

POPLAR A HANDSOME SOURCE OF FARMER INCOME (A case study of district Mardan, KP, Pakistan)

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ABSTRACT

This research was conducted to do financial analysis of poplar plantation in District Mardan. Data was collected through a well-designed pre-tested questionnaire. A total of 60 respondents including 31 Owners, 19 Owner cum Tenants and 10 Tenants were selected randomly from Gadar, Sawaldher and Gujar Garhi villages. Owner category was found dominant in the above mentioned target villages in the parameters of productivity, formal education, planting experience, knowledge of silviculture of poplar and commercialistic nature of respondents. The Net Incomes (NIs) calculated per Avenue Kilometer of poplar plantation were (Rs.301838), (246622) and (Rs.164890) for Owners, Owner cum Tenants and Tenants respectively. Similarly their calculated Net Present Values (NPVs) at interest rate of 12% were Rs.171499, Rs.140127 and Rs.93688 in the above shown order of tenurial classes. Benefit Cost Ratios (BCRs) were 3.5 for Owners, 3.1 for Owner cum Tenants and 2.4 for Tenants at the same interest rate of 12%. The results of BCRs are greater than 1, so the raising of poplar plantations are beneficial in the target areas.

INTRODUCTION

It is projected that by 2050, 75% of the industrial timber supply will come from planted forests, and about half from fast-growing plantations, in order to meet the growing demand for wood, fiber and biomass (Sedjo, 2001). The conversion of natural forests to fast growing plantations is very common throughout the world (FAO, 2001), with obvious impacts on biodiversity and ecosystem services, such as carbon sequestration (Guo and Gifford, 2002; Schroth *et al.*, 2002; Kanowski *et al.*, 2005; Sohngen and Brown, 2006; Danielsen *et al.*, 2009). On the other hand, afforestation of degraded lands or abandoned farmland appears to be a sustainable alternative to forest conversion because its ability to provide wood and many other ecosystem services outside of natural forests (Licht and Isebrands, 2005; Chazdon, 2008; Metzger and Hüttermann, 2009).

In temperate ecosystems, fast-growing species such as hybrid poplars are commonly used to afforest marginal agricultural lands (Christersson, 2008; Mao *et al.*, 2010). High production, adaptability, and ease of cloning by vegetative means has made hybrid poplars one of the most planted in temperate ecosystems (Dickmann, 2001; Ball *et al.*, 2005; Cooke and Rood, 2007). Besides their high yields, afforested stands of hybrid poplars in agricultural landscapes

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also have the potential to improve flood control (Perry *et al.*, 2001), carbon sequestration (Niu and Duiker, 2006), erosion control water quality and sediment (Updegraff *et al.*, 2004), native habitat protection (Weih *et al.*, 2003; Fortier *et al.*, 2011) and nutrient recycling (Fortier *et al.*, 2010b).

In Pakistan poplar is also very popular. Pakistan produces and exports a variety of wooden sports goods, including hockey sticks (about 60% of the world supply), cricket's bats, squash, and badminton and tennis rackets. In 1980, most of the crickets bats were made of willow but poplar are now used for 80% of them (www.pakistan.gov.pk/divisions/environment-division/media/fsmp-chp3.pdf). In Mardan District trees are grown on the boundaries of the fields, paths and water channels. The Forest department is managing only linear plantation i-e roadsides and canal side. An area of about 120 acres is resumed land which is yet to be planted by Forest Department. The detail of afforestation in the District is as under (District census report 1998).

<u>Particular of Forest</u>	<u>Area</u>
Reserved Forest	Nil
Linear plantation (Protected Forest)	
• Road Side	181 Kilometer
• Canal Side	219 Kilometer
• Resume Land	120 Kilometer

The economics of growing hybrid poplar is a difficult subject that has been studied by many researchers for years and it depends on so many ever-changing variables (Rose *et al.*, 1981; Isebrands, 2007). It is complex because the revenues from a multi-year poplar crop are not realized until harvest and the costs incurred to establish and maintain the crop occur long before rotation age (Oosten, 2006). Moreover, the costs vary significantly with soil type, productivity, location including distance from markets, fertilizers cost, and landowner objectives. Other risks involve in growing Poplar include weather, pests and diseases (Voleny *et al.*, 2005). Poplar plantations consider as category of fixed assets in forestry, i.e. the assets with a biological character (Petras *et al.*, 2008; Keca, 2010). Production costs are determined by land, labour and capital costs (Keca, 2011). The investment process in poplar wood production includes financial investments in present to achieve economic benefits in the future, and have seasonal characteristics. Plantations transfer their value gradually to the obtained products during the period of their harvesting, and, by the realization of the products, the money invested in the plantation establishment are obtained (Keca, 2011).

Investment in tree plantation is one of the most significant business decisions for reliable future returns in many forestry areas around the world (Cubbage *et al.*, 2007, 2010; Shao and Li, 2010). Financial returns of tree

plantations are certainly an important concern around the world. The net present value (NPV), equivalent annual income (EAI), and internal rate of return (IRR) and BCR were often used as indicators for judging the commercial profitability of poplar plantations (Keca *et al.*, 2012). Some researchers have used these financial criteria already. For instance, Sedjo (1999) stated that well managed forest plantations in the southern hemisphere are much more profitable and cost effective than those in the northern hemisphere. Cabbage *et al.* (2010) calculated the NPV of exotic plantations of South America and found greater than other countries in northern hemisphere. Wang *et al.* (2008) figured out the IRR in the plantations of eucalyptus (*Eucalyptus grandis*) with different clones ranged from 15.4 to 57.1 % in southern China.

Objectives

- 1) To estimate average cost per avenue kilometer poplar plantation in the study area for owner, owner-cum tenants and tenants.
- 2) To estimate gross income and net income per avenue kilometer in the study area for owner, owner-cum and tenants.
- 3) To assess the commercial profitability of poplar plantation by using NPV (Net Present value) and BCR (Benefit Cost Ratio).

Study site and Methodology

Universe of the Study

The study was conducted at Gadar, Sawaldher and Gujar Garhi areas in District Mardan. The areas are no doubt very popular for growing poplar by the farmers which constitutes a handsome part of their incomes. The data was collected by using the random sampling technique and to get required sample size proportionate sampling technique was used.

Data Collection and Analysis

The primary data was collected by using the empirical tool of questionnaire, duly supported by personal observations and knowledge of the real and experienced growers. The questionnaire was pre-tested to avoid complication in future. For secondary data library and forest department was contacted. After data collection, the same was transferred to a tally sheet and was compiled in the forms of tables for further interpretation and deduction of some meaningful results. The data was analyzed by using simple statistical and mathematical techniques of percentages. The NPV and BCR was calculated with the help of following formulas,

$$\text{NPV} = \text{Discounted Benefit} - \text{Discounted cost}$$

$$\text{NPV} = \text{Bt} \div (1+r)^n - \text{Ct} \div (1+r)^n$$

$$\text{BCR} = \text{Discounted Benefit} / \text{Discounted Cost}$$

$$\text{BCR} = \text{Bt} \div (1+r)^n / \text{Ct} \div (1+r)^n$$

Table 1. Distribution of the Sampled Respondents

S. No.	Name of Village	No. of House Holds	Sample Size Formula = No. of H.H*60/ Total No. of H.H
1	Gaddar	1197	1197*60/7449=10
2	Sawaldher	2655	2655*60/7449=20
3	Gujar Garhi	3597	3597*60/7449=30
4	Total	7449	60

Limitations of the study

- i) Data were not collected at the time of harvesting of Poplar crop, so the farmers/growers had to exert more pressure on their minds while replying to the questions.
- ii) Information on cost of some inputs used was varying from locality to locality and income gained from returns was based on the utterances of the respondents.
- iii) In spite, of the fact that it was tried to convince the respondents about the purpose of the study, some farmers feared that the information collected might be used against them.

RESULTS AND DISCUSSIONS

Cost estimation

Cost per Avenue kilometer for owner. Owner-cum tenants and tenants are presented in table 2a, 2b and 2c and summarized in table 3.

Cost Per Av: Kilometer from Planting to the end for Owner

The table 2a shows, the cost of Owner group on raising of One Avenue Poplar plantation and its maintenance up to 03 years and all other steps already indicated which costs Rs.119912/- For further details see the table.

Table 2a. Cost per Avenue Kilometer from planting to the end for Owner

S.No	Particulars	Cost(Rs)	Remarks
1	Land rent	49400	It is actually charged as Rs:6500/- per Jrib (1acre=2 Jribs) and 1.31 Av: Km=1Acre
2	Initial Planting Cost	8957	Schedule Rates
3	Planting tools etc:	2000	Market Price
4	Maintenance during 1st Year	7337	Schedule Rates
5	Maintenance during 2nd Year	7821	Do
6	Maintenance during 3rd year	7171	Do
7	Total No: of Poplar Plants (330) used in initial planting per Av: Km at a spacing of 10' * 10'	660	Assume that Av:cost per Poplar Plant. 1) Self Growers=Rs:02/- (2) Obtainers from forest Nursery=Rs:04/- (3) Obtainers from Private Nursery=Rs:08/-
8	Total No: of Poplar Plants (50) used as beating up of failure (15%) of the initial planting	100	Schedule Rates
9	Total No: of Poplar Plants (33) used as beating up of failure (10%) of the initial planting	66	Do
10	Chemical Fertilizer/FYM	4800	Market Price
11	Average harvesting and logging cost	6600	Actual labor cost
12	Average transportation cost including loading and unloading	22557	Actual transportation cost including loading and unloading=Rs:15 per Maund in case of supply to match factories in Peshawar & Rs:3.33 in case of local market per Maund. (20% of the production was traded at local market and 80% to Match Industry) by the Owner cum tenant
13	Aabyana cost per Jrib=Rs:300/-	1500	Rs: 300 per Jrib from irrigation department.
14	Forest duty	943	Average 1415 Maund. Rs: 200 per truck loaded with 300 Mond Poplar from Forest Dept:
Total		119912	

Cost Per Av: Kilometer from Planting to the end for Owner cum Tenant

Table 2b shows the cost of Owner cum Tenant group on raising of one Avenue Kilometer poplar plantation and its maintenance up to 03 years and all other steps already indicated which costs Rs.113878/-. For further details see the table.

Table 2b. Cost per Av: Km from Planting to the end for Owner cum Tenant

S.No	Particulars	Cost	Remarks
1	Land rent	49400	It is actually charged as Rs:6500/- per Jrib (1acre=2 Jribs) and 1.31 Av: Km=1Acre
2	Initial Planting Cost	8957	Schedule Rates
3	Planting tools etc:	2000	Market Price
4	Maintenance during 1st Year	7337	Schedule Rates
5	Maintenance during 2nd Year	7821	Do
6	Maintenance during 3rd year	7171	Do
7	Total No: of Poplar Plants (330) used in initial planting per Av: Km at a spacing of 10' * 10'	1320	Assume that av: cost per Poplar Plant. (1) Self Growers=Rs:02/- (2) Obtainers from forest Nursery=Rs:04/- (3) Obtainers from Private Nursery=Rs:08/-
8	Total No: of Poplar Plants (50) used as beating up of failure (15%) of the initial planting	200	Schedule Rates
9	Total No: of Poplar Plants (33) used as beating up of failure (10%) of the initial planting	132	Do
10	Chemical Fertilizer/FYM	3600	Market Price
11	Average harvesting and logging cost	6600	Actual labor cost
12	Average Transportation cost Including loading and unloading	17165	Actual Transportation Cost including loading and unloading=Rs:15 per Maund in case of supply to match factories in Peshawar & Rs:3.33 in case of local market per Maund. (40% of the production was traded at local market and 60% to Match Industry) by the Owner cum tenant
13	Aabyana cost per Jrib=Rs:300/-	1500	Rs: 300 per Jrib from irrigation department
14	Forest duty	670	Average 1000 Maund. Rs: 200 per truck loaded with 300 Maund Poplar from Forest Dept:
Total		113878	

Cost per Av: Kilometer from Planting to the end for Tenant

Table 2c shows, the cost of Tenant group on raising of one avenue Poplar plantation and its maintenance upto 03 years and all other steps already indicated which costs Rs.112160/-.

It is clear from the table 2 (a, b, c) that the costs of the Owners (Rs.119912) was greater than the cost of Owner cum Tenant (Rs.113878) and Tenant (Rs.112160) which shows that they had intensive management as compared to the other groups.

Table 2c. Cost per Avenue Kilometer from Planting to the end for Tenant

S.No	Particulars	Cost	Remarks
1	Land rent	49400	It is actually charged as Rs:6500/- per Jrib (1acre=2 Jribs) and 1.31 Av: Km=1Acre
2	Initial Planting Cost	8957	Schedule Rates
3	Planting tools etc:	2000	Market Price
4	Maintenance during 1st Year	7337	Schedule Rates
5	Maintenance during 2nd Year	7821	Do
6	Maintenance during 3rd year	7171	Do
7	Total No: of Poplar Plants (330) used in initial planting per Av: Km at a spacing of 10' * 10'	2640	Assume that Av: cost per Poplar Plant. (1) Self Growers=Rs: 02/- (2) Obtainers from forest Nursery= Rs:04/- (3) Obtainers from Private Nursery=Rs:08/-
8	Total No: of Poplar Plants (50) used as beating up of failure (15%) of the initial planting	400	Schedule Rates
9	Total No: of Poplar Plants (33) used as beating up of failure (10%) of the initial planting	264	Do
10	Chemical Fertilizer/FYM	3600	Market Price
11	Average harvesting and logging cost	6600	Actual labor cost
12	Average transportation cost including loading and unloading	14000	Actual Transportation Cost including loading and unloading=Rs:15 per Maund in case of supply to match factories in Peshawar & Rs:3.33 in case of local market per Maund. (Half of the production was traded at local market and approximate half to Match Industry) by the Owner cum tenant
13	Aabyana cost per Jrib=Rs:300/-	1500	Rs: 300 per Jrib from irrigation deptt. Assume that it is halfly charged per Av: Km
14	Forest duty	470	Average 700 Maund. Rs: 200 per truck loaded with 300 Maund Poplar from Forest Dept:
Total		112160	

Tenorial Status wise total production and total costs

Data in this context is provided in table 3 which shows that Owner group had the greatest total costs of poplar plantation Rs.1918592/- due to their intensive management. Owners were also on the top in the context of raising most (16 Av:Km) poplar plantation followed by the Owner cum Tenant in the sense of cost i.e. Rs.1024902 per Avenue kilometer poplar production of (9 Av: km) poplar plantation in the target areas. For further details see the table.

Table 3. Tenurial Status wise total production and total costs

S.No	Tenurial Status	Production in Avenue Km.	Ave: Cost (Rs) per Avenue Km.	Total Cost in (Rs)	Remarks
1	Owner	16	119912	1918592	For details of average cost per Av:Km of the Owners please see table No.5.3.1(A)
2	Owner cum Tenant	9	113878	1024902	For details of average cost per Av: Km of the Owners cum Tenant please see table No.5.3.1(B)
3	Tenant	5	112160	560800	For details of average cost per Av: Km of the Tenants please see table No.5.3.1(C)

Source: Survey Data 2009

Income estimation

Income per Avenue Kilometer of Poplar Plantation

Data presented in table 4 shows that the production of the Owners 1815 Maund per Av: km was the highest followed by Owner cum Tenant 1650 Maund per Av: Km.

Similarly the table also highlights that the total income of Rs.421750/- of the Owner growers was on the top as compared to the Owner cum Tenant (Rs.36050) and Tenant (Rs.277050) respectively the same situation is seen due to a number of factors. The Owners had grown a large number of Av: km and supplying their product to the industries was more experienced using intensive management and equipped with the knowledge of silviculture of Poplar crop. For further details see the table.

Table 4. Total income per Avenue Kilometer Poplar plantation

S.No	Tenurial Status	Production in Mond	Ave: Rate (Rs) per Mond	Total Income (Rs)	Remarks
1	Owner	1415	250	353750	Average 1415 Maund sold by owner to match industry @ Rs.250/Maund
		400	170	68000	Average 400 Maund sold by Owner to local market @ Rs.170/Maund
	Sub-Total	1815	420	421750	
2	Owner cum Tenant	1000	250	250000	Average 1000 Maund sold by Owner cum Tenant to match industry @ Rs.250/Maund
		650	170	110500	Average 650 Maund sold by Owner cum Tenant to local market @ Rs.170/Maund
	Sub-Total	1650	420	360500	
3	Tenant	700	250	175000	Average 700 Maund sold by Tenant to match industry @ Rs.250/Maund
		785	130	102050	Average 785 Maund sold by Tenant to local market @ Rs.130/Maund
	Sub-Total	1485	380	277050	

Source: Survey Data 2009

Total Income from plantation:

Data in this context is provided in table 5 which shows that Owner group had the greatest income. Rs.6748000 followed by Owner cum Tenant Rs.3244500/- due to raising large number of Av: Km, intensive management and supplying poplar produce to industries For further details see the table.

Table 5. Total income of the total Avenue Kilometer of Poplar plantation

S.No	Tenurial Status	Production in Avenue Km.	Ave: Income (Rs) per Avenue Km.	Total Income (Rs)	Remarks
1	Owner	16	421750	6748000	Total production of the Owners in Av:Km*Income Per Avenue Km=Total Income
2	Owner cum Tenant	9	360500	3244500	Total production of the Owner cum Tenants in Av:Km*Income Per Avenue Km=Total Income
3	Tenant	5	277050	1385250	Total production of the Tenants in Av:Km*Income Per Avenue Km=Total Income

Net income for One Avenue Kilometer Poplar plantation

Data presented in table 6 shows Net income of all tenurial groups. The net income of Owner is high and is (Rs.301838) followed by Owner cum Tenant and Tenant (Rs.246622), (Rs164890) respectively. The net income per Avenue Kilometer of the Owners is high due to knowledge of silvicultural and cultural practices of growing Poplar and supplying Poplar produce to industries.

Table 6. Net income for one Avenue Kilometer Poplar plantation

S.No	Tenurial Status	Income (Rs)	Cost (Rs)	Net Income	Remarks
1	Owner	421750	119912	301838	Net Income = Income- Cost
2	Owner cum Tenant	360500	113878	246622	Net Income = Income- Cost
3	Tenant	277050	112160	164890	Net Income = Income- Cost

Source: Survey Data 2009

Net income for total Avenue Kilometer Poplar plantation

Data is provided in table 7 shows the Net incomes of the Owners, Owner cum Tenant and Tenants for Total Avenue Kilometer poplar plantation. The net income of Owners group is high because of raising more number of Avenue Kilometer Poplar plantations as compared to the other two groups. For further details see the table 7.

Table 7. Net income for total Avenue Kilometer Poplar plantation

S.No	Tenurial Status	Total Income (Rs)	Total Cost (Rs)	Net Income	Remarks
1	Owner	6748000	1918592	4829408	Net Income = Income- Cost
2	Owner cum Tenant	3244500	1024902	2219598	Net Income = Income- Cost
3	Tenant	1385250	560800	824450	Net Income = Income- Cost

Source: Survey Data 2009

NPV per Avenue kilometer (12% Interest Rate)

Data presented in table 8 shows that NPVs at 12% interest rate for one Av:Km of the Owner is Rs.171499 and is high as compared to the other tenurial groups (Owner cum Tenant and Tenant).The NPV of the Owner is high due to intensive management of poplar plantation they received more production and more income.

Table 8. NPV for one Avenue Kilometer at 12% Interest Rate

S.No	Tenurial Status	Income (Rs)	Cost (Rs)	NPV
1	Owner	421750	119912	171499
2	Owner cum Tenant	360500	113878	140127
3	Tenant	277050	112160	93688

NPV for Total Avenue Km Poplar plantation at 12% Interest Rate

Data presented in table 9 shows the NPVs at 12% interest rate for total production of all tenurial groups i.e. Owner, Owner cum Tenant and Tenant, which indicates that the income and NPV of the Owners growers were high due to raising large number of Avenue Kilometer poplar plantation. For further details see the table.

Table 9. NPV for Total Avenue Km Poplar plantation at 12% Interest Rate

S.No	Tenurial Status	Total income (Rs)	Cost (Rs)	NPV
1	Owner	6748000	1918592	2743984
2	Owner cum Tenant	3244500	1024902	1261143
3	Tenant	1385250	560800	468440

Benefit Cost Ratio for one Avenue Km of Poplar plantation

Data provided in table 10 shows that the calculated BCR at 12% for one Avenue Kilometer Poplar plantation of the Owner was (3.5) followed by Owner cum Tenant (3.1) and Tenant (2.5). All the calculated BCRs are greater than 1. So, the growing of Poplar trees are beneficial.

Table 10. BCR for One Av:Km of Poplar Plantation at 12% Interest Rate

S.No	Tenurial Status	Income (Rs)	Cost (Rs)	BCR
1	Owner	421750	119912	3.5
2	Owner cum Tenant	360500	113878	3.1
3	Tenant	277050	112160	2.5

Source: Survey Data 2009

Benefit Cost Ratio for Total Avenue Kilometer Poplar Plantation

Data provided in table 11 shows the calculated BCRs of all the tenurial groups (Owner, Owner cum Tenant and Tenant) for total Avenue Kilometer Poplar plantation. For further detail see the table.

Table 11. BCR for total Av: Km Poplar plantation at 12% Interest Rate

S/No	Tenorial Status	Total income(Rs)	Cost (Rs)	BCR
1	Owner	6748000	1918592	3.5
2	Owner cum Tenant	3244500	1024902	3.1
3	Tenant	1385250	560800	2.5

CONCLUSION

The average cost for raising of 1 Avenue Kilometer of Poplar plantation including maintenance upto 03 years was Rs.119912/- on the part of Owners followed by Owner cum Tenant (Rs.113878) and (Rs.112160) for Tenants. The total income on tenorial basis was (Rs.421750) for Owners followed by Owner cum Tenant Rs.360500 and Tenant (Rs.277050) for one Avenue kilometer poplar plantation. The net income calculated for one Avenue kilometer poplar plantation for the Owners was (Rs.30183) followed by Owner cum Tenant (Rs.246622). The NPVs calculated for the Owners was (Rs.171499) followed by Owner cum Tenant (Rs.140127) and Tenant (Rs.93688) at 12% interest rate for one Avenue kilometer. The BCRs calculated were (3.5) for Owners followed by Owner cum Tenant (3.1) and Tenant (2.4) at 12% interest rate.

On the basis of the current study it is recommended that,

- 1). the practical implementation of the formal education must be ensured at the fields to increase the Poplar productivity to uplift the socioeconomic condition of community.
- 2). Formal education generates fruitful results but was expensive, so the informal extension education should be encouraged by the Forest Department on large scale by arranging various training programmes to enhance the skill of Poplar growers.
- 3). train extension agents further to bridge the gap between the Poplar growers and extension as well as research department.
- 4). Water scarcity was a common problem in the target areas, Therefore lining of water courses is strongly recommended for quenching the thirst of the Poplar plants.
- 5). Delayed loan payment, complex method of getting loans and high rate of interest are the main bottlenecks in the forestry credits. The government should therefore make the process of getting loans easier without interest or with low interest rates.

- 6). All the required inputs (seedlings, fit planting stock, fertilizers and pesticides etc) should be locally available throughout the season. Shortage in quantity of the inputs and increase in the prices should be strongly discouraged.
- 7). High yielding, disease as well as wind resistant improved fast growing species should be supplied to the growers for getting better production.
- 8). Industries should be developed in the target areas to process the products to give more benefits to the growers at local level to increase their income.

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