

Cost-Benefit Analysis of Spear Mint Cultivation for Herbal Production

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Abstract: In Ethiopia, other than the traditional aspect, the scientific aspect of aromatic and medicinal plants in general and *Mentha spicata* L. commonly known as spear mint in particular is not well known. As a result nothing has been done on the costs, returns, profitability, and financial feasibility of spear mint cultivation. Therefore, the study was aimed at analyzing the costs, returns, profitability, and financial feasibility of spear mint cultivation for herbal production. The study was conducted at Wondo genet agricultural research center experimental field. For this study stolons of spear mint was planted on an area of 100m² with an inter-row spacing of 60cm and all the required cost and benefit data were collected. For the analysis of costs, returns and profitability simple cost accounting method was used whereas cost benefit analysis was used for financial feasibility analysis and the two popular measures namely net present value and cost benefit ratio were applied for final decision making. The result of analyses shows that, spear mint cultivation for herbal production requires a total cost of 57757.37 birr/ha and provides total revenue of 117366 birr/ha. The finding also shows that the first year cost of cultivation is 37.8% higher than the second year and labor cost accounts the largest share of the total cost of cultivation which is 75.2%. Moreover, in the cultivation of spear mint the first year total revenue shares the largest amount which is 75%. Furthermore, involvement in cultivation of spear mint is profitable and can provide a net return of 59608.63 birr/ha. Finally, the result shows that the value of net present value and benefit cost ratio is 54402.46 birr/ha and 2.05 respectively indicating that involvement in cultivation of spear mint is financially acceptable.

Keywords: cost benefit ratio, net present value, net return, Spear mint.

1. INTRODUCTION

As part of the struggle for improving the livelihood of the rural peoples, Ethiopia has made some efforts to promote the use of improved agricultural technologies to make land and labor more productive. To make this effort successful agricultural research has been developing technologies that can change the situation of farmers [1].

Essential oils by definition are the liquid products of steam distillation of plant parts. An essential oil may contain tens or hundreds of volatile and non-volatile compounds, the cause of their characteristic fragrance or flavor. Essential oils are present in plants in specialized cells/glands (sub-cuticular spaces of glandular cells, organelles.); these glands may be at anywhere on plant body depending upon the morphology and physiology of the plant. Some time it may be on leaves, flowers, stems, roots, bark, or wood [2]. Medicinal and aromatic plants (MAPs) are receiving considerable attention across the world because they offer a wide range of safe and cost-effective, preventive and curative therapies, which are useful in achieving the goal of 'health for all' [3].

Aromatic herbs have been used as flavor enhancers and seasonings throughout the world for thousands of years. Many herbs have been recognized to have medicinal properties and have many beneficial effects on health. Mint is one such herb which is not only used for aroma and flavor, but also has many potential health benefits. Mint leaves are used for culinary and medical purposes [4].

Mentha is a genus of aromatic perennial herbs belonging to the family Lamiaceae. It is distributed mostly in the temperate and sub-temperate regions of the world. Several mints of *Mentha* species are industrial crops, a source of essential oils enriched in certain monoterpenes that are widely used in food, flavor, cosmetic, and pharmaceutical industries [5].

Several mints of *Mentha* species are industrial crops that are widely used in food, flavor, cosmetics, and pharmaceutical industries. Different species of mint are used across the globe for their medicinal and culinary properties. Mint is usually taken after a meal for its ability to reduce indigestion and colonic spasms by reducing the gastrocholic reflux [6]. Mints are aromatic perennial herbs with quadrangular stem and bearing leaves with essential oil [7]. It includes 25 to 30 species that grow in the temperate regions of Eurasia, Australia and South Africa [8].

Mentha spicata L. is one member of *Mentha* species with commercial and medicinal uses and is well known for its great medicinal and economic values [9]. Though there are so many species of the genus *Mentha*, the focus of the study was *Mentha spicata* L. It is known as spearmint that belongs to the genus *Mentha* in the family of Lamiaceae [10]. Spearmint is a creeping rhizomatous, glabrous, and perennial herb with a strong aromatic odor. Its oil is rich in carvone and presents a characteristic spearmint odor [11]. The species has been found useful as digestive and gastro-stimulant this is eaten in the form of chutney. Leaves are popularly used as tea flavoring agent, while herbalist use whole plant as Carminative [12]. The fresh and dried plants and their essential oils are widely used in food, cosmetic, confectionary, chewing gum, toothpaste, and pharmaceutical industries [13]. In 2008, spear mint essential oil production was among the top 20 essential oil production which was 750 tones [14].

In Ethiopia other than the traditional use, the scientific use of aromatic and medicinal plants in general and spear mint in particular is at an infant stage. As a result, there is no information on the costs, returns, profitability, and financial feasibility of spear mint cultivation. Therefore, the study was designed with the objective of identifying the costs, returns, profitability, and financial feasibility of spear mint cultivation for herbal production.

2. METHODOLOGY

The study was conducted at Wondo Genet Agricultural Research Center (WGARC), Southern Nations Nationalities, and peoples region, Ethiopia in the Aromatic and Medicinal plants experimental field for two years (2010-2012). The geographical location of the study area ranges from 38° 37'13"-38° 38'20" East and 7° 5'23"-7° 5'52" North with an altitude range of 1760-1920 masl [15]. Planting material used in the study was stolen of *Mentha spicata* L. The planting material was planted on an area of 100m² on the experimental field with inter- raw spacing of 60cm. For the determination of costs; the amount labor in terms of man-days for land preparation, planting, watering, weeding and hoeing, fertilizer application and harvesting operations were recorded. Then after, the total amount of labor cost was calculated based on the specified wage rate. In addition to this, cost of fertilizer, planting material and initial plowing was recorded. Finally, the overall cost of cultivation was obtained through addition of all these costs. On the other hand, in order to calculate the total revenue obtained per each year, total annual yields were recorded and multiplied by their respective price. Finally, all the information was converted in to a per hectare basis for the final analysis. To examine the costs and returns associated with cultivation of Spear mint for herbal production, simple cost accounting method was followed and the summary measure used was net return to land. Since the commercial issue of aromatic and medicinal plants in Ethiopia is at infant stage there is no as such continuous and consistent market for such kind of products, due to this the price was setted based on cost plus price pricing method. The necessary data for the study were collected from wondo genet agricultural research center experimental field with the help of technical assistants. For data collection process; data collection sheet was prepared and encoded in to computer. In addition to this, making a decision on whether to invest on a given business or not requires a common measure of performance. Costs and benefits occur at different points in time and, hence, have different values. Financial analysis methods are tools that will enable us to evaluate the aggregate of these costs and benefits with a common measure and the common measures include net present value and benefit - cost ratio [16]. Therefore, net present value (NPV) and benefit cost ratio (BCR) was used for financial analysis. The formula used to calculate total revenue (TR), total cost (TC), net return (NR), NPV and BCR was as follows:

$$TR=Q*P \dots\dots\dots(1)$$

Where TR: Total Revenue

Q: Total quantity of fresh herb in kg

P: Selling price per kg of fresh herb

$$TC=CPD+CM+CL+MC \dots\dots\dots(2)$$

Where TC: Total Cost

CPD: Cost of /first Plowing and disking

CM: Material Cost (Seedling and Fertilizer)

CL: Cost of Labor (For major farm operations).

$$NR=TR-C.....(3)$$

Where NR: Net return

TR and TC are as defined above.

$$NPV=\sum_{i=0}^t \frac{B_t}{(1+r)^t} - \sum_{i=0}^t \frac{C_t}{(1+r)^t}(4)$$

Where NPV: Net Present Value

B_t : Benefits at time t

C_t : Costs at time t

t: Time in years

r: Discount factor

Then, after having the value of NPV, the decision was: a NPV greater than zero indicates that investing on spear mint for herbal production is feasible, a NPV less than zero indicates it is not feasible and a value of zero shows the decision will depend on the interest of the investor.

$$BCR=\frac{\sum_{i=0}^t \frac{B_t}{(1+r)^t}}{\sum_{i=0}^t \frac{C_t}{(1+r)^t}}(5)$$

Where BCR: Benefit Cost Ratio

B_t : Benefits at time t

C_t : Costs at time t

t: Time in years

r: Discount factor

According to this measure, BCR value of greater than one indicates that investing on spear mint cultivation for herbal production is feasible, and a value of less than one show it is not feasible.

3. RESULTS AND DISCUSSION

In this section results on yield of spear mint, costs and returns associated with cultivation of spear mint for herbal production and financial feasibility analyses is going to be presented.

3.1. Yield of Spear Mint

The marketable part of spear mint is its leaf and the fresh leaf of spear mint accounts 51% of the total above ground bio mass (Including the stem). Therefore, the fresh herb yield was obtained by multiplying the total above ground biomass with the respective leaf proportion. Based on this as presented in Table1, the first and second year total bio mass yield was 57509 and 19200 kg respectively. This implies that the first and second year herbal yield is 29329.59 and 9792 kg respectively. In addition to this, the yield of spear mint per each harvest increases up to the 3rd harvest and starts to decrease after the 3rd harvest. Moreover, the yield of spear mint shows 66.6% reduction from first year to second year and the average yield reduce by 49.9%.

Table 1: Bio mass and herbal yield of Spear mint per each harvest (kg/ha)

Plant name	Frequency of harvest	Bio mass yield	Leaf yield
Spear mint	1 st	5075	2588.25
	2 nd	10835	5525.85
	3 rd	15530	7920.3
	4 th	11269	5747.19
	5 th	8600	4386.00
	6 th	6200	3162.00
	7 th	6000	3060.0
	8 th	4000	2040.0
	9 th	5000	2550.0
	10 th	4200	2142.00
Total/ha		76709	39121.59
Average/ha/single harvest		7670.9	3912.159

Source: Field data, 2010-2012

3.2. Costs and Returns of Spear Mint Cultivation

As presented in Table2, annual costs, revenues and net returns of spear mint were calculated at the specified wage rate and output price. The first year cost of cultivation of spear mint for herbal production was Birr 31139 which accounts 62% of the overall total cost. Similarly, the second year cost of cultivation was Birr 19084.8 which accounts 38% of the overall total cost of cultivation. The per hectare cost of cultivation of spear mint has been found maximum during the initial year, because of the presence of initial costs such as cost of plowing, planting material, labor cost for planting and land preparation but declined substantially in the next year due to the reduction of those initial costs. Due to this, the first year cost of cultivation was 24% lower than the second year cost of cultivation. Moreover, the overall cultivation cost of spearmint for herbal production over the two years of production life was Birr 50223.8.

On the other hand, the first year total revenue of spear mint was Birr 87990 which accounts 74.8% of the overall total revenue. Similarly, second year total revenue was Birr 29376 which is 25.2% of the overall total revenue. This shows the second year revenue was 49.6% less than the second year revenue showing that the herbal yield of spear mint declines from year to year. Moreover, the overall total revenue was Birr 117366.

Finally, the cultivation of spear mint for herbal production provides a net return of 52180.15 and 7428.48 birr /ha in the first and second year of production respectively. In addition to this, the overall net return obtained from cultivation of spear mint was Birr 59608.63 indicating that involvement in cultivation of spear mint generates a positive net return.

Table 2: Costs and returns of Spear mint cultivation for herbal production

Items	Economic life (Years)					
	1			2		
Fixed cost:	Unit charge (Birr)	Frequ ency	Sub-total Cost (Birr)	Frequ ency	Sub-total Cost (Birr)	Total Cost (Birr)
Rental value of tractor (For Plowing and disking)	1700	1	1700		0	1700
material cost:						
Seedling @ 90 kg per ha	10	1	900		0	900
Urea fertilizer @ 50kg per ha	8.4	6	2520	4	1680	4200

Labor (in man-days) for:						
land preparation @ 48 man-days per ha	14.7	1	705.6		0	705.6
seedling preparation and planting @ 90 man-days per ha	14.7	1	1323		0	1323
Watering @ 20 man-days per ha	14.7	9	2646	6	1764	4410
Weeding and hoeing @ 36 man-days per ha	14.7	11	5821.2	10	5292	11113.2
Harvesting @ 40 man-days per ha	14.7	6	3528	4	2352	5880
Leaf separation @ 120 man-days per ha	14.7	6	10584	4	7056	17640
Fertilizer application @ 16 man-days per ha	14.7	6	1411.2	4	940.8	2352
Total cost			31139		19084.8	50223.8
Miscellaneous cost (15%)			4670.85		2862.72	7533.57
Overall total cost			35809.85		21947.52	57757.37
Herbal yield(kg/ha)			29330		9792	39122
Total Revenue @ 3 birr/kg			87990		29376	117366
Net return from Spear mint cultivation			52180.15		7428.48	59608.63

Source: field data, 2010-1012

3.3. Financial Feasibility

The financial feasibility was worked out by comparing costs and returns over the economic life of spear mint in terms of net present value (NPV) and benefit cost ratio (BCR). For this purpose the market interest rate was used to calculate the discount factor which is 8.5%. Based on this, as presented in Table 3, the NPV was Birr 54402.46 indicating that investing on spear mint cultivation for herbal production is financially acceptable. Similarly, the BCR was 2.05 showing that a 1 birr investment in spear mint cultivation results 2.05 birr returns. This again indicates the financial feasibility of spear mint cultivation. Therefore, in both measures unless there is no alternatives which yields higher results, the decision to invest in spear mint cultivation for herbal production is financially acceptable.

Table 3: Results of financial feasibility analysis

Items	Year		Total
	1	2	
Total cost	35809.85	21947.52	57757.37
Total revenue	87990.00	29376.00	117366.00
Discounted total cost	33004.47	18643.44	51647.91
Discounted total revenue	81096.77	24953.60	106050.37
		NPV	54402.46
		BCR	2.05

4. CONCLUSIONS AND RECOMMENDATION

Cultivation of spear mint for herbal production yields a positive net return which is 59608.63 birr/ha. Therefore, the plant can be seen as an alternative source of livelihood in the rural areas of Ethiopia.

In spear mint cultivation, cost of labor for major operations takes the largest share of the total cost which is 75.2%. Hence, means has to be devised to reduce the cost of labor specifically in leaf separation so that the net return will be improved.

Though, the essential oil of spear mint is among the top 20 marketable essential oils of the world, the market situation in Ethiopia is low. Therefore, strengthening the linkage between different stakeholders is very important to create sustainable and favorable market condition for the product.

Even if spear mint has a perennial nature, it can be cultivated as an annual crop in the case of the study area because the output shows a reduction of 66.6% from first year to second year.

Finally, the results of financial feasibility analysis indicate that decision to invest on spear mint cultivation for herbal production is financially acceptable.

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