FINANCIAL ANALYSES OF DIFFERENT TYPES OF TREE PLANTATIONS IN PAKISTAN

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ABSTRACT

This paper presents results of financial analysis for 8 types of tree plantations in different parts of Pakistan. Financial analyses were carried out for 5 multiple purpose tree species planted in the form of both linear and block plantations in the irrigated plains on state as well as on private farmlands throughout the country.The results indicate that cost benefit ratio of the plantations under the existing conditions depend upon the tree species,demand and marketability of forest produce and intensity of management practices. Generally,tree planting on the farmlands is financially favourable in all localities irrespective of tree species planted on them.On the other hand,large block plantations on state land,with the exception of poplar plantation in Changamanga, have low cost benefit ratio especially if rental value of the land (opportunity cost) is included in the financial analysis. It is suggested that management practices in these plantations should be intensified with large financial and technical inputs to make them financially sound undertaking.

INTRODUCTION

Tree crops are grown in numerous forms for a number of economic,social and environmental benefits. They provide timber, fuelwood, fodder, food and humus,which can be quantified for determining their economic value at market prices. Therefore,economic importance of forests and plantations has been generally stressed and their financial analysis are carried out to determine their soundness through cost benefit ratios. However, recently the social and environmental benefits of tree crops are also increasingly being highlighted and their role in sustainable development is recognized. People living in the vicinity of forests receive a number of social benefits. The social benefits of tree crops are; soil improvement,erosion control, recreation, employment, income generation, etc. The social and environmental benefits are however, difficult to quantify and valuate. From environmental point of view, tree plantations are important for sequestration of atmospheric carbon emissions and reduction in greenhouse effect and conservation of biological diversity.

Tree planting on the farmlands and state land is presently receiving considerable attention in Pakistan due to its meagre natural forest resources in order to meet needs of the people for good and services.The forested area in the country is only 4.27 million ha or 4.8 % of its total area.For a population of 110.76 million,the per capita forest area is only 0.04 ha. The proportion of production (commercial) forests is even smaller - 26.2 % of the total forest area or 1.12 million ha. The biggest timber resource of Pakistan are the natural coniferous forests in the north, north-east and north -west hilly regions. These forests cover an area of about 1.93 million ha and about half of these are production forests.Other timber and fuelwood producing areas are

man-made irrigated plantations (0.224 million ha) and riverain forests (0.3 million ha) in the plains. The non-productive forests are scrub forests (1.3 million ha) in the sub-mountainous regions and coastal forests (0.35 million ha).

The above wood resource is not sufficient to meet the needs of population which is increasing at the rate of more than 3 %. The recorded production of timber and fuelwood is 480,000 cubic meters and 400,000 cubic meters per annum respectively. On the other hand,the estimated annual requirements of these two commodities are 2.65 million cubic meters and 22.15 million cubic meters on the basis of annual per capita timber consumption of 0.0239 cubic meter and fuelwood consumption of 0.2 cubic meter respectively. It may be mentioned here that the combined production of timer from the irrigated plantations and riverain forests is only 129,000 cubic meters out of total production of 482,000 cubic meters. Almost all recorded fuelwood comes from these two sources. Under these circumstances, the balance of fuelwood requirement are met from cutting of trees grown on the farmlands and wastelands, which also provide an estimated quantity of 0.922 million cubic meters of timber annually. Substantial quantities of timber in round and sawn forms as well as wood-based pulp and paper and panel products are imported into the country every year to meet the demand for these products.

Though coniferous forests have considerable scope for increased extraction of timber and fuelwood from them, the same can be done only through their intensive management at high capital cost for artificial regeneration, mechanization of harvesting operations, provision of roads, etc. Sufficient capital may not be available at this stage. Further,it may also be not desirable from ecological and environmental points of view. Therefore it is necessary to increase wood production in the irrigated plantations and riverain forests and on the farmlands which should be done economically. Only few studies have carried out the financial analysis of such plantations to determine their cost-benefit ratios (4). This papers give financial analyses for 8 types of tree plantations in different parts of Pakistan.

MATERIALS AND METHODS

The financial analysis were carried out for the following plantations in the manner described for each of them.

i. Poplar planting on the farmlands of Peshawar and Mardan districts

Poplar planting on farmlands has been practiced in these districts for a long time. Earlier, *Populus nigra*, Linn., was extensively planted on the farmlands for fuelwood and rural construction. An exotic poplar clone from Italy, namely, *Populus* x *euamericana* cv. I-214 was introduced to the farmers of this tract by the Pakistan Forest Institute in mid sixties, which became highly popular among them. However, this clone was found to be susceptible to insect attack and was therefore, replaced by selected clones of *Populus deltoides* in late seventies. A number of ecological, social and economic factors led to the widespread planting of these clones by the farmers. The region was found to be highly suitable for growing exotic poplar from climatic and adaphic points of view, which was reflected in high growth rate of poplar plantation. Its

wood found ready market in the newly established match, plywood and sports goods industries in the North West Frontier and Punjab provinces. Therefore, the farmers started growing poplar on rotation of 5-8 years on a large scale and sold a tree of 20-25 cm diameter for Rs. 100. Further, the problem of land tenancy in the area also encouraged poplar planting in place of agricultural crops.

Data for economic analysis were obtained through interviews of the farmers in the two districts.A proforma was prepared for this purpose and 21 farmers were interviewed.Poplar trees are generally grown by them in rows along the boundaries of their fields. For this analysis, data on cost of establishment and maintenance of the tree plantation,loss of agricultural crops as a result of growing of trees and income from sale of tree crop were determined on a hectare basis. The costs of establishment and maintenance were estimated on the basis of man-days of work put in by the farmer and current rate of daily wages of a semi-skilled farm worker.The rotation age of the trees was taken as 6 years as this is age at which most of the trees are sold standing by the farmers.

ii. Shisham, Mulberry and Poplar planting in Changamanga irrigated plantation

Changamanga plantation, the world's first irrigated forest plantation was started in 1866. Its total area is 5063 ha (12,510 acres). It is situated at a distance of about 75 kilometers in south-west of Lahore the capital of the Punjab province, Pakistan. Presently, the total area of irrigated plantations in the Punjab is 142,000 ha. Under the latest working plan of Changamanga plantation, 4,065.6 ha or 80.3 % of the plantation area is managed for raising shisham (*Dalbergia sissoo*, Roxb.), and mulberry (*Morus alba*, Linn.) and balance for growing poplar wood. The former are worked on 22 year rotation with thinning at 6, 11 and 16 years age. The silvicultural system is coppice with standards. The poplar is worked on 11 year rotation. The plantation receives irrigation water from 15th April to 30th September at the rate of 12 cusecs (cubic feet per second) for 1000 acres (404.7 ha).

The major forest produce of the plantation are timber and fuelwood of various species. The average annual production of these two commodities during last 11 years (1980-91) was 7652 m3 and 24,692 m^3 (stacked volume) respectively. The shisham timber is supplied to furniture and plywood industries; mulberry to sport goods industry and poplar timber to match and plywood industries. The fuelwood is supplied to all major towns in the Punjab. The minor produce of the plantation are; mulberry leaves, honey, brushwood, grass, seed, etc. These are locally consumed and about Re.1 million revenue is generated every year from their sale. The direct average annual income and expenditure of the plantation over a period of 11 years are Rs. 23.659 million and Rs. 5.848 million respectively. The indirect income from employment and recreation is estimated at Rs. 30 million per annum.

a. Shisham and mulberry planting: Shisham is planted in the form of root-shoot cuttings at 3m x 1.8m spacing, 1851 plants per ha. Mulberry comes naturally with irrigation water. The economic analysis was done with or without inclusion of rental value of the land for agricultural purpose (opportunity cost), estimated at

Rs.2000 per ha per annum. Further, discounting factor 14 %, which is the current bank rate of commercial banks has been employed. Current rate of daily wage for workers was used in the analysis.

b. Poplar planting: In the current working plan of Changamanga plantation, a working circle for growing of poplar in place of shisham and mulberry over about 1,000 ha was created in 1972-73 for the first time. As in the case of Peshawar and Mardan districts, early poplar planting consisted of *Populus* x *euamericana* Cv. I-214, which was later on replaced by *P.deltoides* clones.

3. Shisham planting on the farmlands in Punjab

Shisham is most commonly planted on the farmlands in the irrigated tract as it has a fairly high rate of growth and being deciduous, does minimal damage to agricultural crops especially to wheat crop in winter. The data for financial analysis were collected from a number of villages in the vicinity of Changamanga plantation. The trees are grown by planting root shoot cuttings on water channels and boundaries of the fields. Shisham trees are generally grown on a rotation of 15 years and sold standing for conversion into fuelwood and timber. Cost of maintenance is low and only weeding and pruning of trees are carried out by the farmers. As in the case of Changamanga plantation, rental value of land (opportunity cost) was taken as Rs. 2000.00 per ha and current daily rate of wages of semi-skilled labour.

4. Babul planting in Sindh

a. Riverain forests

Babul (*Acacia nilotica*) is the principal timber and fuelwood species in Sindh province of Pakistan. It is extensively grown in the riverain forests and irrigated forest plantation as well as on the farmlands throughout the province. The state-owned riverain forests occur on the banks of main stream of river Indus and are restricted to the areas between the protection embankments on both sides of the river. The total area of riverain forests in Sindh is 300,000 ha, which are managed under the silvicultural system of clear felling with artificial regeneration on 15 year rotation. This study was carried out in Rajri forest of Hyderabad Forest Division and data on cost of establishment and maintenance of the forest as well as revenue received during 1985-86 were collected from the office of the Divisional Forest Officer. The daily rate of Rs. 18 per man day was used in this analysis. The rental value of land in the riverain forest was found to be very low, e.g., Rs. 50 per ha.

b. Irrigated forest plantations in Sindh

The provincial forest department of Sindh also manages a number of irrigated plantations in which babul and other species are grown. The total area of these plantations is 82,000 ha. The analysis was carried out for Miani irrigated plantation with a total area of 658.3 ha. It is situated at a distance of about 11 km in the north-west of the town of Hyderabad. Babul is planted in it by sowing in trenches 3 m x 1.8 m. The sowing of seed is carried out during the months of May to July and fresh sowing to cover the failures along with weeding are done in the later part of the year. Two weedings in the first year and one weeding and one cleaning are undertaken in the plantation during 2nd and 3rd year of sowing of seed. The rotation of the tree crop is 15 years and the produce is marketed as timber,

pit props and fuelwood. The rental value of land is estimated at Rs. 741 per ha per annum. The daily rate of labour is Rs. 18 per manday.

c. 'Hurries'plantations on the farmlands

The practice of growing babul on farmlands of Sindh is more than one hundred years old. It was started in 1858, when the government decided to give 4 ha of state land free to any farmer who would raise tree plantations called 'Hurries'. This was done to ensure adequate supply of fuelwood to the farming communities. These measures enabled a large number of farmers to grow tree plantations on their farmlands. Presently, 'Hurries' plantations are common in Thatta, Hyderabad and Sanghar districts. For the purpose of this study, data on the cost of establishment and revenue for growing babul in 'Hurries' plantations were collected from two villages namely, Sekhat and Kheber which are situated at a distance of 30-35 km north of Hyderabad town. The babul trees are grown in conjunction with agricultural crop (cotton) for one year only, in the form of block plantations in these villages. The seed of babul is broadcast sown or sown in drills along with cotton seed in the month of April in blocks of 20m x 20m. Cleaning and pruning are carried out during 3rd and 4th year. Trees are sold standing by the farmers at the age of 7 years. Financial analysis were carried out separately for canal irrigated and tubewell irrigated 'Hurries' plantations because water rates differ in them. The land rent in these villages is Rs. 1235 per ha per annum and daily rate of unskilled worker is Rs. 20.

5. *Eucalyptus camaldulensis* planting in Khipro plantation, Sindh. Khipro plantation covers an area of 9232.4 ha on both banks of Nara canal near Khipro town of Sanghar district in the form of two narrow strips of land. The plantation was established in 1891 for growing of babul. *Eucalyptus camaldulensis* planting was started in it in 1973 under a project to provide raw material to pulp and paper, chipboard and furniture industries. To-date, about 3500 ha have been planted with this species. One year old plants are raised in polythene containers in the nursery. These are planted at 1.5m x 1.5m spacing in trenches during the months of February and March. The restocking of failures is carried out in 2nd and 3rd year of planting. Two weedings in first year and one weeding in each of 2nd, 3rd and 4th year are undertaken in the plantation. The rotation of tree crop is fixed at 8 years and trees are sold standing through open auction. The rental value of land is rather low due to water logging and salinity in the plantation, e.g., Rs. 247 per ha per annum. The daily rates of labour are Rs. 18.00 per manday.

RESULTS AND DISCUSSION

In the cost:benefit analyses of different types of tree plantations, both on private farmlands and on state lands, the yearly expenditure and income data of individual plantation were discounted to present value using a discounting factor of 14 % . The expenditure was computed in terms of mandays of work needed for establishment and maintenance of tree plantations. However, both the number of mandays and daily rates of wages for plantation workers differed in various localities. Further, the expenditure also included the yearly loss in agricultural crop income due to the presence of trees on the farmlands. The latter progressively increased every year as the effect of

trees on agricultural crops enhanced due to their growth with age. On the other hand, the income from the tree plantations consisted of income from sale of timber and fuelwood from their periodic thinnings and final felling at the end of rotation as well as from sale of minor produce, e.g., grazing and grass cutting fees, sale of mulberry leaves and branches and honey and income from leasing of planted area for cultivation during initial years of plantation establishment. The data pertaining to market prices of various produce was originally collected in 1986 for the analysis.

The above results of financial analyses indicate that cost-benefit ratios of different types of plantations depend upon the tree species, demand and marketability of forest produce and intensity of management. Generally, tree planting on the farmlands, be it poplar, shisham or babul and irrespective of locality has favourable financial results. On the other hand, large plantations on the state lands, with the exception of poplar plantation in Changamanga, have low cost-benefit ratio, especially when rental value of the land (opportunity cost) is included in the analyses. This value is also highly variable in different localities.

Financial analysis of different types of tree plantation on per hectare per annum basis

Type of plantation	Gross discounted expenditure (Rs.)	Gross discounted revenue (Rs.)	Net discounted revenue (Rs.)	Cost benefit ratio
1. Poplar planting on the farmlands of Peshawar and Mardan districts	1390.50	3572.33	2182.33	1:2.57
2. Shisham, Mulberry and Poplar planting in Changamanga irrigated plantation				
a. Shisham and mulberry planting				
i. excluding land rent	360.50	496.54	136.04	1:1.35
ii. including land rent	975.42	496.54	(-)478.88	1:0.51
b. Poplar planting				
i. excluding land rent	698.05	1879.12	1181.07	1:2.69
ii. including land rent	1646.26	1879.12	232.74	1:1.14

continue

Type of plantation	Gross discounted expenditure (Rs.)	Gross discounted revenue (Rs.)	Net discounted revenue (Rs.)	Cost benefit ratio
3. Shisham planting on the farmlands in Punjab	201.51	225.41	23.90	1:1.12
4. Babul planting in Sindh				
a.Riverain forests				
i.excluding land rent	75.18	171.33	96.15	1:2.28
ii.including land rent	95.68	171.33	75.65	1:1.79
b.Irrigated forest plantation				
i.excluding land rent	257.05	147.55	(-)109.50	1:0.57
ii.including land rent	560.41	147.55	(-)412.86	1:0.23
c.'Hurries' planting on the farmlands				
i.with tubewell water				
- excluding land rent	979.31	2545.19	1565.88	1:2.13
- including land rent	1725.25	2545.19	819.94	1:1.26
ii.with canal water				
- excluding land rent	711.37	1366.88	655.51	1:1.61
- including land rent	1512.11	1366.88	(-)155.23	1:0.76
5. *Eucalyptus camaldulensis* planting in Khipro				
i. excluding land rent	734.18	265.32	(-)468.86	1:0.33
ii. including land rent	924.24	265.32	(-)658.92	1:0.27

There are a number of reasons for low or negative cost benefit ratio of the plantation and riverain forests on the state lands. Very small amount is spent on their establishment and maintenance. Of course their establishment cost consumes the major portion of funds allocated for them. The maintenance costs are extremely low and are spent mostly on providing irrigation water to the plantation after their establishment, which directly effects the growth rate of tree crops. Most of the time, the stocking is also not satisfactory. This reduces the wood production drastically. The situation is detorating with time. The seeds and planting are of poor genetic quality used for establishment

of plantation also contribute to low productivity. Irrigation system is not efficient due to the absence of precision levelling of the planted area. Therefore, the irrigation water does not reach all trees evenly. Further, the returns from these planting are also low because wood produced in them is used mostly as fuelwood with low economic value. Timber is produced in small quantity which is mostly of low quality and cannot be used for the manufacturing value added products. Under these circumstances, considerable financial and technical inputs are needed to improve the situation.

CONCLUSION

It would be inappropriate to conclude from the above analyses that large block plantations on the state land in the Punjab and Sindh provinces of pakistan are not financially sound undertakings. Rather, the results point out the fact that management in these plantations should be intensified with large financial and technical inputs. These include improved irrigation practices through precision levelling and lining of water channels to reduce water losses and ensure its efficient utilization by the trees, soil working, fertilization application, use of good quality seed and planting stock, close spacing of plants in the initial stages, timely weeding, cleaning, prunning and thinning, and efficient and economic utilization of wood produced in them. These measures are especially needed in the riverain forests and plantations in Sindh provinces, wherein, present working is not intensive at all. Consequently the economic investment and returns are very low. These forests and plantations represent a big economic resource and need to be developed on a sound basis to ensure not only economic benefit to provincial exchequer but also social benefits to population living in their vicinity.

Indirect or social benefits of the tree plantations to the people have only been briefly mentioned in the case of Changamanga plantation. Detailed social and economic analyses could not be done as these were beyond the scope of this paper. However, these need to undertaken because future investment in forestry sector in a developing country like Pakistan depends upon their results. Local foresters, all too often, have been stressing the role of forestry in social and economic development without supporting it with adequate data base. The data in ~~the~~ regards are totally lacking and studies should be carried out to fill in the information gap.

ACKNOWLEDGEMENTS

I am grateful to Dr.Y.S.Rao, Regional Forestry Officer, FAO, Regional Office, Bangkok, Thailand, for assistance in preparation of this report. The assistance of Mr.Mohammad Amjad, Forest Economist, and M/S. Mohammad Saliheen, Altaf Hussain and Saleem Ahmad, Research Officers, Pakistan Forest Institute, in data collection and analyses is also gratefully acknowledged.

REFERENCES

1. Amjad, M. 1983. A appraisal of investment of Daphar irrigated plantation. Ann. Prog. Rep. 1982-83.

2. Amjad, M. and Nadar Khan. 1990. The State of Forestry in Pakistan. Forest Economics Branch, Pakistan Forest Institute, Peshawar 77 pp.

3. Amjad, M. 1991. Report on tree growth on farmlands of NWFP. Pakistan Forest Institute, Peshawar 33 pp.

4. Amin, R. 1985. Analysis of marketing of poplar wood in Peshawar and Mardan districts. Pakistan Forest Institute, Peshawar 55 p.

5. Bokhari, A.S. 1973. Revised Working Plan of Changa Manga Plantation 1972-73 to 1993-95.

6. Sheikh, M.I. 1986. A case study on Hurries *Acacia nilotica* block plantations for wood production in Pakistan. Pakistan For. Instt. Peshawar, Pakistan.

7. Sterk, A. Pvan Ginneken. 1988. Cost-benefit analysis of forest plantations in a watershed in north-eastern Thailand. Proc. Inst. Wsp. Multipurpose Tree Species for Small-farm Use. Nov. 2-5, 1987.