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Experimental Study on Cost Benefit Analysis of Lemon Verbena (Lominat) Cultivation for Herbal Production: The Case of Wondo Genet District, Southern Ethiopia

Guta Bukero* Muluken Philipos
Agricultural Economics Research Process, WGARC
P.O.Box , 198 Shashemene, Ethiopia

Abstract
Even though, herbs had been valued for their medicinal, flavoring and aromatic qualities for centuries, the synthetic products of the modern age surpassed their importance, for some time. Never the less, the blind dependence on synthetics is now over and people are turning their face to the naturals with hope of safety and security. In Ethiopia however, other than the traditional aspect, the scientific aspect of Lemon Verbena is not well known and documented, as a result nothing is known about the cost, benefit and profitability of Lemon verbena cultivation for herbal production. Therefore Wondo genet agricultural research center has undertaken cost and benefit analysis for aloysia triphylla at wondo genet experimental site. The selected herb was planted based on the recommended spacing at wondo genet experimental site and the required data was collected. For the analysis net return to land (dollar/ha) was used as a parameter. The analysis shows that the selected herbal plant provides the net return, net present value (NPV) and Benefit-Cost Ratio (BCR) of 12828.5$/ha, 10043.6 and 0.2 at fresh bio mass price of 0.4$/kg respectively.
Keywords: Aloysia Triphyla, Benefit, BCR, Cost and NPV

1. INTRODUCTION

The herbal products nowadays symbolize safety in contrast to the synthetics that are regarded as unsafe to human and environment. Ethiopia is remarkably rich in its biological, ecological and landscape diversity and is home to outstanding natural bio-resources. The flora of Ethiopia is estimated to be between 6,500 and 7,000 species, of which 10-12 percent is considered to be endemic making the country one of the most diverse floristic regions in the world. Even though, there are a large number of herbs and aromatic plant species ranging from 600-1000, it is very hardly possible to get the exact production areas covered by herbs and aromatic plants due to lack of comprehensive assessment studies for estimation of herbs and aromatic plants production potentials and its costs and benefits in Ethiopia.

Basing on the available data from some parts of Oromia region, Amhara and SNNPRS, there is a total of 134,541.97 ha area are covered by herbs and aromatic plants. Though, herbs had been valued for their medicinal, flavoring and aromatic qualities for centuries, the synthetic products of the modern age surpassed their importance, for some time. Never the less, the blind dependence on synthetics is over and people are returning to the naturals with hope of safety and security. Traditional medicinal systems are continuing to be widely practiced on many areas of the world. Population increase, insufficient supply of drugs, costly treatments, side effects of several allopathic drugs and development of resistance to currently used drugs for infectious diseases are the main reasons for the increased emphasis on the use of plant materials as a source of medicines for a wide variety of human ailments *(*Joy, P.P., Thomas, *et al*, 2001). Aromatic herbs are plants that have odorous volatile substances that occurs as essential oil, balsam, gum exudates and oleoresin in part or all, namely, root, wood, bark, stem, foliage, flower and fruit.

Overall, the main benefits expected from organic aromatic farm include better prices, higher yield from improved agricultural technologies and a market access for produce. The agenda for support of organic over conventional agriculture in developed economies rests on its theorized positive environmental effects like on biodiversity, input-output balances, and soil and water resources), high quality products and lower risk of contamination with pesticides, and comparable income generated which establish it as a clear profitable alternative for the latter (Haring *et al.*, 2001). In many developing countries on the other hand, organic agriculture has been promoted by NGOs as an appropriate technology for small scale farmers, emphasizing its low use of inputs, its independence from agro-business, its care for natural resources rather than market potential, its ability to increase incomes in the agriculture sector, and lately, its economic sustainability according to the UNEP-UNCTAD (2008). The importance of justification for these activities is that organic agriculture is important for environmental conservation; it is also low cost and capable of generating comparable or even higher incomes to producers than traditional or conventional agriculture system.

According to (LEISA, 2008; UNEP-UNCTAD, 2008), the merit of taking into account specific market, ecological and institutional situations when implementing or introducing organic principles in an area need to be recognized. These have direct importance for the relative values of the main variables like production costs,

yield/output, incomes, and prices under different conditions. These variables require independent assessment on a case by case basis if their values and inter-actions are to be captured for a particular organic farming implementing area. Wando genet agricultural research center is therefore, one of the centers of Ethiopian institute of agricultural research which is mainly responsible in doing research, promoting and coordinating aromatic, medicinal and bio energy plants at national level including other research activities on soil and water, livestock, forestry, and other food crops addressing problems related to this field.

1.2 Beneficiaries and world production of *Aloysia Triphyla*

Aloysia Triphylla family *Verbenacea* is a green leaf that can be used fresh or dried is a long, pointed herb. It also can be used whole or chopped. The dried form retains its flavor well while the fresh has a strong, lemon-lime-like flavor with a fruity and penetrating aroma. It is indigenous to Central and South America and is cultivated in Latin America, France, China and Algeria. There are many species of Lippia (species of Lemon verbena) in Latin America and Africa such as Mexican oregano and Ethiopian Koseret (http://theepicentre.com/spice/lemon-verbena/). *Aloysia triphylla* is named after Maria Louisa (Aloysia is thought to be a derivative of Louisa) the princess of Parma and wife of King Carlos IV King of Spain. Triphylla refers to the placement of the leaves (phylla) are arranged in whorls of three (tri). (http://www.mountainvalleygrowers.com/alotriphylla.htm)

1.2.3 Commercibility of Medicinal and Aromatic plant in the world

In the period from 1991 to 2003, the reported average annual global exports of medicinal and aromatic plant material reached on average to 467,000 tones, or approximately € 1.06 billion. The herbs international trade was dominated by only a few countries: of which 80% of the worldwide imports were channeled to just only 12 countries. Three international trade centers for botanicals could be recognized: the USA for North and South America, Hong Kong for Asia, and Germany for intra- European trade. On the other hand, Europe was responsible for one third of the annual global imports. Similarly, Germany accounted for 12% of the total, and four other EU countries (France, Italy, the Unit United Kingdom and Spain) were among the major importers. In these countries, the raw material was mainly processed in each country's industry, and then sold as finished products either on the domestic market or exported reported by (CBI market survey 2008).

1.2.3.1 World Market trend of Herbal Medicines

Due to importance as antioxidant, free radical scavenger, tonic, phytoestroenic, therapeutic, prophylactic and other useful physiological properties of various foodstuffs or medicinal and aromatic plants, major food companies are investing in the field of nutraceuticals or functional foods. In the year 2001, the global market for dietary supplements was at $ 50.6 billion. The largest market was North America with sales to the tune of $ 16.3 billion, followed by Europe ($ 15.0 billion) and Asia ($ 7.8 billion). Japan was the 4th largest market in total sales with $ 7.2 billion. Herbals/Botanicals market had a share of $ 19.6 billion (39% of total sales) and was as big as the Vitamins and Mineral Supplements (VMS) market (Grünwald and Herzberg, 2002). The herbal supplements market is experiencing some problems due to insufficient raw material supply. This causes a fall in the quality of most products. Negative mass media coverage and loss of consumer confidence seem to be the main factors affecting the growth of herbal supplements market. Although the European market is also affected by the current situation in USA, the market growth rate was estimated at around 6% for 2002. This was attributed to the strong growth of the market in South America and Asia. The global growth rate was estimated at 8.7% (Grunwald and Herzberg, 2002).

2.1 Objectives:

1. To identify the costs and returns of Lemon verbena cultivation.
2. To provide information on costs and returns of Lemon verbena cultivation

3. METHODOLOGY

3.1. Description of Study Area

The analysis was conducted at Wando Genet agricultural Research Center which is one of the centers of Ethiopian institute of agricultural research and is found in SNNPRS, in Sidama zone wondo genet woreda. It is situated about 268km south of Addis Ababa and 14 km south east of shashemene. Its geographical location and altitude ranges from 38^{o} 37'13"-38^{o} 38'20" East and 7^{o} 5'23"-7^{o} 5'52" North and 1760-1920 masl respectively. The center has been doing research activities on aromatic & medicinal plants and other crops, soil and water, livestock and forestry with focus on Aromatic and medicinal plants (Adugna *et al* 2010).

3.2. Experimental Data Collection and Analysis Method

The study was conducted at Wando Genet Agricultural Research Center (WGARC), Southern Nations Nationalities and peoples region, Ethiopia in the Aromatic and Medicinal plants experimental field. Planting material used in the study was slips of *Aloysia Triphylla.* The planting material was planted on an area of $100m^{2}$

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 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 summing up 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 lemon verbena for herbal production, simple cost accounting method was used and the summary measure followed 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, for this reason, the price was set based on cost plus price pricing method (Hassen N. and Muluken P.2014). 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 included net present value and benefit - cost ratio (Abol Ardalan, 2000). 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: Total

Revenue=Q * Price ……..……...……..... (i)

Where

Q: Total yield of fresh herb in kg

P: Selling price per kg of fresh herb market

TC=CPD+CM+CL+MC…….……..... (ii)

Where TC: Total Cost

C_{PD}: Cost of /first Plowing and disking

MC: Material Cost (Seedling and Fertilizer)

LC: Labor cost (For major farm operations).

NR=TR-TC…..…… (iii)

Where NR: Net return

TR and TC are as defined above.

NPV== $\sum_{i=0}^{t}(Bt/1+r)$ - $\sum_{i=0}^{t}(Ct/1+r$)……(iv)

Where NPV: Net Present Value

B_t: Benefits at time t

C_t : Costs at time t

t: Time in years

r: Discount factor

After having the value of NPV, the decision was: a NPV greater than zero indicates that investing on *Aloysia Triphylla* 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.

$BCR = \sum_{i=0}^{t}(Bt/1+r)/\sum_{i=0}^{t}(Ct/1+r)$ ……...…….(v)

Where BCR: Benefit Cost Ratio

B: Benefits at time t

Ct: 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 *Aloysia Triphylla* cultivation for herbal production is feasible, and a value of less than one show it is not feasible.

3. RESULTS AND DISCUSSION

3.1 Yield of lemon verbena

As indicated in the table 1, the bio mass yield of Lemon verbena harvest fluctuates seasonally. It increases till the second harvest and then falls in the third while then increases up to the fifth and starts to fall. The first harvesting time after planting for Lemon Verbena was after 4.5 months and the rest consecutive harvests were made after 2.5 months.

Table 1 Quantity and frequency of harvest for lemon verbena (per ha for 3 years)

Frequency	Quantity of harvest (in kg)
1st	2100
2nd	5400
3rd	3900
4th	4000
5th	7000
6th	6100
7th	6050
8th	5700
Total Yield in kg	40250

Source: field data, 2011/12/13

3.2 Variable costs and their quantification

Due to variation in aromatic and medicinal crop type, geographical or ecological location, land tenure system, farming system and infrastructure, the components or categories of production and investment costs used in the analysis require further explanation. The main cost categories considered are the recurrent costs of ploughing / harrowing, planting, weeding, pruning / thinning, harvesting, post-harvest handling, as well as non-recurrent cost for farm equipment. These are discussed in turn.

3.3 Ploughing and harrowing lemon verbena

Ploughing and harrowing is normally required for land clearance purposes, and entails the use hiring of tools and labor (normally in a team of contractors). This cost is incurred in the form of using hired labor during 2011/12/13. This related to newly opened-up rented land.

3.4 Planting cost of lemon verbena

In almost all cases seedlings (plants) are prepared using polytune (plastic bag) tube rather than using seed directly for cultivation. This cost is incurred only once since the nature of the aromatic plant is perennial.

3.4.1 Weeding/hoeing cost of lemon verbena

Weeding/hoeing occurred for all seasons but more during rainy season than dry. The cost for weeding and hoeing may varies with varying environment.

3.4.2 Watering cost of lemon verbena

The watering cost for Lemon verbena was another higher cost incurred mostly during dry season as this aromatic plant can't withstand moisture stress area. This aromatic crop needs irrigation during the dry season.

3.4.3 Harvesting cost of lemon verbena

The harvesting and transportation cost is another parameter that was taken in to consideration. When farms are far away from homesteads, the cost of transporting the harvest is paid separately from picking cost. Hired labor for this activity is thus costly.

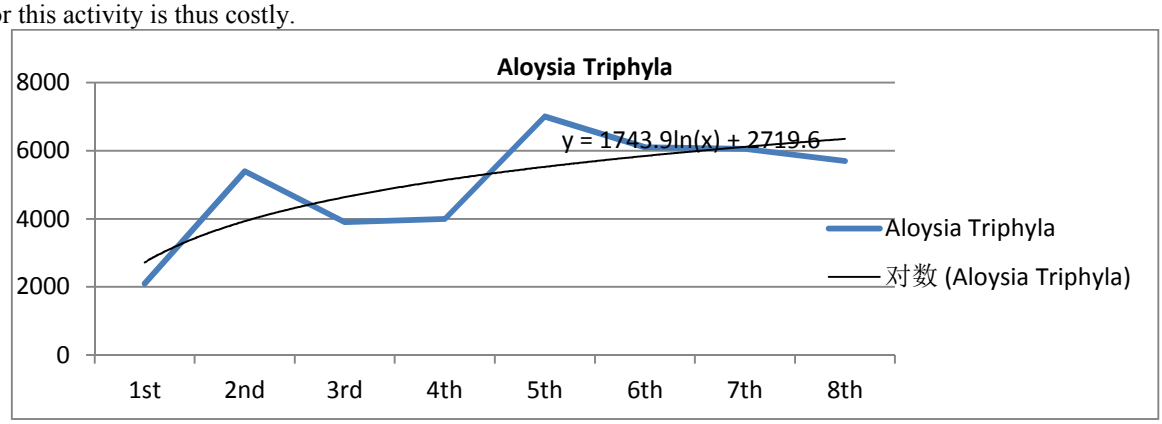

Figure 1: Frequency and Trend of fresh biomass yield of Aloysia Triphyla

Table 2 Costs and Return from Lemon Verbena Cultivation (in $)

Total cost of herbal cultivation	1263.3	758.4	823.1	2844.7
Contingency/ miscellaneous cost (15%)	189.5	113.8	123.5	426.7
Overall cost of herbage cultivation	1452.8	872.2	946.5	3271.5
Herbal yield (kg/ha)	651.4	977.1	671.4	2300.0
Total value	4560.0	6840.0	4700.0	16100.0
Net return from herbage cultivation	3107.2	5967.8	3753.5	12828.5
BCR	3.1	7.8	5.0	4.9
NPV	2432.7	4672.3	2938.6	10043.6

NB: fresh biomass of price 0.4$/kg Source: field data, 2011/12/13

From the table we can observe that Lominat (aloysia triphyla) provides net return of 12,828.5$ at bio mass price of 0.4$. On the other hand, of the different costs of cultivating this herb, weeding and hoeing cost share the largest production cost (on average 33.8% of the total production cost) in the case of Wondo Genet Agricultural Research Center. But this may vary from place to place depending on the severity of weed in the area.

The cost-benefit analysis was done to measure the profitability of these selected aromatic herbs prioritized for expansion in Ethiopia. To measure the profitability, the total cost of production (which includes cost of land preparation, seedling preparation and planting, watering, weeding and hoeing , harvesting, fertilizer and fertilizer application and other were recorded and deducted from the total benefit obtained from a hectare of land. Even if these aromatic herbs are perennial, they can be cultivated as annual crops because their biomass decreases at an increasing rate after four successive harvests.

Table 3: Costs and Returns from cultivating Lominat/Lemon Verbena/ in USD($)

Particulars	**Economic life (in year)**			**Sub total**
	1	2	3	
Fixed cost:				
Rental value of tractor	97.1	0	0	97.1
material cost:	0	0	0	0
Seedling cost	111.2	0	0	111.2
Fertilizer cost	120	120	120	360
Labor charge for:	0	0	0	0
land preparation	52.1	0	0	52.08
seedling preparation and planting	81.5	0	0	81.5
Watering	283.9	329.3	525	1138.2
Weeding and hoeing	485.5	283.9	164.6	934.08
Harvesting	15.1	15.1	6.7	37
Leaf separation	16.8		6.7	33.6
Total cost of herbage cultivation	1263.3	758.4	823.1	2844.7
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4. CONCLUSIONS AND RECOMMENDATION

Even though the price of this aromatic herb is not set by the market, at the current price it is profitable. The major production cost for this aromatic herb is weeding and hoeing but it may vary from place to place. It is too difficult to study profitability comparison between this selected aromatic herb and major crops grown around the area (Wondo and Wondo Genet) because of price fluctuation for those major crops due to their market existence.

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