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Cost of Cultivation and Economic Feasibility of Grafted *Harar* (*Terminalia chebula*) In Himachal Pradesh

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ABSTRACT

Present study analyzed the "Economics of Production of NTFPs: A case study of Harar (Terminalia chabula) in Himachal Pradesh", a sample of 40 farmers each from Sirmour and Kangra dist. of Himachal Pradesh. Average establishment cost per year was Rs 13550 per 100 plants. The maintenance cost of grafted harar increased from Rs 12241.78 to Rs 123675.30 during 2nd year to 15^{th}year and net returns varied from Rs (-) 12241 to 116262. The payback period worked out to be 9 years, NPV as Rs226,106, the benefit-cost ratio as 1.57 and internal rate of return (IRR) as 33 per cent under the present value summation method.

Key words: *Non-timber forest produce, cost of cultivation and harar*

INTRODUCTION

Terminalia chebula commonly known as *harar* is distributed throughout the greater part of India except arid zone. The species is found in mixed dry deciduous forests and frequent in tropical and subtropical zones, mostly hilly tracks. The tree is found in the outer Himalayas ascending up to 1600 m from Himachal Pradesh to Bengal and then throughout Central and South India. In North Western Himalayas, it is distributed between the altitude of 500-1100m in states of Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana and Uttrakhand. Trees found growing naturally on the bunds of farmer's fields and village common lands popularly known as *ghasnis.* The species is frost hardy and can grow under varied environmental conditions. *Harar* is capable of growing on different types of soils, but attains best growth on loose well-drained soils, such as sandy loam as well as clay loam[16].

Terminalia chebula Gertn. is an important herbal drug in Ayurvedic pharmacopeia. It is called the "king of medicines". It is always listed first in the Ayurvedic material because of its extraordinary potential of healing.

In Ayurveda it is thought to destroy all diseases and remove all waste from the body. At the same time, it is known to help tissue growth and health. It is known by its local name as Haritaki, *Harar* ,Harida, Black myroblan, Chebulic myroblan and Harada. *Terminalia chebula* Gertn. is reported to be antimicrobial[11,1,8,4&3], hepatoprotective[13&14], anti-inflammatory[9], immunomudulatory[12], anti-oxidant[7,15&6]and adaptogenic[10].

MATERIALS AND METHODS

The methodology of the study has been described under the following sections:

SELECTION OF STUDY AREA

Harar is cultivated in Sirmour, Kangra, Bilaspur, Hamirpur, Una and Mandi districts of the state. Mostly it is collected from the trees grown in the *ghasnis*or common village lands.Purposive sampling has been adopted to select two districts namely Sirmaur and Kangra districts out of 6 districts.

SAMPLING DESIGN AND SAMPLING SIZE

A Simple random sampling design was used for the selection of the respondents. Production areas in the selected districts were identified through pilot survey and a sample of 50 farmers each from the selected areas from the selected districts.

PRIMARY DATA

The primary data on cost of cultivation, area under cultivation, yield, marketable or marketed surplus were collected on well-designed pre-tested schedules by adopting a personal interview method from the selected households and traders in the study area and markets respectively during the year 2014-15.

Financial analysis

To evaluate the economic feasibility of investment under cultivation of grafted *harar*, viz., net present value, benefit cost ratio, internal rate of return and Modified internal rate of return were used. The following equations were used to derive the results.

Net Present Value

The net present value represents the discounted value of the net cash inflows to the project. In the present study a discount factor of 12 per cent was used to discount the net cash inflows representing the opportunity cost of capital. It can be represented by

$$NPV = \sum_{t=1}^{n} \frac{B^t - C^t}{(1 + r)^t}$$

Where,

NPV	=	Net present value in period 't'
B_t	=	Benefit fromgrafted harar in each year
C_t	=	Cost of cultivation in each year
r	=	Discount rate
t	=	1,2,3… n, the entire life of plantation across the study regions
n	=	number of years

Benefit cost ratio

The benefit-cost ratio of an investment is ratio of the discounted value of all cash inflows to the discounted value of all cash outflows during the life of the project and computed as

$$BCR = \frac{\sum_{t=1}^{n} \frac{B^t}{(1 + r)^t}}{\sum_{t=1}^{n} \frac{C^t}{(1 + r)^t}}$$

Internal rate of return (IRR)

The rate at which the net present value of project is equal to zero is internal rate of return (IRR) to the project. The net cash inflows were discounted to determine the present worth by the following interpolation technique. Derivation of the IRR is analogous to solving for 'r' in the equation given as under:

$$\sum_{t=1}^{n} (B_t - C_t)/(1 + r)^t = 0$$

Modified Internal rate of return (MIRR)

There are many problems with IRR as criterion for project evaluation[5&2]. Some of which are:

- The IRR method can lead to erroneous rankings of the mutually exclusive projects when compared to net present value (NPV) method of capital budgeting.

- The IRR method assumes that the future cash flows will be reinvested and get the returns equal to IRR.

- IRR ignores differences in the size of the projects, the scale problem and

- Differences in the risk classes of the projects and capital rationing can also cause ranking differences if done base on IRR.

In literature, Modified Internal rate of return (MIRR) method of capital budgeting has been suggested to take care of the problems arising out of reinvestment assumption. When scale or time span differences exist, the MIRR method may still give ranking of mutually exclusive projects that are different than of NPV. Hence, IRR needs adjustments to take care of these problems. One may question the need for adjustments not mutually exclusive and apparently are not subjected to capital rationing. Even if we buy these arguments, through difficult as the project are competing for scarce public funds, the fact remains that an overestimated IRR due to reinvestment assumption gives false sense of profitability of the projects.

$$\text{MIRR} = \sqrt[n]{\frac{\text{FV (Positive cash flows)}}{-\text{PV (Negative Cash flows)}}} - 1$$

where *n* is the number of equal periods at the end of which the cash flows occur (not the number of cash flows), *PV* is present value (at the beginning of the first period), *FV* is future value (at the end of the last period).

RESULTS AND DISCUSSION
COST OF CULTIVATION OF GRAFTED *HARAR* PLANTATION

With the advancement in the propagation technology, grafted *harar* is also becoming popular among the farmers. Though, in the sampled farmers only two farmers have planted grafted plants of *harar* and only harvested sample fruits. In order to make this technology more effective, its cost of cultivation has been estimated based on the data on yield from Regional Horticultural research Station Jachh where grafted *harar* is planted and is about 12-year old plantation. The cost of establishment per 100 plants has been estimated assuming a spacing of 8 X 8 metres. Further, *harar* is grown in a area where mango is also grown. So the package of practices for mango has been considered in estimating the cost of maintenance. Further it was assumed that after 25 years of age the *harar* yield starts declining. Based on these assumptions the financial analysis of grafted *harar* was carried out and results have been presented in this section. It was found that average establishment cost per year was Rs 13550, of which 78.60 percent was labour component and 21.40 per cent material cost (Table 1).

The cost and returns from the grafted *harar* have been presented in Table 2. Grafted *harar* start bearing fruit from the fourth year onward and bearing continues for about 30 to 40 years but reasonable rate of return can be expected up to 25 years. The cost of grafted *harar* increased from Rs 12241.78 to Rs 123675.30 during 2nd year to 15th year, whereas, after that it was estimated Rs 68868.57. Similarly yield also increased up to 15th year. The net returns varied from Rs (-) 12241.78 to 116262.20. Though returns increased till 15th year of age and then declined.

Table 1: Establishment cost of grafted *harar*

Items	Value (Rs.)	Percent
Labour Cost		
Bush Clearing/Burning	1050.00	7.75
Digging of Pits	6300.00	46.49
Planting	600.00	4.43
FYM	600.00	4.43
Fencing	1200.00	8.86
Others	900.00	6.64
Sub-Total	**10650.00**	**78.60**
Family Labour	3900.00	28.78
Hired labour	6750.00	49.82
Material Cost		
Planting Material	2000.00	14.76
FYM	600.00	4.43
Miscellaneous	300.00	2.21
Sub-Total	**2900.00**	**21.40**
Total Plantation Cost	**13550.00**	**100.00**

Table 2: Cost and returns from Grafted *harar*   (Rs/100plants)

Items of cost	Year					
	2	**3**	**4-7**	**8-11**	**11-15**	**16-25**
Gross return	0.00	0.00	35106.25	141687.50	239937.50	131275.00
Maintenance cost	8006.25	7944.00	26161.80	72313.95	116032.13	61227.23
Land revenue	6.00	6.00	6.00	6.00	6.00	6.00
Depreciation	66.67	66.67	60.25	58.67	55.33	53.67
Interest on fixed capital	7.27	7.27	6.63	6.47	6.13	5.97
Rental value of land	2250.00	2250.00	2250.00	2250.00	2250.00	2250.00
Interest on past establishment cost	1905.59	3374.61	5325.71	5325.71	5325.71	5325.71
Total cost of cultivation	12241.78	13648.55	33810.38	79960.80	123675.30	68868.57
Net return	-12241.78	-13648.55	1295.87	61726.70	116262.20	62406.43

ECONOMIC FEASIBILITY OF *HARAR* CULTIVATION

Before making choice on selecting any enterprise, it becomes necessary to examine the economic feasibility of that enterprise. The length of the period, a particular enterprise bears fruit play key role in its selection. *Harar* is a perennial crop which gives return for about 25 years, four indicators, viz., net present value, benefit cost ratio, internal rate of return and payback period were used to examine the economic feasibility of investment in the cultivation of grafted *harar*.

The economic productive life as well as profitability of grafted *harar* was calculated with the help of different investment appraisal methods and project evaluation techniques. The benefit-cost (B-C) ratio, net present value (NPV) and minimum income required for taking decision on re-plantation of plantation based on the present value summation methods and annual amortization method along with IRR and payback period have been presented in Table 3. The discounted and amortized values of returns were calculated at the rate of 12 per cent, because the financial institutions advance short-term loan to the growers/farmers at this rate of interest. A perusal of table revealed that the payback period was 9 years. The NPV worked out to be Rs 226,106, the benefit-cost ratio as 1.57 and internal rate of return (IRR) as 33 per cent under the present value summation method. Under the amortization method also, the NPV and B-C ratio were similarly at Rs 220780.30 and 1.55, respectively. Both these measures clearly indicated that grafted *harar* cultivation in the study is profitable venture. Grafted *harar* cultivation could be a vital alternative for crop diversification endeavours, if infrastructure facilities were improved for scientific post-harvest handling, storage, packaging, transportation and marketing.

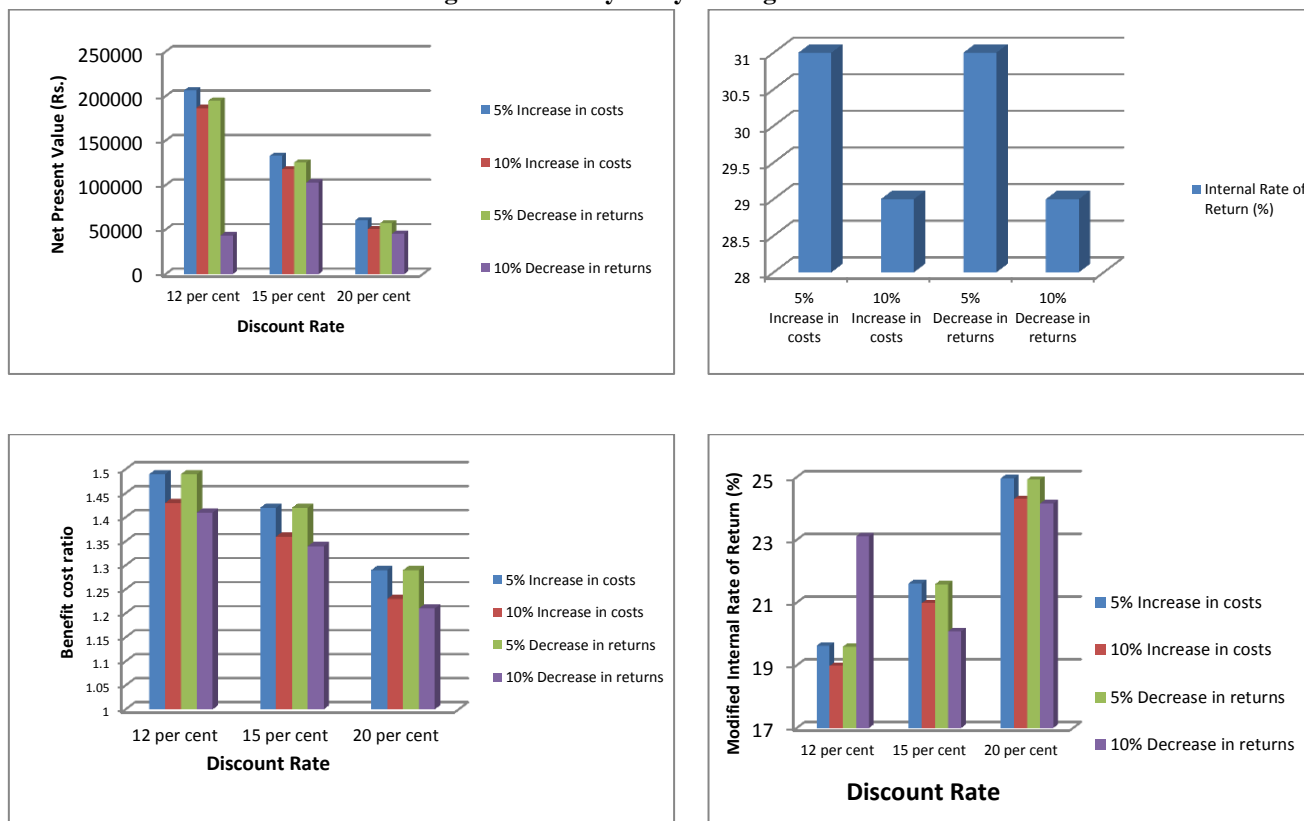### Table 3: Measures of investment worth per 100 plants of grafted *harar*

Measures of investment worth	Method	
	Present value	Amortization
Benefit-cost ratio	1.57	1.55
Net present value (Rs)	226106	220780.30
Uniform annual return (Rs)	28828.52	28149.49
Internal rate of return (%)	33%	-
Modified Internal Rate of Return (%)	20.24	-
Payback period (years)	9	-

A comparison of the results obtained from the two appraisal methods revealed that the amortization method had slightly underestimated the benefit-cost (B-C) ratio and present (capital) value; however, the difference in B-C ratios was not large (Table 6). Further, average annual annuity of *harar* at 12 per cent for 25 years life span was estimated Rs. 28828.52 with present value method and Rs. 28149.49 with amortization method.

SENSITIVITY ANALYSIS

The financial measures used are based over certain assumptions like constancy of prices, future yields demand estimates, however, in real world, situations prices yield and demand conditions keep on changing, having repercussions on the economic feasibility of the investments.

Fig. 1: Sensitivity analysis for grafted *harar*

Therefore, sensitivity analysis of *harar* has been carried out under two assumed situations i.e. assuming an increase of 5 and 10 percent in the cost and in the second situation same

percentage decrease in returns. The results of the analysis have been presented in fig 1. The analysis showed that an increase of 5 to 10 per cent in cost does not make the cultivation

uneconomic as economic measures are well in the range with small change in their magnitudes. Similarly a decrease of 5 to 10 per cent in returns does not affect the economic feasibility. Benefit cost ratio ranged between 1.41 to 1.49 and IRR between 29 to 31 percent. Hence investment in grafted *harar* proves to be stable to changes to cost and yield variations.

CONCLUSION

Terminalia chebula Gertn. is an important herbal drug in Ayurvedic pharmacopeia. It is called the "king of medicines". It is always listed first in the Ayurvedic material because of its extraordinary potential of healing. This study concluded that *Terminalia chedula* becomes one of the crop for raising the income of the farmers in lower belt as apple in the upper belt of Himachal Pradesh. Average establishment cost per year was Rs 13,550 per 100 plants, of which 78.60 per cent was labour component and 21.60 per cent material cost. The cost of grafted *harar* increased from Rs 12241.78 to Rs 123675.30 during 2nd year to 15th year, whereas, after that it was estimated Rs 68868.43. Similarly yield also increased up to 15th year. The net returns varied from Rs (-) 12241 to 116262. Though returns increased till 15th year of age and then declined. The payback period worked out to be 9 years, NPV as Rs 226,106 the benefit-cost ratio as 1.57 and internal rate of return (IRR) as 33 per cent under the present value summation method. Under the amortization method also, the NPV and B-C ratio were similarly at Rs 220780.30 and 1.55, respectively. Both these measures clearly indicated that grafted *harar* cultivation in the study is profitable venture. A comparison of the results obtained from the two appraisal methods revealed that the amortization method had slightly underestimated the benefit-cost (B-C) ratio and present (capital) value; however, the difference in B-C ratios was not large. Further, average annual annuity of *harar* at 12 per cent for 25 years life span was estimated Rs 28828 with present value method and Rs 28149.00 with amortization method.

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