheat crop alone. The reason for positive result is that the production per acre of wheat in the study area is very low as compared to the fertile irrigated lands of lower Punjab.

Returns from one acre Eucalyptus Plantation

Similarly the returns per acre of Eucalyptus plantation with 6 years rotation is about five folds of agriculture crops. Thus Eucalyptus tree raising is highly economical for the farmers having large landholdings, family savings and who can abandon part or whole of their agriculture production to raise Eucalyptus trees.

Moreover, the benefit cost ratio of Eucalyptus plantations with 6 years rotation age is very high (12.4) than that of agriculture production alone (1.7), and the agroforestry practice of raising Eucalyptus trees as shelter belts along agriculture field boundaries also (2.3).

Conclusion and Recommendations

- Raising of Eucalyptus as either compact or linear plantations under agroforestry system has been profitable. Low agriculture production is due to lack of irrigation water and low rainfall.
- According to majority of farmers, Eucalyptus trees have negative impact on agriculture crops. Only farmers who have reclaimed their lands from waterlogging due to Eucalyptus have appreciated the positive impact of Eucalyptus over agriculture production. Although Eucalyptus have allelopathic effects on agriculture crops, but it is necessary to demonstrate the farmers about the high economic profitability of Eucalyptus planting on farmlands. It is also necessary to check and to combat the negative trends about Eucalyptus planting on farmlands.

According to this survey, most of the farmers are facing marketing problems and low returns from Eucalyptus wood. These are the two major factors governing the non-willingness of farmers to plant more Eucalyptus on their farmlands. So it is strongly recommended to improve the marketing of Eucalyptus wood by establishing Eucalyptus based pulp & paper industry and chipboard industry in the area.

According to farmers' perception Eucalyptus plantings in the area have resulted into pleasant climatic changes i.e., reducing the storm frequency and high velocity of wind, lowering the maximum temperature, increasing the humidity except one negative change in term of lowering the water table. However, these need a detailed study for confirmation.

Moreover, Eucalyptus is strongly recommended to be grown along river banks and waterlogged areas as it is thought to be solar tube-well, transpiring an average of 50 liters water per day and results in lowering the water table from 10-25 ft as per farmers' perceptions.

References

Ashraf, S. 1994. Perception of Tree Farmers about tree planting in Attock District. Thesis report. Pak. Jour. of Forestry. 44(2): 74.

Malik, F.B. and B.H. Shah, 1995. Allelopathic effect of Eucalyptus species on legume vegetables. Pak. Jour. of Forestry. 45(2): 65-72.

Rabani, G. 1990. Working Plan for the Forests of Attock forest division. Prepared and issued by Development & Working plan circle, Ravi Road, Lahore. pp: 4-11, 23, 37.

Rafique M. and M. Hafeez. 1994. Allelopathic effect of *Eucalyptus camaldulensis* on wheat (*Triticum astivum*) crop. Pak. Jour. of Forestry. 44(4): 152-158.

Rafique, M. 1995. Allelopathic effect of different parts of *Eucalyptus camaldulensis* on wheat variety "Inqalab-91". Pak. Jour. of Forestry. 45(1): 21-24.

Suleman, K.M. and Hakeem Shah. 1995. Identification of marketing constraints of Eucalyptus in Pakistan and their potential impacts on national economy. Pakistan Forest Institute Peshawar. 48 p.

Suleman, K.M. and R.W. Rice. 1993. Strategic Marketing Advantages of Brazil, Portugal, Thailand and Pakistan in Eucalyptus Pulp Production. Pak. Jour. of Forestry. 43(4): 207-216.

Annexure - I

QUESTIONNAIRE

1. Farm No. _____ Date. _____

2. Address

a. Village..... b. Tehsil.....

3. Name of area _____

4. Location of Farm _____

5. Land Configuration:

Plane ☐ Undulated ☐ Hilly ☐

6. Soil:

Sand ☐ Clayey ☐ Rocky ☐

7. Name of Farmer _____

a. Age: _____ b. Caste _____

c. Education _____ d. Profession _____

Family Details:

8. Family type ☐ Single ☐

9. Family Details

	Total	Educated	Earning	Occupation	Income
Male	_____	_____	_____	_____	_____
Female	_____	_____	_____	_____	_____
Total	_____	_____	_____	_____	_____

10. Total Income _____
11. No. of Dependents on this Income _____
12. Expenditure _____
13. Net Savings _____

Farm Description

14. Total landholding _____
- a. Cultivated land _____
- b. Waste land _____
- c. Orchard _____
- d. Planted area _____
15. Ownership patterns:
- Owner ☐ Shareholders ☐ Employee ☐
16. Farm Operation:
- Self cultivated ☐ Leased ☐ Tenant operated ☐

17. Watering or irrigation _____

18. Agriculture Crop Produced

Crop	Production
------	------------

Rabi (Winter)

Kharif (Summer)

19. Annual Income from Agriculture production _____

20. Tree Planted Area:

- a. Species _____
- b. Planting pattern _____
- c. Plant spacing _____
- d. Total No. of Trees _____
- Eucalyptus no. of trees _____

21. a. Date of Planting _____ Age of plantation _____

22. Utility of Farm trees
 Fuelwood ☐ Furniture ☐ Construction ☐ Industry ☐
23. House hold use of timber
24. Effects on Agriculture production +ve ☐ -ve ☐
 Comments _____
25. Have you sold trees/wood in the past ? _____
 If Yes, /
- a. What were earnings _____
 b. At the rate of _____
 c. Total Vol. Sold _____
- If No, Why? _____
- a. What was market price offered? _____
 b. What was your expected price? _____
 c. For what purpose market is existing? _____
 d. What was expected market? _____
27. Willingness to do more planting. Yes ☐ No. ☐
- If Yes, How much area _____
 If No, Why? _____

	Parameters		Perceptions	
Rain	Increased	<input type="checkbox"/>	No Change	<input type="checkbox"/>
Wind velocity & storm frequency	Decreased	<input type="checkbox"/>	No Change	<input type="checkbox"/>
Temperature	Decreased	<input type="checkbox"/>	No Change	<input type="checkbox"/>
Humidity	Increased	<input type="checkbox"/>	No Change	<input type="checkbox"/>
Water table	Decreased	<input type="checkbox"/>	No Change	<input type="checkbox"/>