ROSEMARY GROWER'S MANUAL

Scientific name: Rosmarinus officinalis

Common name: Rosemary



1.0 Introduction

Rosemary *(Rosmarinus officinalis)* is a perennial herbal plant of the *Lamiaceae* family, native of the Mediterranean countries. It's an evergreen shrub with an intense pleasant smell planted for its usefulness in culinary, food flavourings, oil, cosmetics, pigments, and as an ornamental crop. The medicinal herb is highly demanded for its nutritional and health benefits including minerals, antioxidants and ant-inflammatory properties. In Kenya, rosemary farming has gained an increasing popularity due its high demand for both local and international markets.

1.1 Varieties grown in Kenya

The varieties to grow should be guided by a market survey finding. However, in Kenya the most popular rosemary varieties are;

Tuscan Blue: This variety has dark green leaves and blue flowers. It is a vigorous grower and can reach a height of up to 6 feet.

Arp: The Arp variety is a hardy plant that is resistant to cold temperatures. It has gray-green leaves and pale blue flowers.

Salem: The variety has dark green leaves and blue flowers. It is a slow grower and is ideal for cultivation in small gardens.

Barbeque: The variety has dark green leaves and blue flowers. It is a compact plant that is ideal for container gardening.

1.2 Counties where grown

Rosemary farming is a profitable venture that can be carried out in various agroecological zones of the country. The counties leading in production of rosemary are: Meru, Kiambu, Nakuru, Kajiado, Muranga, West pokot, Embu, Narok, Vihiga, Mandera, Homabay, Kisumu, and Kakamega.

1.3 Ecological conditions

The optimal growth for rosemary occurs at altitudes ranging from 1200-2400 meters above sea level with ideal temperatures ranging between 15-30°C under full sunlight. The herb prefers sandy loamy soils that are well drained with a pH of 6.0-7.0. Poorly drained soils can lead to root rot, a common problem encountered in rosemary farming.

2.0 Good Agricultural Practices (GAP)

Horticulture industry in Kenya is guided by a code of practice KS1758 which is a standard for flowers, vegetable, fruits, herbs and spices for both local and export market. The standard aims at ensuring food safety, environmental sustainability and social accountability by following good agricultural practices from production, processing, transportation and marketing of fresh produce.

The manual seeks to adopt climate smart technologies aimed at increasing production and productivity, enhancing resilience and reducing greenhouse gas (GHG) emissions.

2.1 Crop establishment

It is important to prepare a planting calendar based on market survey which will guide on when to cultivate, varieties, quality and quantities required.

2.1.1 Land preparation

Clear the land of any weeds, rocks, or debris that may interfere with the planting process. The land should be leveled and well-drained to prevent water-logging, which can cause root rot and other soil-borne diseases.

2.1.2 Soil and water testing

The testing is recommended before planting to guide on fertilizer and manure application and water suitability for irrigation.

The first step in soil preparation is to conduct a soil test to determine the soil's pH and nutrient levels. This will help determine the necessary amendments needed to improve the soil's fertility. A soil test should be conducted at least six months before planting to allow for adequate time for soil amendments.

2.1.3 Manure application

After clearing the land, organic matter such as compost or well-rotted manure should be added to the soil (15-20 tons per ha). This helps to improve soil structure, fertility, and water-holding capacity. The organic matter should be evenly spread across the land and mixed into the soil to a depth of at least 12 inches.

2.1.4 Beds preparation

Prepare raised beds for planting rosemary. This enhances drainage and prevents root rot problems. The beds should be 1-2 meter in diameter with paths of 40 cm between the beds.

2.1.5 Planting and Spacing

Sourcing of planting materials should be from certified sources or registered stockists. Rosemary can be propagated from seeds or cuttings. However, propagation from cuttings is termed to be faster and more reliable than that of seeds. One can either buy the seedlings or make their own. Cuttings can be taken from young shoots of mature rosemary plants and should be at least 4-6 inches long. Cuttings should not be derived from woody stems. The cuttings should be planted in well-draining soils and kept moist until they have developed roots. One can use rooting hormone to quicken root establishment.

Once the seedlings have established the roots, transplanting should be done at a spacing of 50 cm between the plants and 70cm between rows. The spacing is ideal to ensure air circulation and reduces the risk of diseases.

70 cm	50	cm	•	•	•	•	•	•	•	•
40 Pa	cm th									
	٠	٠	٠	٠	٠	•	٠	٠	•	٠
	٠	٠	•	٠	٠	٠	٠	•	•	•

Fig1: Illustration of spacing for rosemary

2.2 Crop management

2.2.1 Crop water requirement

The crop water requirement is determined by the stage of the crop, soil type and prevailing climatic conditions.

Rosemary requires moderate rainfall, because too much water causes the root rot disease leading to death of the crop. Irrigation is necessary especially in dry seasons to ensure roots are well established in the soil. Water should not stagnate in the field and should be drained out in case of water-logging.

2.2.2 Crop nutrition

Farmers are required to do a soil analysis which serves as a base for coming up with a fertilizer program. Manure and fertilizers should be applied based on soil test results.

Apply farmyard manure at a rate of 20 tons per acre during land preparation to improve soil structure and provide nutrition. Manure application can be repeated annually especially after pruning, at a rate 10-15 tons per acre. For organic farmers, during this stage, you can use organic options like compost or well-rotted manure to promote healthy growth as you enhance foliage production. For farmers farming inorganically, you can apply balanced NPK fertilizers at planting and top dress with nitrogen-rich fertilizers during the growing season.

2.2.3 Mulching and weeding

After planting, the land should be mulched to conserve soil moisture and suppress weed growth. Some farmers use cheap mulch such as organic materials such as hay or straw. A layer should be at least 2-3 inches deep and placed around the base of the plants, taking care not to cover the leaves or stems. One can also use mulching films which are laid on the soil surface to provide a protective barrier that benefits crops and soil health. Typically, the films are made from polyethylene or biodegradable materials, and come in various colour, thicknesses, and sizes to suit different farming needs.

Although mulching reduces weed prevalence's, it is important to maintain a clean farm free of weeds to avoid alternative hosts of pests.

2.2.4 Pinching

Pinching should be done 3-4 weeks after transplanting when plants achieves the height of 20 cm to encourage lateral branching.

2.2.5 Pruning

Pruning rosemary is necessary to shape its growth after the plants are mature and at flowering stages. Rosemary responds well to pruning, but don't prune off more than a third of the plant at a time, as this can stress the shrub and leave it vulnerable to diseases and pests.

2.2.6 Pest and Disease Management

Integrated crop management (ICM) is the best option for food safety. These practices include scouting of pests, field hygiene, proper spacing, physical methods, and biological methods like use of pheromone traps and others that will only give option of using Pest Protection Products as last option. The products must be registered for use on the crop in Kenya(www.pcpb.go.ke/list-of-registered-products/).

Rosemary has insect-repelling properties that make it an effective natural pest control agent. However, Rosemary crop is vulnerable to spider mites, mealy bugs, whitefly and thrips. Major diseases affecting rosemary include; powdery mildew and root rot.

To manage pests and diseases in your rosemary farm;

- Plant disease-resistant varieties: Choose rosemary varieties that are resistant to common diseases in your area.
- Rotate crops: Avoid planting rosemary in the same area year after year. This can help reduce the build-up of soil-borne diseases and pests.
- Monitor for pests: Regularly check your rosemary plants for signs of pest infestation such as damage to leaves, stems, or flowers, or the presence of eggs or larvae. Early detection is important for effective pest management.
- Use natural predators: Introduce natural predators such as ladybugs or lacewings to control pest populations. These predators can help keep pest populations in check without the use of chemicals.
- Practice good sanitation: Keep your farm clean and remove any dead or diseased plant material. This can help prevent the spread of diseases and pests.
- Use organic pesticides: If necessary, use organic pesticides to control pest populations. These pesticides are less harmful to beneficial insects, human health and can help protect the environment.

Pest/Disease/deficiency	Symptoms/Signs	Control
Aphids (Aphis gossypii, Myzus persicae)	Aphids (<i>Aphis gossypii</i>) and the green peach aphid (<i>Myzus persicae</i>) suck plant sap, which can reduce plant growth; they also secrete honeydew, on which sooty moulds growth. Sooty mould on fruits reduces their market value.	-Conserve and use natural enemies like the Parasitic wasps, avoid use of wide spectrum pesticides since they kill natural enemies -Trap crops -Hot pepper extracts -Garlic extracts
Spider mites (<i>Tetranychidae spp</i>)	-Infested leaves turn silvery and have yellowish-brownish spots -The leaves have cobwebs and live mites on the lower leaf surface -The pest develops rapidly during warm dry	-The natural enemy <i>Phytoseilus pepersimilis</i> (predatory mite) has been very effective. mite- eating ladybug, lacewing lar vae and predatory thrips. <i>-Beauveria bassiana</i> is a type of fungus that greatly
Photo:Nature & garden.	weather	reduces red spider mite fertility and egg hatching.

Table1: Major Pests, diseases and nutrient deficiencies

	-High population causes drying and defoliation of leaves	-use essential oils to kill spider mites, such as neem, peppermint, rosemary, and others. -Bordeaux mixture is an organic pest killer.
Whiteflies (Aleurodicus disperses) Photo:TomaszKlejdysz	Whiteflies under leaf. They suck sap from the leaves, and may weaken the plants. They cause yellowing on the infested leaves	Careful and thorough monitoring, use of sticky traps as well as applying organic insecticides
Mealy bugs Fhoto: Ohishiapply	-Signs includes; white, cottony egg masses on plants, wax-covered plants, sticky honeydew, black sooty mold growing on top of honeydew or ants feeding on honeydew. -Mealybugs suck sap, weakening the plants. -High populations can slow plant growth and cause leaf drop.	-Careful and thorough monitoring -Spray with water: for lighter infestations, mealybug adults, nymphs and eggs can be dislodged with a gentle spray of water. -Introduce natural predators such as lacewings, ladybugs, parasitic wasps, minute pirate bugs, and a lady beetle -Insecticidal soap -Use neem oil
Powdery mildew (Erysiphe necator) View of the second secon	The disease occurs in warm, wet periods and is characterized by a dusting of whitish, fine spores on all parts of the plant. It is most prevalent when the humidity is high and temperatures are at 20-27°C	-Ensure proper air circulation and keep the leaves dry -Use Bio fungicides e.g. Neem extracts

		r	•
Root rot solani, citrophthora cinnamoni)	(<i>Rhizoctonia</i> <i>Phytophthora</i> <i>and P.</i>	Necrosis- terminal leaves and stems die off. This is because the roots are no longer able to uptake and	-Plant rosemary in well- draining soil and avoid over watering. -Dig up the plant and prune
Photo: Garden	ingsg	move nutrients and water to the plant.	out any infected roots and dust with fungicide powder. If the entire root system is black and mushy, carefully uproot and discard the plant.
Leaf spots (<i>F</i> spp. and Altern	Pseudomonas naria spp.)	Leaf spot is a bacterial and fungal disease that causes dark, water- soaked lesions to form on the leaves of rosemary plants. As the disease progresses, the spots may enlarge and coalesce, leading to defoliation and reduced plant vigour.	Practice good sanitation by removing and disposing of infected plant material. Avoid overhead watering to reduce leaf wetness, which can promote the spread of pathogens. Apply copper- based fungicides as a preventative measure, especially during periods of high humidity.

2.3 Harvesting

Harvesting practices can impact rosemary production per acre. Rosemary can be harvested 6 to 12 months after planting, depending on the growing conditions. Harvesting can be done year-round but the best quality is obtained before flowering. However, harvesting rosemary for the purpose of oil extraction is done at flowering stage.

2.3.1 Harvesting technique

For fresh herbs, young vegetative shoots 15-20 cm long are cut. Older shoots can also be harvested for drying. Rosemary plants can be harvested several times in a season, but they should be allowed to replace their growth between harvests. Some varieties are valued for their small flowers, which are harvested for use in salads.

2.3.2 Expected Yields

The production per acre in rosemary farming in Kenya vary depending on several factors such as the type of variety grown, the farming practices used, soil conditions, and climate. However, on average, a well-managed rosemary farm can produce up to

3-4 tons per acre of fresh rosemary leaves annually, and up to 8-10 tons after year two under optimal growing conditions.

2.4 Post-harvest handling

Packaging of harvested fruits should be done to maintain quality, preferably in crates and transported in closed trucks as per the Crops (Horticultural crops) Regulation 2020. Fresh cuttings will retain their best flavour for 2 to 7 days under refrigerated conditions. Since rosemary is a perishable leafy herb, proper after-harvest handling is very crucial for maintaining quality and increasing shelf life.

2.4.1 Cooling

After harvesting, post-harvest cooling to remove excessive field-heat aids greatly in maintaining quality and substantially lengthens the shelf-life for rosemary.

2.4.2 Sorting

Remove the diseased, deformed and poor-quality shoots.

2.4.3 Grading and bunching

Grading is done according to the various sizes. The harvested herbs are sized in 10 to 22 cm length as per customer requirement and bunched into 100 grams /

2.4.4 Packaging

The bunches are put in a polythene bag and packed into 1kg boxes for fresh rosemary. Any other type of packaging depends on the market specification.

2.4.5 Drying

Older shoots can also be harvested for solar drying and packed in air tight containers, or according to market requirements.

2.4.6 Transportation

The packed produce should be transported in closed trucks as per the crops (Horticultural crops) Regulation 2020.

3.0 Gross margin Analysis as at 2024

A. ROSEMARY PRODUTION UNDER SHADENETS

(Roll size 4m x 50m, Quality 55-60%) for 1 ACRE

- Expected yield and cost 3000kgs/acre (year 1) 4000kgs/acre (Year 2) 8000kgs/acre (Year 3-5)

Item	Quantity	Unit cost	Total Amount (Ksh.)			
			Year 1	year 2	year 3-10	
Gross Income	3,000	300	900,000	1,200,000	2,400,000	
Constant costs						
Land leasing	1	10,000	10,000	10,000	10,000	
Soil Analysis	1	2,500	2,500	0	0	
Water analysis	1	1,000	1,000	0	0	
Shade nets structures		•	•	•	•	
Shade nets rolls	25	16,000	400,000	0	0	
Insect screen nets rolls	8	12,000	96,000	0	0	
Support frame (posts, K12	1	165,000	165,000	0	0	
wire, binding wire, fitting		-				
labour)						
Irrigation systems						
Drip lines	1	160,000	160,000	0	0	
Tank Platform	1	45,000	45,000	0	0	
 Tank (10000) ltrs 	1	75,000	75,000	0	0	
 Plumbing and fitting 	1	50,000	50,000	0	0	
Bump/Solar power	1	100,000	100,000	0	0	
Charcoal cooler	1	100,000	100,000			
Subtotal (fixed cost)		736,500	1,204,500	10,000	10,000	
Variable costs						
Land Clearing (man days)	8	500	4,000	0	0	
Ploughing	1	4,000	4,000	0	0	
Manure (tons)	6	1,500	9,000	3,000	3,000	
Beds making	8	500	4,000	0	0	
Seedlings	10,000	10	100,000	0	0	
Planting labour (Man days)	8	500	8,000	0	0	
Pinching (Man days)	4	500	2,000	0	0	
Insecticides	3	2,000	6,000	6,000	6,000	
Spraying labour (man days)	12	500	6,000	6,000	6,000	
Fertlizer	6	3,000	18,000	18,000	18,000	
Fungicide	3	1,500	4,500	4,500	4,500	
Sticky Traps	20	200	4,000	4,000	4,000	
weeding (6 times) x 4-man days	6	500	12,000	12,000	12,000	
Harvesting labour (10 times) x 4-	10	500	20,000	20,000	20,000	
man days						
Crates	10	1,000	10,000	0	0	
Packaging materials	1	20,000	20,000	20,000	20,000	
Grading (10 times) x 4-man days	10	500	20,000	20,000	20,000	
Sub-total (Variable costs)			251,500	113,500	113,500	
Total cost of production			1,456,000	123,500	123,500	
Gross margin(Gross income- Tota	I production	cost)	-556,000	1,076,500	2,276,500	

Monthly profit/loss		-46,333	89,708	189,708
Production cost/kg		485	31	15

NB: Production can get to 8tons by year 2 depending on growing condition and thereafter up to 10 tons

B. ROSEMARY PRODUCTION UNDER OPEN FIELD

- Expected yield and cost 3000kgs/acre (year 1) 4000kgs/acre (Year 2) 8000kgs/acre (Year 3-5)

Item	Quantity	Unit	Total Amount in Ksh.			
		cost	Year 1	year 2	year 3-10	
Gross Income	3,000	300	900,000	1,200,000	2,400,000	
Constant costs	•		•	•		
Land leasing	1	10,000	10,000	10,000	10,000	
Soil Analysis	1	2,500	2,500	0	0	
Water analysis	1	1,000	1,000	0	0	
Irrigation systems						
Drip lines	1	160,000	160,000	0	0	
Tank Platform	1	45,000	45,000	0	0	
• Tank (10000) ltrs	1	75,000	75,000	0	0	
 Plumbing and fitting 	1	50,000	50,000	0	0	
Bump/Solar power	1	100,000	100,000	0	0	
Charcoal cooler	1	100,000	100,000	0	0	
Subtotal (fixed cost)			543,500	10,000	10,000	
Variable costs						
Land Clearing (man days)	8	500	4,000	0	0	
Ploughing	1	4,000	4,000	0	0	
Manure (tons)	6	1,500	9,000	3,000	3,000	
Beds making	8	500	4,000	0	0	
Seedlings	10,000	10	100,000	0	0	
Planting labour (Man days)	8	500	8,000	0	0	
Pinching (Man days)	4	500	2,000	0	0	
Insecticides	3	2,000	6,000	6,000	6,000	
Spraying labour (man days)	12	500	6,000	6,000	6,000	
Ffertilizer	6	3,000	18,000	18,000	18,000	
Fungicide	3	1,500	4,500	4,500	4,500	
Sticky Traps	20	200	4,000	4,000	4,000	
weeding (6 times) x 4-man days	6	500	12,000	12,000	12,000	
Harvesting labour (10 times) x 4-	10	500	20,000	20,000	20,000	
man days						
Crates	10	1,000	10,000	0	0	
Packaging materials	1	20,000	20,000	20,000	20,000	
Grading (10 times) x 4-man days	10	500	20,000	20,000	20,000	
Sub-total (Variable costs)			251,500	113,500	113,500	
Total cost of production			795,000	123,500	123,500	
Gross margin(Gross income- Tota	I production	cost)	105,000	1,076,500	2,276,500	
Monthly profit/loss			8,750	89,708	189,708	
Production cost/kg			265	31	15	

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