

# Investment Opportunities in Ethiopia: The Case of Financial Feasibility of Rosemary Production

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[Exchange rate= 1USD=54 ETB]

## Abstract

This study was conducted at Wondo Genet Agricultural Research Center experimental field from January 2018 to March 2021. The study was undertaken to examine the financial feasibility of WG-Rosemary-III rosemary variety for fresh herb production and WG-Rosemary-II rosemary variety for dry herb production. For this study, both rosemary varieties were planted on 100m<sup>2</sup> areas of land with an intra and inter-row spacing of 60cm. All cost and benefit data were collected during the cultivation period by preparing data collection sheets. The study utilized financial analysis methods such as net present value (NPV) and benefit-cost ratio (BCR) to analyze the feasibility of their production. The study found that the net present value of production of WG-rosemary-III for fresh herb was birr 1,599,641.65 per hectare in its entire three years course of cultivation, which indicates that its production is financially feasible. The benefit-cost ratio of production of WG-rosemary-III for fresh herbs was birr 7.11 per hectare, which indicates that a 1 ETB outlay for this rosemary production results to gain a net return of birr 6.11 per hectare. Besides the net present value of production of WG-rosemary-II for dry herb was birr 897,179.46 per hectare in its entire three years course of cultivation, which indicates that its production is financially feasible. The benefit-cost ratio of production of WG-rosemary-II for dry herbs was birr 4.01 per hectare, which indicates that a 1 ETB outlay for this rosemary production results to gain a net return of birr 3.01. The aforementioned results indicate that the production of these rosemary varieties is profitable.

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## 1. Introduction

Rosemary (*Rosmarinus Officinalis*) is a perennial aromatic plant of the Lamiaceae family. It's an evergreen shrub with an intense pleasant smell reminiscent of pine wood. Rosemary is cultivated mainly in Mediterranean countries (Porte et al. 2000; Flamini et al., 2002). Rosemary is used as food flavorings, in culinary, cosmetics, and medicinal products due to the presence of valuable bioactive phytochemicals, flavors, and pigments (Ali et al., 2020; Celiktas et al., 2007, Jemia et al., 2013; Ribeiro et al., 2016). It has been traditionally used as a carminative, antispasmodic, painkiller, and circulatory tonic, to stimulate hair growth and improve memory dysfunction (Kuhn and Winston, 2000; Okoh et al., 2011). In the Kurdistan region and Iraq, Rosemary has been widely used in the form of tea for headache, blood circulation, and memory improvement as well as in manufactured products and as an ornamental plant (Ahmed, 2016). Rosemary is accompanied by several biologically active molecules that lead to producing pharmacological effects, such as anti-inflammatory (Altinier et al., 2007), antitumor (liver, breast, prostate, lung, and leukemia cancer cells (Visanji et al., 2006), antimicrobial and antioxidant (Karadag et al., 2019), anti-proliferation, and protective, inhibitory and attenuating activities (De Oliveira et al., 2017). Rosemary is used as a ground cover and garden plant due to its attractiveness and pleasant aroma. It can be planted as a hedge. It is a good source of nectar for bees and is used as an insect repellent and in some cases used as a holiday pot plant at Christmas. Moreover, the fresh and dried leaves of rosemary and its essential oil have several uses (German et al., 2016). Due to its high content of essential oils rosemary has been suggested to increase blood circulation, improve digestion, enhance memory and activate the immune system (Begum et al., 2013).

The two basic forms of culinary herbs of rosemary are fresh and dried. The fresh and dried herb is widely used as flavoring in many different food products on account of its powerful aromatic odor. The fresh and dried leaves of rosemary can be used as a spice or to make herbal tea for the curing of gastrointestinal disorders, pain, and inflammation-related diseases (Ahmed and Babakir-Mina, 2020). Fresh and dried rosemary leaves are used as seasonings for soups, stews, sausages, meat, fish, and poultry (German et al., 2016). Essential oils and oleoresins, obtained from the herb and the seeds of rosemary, are also used as flavors, mainly as fragrances in perfumery. The leaves have essential oils that contain tannin and resin (Angelini et al. 2003; Angioni et al. 2004; Díaz-Maroto et al., 2007).

Different rosemary types are grown in different agro-ecologies of Ethiopia and used for different purposes such as fresh leaf, dry leaf, and essential oil production. It is grown by the community and investors in several parts of the country (Kassahun et al., 2013; Banjaw et al., 2016). Although rosemary has been produced in many

parts of Ethiopia; the financial feasibility of the production of rosemary is not studied. Thus, this study is therefore to examine the financial feasibility of rosemary production at Wondo Genet.

### Objectives of the study

- To examine the financial feasibility of rosemary production
- To assess the production potentials of each rosemary variety

## 2. Methodology

### 2.1. Description of the Study Area

The study was conducted at Wondo Genet Agricultural Research Center, Sidama Regional State of Ethiopia, and was undertaken at Wondo Genet agricultural research center experimental field for three years (January 2018 to March 2021). 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.

### 2.2. Methods of data collection and analysis

The planting materials used for this study were cuttings of rosemary varieties namely WG-rosemary-II and WG-rosemary-III. The cuttings of these rosemary varieties were planted and grown at the nursery site and then transplanted to the experimental field to a 100m<sup>2</sup> area of land for each variety. The inter and intra-row spacing of both varieties was 60 centimeters. To study the costs of WG-rosemary-II and WG-rosemary-III rosemary varieties production: the amount of labor in terms of man-days for pot filling for seedlings, cutting and planting of seedlings on the pots, watering of seedlings at nursery, land preparation of experimental field, planting, watering, weeding, and hoeing and harvesting operations were recorded accordingly by preparing data collection sheets. The total labor cost was calculated by using the average wage rate of Wondo Genet's surrounding wage rates. In addition to this, the cost of polythene tubes for seedlings, and the cost of plowing was recorded. Then the total cost of production was obtained by adding all these recorded costs. To calculate revenues of rosemary production, the dry and fresh herb yields of rosemary from the experimental field were recorded. Then using the average farm gate price that was used to purchase rosemary fresh herb and dry herbs farmers, the total revenues of production of rosemary varieties were calculated. Finally, all the data were converted to a per-hectare basis for analysis. To examine the feasibility of production of WG-rosemary-II for dry herb and WG-rosemary-III for fresh herb; financial analysis methods analyzing feasibility was followed. Thus, for this study, the two discounted measures: net present value (NPV) and benefit-cost ratio (BCR) methods were employed for analyzing financial feasibility.

Using the following formulas: the Total Revenue (TR), Net Present Value (NPV), and Benefit Cost Ratio (BCR) were calculated:

#### Total Revenue (TR)

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

Where:

TR: Total Revenue

Q: Total quantity of fresh herbs and dry herbs of rosemary in kg

P: Selling price per kg of fresh herbs and dry herbs of rosemary

$$NR=TR-TC \dots\dots\dots 2$$

Where:

NR: Net return (profit)

TC: Total cost of rosemary production for fresh herbs and dry herbs

TR: total revenue of rosemary production for fresh herbs and dry herbs

#### Net Present Value (NPV)

Net present value is the difference between the present worth of the benefit stream less the present worth of the cost stream. Or it is simply the present worth of the cash flow stream.

$$NPV = \text{Present worth of benefit stream} - \text{present worth of cost stream} = PV (\text{benefits}) - PV (\text{costs})$$

mathematically, it can be shown as:

$$NPV = \sum_{t=0}^n \frac{(B_n - C_n)}{(1+r)^n} \dots\dots\dots 3$$

Where:

NPV: Net Present Value

Bn: Benefits in each year

Cn: Costs in each year

n: number of years

r: discount rate.

Using NPV values, the decision is, if NPV values are positive, indicates that production of rosemary varieties viz. WG-Rosemary-II and WG-Rosemary-III for dry herb and fresh herb production are feasible if NPV values are

negative indicating that the production of rosemary varieties is not feasible (Campbell and Brown, 2003).

**Benefit Cost Ratio (BCR)**

It is the ratio of the present worth of the benefit stream to the present worth of the cost streams, that is:

**BCR** = Sum of the present worth of benefit/sum of the present worth of costs

Mathematically, it can be shown as:

$$BCR = \frac{\sum_{t=0}^n \frac{Bn}{(1+r)^n}}{\sum_{t=0}^n \frac{Cn}{(1+r)^n}} \dots\dots\dots 4$$

**Where:**

**BCR**= Benefit-cost ratio

**Bn** = Benefit in each year

**Cn** = Cost in each year

**n** = number of years

**r** = discount rate.

Using **BCR**, the production of WG-rosemary-II for dry herbs and WG-rosemary-III for fresh herbs is feasible if the **BCR** of each rosemary variety is greater than 1. If it is less than one, it indicates that the productions of rosemary varieties are not feasible (Campbell and Brown, 2003).

**3. RESULTS AND DISCUSSION**

This section presents the results and discussion of the analysis of the data of the study. It presents the results of yield, costs, returns, and financial feasibility analysis of the cultivation of WG-rosemary-II and WG-rosemary-III rosemary varieties.

**3.1. Yield of Rosemary Production**

As presented in Table 1, the average fresh herb yield per harvest of WG-rosemary-III rosemary variety in its entire course of cultivation was 15,670 kilograms per hectare. The maximum fresh herb yield per harvest was 25,140 kilograms per hectare and harvested in the third year of WG-rosemary-III rosemary variety cultivation and the minimum fresh herb yield per harvest was 8,400 kilogram per hectare and harvested in the first year of WG-rosemary-III rosemary variety cultivation. The average fresh herb yield per harvest in the third year was 17,456.67 kilogram per hectare which is greater than the average fresh herb yield per harvest for the first and second year of its cultivation which was 8,400 kilogram per hectare and, 16,625 kilograms per hectare respectively. This implies that even though there were fluctuations in yields, the trend on average fresh herb yields per harvest of WG-rosemary-III variety cultivation per each harvesting year of did not diminish in the third year of its cultivation. Thus, this indicates this rosemary variety has the potential of producing adequate fresh herbs in its fourth year of cultivation.

Table 1: Fresh herb yield of WG-rosemary-III per harvest

Years of cultivation	Harvesting frequencies	Fresh herb yield (kg/ha)
1	1 <sup>st</sup>	8,400
2	2 <sup>nd</sup>	18,830
	3 <sup>rd</sup>	14,420
3	4 <sup>th</sup>	25,140
	5 <sup>th</sup>	11,330
	6 <sup>th</sup>	15,900
Average fresh herb per harvest(kg/ha)		15,670
Total fresh herb (kg/ha)		94,020

Source: field data, 2018-2021

As shown in Table 2, the average dry herb yield per harvest of WG-rosemary-II rosemary variety in its entire course of cultivation was 2,483.38 kilograms per hectare. The maximum dry herb yield per harvest was 3,633.12 kilogram per hectare and harvested in the second year of WG-rosemary-II rosemary variety cultivation and the minimum dry herb yield per harvest was 2,040.81 kilogram per hectare and harvested in the first year of WG-rosemary-II rosemary variety cultivation. The trend of dry herb production of WG-rosemary-II rosemary variety in years regarding average yield per harvest shows that, the average dry herb yield per harvest in the second year was 2,912.90 kilogram per hectare which is greater than the average dry herb yield per harvest for the first and third year of its cultivation which was 2,040.81 kilogram per hectare and, 2,344.56 kilograms per hectare respectively. The result reveals that the average dry herb yield of the WG-rosemary-II variety increased up to the second year of its cultivation and then it declines in the third of its cultivation.

Table 2: Dry herb yield of WG-rosemary-III per harvest

Years of cultivation	Harvesting frequencies	Dry herb per yield (kg/ha)
1	1	2,040.81
2	2	3,633.12
	3	2,192.69
	4	2,572.37
3	5	2,346.93
	6	2,114.38
	Average dry herb per harvest(kg/ha)	2,483.38
Total dry herb (kg/ha)	14,900.30	

Source: field data, 2018-2021

### 3.2. Costs and Returns of Rosemary Cultivation

To calculate the costs of production of rosemary varieties the study used: the average wage rate of Wondo Genet surrounding wage rates which were birr 140 per man days and it was used to calculate costs of daily labor, cost of polyethylene tube (roll) was birr 105.59 per kilogram at the time of establishment of nursery seedlings. In addition to this, the costs of plowing and disking as well as other input costs of rosemary production were used in the calculation of the total cost of cultivation of rosemary varieties.

As shown in Table 3, the annual total cost of the first year of cultivation of WG-rosemary-III rosemary variety for fresh herb was birr 179,874.61 per hectare which accounts for 59.02% of the entire cost of cultivation over three years. The annual total cost of the second year's cultivation was birr 60,586.37 per hectare which accounts for 19.88% of the entire cost of cultivation over three years. The annual total cost of the third year's cultivation was birr 64,308.69 per hectare which accounts for 21.1% of the entire cost of cultivation over three years. This shows that the cost of cultivation of the WG-rosemary-III rosemary variety was maximum in the first year and decreased in the second and third years of cultivation. This is because there were high initial costs in the first year such as the cost of plowing and disking, nursery costs, land preparation at the field, and cost of planting. In the three years life of WG-rosemary-III rosemary variety cultivation, the maximum cost was the cost of weeding and hoeing which was birr 81,286.80 per hectare which accounts for 26.67% of the entire cost of cultivation over three years and the minimum cost was the cost of Tractor rent for plowing and disking which was birr 3,000 per hectare which accounts 0.98% of the overall three years costs of cultivation.

The total revenue of WG-rosemary-III rosemary variety production in the first year was birr 210,000 per hectare which accounts for 8.93% of the overall total revenue of three years of cultivation. In the second year, total revenue was birr 831,250 per hectare which is 35.36% of the entire cost of cultivation over three years. In the third year, total revenue was birr 1,309,250 per hectare this accounts for 55.7% of the overall total revenue of three years of cultivation.

The cultivation of WG-rosemary-III rosemary variety for fresh herb production provided a net return of birr 30,125.40 per hectare in the first year, birr 770,663.63 per hectare in its second year, and birr 1,244,941.31 per hectare in the third year of its production. In addition to this, the overall net return obtained from cultivation of WG-rosemary-III rosemary for fresh herbs was birr 2,045,730.34 per hectare indicating that investing in the production of WG-rosemary-III rosemary variety fresh herb is profitable and its profit was attractive.

Table 3: Costs and returns of WG-rosemary-III for fresh herb production

Particulars	Economic life in years			Total
	1	2	3	
<b>A. Fixed costs</b>				
Tractor rent of plowing and disking(birr/ha)	3,000			3,000
Annual land rent (birr/ha)	8,000	8,000	8,000	24,000
<b>B. Nursery costs in birr/ha (calculated using amounts of seedlings required for 1 hectare)</b>				
Costs polyethylene tube for seedling	6,567.70			6,567.70
Labor cost of traveling soil for pots and pot filling and arranging	20,720			20,720
Labor cost of cutting and planting of seedlings on pots	10,500			10,500
Labor cost of watering seedlings	21,000			21,000
<b>C. Costs after transplanting</b>				
Costs of land preparation (plowing and leveling) (birr/ha)	5,833.80			5,833.80
Cost of planting and furrow making(birr/ha)	20,854.40			20,854.40
Labor cost of watering(birr/ha)	10,295.60	7,729.40	3,354.40	21,379.40
Weeding and hoeing (birr/ha)	41,241.20	22,254.40	17,791.20	81,286.80
Harvesting (birr/ha)	8,400	14,700	26,775	49,875
Miscellaneous costs (15%)	23,461.91	7,902.57	8,388.09	39,752.57
Total cost(birr/ha)	179,874.6	60,586.37	64,308.69	304,769.6
	1			7
Fresh herb yield (kg/ha)	8,400	33,250	52,370	94,020
Total revenue (price 25 birr/kg)	210,000	831,250	1,309,250	2,350,500
		770,663.6	1,244,941.	2,045,730.
Net return of production (birr/ha)	30,125.40	3	3	3

NB: Rosemary (fresh herb) = 25 ETB/kg

Source: field data, 2018-2021

As shown in Table 4, the annual total cost of the first year's cultivation of WG-rosemary-II variety for dry herb was birr 194,528.83 per hectare which accounts for 55.77% of the entire cost of cultivation over three years. The annual total cost of the second year's cultivation was birr 73,498.57 per hectare which accounts for 21.07% of the entire cost of cultivation over three years. The annual total cost of the third year's cultivation was birr 80,770.94 per hectare which accounts for 23.16% of the entire cost of cultivation over three years. This shows that the cost of cultivation of the WG-rosemary-II rosemary variety was maximum in the first year and decreased in the second and third years of cultivation. This is because there were high initial costs in the first year such as the cost of plowing and disking, nursery costs, land preparation at the field, and cost of planting. In the three years life of WG-rosemary-II rosemary variety cultivation, the maximum cost was the cost of weeding and hoeing which was birr 78,866.20 per hectare which accounts for 22.61% of the entire cost of cultivation over the course of three years and the minimum cost was the cost of Tractor rent for plowing and disking which was birr 3,000 per hectare which accounts 0.86% of the overall three years costs of cultivation.

The total revenue of WG-rosemary-II rosemary in the first year was birr 204,081 per hectare which accounts for 13.7% of the entire total revenue of three years of cultivation. In the second year, total revenue was birr 582,581 per hectare which is 39.1% of the overall total revenue of three years of cultivation. In the third year, total revenue was birr 703,368 per hectare this accounts for 47.2% of the overall total revenue of three years of cultivation.

The cultivation of WG-rosemary-II rosemary for dry herb production provided a net return of birr 9,552.18 per hectare in the first year, birr 509,082.43 per hectare in its second year, and birr 622,597.06 per hectare in the third year of its production. In addition to this, the overall net return obtained from cultivation of WG-rosemary-II rosemary variety is birr 1,141,231.67 per hectare indicating that investing in the production of WG-rosemary-II rosemary for dry herb has a positive net return, or in other words it is profitable and the profit was desirable.

Table 4: Costs and returns of WG-rosemary-II for dry herb production

Particulars	Economic life in years			Total
	1	2	3	
<b>A. Fixed cost</b>				
Tractor rent of plowing and disking (birr/ha)	3,000			3,000
Annual land rent (birr/ha)	8,000	8,000	8,000	24,000
<b>Nursery costs in birr/ha (calculated using amounts of seedlings required for 1 hectare)</b>				
Costs polyethylene tube for seedling	6,567.70			6,567.70
Labor cost of traveling soil for pots and pot filling and arranging	20,720			20,720
Labor cost of cutting and planting of seedlings on pots	10,500			10,500
Labor cost watering of seedlings	21,000			21,000
<b>C. Costs after transplanting</b>				
Costs of land preparation (plowing and leveling) (birr/ha)	7,233.80			7,233.80
Cost of planting and furrow making (birr/ha)	23,772			23,772
Labor cost of watering (birr/ha)	14,729.40	8,908.20	5,979.40	29,617
Weeding and hoeing ((birr/ha)	41,241.20	21,233.80	16,391.20	78,866.20
Harvesting (birr/ha)	8,779.40	15,458.80	27,416.20	51,654.40
Cost of leaf separation from its stem(birr/ha)	3,612.00	10,311.00	12,448.80	26,371.80
Miscellaneous costs (15%)	25,373.33	9,586.77	10,535.34	45,495.44
	194,528.8			
Total costs (birr/ha)	3	73,498.57	80,770.94	348,798.34
Dry herb yield (kg/ha)	2,040.81	5,825.81	7,033.68	14,900.30
Total revenue (price 100 birr/kg)	204,081	582,581	703,368	1,490,030
		509,082.4	622,597.0	1,141,231.
Net return of production (birr/ha)	9,552.18	3	6	67

NB: Rosemary (fresh herb) = 25 ETB/kg

Source: field data, 2018-2021

### 3.3. Financial feasibility of Rosemary production

The financial feasibility of rosemary production was investigated by using investment analysis criteria. Among the criteria, the net present value (NPV) and benefit-cost ratio (BCR) were utilized to analyze the feasibility of the rosemary varieties for their dry and fresh herb production. The average market interest rate of 10% was used to calculate the discount factor.

As shown in Table 5, the net present value (NPV) of WG-rosemary-III rosemary variety for fresh herbs production was birr 1,599,641.65 per hectare which is positive. Thus, this indicates that investing in WG-rosemary-III rosemary variety for fresh herb production is financially feasible. Similarly, the benefit-cost ratio (BCR) of WG-rosemary-III rosemary variety for fresh herb production was ETB 7.11 per hectare which is greater than 1; indicating that a 1 ETB investment in WG-rosemary-III rosemary variety cultivation gives a net benefit of ETB 6.11. The result revealed that in both feasibility measures investing in WG-rosemary-III rosemary variety for fresh herb production is financially feasible.

Table 5: financial feasibility analysis of WG-rosemary-III for fresh herb production

Particulars	Economic life in years			Total
	1	2	3	
Total revenue (ETB/ha)	210,000.00	831,250.00	1,309,250.00	2,350,500.00
Total cost (ETB/ha)	179,874.61	60,586.37	64,308.69	304,769.67
Discounted total revenue (ETB/ha)	190,909.09	686,983.47	983,658.90	1,861,551.47
Discounted total costs (ETB/ha)	163,522.37	50,071.38	48,316.07	261,909.82
NPV				1,599,641.65
BCR				7.11

Source: field data, 2018-2021

As shown in Table 6, the net present value (NPV) of the cultivation WG-rosemary-II rosemary variety for dry herb was birr 897,179.46 per hectare which is a positive number. Thus, this indicates that investing in WG-rosemary-II rosemary variety for dry herb production is financially feasible. Similarly, the benefit-cost ratio (BCR) of WG-rosemary-II rosemary variety for dry herb production was ETB 4.01 which is greater than 1; indicating that a 1 ETB investment in WG-rosemary-II rosemary variety cultivation gives a net benefit of ETB 3.01. The

result revealed that in both financial feasibility measures investing in WG-rosemary-II rosemary variety for dry herb production is financially feasible.

Table 6: financial feasibility analysis of WG-rosemary-II for dry herb production

Particulars	Economic life in years			Total
	1	2	3	
Total revenue (ETB/ha)	204,081.00	582,581.00	703,368.00	1,490,030.00
Total costs (ETB/ha)	194,528.83	73,498.57	80,770.94	348,798.34
Discounted total revenue (ETB/ha)	185,528.18	481,471.90	528,450.79	1,195,450.87
Discounted total costs (ETB/ha)	176,844.39	60,742.62	60,684.40	298,271.41
	NPV			897,179.46
	BCR			4.01

Source: field data, 2018-2021

## CONCLUSION AND RECOMMENDATION

This study analyzed the costs and benefits of WG-rosemary-III rosemary variety for fresh herbs and WG-rosemary-II rosemary variety for dry herb production at Wondo Genet, Sidama regional State of Ethiopia. The objective of this study was to analyze the financial feasibility of rosemary varieties for fresh herb and dry herb production at Wondo Genet. The study has been conducted at Wondo Genet Agricultural Research Center for three years. During the period of cultivation, data was collected accordingly from the experimental site. Based on this the costs, benefits, and financial feasibility of the production of rosemary varieties were analyzed. The results of the study revealed that the production of the WG-Rosemary-III variety for fresh herbs and the WG-rosemary-II variety for dry herbs are financially feasible or in other words their production is profitable. Therefore, the production of WG-rosemary\_III for fresh herbs and WG-rosemary\_II for dry herbs is an important alternative to generating additional income as well as diversifying sources of income for producers in rural areas. Production of rosemary varieties was found to have a positive net return and was financially feasible and the profit was too attractive to stakeholders who want to engage in rosemary production. As a result, further scaling up of production of rosemary technology through awareness creation and training for farmers, and investors by extension agents and other concerned government officials will help to gain additional income and improve the well-being of households.

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