Cultivation of *Cinnamomum tamala* in marginal lands for greater income at Palpa District

Damodar Prasad Parajuli[1]

Since long the people of Palpa district are involved in the trade of the bark and leaves of *Cinnamomum tamala*. The way its export is increasing by many folds in the last seven years, replacement of the traditional crops by the cultivation of *C. tamala* could be one of the viable options of maximising the financial return. In this connection, the paper analyses the cost-benefit ratio of *C. tamala* cultivation as against the the conventional crops being cultivated on the marginal lands such as steep slopes, and on degraded soils. Calculation on the basis of a thirty years project period, cultivation of *C. tamala* on such lands is suggested for its cost-benefit ratio of 1:16. With the additional opportunity of employment generation, majority of the Palpali people who are presently depending upon the subsistence agriculture, could be attracted towards C. tamala cultivation. The environmental risks generated by the cultivation of cereal crops on steep slopes could also be minimised.

Keywords: Cinnamomum tamala, Cost- benefit analysis, Internal Rate of return, employment generation, Nepal

Cinnamomum tamala (called Dalchini in Nepali) is a tall tree which occurs in the mid-hills of Nepal (more detailed information on this species are available in Krishnamurty, 1993; Bhatta, 1977; Kirtikar and Basu, 1994; ANSAB, 1997). Leaves (called tejpat or tejpatta) and bark (called dalchini) of this species contain aromatic oil and are used as spice in the Indian sub-continent. Since the early sixties farmers of Palpa District have been planting, protecting, harvesting *C. tamala* and marketing them in the nearby markets such as Butwal and Khasauli of Rupendehi District. Export of these products to India have continued to increase for the last seventeen years by almost twentyfive times (23.70 tons in 1976/77 to 586.10 tons in 1993/94) (DOF,1997) indicating that the species has a tremendous potential of economic upliftment for the local people.

One of the viable options to maximise financial return at the district, is the replacement of conventional crops such as maize and millet from marginal lands by *Cinnamomum tamala* - the cultivation and marketing techniques of which are already available in the district. The present paper has explored such potential through the cost-benefit analysis of dalchini cultivation in marginal lands.

The district

Palpa district (1366 sq. km) is in the mid-hills (152 m -1936 m) of Nepal. The district comprises 65 Village Development Committees (VDCs) and a municipality. Population is 2,36,238 (1991 census), of which 53 percent are female and 47 percent male. The annual growth rate is recorded as 1.7 per cent, and literacy is about 48 percent (61% male, 39% female).

Palpa is inhabited by different casts and tribal groups such as Magar (49%) , Brahmin (22%), Chhetri (9%), Kami (6%), Newar (4%), Sarki (3%), Damai (2%), Kumal (2%) Gharti (1%) and others (2%). Magars mostly inhabit the upper Middle hills and Siwalik areas of the district. Population depends mainly on subsistence agriculture. However, the district is catagorised as a food deficit area because of continuous population increase, lack of arable lands and declining soil fertility particularly in slopes more than 30 percent gradient. For the porpose of this study, such slopes are designated as marginal land where not more than 2.6 ton/ha of food grains (maize and millet) produce.

[1] ITTO Visiting Scholar, IOF/ITTO Project, Pokhara

Table 1: Export of *C. tamala* leaves and bark (figures are in thousand) from Nepal

Fiscal year	Quantity (Kg)	Dalchini Value (NRs)	Tejpatta Quantity(Kg)	Total amount Value (NRs)	(US$)
1976/77	11.87	11.40	11.87	11.40	1.45
1977/78	15.57	20.93	15.57	20.93	
1978/79	60.04	39.71	60.04	39.71	
1979/80	0.10	0.20	240.91	154.35	
1980/81	N.A	N.A	37.63	155.35	
1981/82	186.19	1229.55	N.A.	N.A.	
1992/93*	263.56	5271.18	100.85	1008.50	110.17
1993/94*	328.59	6571.78	257.51	2575.06	160.47

Sources: -Customs records, Nepal (between 1976/77-1980/81)
*1992/93-1993/94 royalty collection, Department of Forests records , Nepal (1997).

The major land use classification of this district as shown by the Land Resource Mappping Project are 18460 ha. of unarable land in the district. The land which is believed to be under permanent cultivation of maize and millet, could be available for dalchini cultivation.

The district has 39.5 percent high forests, 12.6 percent shrub land and degraded forests. So far, almost 8100. ha (11.4%) of national forests have been already handed over as community forests to about 17112 households, covering all VDCs and one municipality (DFO, Palpa, 1997).

In the north slopes of Koldanda and Masyam VDC there exist a natural stands of a dalchini with average density of 90 trees/ha (Upadhaya, 1984). These VDCs also have some plantations in the farm lands. The presence of natural stands and plantations indicate towards the technical feasibility of cultivating them in marginal lands also at other places of the district through which farmers could receive considerable benefits on sustainable basis. With such background the present paper attempts to find out i) the current level of agricultural yield from the farm land and the costs involved in production; ii) estimate total benefits received by farmers through cultivating agricultural crops for a period of 30 years; iii) estimate the costs involved in planting, protecting, managing, harvesting C.tamala trees, and the maximum benefits received towards the end of the cultivation period so as to justify recommendation to change the present land use system, iv) to predict additional employment and income opportunity from its cultivation, and v) to assess value addition.

Methods

The research was carried out through direct observation in fields, interview, collection of official records and survey of pertinent literatures.

Official record and interviews

Official records of Custom offices and the Department of Forests (DoF) from 1990 to 1997 were analysed to predict the trends of production and export of leaves and bark, and the cash received from their sale. Almost 36 mid-hill districts of Nepal, are found to issue the transport permits for these products. The quantity of products sold and the cash received during 1976/77 to 1993/94 is shown in Table 1.

There is an increasing trend in the production of both leaves and bark, with the amount received being 100 times more in the 8 years. Such increase in production and marketing has a direct positive impact on the economic incentives to the farmers who deal with the products.
In order to find out the perception of the farmers on cultivating more trees on their farm land, particularly on the margin which are highly susceptible to soil erosion, the author conducted a group interview with the farmers at the Masyam and Koldanda VDCs. The local leaders, school teachers and local forestry officials were also interviewed on the proposed land use change. In a semi-structured interview, the respondents were mobilised to discuss on whether or not the level of income was increased by planting Dalchini trees?; expenditure required and the provision of financial assistance or loan for cultivation; market support of the products and the government's initiative to explore the potential in establishing processing industry for value addition and ways and means to overcome food deficit during the initial stages (say 5 years) of plantations.

Results and discussion

Dalchini trees produce bark when they attain 3-5 m height at around 5 years after plantating or from re-growth of coppice shoot after reaching 6-10 cm diameter. Farmers harvest bark during March /April

Table 2: Projected cost for agricultural production in bari lands (NRs/ha)

Particulars	Annual cost (NRs/ha)	Expected cost /30 year (NRs)	Remarks
Maize and Millet	6000.00	180000.00	Includes labour, fertilizer , seeds and harvesting cost , etc.
Net present value of cost 56586.00 10% discounted interest rate at the end of 30 years			

Source for production cost: DADO (1997), Palpa; see appendix 1 for calculation

Table3: Expected income from the agricultural production in the Bari land (NRs/ha)

Particulars	Annual Production (ton/ha)	Expected income (NRs/ha/yr.)	Total income/30 year (NRs)
Maize & Millet	2.37	7500.00	225000.00
Maize and Millet stalks, cobs and husks	5.00	1250.00	37500.00
NPV of income at 10% discounted interest rate at the end of 30 years = 82559.00			

Source: DADO (1997) Palpa.

when the trees start refoliating. Upadhaya (1984) estimated around 22.6 kg of fresh bark from a single tree per harvest which dry weight (12 kg). The yield varies between 6-20 kg. Leaves are ready for harvesting when trees are 10 years old, and they continue to bear for a century (Edwards, 1996). However, they become ready for harvest even at the age of 5 years yielding around 6-20 kg of dried leaves (Upadhaya 1984). Leaves are plucked once a year or in alternate years from young trees in dry and mild weather from October to March. The annual average yield per tree is 13 kg of dry leaves.

The farm land for Dalchini cultivation would be the land of low fertility, highly susceptible to soil erosion and under permanent agricultural practices. The land (more than 30% gradient and mostly on north facing slopes) produces not more than two crops (maize and millet). For the purpose of this study one hectare of land is taken as a basis for calculation.

Costs and benefits of conventionl crops

The cost of cultivation and benefits received from these crops are calculated by using official records of the District Agricultural Development Office, Palpa (DADO, 1997). The agricultural production costs include land preparation, seed purchase, compost and fertiliser application, cultivation and harvesting. The cost of land is not included, as in both cases it remains the same. Expected agricultural crop production and the benefits received from their sale are also calculated from the records available of the same district (DADO, 1997). The forestry projects being a long term enterprises, the 30 years project period is fixed and all calculations are done at the discounted net present value of 5 percent, 10 percent and 13 percent interest rates (Appendix 1, 2, 3 and 4); however, for comparison with Dalchini cultivation and to justify the hypotheses, the interest rate is fixed at 10 percent throughout the main text. Projected costs of agricultural production and benefits received from the sale of the products are given in the tables 2 and 3. The opportunity cost of maize and millet stalks, husks and cobs production are also calculated @ NRs .0.25 perkg for each year in a discounted net present value of the same interest rate as above. This production could be otherwise used to feed animals for more production of meat, milk and cow dung.

Tables 2 and 3 show that the net profit received by the farmers in agriculture practices is very marginal if the self employed labour is costed. Around 20percent net margin is expected to the farmers if invested into agricultural crop production. Details of calculation is given in appendix 2.

Cost - benefit

The cost of Dalchini cultivation on farm lands, appropriate age of harvest, frequency of harvest, and the expected benefit from the barks and leaves are worked- out on the basis of author's experiences, review of available literature, and the farmers' empirical knowledge.

The production cost of bark and leaves production including all associated costs and benefit expected from the sale of these products are projected on the following basis:

1. Three years old Dalchini seedlings will be purchased from private nursery @ NRs. 7 per seedling
2. Plantation at a spacing of 4 m x 4 m will allow 625 seedlings on a hectare and 70percent (437 seedlings) may survive up to the harvesting stage
3. No natural calamities are expected to disturb the growth of trees, and production of bark and leaves throughout the project period
4. Market price of the products will remain constant and the demands for the product will continue to increase
5. Harvesting cycles and all yield figures given in different literature will match with the project situations
6. Trees could be coppiced up to 5 rotations for the period of 30 years

Projected costs of tree cultivation, maintenance, and the benefits received from the sale of the products are given in tables 4 and 5.

The cost of cultivation, maintenance, harvesting, etc. seem to be very low and do not require heavy investment throughout the project period. Out of the total project cost, only NRs. 50,000 is required in the initial stages (1-3 years). The cost involved in harvesting the bark and leaves from 5 years onwards could be recovered in the same year by selling the products in the market. Parts of the cost could also be recovered by selling the small sized timber and fuelwood obtained from coppice.

Tables 4 and 5 reveal that the benefit (NPV at 10 % interest rate) received from the sale of products is NRs 986958 which is almost **16 times** more than the cost of production. Also farmers would start getting benefit five years after cultivation (table 5). Intercropping of agricultural crops is possible in the initial stages of plantations which would help suppliment food deficit.

The inferences favour of changing the present land use practice into Dalchini cultivation at the project site. From table 2 and 3 the profit (without discount) likely to be received by the farmers from agricultural crop production would be around NRs 262500 for the whole project period. If the same piece of land were converted into Dalchini farm, the profit (without discount) could reach as much as NRs.4030440. for the same period which is **15 times** more than that of maize and millet. The net present value of benefits from cultivating Dalchini (at 10% discounted interest rate) at the end of project period comes around **12 times** more than that of maize and millet. Calculation of internal rate of return (IRR) of this project also shows more than 50 percent return at the same interest rate (i.e.10%). Even the benefit-cost ratio of **1:16** suggest the project to be extremely viable.

Additional employment opportunities to the rural people would be one of the attractions to the rural farmers. Present study showed that the level of employment would increase substantially by providing additional activities like tree planting, protection, maintenance, coppicing, debarking of coppiced trees, collection of leaves, processing of harvested products and transportation to the local markets, use of debarked trees and branches in making incence sticks, etc. For all these activities the labour requirement is almost year round unlike

Table 4: Projected cost (NRs/ha.) for cultivation, maintenance and harvesting of *C. tamala*

Particulars	Estimated cost /unit work	Annual year requiring expenditure	Total cost for 30 years
Seedling cost	5000.00	1	5000.00
Site preparation	2000.00	1	2000.00
Plantation cost	28000.00	1	28000.00
Maintenance	5000.00	1,2,3	15000.00
Harvesting and debarking (includes bark extraction)	20000.00	5,10,15,20,25,30.	120000.00
Leaves collection	2600.00	5,7,9,10,12,14,15,17,19 20,22,24,25,27,29,30	41000.00
		Total cost (NRs)	186400.00
NPV of cost at 10% discount interest rate at the end of 30 years (NRs)			61024.00

maize and millet cultivation which is seasonal. The creation of additional employment within and outside the district from these activities is estimated to be around one man day throughout the project period at the present labour rate (NRs 85.00/day). Benefit and cost analysis indicated that the profit is very lucrative. The farmers need not wait long period to generate income from plantations. Though, some income is expected from the sale of grass in the first few years of cultivation, yet, this income is not considered in the benefit-cost analysis. Since the initial investment for the farmers is not heavy and the projected benefits are attractive some lending agencies might take interest to support the proposed land use. Some intervention on exploring the forest-based enterprises and market intelligence from the government might help to respond to the queries of the farmer for innovative work such as this.

Establishing new small enterprises would create employment and value addition of the products thus creating market outlets for rural producers. Institutions such as Agricultural Development Bank/Nepal and the concerned government agencies should come forward for relevant support.

Conclusion and recommendations

Farmer would have no hesitation to change the present land use practice if that were likely to give more return per unit area, requires less investment for production, provision of having soft loans for investments and above all have market facility and food security. Besides, the low gestation period and technical support for enterprise development, etc. could draw their attention. The present study has drawn conclusions in favour of the new land use which could also be justified in terms of *cost-effectiveness*, *sustainability* and *replicability*. With more than 50 percent Internal Rate of Return (IRR), cost-effectiveness is proved. Also coupled with the value of biodiversity conservation, use of local resources (mostly human resources), value addition to the products, flexible in market outlets and the use of products, and adequate support of the market at Butwal and elsewhere in the country, the new proposal seems to have a bright side for replicability.

With additional benefit of soil and biodiversity conservation, and no need of high tenchology and investment, it also provides an ideal demonstration effect for the nearby farmers of mostly medium to small economic classes.

It is, therefore, highly recommended to implement this plan, at least as a pilot project, in a few areas of Palpa District so that it could play a demonstrative role to other farmers who are willing to cultivate their marginal land with *C. tamala* for high economic returns. The policy makers are also suggested that the producers should be safeguarded against those who reap most of the farmers' benefit.

References

ANSAB, 1997. Forest Products Marketing /Enterprise Studies, Annex 7. Asia Network for Small Scale Agricultural Bioresources, PO Box 16 Kathmandu Nepal. pp28-34.

Bhatta, D. D. 1977. Natural History and Economic Botany of Nepal, Orient Longman Limited, Calcutta, 238 pp.

Edwards, D. M. 1996. Non-timber Forest Products from Nepal: Aspects of the Trade in Medicinal and Aromatic Plants. FORESC

Table 5: Projected benefits (NRs/ha.) from Dalchini plantation on Bari land

Particulars	Estimated benefits (Kg/ha/harvest)	Market price (NRs/Kg)	Frequency of harvest (Annual_years)	Total benefits
Bark	5244.00	100.00	5,10,15,20,25,30	3146400.00
Leaves	2622.00	20.00	5,7,9,10,12,14,15,17,19 20,22,24,25,27,29,30	839040.00
Fuelwood , poles etc.	15000.00	0.50	5,10,15,20,25,30	45000.00
Grass	10000.00	0.10	Each year, Social cost to farmers	
Benefits received from soil conservation and environmental protection are not costed.				
			Total direct benefits projection for 30 years	4030440.00
NPV of benefits at 10% discount interest rate at the end of 30 years = 986958.00				

Details of cultivation costs are given in appendix 3 and 4.

Monograph No.1/96, Forest Research and Survey Center, Ministry of Forests and Soil Conservation , Kathmandu, Nepal.

Kirtikar, K.R. and Basu, D.B. 1994. **Indian Medicinal Plant**, Volume III, Bishen Singh Mahendra Pal Singh, International Book Distributors, Dehra Dun, India, pp 2146-47

Krishnamurthy, T. 1993. **Minor Forest Product of India**, Oxford and International Book House Publishing Company Limited, New Hehli, 645pp

LRMP, 1986. Land Resources Mapping Project Land Utilization Report, His Majesty's Government of Nepal, Kathmandu.

Upadhaya, M. P. 1984. Cinnamon Production and Marketing in Koldanda and Masyam Panchayat of Palpa District, Nepal: A Study Report. Nepal Institute of Development Studies, Dillibazar, Kathmandu, Nepal.

Appendix1: Expenditure in Millet and Maize Production (NRs/ha)

S.N	Particulars	Years 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Maize & Millet Cultivation cost (Including labor Fertilizer, Seeds, Compost, Harvesting etc.)	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000
2	Discounted value															
	(a) 5% interest	5712	5442	5178	4932	4692	4476	4262	4062	3870	3672	3510	3342	3180	3030	2886
	(b) 10% interest	5454	4956	4542	4098	3736	3384	3078	2796	2544	2310	2100	1908	1794	1578	1434
	(c) 13% Interest	5310	4698	4158	3678	3252	2881	2550	2268	1998	1764	1566	1380	1224	1086	918

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Total	Remarks
6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	180000	without discounting
274913	2616	2490	2388	2262	2154	2052	1950	1860	1770	1686	1608	1530	1458	1386	92203	After 5% interest rate discounting
02846	1188	1080	978	894	810	738	672	606	552	504	456	414	378	342	56586	After 10% interest rate discounting
	750	666	588	522	460	403	360	318	282	250	221	195	173	173	44918	After 13% interest rate discounting

Appendix 2: Benefits Receiving from Agricultural Production (NRs/ha)

S.No	Particulars	Years 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Agricultural Production (Maize 1:6 ton & 0.77 tan Millet/ha/year	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500
2	Maize & Millet stalks , Maize comb and khosta etc. (2.4+1.54+0.96+0.16) tons/ ha/ year = 5 tons/ha/year @ 0.25/kg	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250
		8750	8750	8750	8750	8750	8750	8750	8750	8750	8750	8750	8750	8750	8750	8750
3	Net per cent value															
	(a) 5% interest	8330	7936	7551	7192	6857	6527	6215	5924	5644	5355	5119	4874	4637	4418	4209
	(b) 10% interest	7953	7227	6623	5976	5434	4935	4489	4077	3710	3369	3062	2782	2616	2301	2091
	(c) 13% Interest	7744	6851	6064	5364	4742	4202	3718	3214	2914	2572	2284	2012	1785	1584	1391

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Total	Remarks
7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	7500	225000	Without discounting @ NRs. 3122 /tan (Source DADO Palpa, 1997)
1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	1250	37500	Source DADO Palpa, 1997
8750	8750	8750	8750	8750	8750	8750	8750	8750	8750	8750	8750	8750	8750	8750	262500	Source DADO Plapa,1997
4008	3815	3631	3482	3299	3141	2993	2844	2712	2581	2459	2353	2231	2126	2021	134488	5% Interest
1899	1732	1575	1426	1303	1181	1076	980	884	805	735	665	603	551	499	82559	10% Interest
1234	1094	971	805	761	672	589	525	464	412	365	323	285	252	223	65492	13% Interest

Appendix 3 : Expenditure in *C. tamala* cultivation by years (NRs/ha)

S.No	Particulars	Years 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Seedling cost	5000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Site preparation	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	Plantation cost	2800	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	Maintenance	-	5000	5000	5000	-	-	-	-	-	-	-	-	-	-	-
5	Coppicing & Debarking cost	-	-	-	-	20000	-	-	-	-	20000	-	-	-	-	20000
6	Leaf collection (Tej Patta)	-	-	-	-	2600	-	2600	-	2600	2600	-	2600	-	2600	2600
7	Expenditure (1-6)	9800	5000	5000	5000	22600	-	2600	-	2600	22600	-	2600	-	2600	22600
8	Net discounted expenditure 5%	9330	4535	4315	4110	17700	-	1846	-	1677	13831	-	1396	-	1313	10870
9	Net discounted expenditure 10%	8908	4130	3785	3415	14035	-	1490	-	1102	8701	-	811	-	684	5400
10	Net discounted expenditure 13%	8673	3915	3465	3065	12249	-	1249	-	977	7526	-	679	-	471	3593

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Total	Remarks
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5000	Direct purches from private nursery @ Rs 7/each
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2000	4m x 4m spacing; 625 plants/ha
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2800	25 plants/man/day@Nrs 100/ man/day
-	-	-	5000	-	-	-	-	-	-	-	-	-	-	-	15000	0.25 man/day for 365 days, 473 trees (70% of plants) are expected for coppicing and debarking (7 men ha/tree)
-	-	-	-	20000	-	-	-	-	20000	-	-	-	-	20000	120000	
-	2600	-	2600	2600	-	2600	-	2600	2600	-	2600	-	2600	2600	41600	1 man hour/tree, @ Nrs. 60/day labour cost
-	2600	-	2600	22600	-	2600	-	2600	22600	-	2600	-	2600	22600	186400	Without discounting (Total expenditure)
-	1334	-	1019	8520	-	890	-	806	6667	-	696	-	632	5221	96508	Discounted expenditure at 5% interest
-	515	-	424	3367	-	320	-	268	2079	-	198	-	164	1288	61084	Discounted expenditure at 10% interest
-	325	-	255	1966	-	176	-	138	1065	-	96	-	75	576	50534	Discounted expenditure at 13% interest

Appendix 4: Benefits (Nrs/ha) receiving from *C. tamala* cultivation

S.No	Particulars	Year 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Bark yields (la)															
	(a) Quantity (kg)	-	-	-	-	5244	-	-	-	-	5244	-	-	-	-	5244
	(b) Market price (Rs)	-	-	-	-	524400	-	-	-		524400	-	-	-	-	524400
2	Leaves/ha.															
	(a) Quantity (kg)	-	-	-	-	2622	-	2622	-	2622	2622	-	2622	-	2622	2622
	(b) Market Price (Rs)	-				52440		52440	-	52440	52440		52440	-	52440	52440
3	Fuelwood Production															
	(a) Quantity	-	-	-	-	15	-	-	-	-	15	-	-	-	-	15
	(b) Price of Site (Rs)	-				7500		-		-	7500	-	-	-	-	7500
4	Grass Production (ton)(first 4 years)	10	30	40	20	10	10	10	10	10	10	10	10	10	10	10
5	Soil Conservation, Environment Protection															
	Total benefits (Rs) (1-3 only)	-	-	-	-	584340	-	52440	-	52440	584340	-	52440	-	52440	584340
6	Discounted benefits (5%)	-	-	-	-	457538	-	37232	-	33824	351616	-	29209	-	26482	281067
7	Discounting benefits (10%)	-	-	-	-	362875	-	26901	-	22235	224970	-	15679	-	13891	139657
8	Discounting benefits (13%)	-	-	-	-	316712	-	22287	-	17462	171796	-	12061	-	9492	92910

16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	Total	Assumed 437 trees/ha
-	-	-	-	5244	-	-	-	-	5244	-	-	-	-	5244	31464	Yield 12 kg/Tree (dry)
-	-	-	-	524400	-	-	-	-	524400	-	-	-	-	524400	3164400	Nrs 100/kg Market price
-	2622	-	2622	2622	-	2622	-	2622	2622	-	2622	-	2622	2622	41952	Yield 6 kg/Tree (dry)
-	52440	-	52440	52440	-	52440	-	52440	52440	-	52440	-	52440	52440	839040	Nrs 20/kg Market Price
-	-	-	-	15	-	-	-	-	15	-	-	-	-	15	90	3 Ton/ha/yr; poles,small timber, fuelwood
-	-	-	-	7500	-	-	-	-	7500	-	-	-	-	7500	45000	Nrs 0.5/kg or Nrs 500/Ton
10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	360	Not costed, left as opportunity cost to the farmer
-	52240	-	52440	584340	-	52440	-	52440	584340	-	52440	-	52440	584340	4030440	Total benefits without discounting
-	22864	-	20871	220296	-	17934	-	16256	172380	-	14054	-	12743	134982	1849348	Total benefits with 5% discounting
-	10383	-	8547	87067	-	6450	-	5296	53759	-	3985	-	33040	33307	1048042	Total benefits with 10% discounting
-	6555	-	5139	50838	-	3529	-	2779	27522	-	1709	-	1337	13206	755334	Total benefits with 13% discounting