



**FACULTY OF AGRICULTURAL SCIENCES AND ALLIED INDUSTRIES**

**Rosemary -Importance, chemical composition ,origin, distribution, area, production, climate and soil requirements, types and varieties, propagation techniques, planting and after care, nutritional requirements, plant protection, harvesting and extraction of oil**

### **Importance and chemical composition**

- Rosemary (*Rosmarinus officinalis* L.) belonging to family Lamiaceae.

The leaves and flowering tops, on steam-distillation, yields the essential oil.

- The oil is valued for its use in culinary, medicine, perfumery and cosmetic industries.
- It is an excellent fixative material and the oil also contributes a strong fresh odour, which blends well with various other oil odours and also serves to mask the unpleasant smell of certain other ingredients in any preparation.
- Rosemary oil is known to have antimicrobial activity against certain gram-positive and gram-negative organisms.
- It is also used in formulations of compounded oils for flavouring meat, sauces, condiments and other food products.
- The leaves are used in cooking. Distilled water is obtained from the flowers which are used as a soothing eye-wash.

- The oil has 1, 8 cineole (20-50%), borneol (20%), camphor, linalool,  $\alpha$ -pinene, camphene,  $\beta$ -pinene, sabinene, myrcene,  $\alpha$ -phellandrene,  $\alpha$ -terpinene, limonene,  $\alpha$ -terpinene, p-cymene, terpinolene, thujone, copaene, terpinen-4-ol, caryophyllene, methyl chavicol,  $\alpha$ -terpineol, thymol and carvacrol.

## Origin and distribution

- It is a native of the Mediterranean regions of Europe, Asia Minor and North Africa. Rosemary is grown in Spain, Italy, France, Algeria, Morocco and Portugal for its essential oil.
- Spain has traditionally been the largest supplier of the oil, but it appears to be rapidly losing ground to Tunisia.
- The annual world production of the oil has been increasing gradually over the years and now 200-300 t of oil is being produced annually.
- In India, a negligible quantity of oil is produced.
- Rosemary is cultivated to a limited extent in the Nilgiris in South India. Its cultivation in the plains is of recent origin and now it is being cultivated in and around Bangalore on a small scale.
- The oil is comparable to the Spanish oil in quality and has been well received by the trade.

## Soil

It is a very hardy plant and is found growing on rocky terrains in the temperate parts of the world. In India, the plant comes up well on the light, loamy soils of the Nilgiris and the sandy loam soils of Bangalore. The crop requires a soil pH ranging from 6.5 – 7.0 for its successful growth.

## **Climate**

Rosemary prefers a Mediterranean type of climate with low humidity, warm winters and mild summers for its successful growth. However, any place where frost occurs frequently should be avoided as the plant is susceptible to it. The climate of the Nilgiris and Bangalore, in India, has been found suitable for its cultivation.

## **Land preparation**

The land is prepared well by repeated ploughing and harrowing. About 20 t of well decomposed FYM is incorporated into the soil at the time of the final ploughing.

## **Propagation**

### **Vegetative propagation**

It is best propagated by vegetative method by stem-cuttings. Cuttings from healthy mother-plants, 10-15 cm in length, are taken. All leaves about half of the length from bottom should be removed. The cuttings are then planted in nursery beds of sandy soil under partial shade at a depth of about 6 to 10 cm. Thereafter, regular watering and weeding is provided to the nursery for about a month. After about 6-8 weeks, the cuttings are ready for transplanting into the main field. They can also be raised in small polybags or seed-pans. This helps in easy transportation of the rooted cuttings.

### **Seed propagation**

The crop can be propagated by seeds also. The ideal season for raising the nursery is between September and November. The seeds are very small and about 0.2 to 2.5 g seeds are required to cover 1 sq. m area and are sown to a depth of 1-2 cm. After they are sown in well-prepared nursery beds, regular watering and weeding of the nursery is continued. The seeds germinate best at a soil temperature ranging from 14-15°C. When the seedlings are about 8 to 10 weeks old, they are ready for transplanting into the main field.

## **Transplanting**

Eight to ten weeks-old rooted cuttings or seedlings are planted in the main field at a spacing of 45 x 120 cm. About 20,000 plants/ha give the highest yield of oil. It is reported from the CIMAP, Lucknow, that a spacing of 45 cm x 45 cm between plants is optimum and gives the best yield.

## **Manures and fertilizers**

Prior to transplanting, 20 t of FYM, along with 40 kg of P<sub>2</sub>O<sub>5</sub>, 40 kg of K<sub>2</sub>O and 20 kg of N is applied to the soil as a basal dose. After each harvest, 80 kg/ha of N is applied in 4 equal split doses as a side-dressing to promote vegetative growth. For obtaining the highest yield, the CIMAP, Lucknow has recommended the application of 300 kg N/ha/year.

## **Irrigation**

Initially the crop is irrigated twice a week till the plants establish. Afterwards, once a

week is enough. By nature, this crop is drought-resistant and can withstand long drought periods.

## Inter-cultivation

About 5-6 cultivations between the rows and an equal number of weedings within the rows are required to keep the weeds under control.

## Pruning

After 2 to 3 years, the bushes are cut frequently to keep them from becoming leggy and to promote the formation of numerous shoots, which can be harvested for the oil.

## Pests and diseases

When the crop was introduced, there were no major pest and disease problems for this plant. But of late, blight caused by *Rhizoctonia spp.* a soil borne fungus, *Phytocoris rosmarini* and *Orthotylus ribesi* have been reported. Mancozeb (1%) can be sprayed on the crop and drenching may be done at an interval of 8-10 days to keep these diseases under control.

## Harvesting and yield

During the first year, the crop is ready for harvest 8 months after planting and only 2 harvests are obtained. In subsequent years, 3 to 4 harvests at 100 to 120 days intervals can be taken. Depending upon the exposure of the plantation, the plants start flowering earlier in warmer and low altitude areas and later on the high slopes.

Harvesting should begin at the time of 50% blossoming and continue till 75-90% inflorescence emerges and must end when the flowers have finished blossoming. The shoots are cut for distillation when they have reached their maximum size, but have not become woody. The hardwood should not be distilled as it imparts an odour of turpentine.

Essential oil is obtained by steam-distillation of the freshly harvested

herbage. The herbage can also be shade-dried, stored and distilled at convenience without any loss of oil.

The time required to distil one charge is 3 hours. Recently, the CIMAP, Bangalore, has recommended that rosemary be distilled for 2 hours for the maximum recovery of oil.

In the laboratory, the fresh rosemary leaves yield 1% and shade-dried leaves yield 3% oil. However, in field-distillation units a yield of 0.7% is considered satisfactory. About 12 to 15 t/ha/year of herbage, yielding about 85 to 100 kg of oil is obtained.