AROMATIC HERBS

by
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Department of Agriculture , Peradeniya
Ministry of Agriculture & Lands

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Extension & Training Division

Department of Agriculture

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PREFACE

The herbal plants earn global attention in agriculture programmes due to the growing demand and expanding markets for herbal products. Attempts made to identify, evaluate, and conserve herbal plants and the use of processed product of herbal plants in a meaningful way, all over the world. There is a growing interest for herbal plants and their products in Sri Lanka too.

In Sri Lanka, information on identification, cultivation, processing and storage of herbal plants are not readily available. Herbal plants were included in the secondary school curriculum. The school teachers and the students show their interest for seeking information of herbal plants from training institutes attached to the department of Agriculture. The Schools of Agriculture attached to the department of Agriculture also included medicinal plants in their curriculum recently as a new subject area in the two-year diploma course.

In this context, there is an urgent need of publications that provide useful information on identification, cultivation, processing and storage of herbal plants. Therefore, extension and training division of department of agriculture decided to collect information and publish some books on herbal plants. This book is a result of that decision.

This book released only for a limited circulation among the training staff of In-Service Training Institutes, District farmer training centres and Schools of Agriculture as a reference book. We expect to improve and up date this book in the near future. Therefore, suggestions for improvement are warmly welcome.

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Introduction

Herb

Herb is by strict definition, a non woody plant that dies down to the ground after each growing season more generally, any plant that is of use to man.

The term 'herb' in its broadest sense covers many plants grown in both the flower and vegetable gardens for medicinal and cooking purposes. Some herbs are edible as aromatic flavouring agents, spices, condiments and some are medicinal and some are for utility (bedding & clothing). Few plants have all edible, medicinal, and utility value. About 2000 natural, plants have curative properties and 1300 spices are known for their aroma and flavour.

Aromatic herbs

Aromatic herbs could be defined, in a dim way as tasty plants with strong aroma, parts of which fresh or dried whole or cut up, or crumbled, can be used in flavouring cooked dishes, or salads or sauces or drinks.

Aromatic herbs are the plants with fragrant leaves, wood, or fruits. The active principle or flavouring quality is due to the presence in the seeds or leaves of certain characteristic essential oils. The original concept of aromatic compounds as derivatives of benzene has been extended to certain other organic compounds.

Aromatic herbs are flavouring agents, and like spices they are used in cooking to season, enrich or otherwise alter the flavouring and odour of certain foods to make them more pleasing to taste and more palatable. The spices cannot be grouped as foods, as they contain less nutritive value. However they give a good flavour and aroma to food,

and add greatly to the pleasure of eating. They stimulate the appetite and increase the secretion and flow of gastric juices. For this reason they are commonly known as "Food adjuncts".

Spices

The aromatic value of the spices is due to the presence of the essential oils. Good cooks know well how they enhance the pungency of various dishes "Condiments" are spices or other flavouring substances, which possess a sharp, taste, and commonly added to food after cooking. In general, all aromatic products that are used for flavouring foods and drinks are known as "Spices". Sometimes the term "spice" is used for hard or hardened parts of plants, which are generally used in a pulverized state.

In the past the term "spice" was applied to all plants used medicinally, but today, it is customarily restricted to those plants, which produce leaves, flowers, or seeds that can be used for their flavour or fragrance. Different parts of the plants, such as the leaves, fragrant seeds, fruits, buds, bark and roots have been used for this purpose since ancient times.

Delicate cooking which demands a pinch of this or that herb for the right flavour, developed quite recently. In the past our ancestors cooked grossly, ate grossly, overloading their stomachs. So they added herbs to dishes, not only for enhancing flavour, but also as a precaution, or a remedy against the ill effects of their eating habits.

In some texts aromatic plants are referred as "Spices and condiments".

History

Man's first experience with a herb would have led to his

continuous search for herbs as food. The sampling of potential food sources must have been quite unscientific and extremely hazardous. Perhaps early man observed what animals consumed and then decided to try those plants himself. Or perhaps he just took a chance on eating plants that looked appetizing. Some primitive natural impulse that modern man has long since suppressed drove early man to seek or pick out a particular plant for consumption.

As man became more civilized, perhaps he lost some of his instinctive abilities, and he probably communicated his experiences with plants to his children and to the members of the society, say the tastiness of a particular plant or how the plant made him feel after he ate it.

As man developed written communication ability the next step naturally was to catalog his experiences in an orderly fashion for the benefit of those who were to come after. One of the earliest and best known of this work was the herbal catalog directory, encyclopedia or simply the "book on herbs" compiled by the Greek physician, Diocorides

The knowledge of herbs continued to be passed along, in many ways, first by the Romans, and then throughout Europe as Roman armies swept over the land.

Later in sixteenth and seventeenth centuries John Gerard and Nicholas Culpeper produced that two of the better-known herbals of England, respectively. About the same time Gerard's work was being released in England, a Spanish physician, Nicholas Monardes, was publishing his "Joyful news of out of the Newe Founde world" a treatise on herbs which included descriptions and tales of herbs and plants that visitors to the new world had learned about through contact with Indians. Perhaps the Shakers, who were devoted to the natural life and the natural healing properties of medicinal herbs, carried on the most extensive cataloging and use of herbs in America. The Shakers were one of the first American groups to publish a complete catalog of herbs

and they were the first to produce herbs for hospitals and pharmaceutical market.

In the East especially in India herbs have been used extensively as food, medicine, spice, etc, from time immemorial. The entire Auruvedic medical system is based on the therapeutic properties of herbs growing in the region. The healthiness of vegetarian dietetic habit originated in India.

Commercial aspects

Herbs are used in the manufacture of cosmetics and drugs and in food processing.

Cosmetics

If beauty is only skinning deep, then you obviously want to keep your skin as healthy and glowing as possible. Herbal cosmetics might be of interest but when making them use only pure ingredients

Herbs for bath

An easy way to prepare herbs for a bath is to boil the selected plants in a pot on the stove, making sure they are completely covered with water. Put the boiled water, with or without the herbs, as you may desire in to the bath or basin. This method will fill the house with a wonderful aroma. You can cut down the preparation time by simply hanging a bag of herbs under the facet. Chop, blend and mix herbs with baby oil and place in a glass jar with a tight lid. Place the mixture in the sun for two weeks, and shake it occasionally. Strain the finished mixture and use in your bath. This is a wonderful application for the complexion, and it is especially beneficial during cold and dry periods.

Culinary herbs

Herbs have long been used in many of the finest dishes to bring out the best in a meal. The trick is not to use it excessively. Often half a teaspoonful of milder herbs will suffice for taste and a quarter will be plenty for stronger herbs. Naturally, each vegetable or meat will agree more with certain herbs than others. Of course there are individual likes and dislikes for herbs.

Gardening

Growing of herbs

The herb garden not only gives you the pleasure and sensuality of the day, but each plant brings with it a love and tradition from the past, offering it to you to carry on in your lifetime. The herb garden fulfills that need; and more so, will grow and mature through years.

Not only the herbs in your own garden readily available to you, but also they are also much less expensive than any "store-bought" or dried varieties. Herb gardening soothes you physically and mentally.

Starting a herb garden

The basis of a herb garden begins with drainage. Many of our herbs had their origin along the dry and sandy lands. This means plenty of drainage as well as plenty of sun. For the most part, herbs need a great deal of sunlight to form their volatile oils. They need soil that is rich and loamy

Good soil provides the best foliage growth and overall height. Most plants will do fine in lesser soil, but for top performance, use topsoil. With less than best, the plants may not get as many leaves and may instead go to flower and seed quickly. The best way to make good soil is to add organic matter and chemical fertilizer to the soil.

A compost heap is the first step in that direction. A homemade compost pit will be preferred, where all the household organic garbage is converted in to manure.

Ideally the soil in your garden should be somewhere at the mid point between acid and alkaline. Add limestone if it is too acid. Incorporate organic manure to improve the soil. Herbs could be grown in boxes, other containers, slabs surrounded by bricks, ceramic vases, and clay pots etc

Herb garden

Make sure that you will have the type of herb garden you want before you begin the process. Nowadays most people confine the garden to their lawn, which is not adequate. You can design your own formal garden. Just make sure you trim the hedges to a specific height, and add some fragrant plants to add spice to the visual ones.

Harvesting and drying of herbs

Harvesting the herbs is one of the joys that accompany growing on your own. The process is satisfying, and the drying plants lend an aroma of freshness to the home, while being pleasant to the eye. The day before you intend to harvest, spray the herbs with fine mist water. Harvesting is better just before coming in to flower. Just after morning dew has dried from the leaves, cut the stalks with a sharp knife or pruning tool.

Gather a handful of herbs and tie them together. Turn the herbs upside down and hang them in any airy place to dry.

Another way to dry the harvest is to strip the leaves from the stem on to a screen. Turn the plant upside down once again, spread the leaves out and turn them in a few days to make sure they are thoroughly dried.

Herbs can be dried using a stove. Set the oven at low temperature and check the leaves often to see how they are progressing. Turn them at least once and do not remove them until they are perfectly brittle and will crumble in hands.

Storing

When the leaves are dry place them in a jar with a tight fitting lid so the air does not escape and take with it the volatile oils. Sunlight is also a robber of flavour and colour. If the aroma is gone, most likely the oils, and therefore the essence are gone as well.

Classification of aromatic herbs

Aromatic herbs are classified into annuals, biennials, and perennials. Some are grown for their leaves; some are for their flower and others for their fruit and seed. In general a few plants of any one kind will supply the needs of an individual family.

Herbs grown for their leaves:

Perennials-peppermint, spearmint, rosemary. sage, thyme chives, curry leaf and rampeh.

Biennials-Kalukamberiya, Asamorhagam, Monarakudumbia, Parsley, celery.

Annuals-Mint, summer savory, sweet marjoram, and sweet basil.

Herbs grown for their seed

Biennials-caraway

Blennials-caraway

Annual/perennial-Fennel, Fenugreek, Coriander, and Cumin.

Herbs for their fruits or pods:

Annual-pungent and hot pepper.

Why herbal plants are important to grow in our country

Because of the local demand from hotels and for exportation, the necessity of growing herb is unavoidable. And also the climatic condition of certain areas in our country is suitable for the cultivation. These reasons have been considered by the Government and encourage growing herb for commercial production.

There is a great demand for herbs from local hotels as it is savored by the tourists. There also exists a huge demand for tropical herbs in the western market. With the varied and favourable climatic conditions for the cultivation of different herbs Sri Lanka could profit by cultivating and trading in herbs. Hence the Government hopes to encourage the cultivation of herbs.

Thyme

Family: Labiatae

Botanical Name: *Thymus vulgaris*. Linn

Origin: Mediterranean regions.

Botany of the herb:

Thyme is a delightful perennial small bush producing very small aromatic leaves as ground covers. The dried leaves contain protein, CHOs, fibre, mineral matter, Vitamins and volatile oil. The pleasant odour and sharp taste is due to the presence of *thymol*. It grows 15-to 30-c.m height.

Types:

Common thyme - *T. vulgaris*. Grows 20-c.m to a height, with dark green narrow leaves and good flavour.

Ornamental golden leaved form	-	*T.v.aureus*.
Lemon scented thyme	-	*T.citrodorus* grows to 30-c.m heights
Mat forming species	-	*T. herba* - barona, not fully hardy, traditionally used to flavour roast beef.

Economic importance:

These plants are used as ornamentals and as ground covers. The fresh and dried leaves are used as condiment. *Thymol*, a derivative of the essential oil is used in toothpastes; mouth washes, as a fungicide, and as an internal medicine effective against hookworms. It is used for boils as a tonic bath or as an ointment for insect bites. It is used for various skin conditions. Reputed to be invaluable for the treatment of bronchial congestion, whooping cough, gastric disturbances and cold.

It is included in bouquet garnishes, in stuffing with vegetables, in omelet's and on pizza. Dried thyme keeps its flavour well.

Altitude:

Thyme is grown in high altitudes but some success has been observed at the lower altitudes when the plants are pot grown.

Climate:

Thyme prefers dry climate even though the plant is hardy. This crop does well in cold climates, where temperature is between 13° C to 14° C. These plants can tolerate drought than excess moisture.

Soil

Well drained sandy light soil is suitable for this crop. Alkaline soil is preferred for thyme. The soil PH is between 5.0 to 7.0.

Propagation:

Thyme is propagated by division, seed or by cuttings. Propagation

is the easiest by divisions or cuttings. Cuttings are taken from new growth, just before the plant starts to flower. Cuttings root easily.

To get divisions from old plants earth up the centre of the old plant. In time the branches will root. Separate the rooted branches.

Seed rate:

5 grams in 70 square meters.

Nursery:

Seeds are sown in seed box or in a nursery bed and later transplanted in pots, or in the field. Germination takes place in 3 to 6 days. Transplant them when the seedlings are 8 c. m. in height

Land preparation:

Plough the field and prepare raised beds. Apply organic matter @ 5 to 10 tons/ha. It is better to apply lime 2 weeks before planting to get the required soil PH.

Transplanting:

Seedlings are transplanted in the field 12 to 18 days after sowing. Planting spacing is 50 c.m x 20 c.m.

Fertilizer application:

Apply Urea - 20 grams, TSP - 30 grams and MOP- 15 grams per square meter as basal dressing

Apply Urea - 12.5 grams and MOP - 7.5 grams per square meter, 4 to 5 weeks after planting as top dressing..

Irrigation:

Irrigate daily till seedlings or cuttings establish well and thereafter every 3 to 4 days depending on rain.

Harvesting:

Thyme should be cut 12.5 c.m.off the top just before flowers appear. Mature plants can be harvested by cutting the entire plant 5 c.m above the ground level.

Sweet Basil

Family: Labiatae

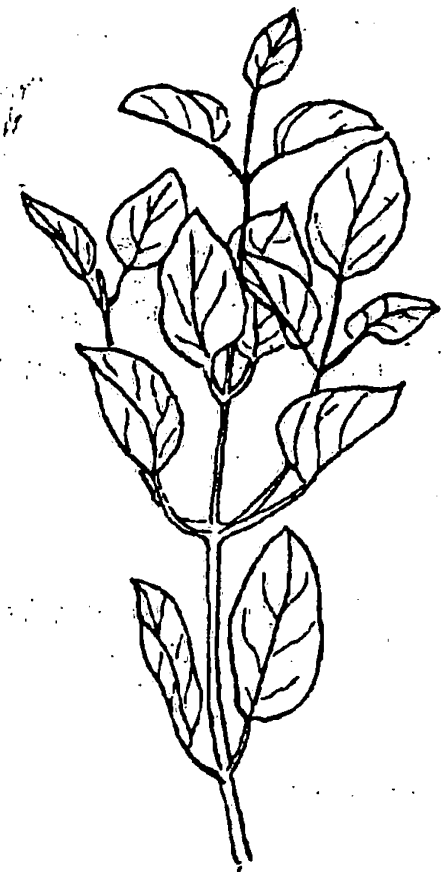
Botanical name: *Ocimum basilicum. Linn*

Sinh - Panirasa
Maduratala

Origin: India and Africa.

Tam - Inipputulasi

Botany of the herb:



Basil is a small shrub and an annual crop, which grows up to 50 - 70 c.m in height. The leaves are dark green, 2.5 to 7.5 c.m long usually lanceolate, with a clove -pepperish odour and taste. Corolla is white, purplish or pink in colour. The plants may be either green or purple. Basil is a 52-week-old herb. Sweet basil contains protein, cellulose, mineral elements, fixed oil and volatile oil. The volatile oil of sweet basil is yellowish to greenish in colour and highly aromatic. The organic compounds of the oil are *methylchavicol*, d - *linalool*, *ceneol* and *eugenol.*

Varieties:

Ocimum minimum. L Bush basil

Purple basil - a variety of *Ocimum basilicum* L

Economic importance:

Highly esteemed by good cooks and is best used fresh. Basil is an essential ingredient of sauce, soups, stews, omelettes and egg dishes. Added to tomato salad. Sweet basil is one of the best culinary spices. It has a pungent flavour. A very few finely cut fresh leaves make the salad delicious. Oil of sweet basil is used in perfumery and beverages. It has medicinal value. Dried powdered leaves are used as snuff, perfumes and stimulant. It is a remedy for head ache & snake bite. The seeds are given during dysentery.

Climate:

The optimum growing temperature for this herb is between 17° C.and 18° C. The leaves are sensitive to temperature. Although the basil thrives in warm climates, it is frost tender.

Soil:

Optimum soil PH for the crop is between 6.0-6.5. Light, and well-drained, medium rich soil is preferred.

Propagation:

Basil is propagated by seed and cuttings.

Seed rate:

100gms/100 M^2

Nursery management

The seed coats are mucilaginous and when placed in water liberate a copious jelly.

Nursery beds or containers are used to raise seedlings. Seeds are sown 1 c.m deep in rows, 25 c.m apart. Germination takes place in 5 to 8 days. Seedlings are ready for transplanting 15 to 18 days after sowing.

Land preparation:

Apply organic matter @ of 10 to 15 tons/per hectare when the land is prepared for cultivation.

Transplanting:

The seedlings are transplanted on beds or containers. Use 50 c.m x 20 c.m spacing while transplanting in the field. After planting, if dry climate prevails irrigate daily until seedlings are well established. If cuttings are used plant in the bed and give shade until they recover.

Weeding:

Weed the crop when necessary.

Irrigation:

Daily irrigation is essential until the transplanted seedlings are well established. After that, irrigate once in 3 or 4 days, when a dry period prevails.

Fertilizer application:

Apply inorganic fertilizer as a basal application before planting the seedlings. Apply urea 20grams TSP-33 grams and MOP 15 grams per square meter as basal dressing.

Apply Urea - 12.5 grams and M.O.P - 7.5 grams per square meter as top dressing.

Pruning:

Pinch out the plant tops to make the plant grow in to a little bush. Remove the flower heads as soon as they form, to stimulate continual foliage development.

Harvesting:

Leaves can be harvested within a month after planting, a few being taken from each plant at a time. The small bush will soon start to produce flower buds, and these must be removed at the early stage, otherwise no further young shoots and leaves will be produced. When plants start to flower the flavour is at its best and cutting should start. Cut the plants 18 to 20 c.m above the surface of the ground, leaving the lower part of the plant to produce further. shoots. This type of cutting can be repeated through out the crop period as and when necessary. One plant may be allowed to flower to provide seeds for the next crop.

It is better to pot a few plants towards the end of the rains and grow them through the dry season in the verandah in a shady and cool place or on a windowsill as the plant cannot stand very dry condition.

Drying & Processing:

Leaves are dried in a shady area. Tender green leaves can be used fresh but main cuttings should be tied in smaller bunches and dry in well-ventilated shady place. If leaves are dried in light, the leaves will loose their green colour. When quite dry, strip leaves and tops from the stems, and pack in a coloured jar.

Chives

Family: Liliaceae

Botanical name: *Allium schoenoprasum.* L

Origin: Mediterranean.

Botany of the Herb:

Chives is a perennial, plant, which grows about 30 to 37.5 c.m heights. Narrow grass-like leaves grow in clumps of small bulbous plants. If the plants are allowed to flower, it will produce seed. It is a 52-week-old herb.

Economic importance:

It is an important culinary herb with a mild onion flavour. The chopped leaves are used in making omelets or mixed with cream cheese. Leaves are used for flavouring smashed potatoes, salads and other dishes. For the best flavour, however, flower head should not be allowed to form. While drying the leaves, they loose their flavour. Therefore, invariably leaves have to be used as afresh. Chive plants are used as edge plants in cottage gardens.

Altitude:

This crop grows well in all altitudes.

Climate:

The optimum temperature for this herb is about 15° C.The plant needs light; therefore it is best for growing in the field in small plots.

Soil:

The optimum soil PH is between 6.0 - 6.8. Average, medium, rich soil in a sunny place is preferred for this crop.

Propagation:

Chives are propagated by seed and clumps.

Seed rate:

10 grams/435 M^2.

Nursery:

Chives may be raised from seed, sown in nursery beds or in a seed box. Seeds germinate in 14 days. Irrigate daily up to germination and continue to irrigate to retain the soil moisture to a sufficient level.

Land preparation:

Beds in shady places are suitable for the cultivation of chives in the field. Apply organic matter @ of 10 to 15 tons/ha.

Transplanting:

Use 30-c.m x 20 c.m spacing to plant seedlings in the field. Young clumps are used to establish the crop in the field, and set them out in light, moisture - retentive soil. Watering is essential during dry periods.

Transplant the seedlings and mulch round them well. There may be difficulty in keeping the plants growing through the dry season unless they are given sufficient water, mulched well and shaded. Every few years the clumps are divided into several sets and replant them in fresh soil.

Transplant chives on a bed prepared in the field under shade, or adjacent to beds, which have tall vegetables, as these will give the chives the shade they require.

Weeding:

Weed the crop when necessary.

Irrigation:

After transplanting, irrigate daily until the young clumps or seedlings, establish well in the field,and then irrigate every 4 days depending on the rainfall.

Fertilizer application:

Apply inorganic fertilizer as a basal application before transplanting the clumps or seedling.

Apply Urea - 20 grams, TSP - 33 grams, and MOP -15 grams per square meter as basal dressing.

Apply Urea - 12.5 grams and MOP - 2.5 grams per square meter, 4 to 5 weeks after transplanting.

Harvesting:

Leaves are harvested when the plant attains a reasonable size, and used immediately.

Processing:

Leaves are chopped and frozen for later use.

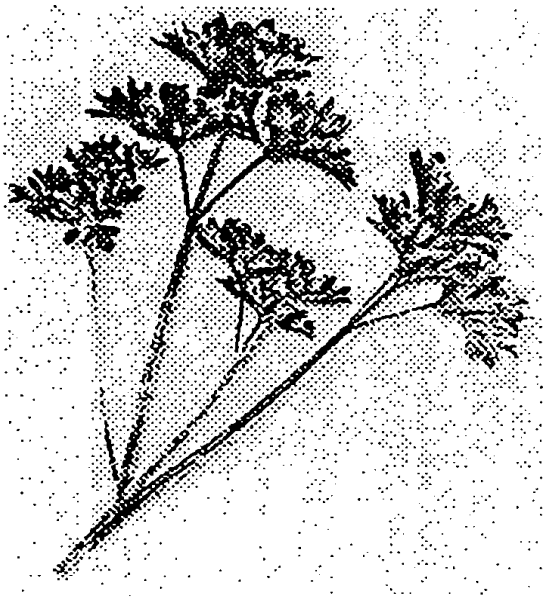
Parsley

Family: Umbelliferae.

Botanical name: *Petroselinum crispum.* A.H.Hill

Origin: Mediterranean.

Botany of the herb:



Parsley is a popular biennial herb. With a long taproot, that grows to about 30 c.m deep. In the second year it produces seeds, thus it is frequently grown as an annual for its leaves. It is rich in vit A and vit C.

Types:

Curley leaved: *P.crispum*

This is the variety most often used for garnish.

Flat leaved (Italian parsley). *P.hortense.*

Flat leaved or French kind is said to have the better flavour.

Turnip rooted *P.C.fusiformis*

Turnip rooted is grown for its celery - flavoured roots.

Economic importance:

Parsley is a popular, aromatic herb. One of the few which good cooks insists on using fresh. Leaves are used in soup, stew, cream vegetable salad, and other dishes. An essential component of a bouquet garnish; it is in traditional cottage gardens, as an edging plant. It attracts bees and is thought to repel green fly. It is used to treat wounds. Whole herb is used for colouring wine. Planted between rows of onions and carrots to counteract odour and lessen the attraction of attacking flies. Seed is used to dispel fever. Root is used for kidney ailments and as a mild laxative. Oil is used medicinally. It is aromatic, stimulating and carminative. It is used in rheumatism, and neuralgia, and as an anticeptic and a flavouring agent. The oil destroys vermin.

Altitude:

With care, parsley could be grown at all altitudes, but it grows better up 60 to 65 meters high and above.

Climate:

Frost damages the crop. In a cool and moderate rain fall area the crop performs well. During hot and dry period, the plants must be shaded. The temperature requirement for this crop is 15°c to 17°c. The plant prefers partial shading.

Soil:

The optimum Soil PH is between 6.0 to 7.0.This crop prefers a well-drained soil enriched with organic matter and moisture.

Propagation:

Seed propagates parsley. Although parsley is biennial, it is grown as an annual and raised from fresh seed each year.

Nursery:

The seed of parsley does not seem to keep well in the tropics and fresh seed is preferred. The seed can be drilled thinly direct in either to a well - manured nursery bed or to a seed box. In either case, do not plant deeper than 1.5 c.m. The seed may take several weeks to germinate, so do not become anxious if no seedlings appear straight away. Normally germination takes place after 15 to 20 days from sowing. Warmer temperature will shorten the germination period. Thin the seedlings to 3.0 -.8.0 c.m spacing.

Germination may be shortened by soaking seeds for 24 hours before planting and sowing on the surface and tamping them firmly with a flat board. Water well in dry weather and provide a cover to protect from frost during nights in cooler area. If the weather condition is not good, some form of protection should be given to the nursery bed. Seedlings are raised in the seedbed for six weeks.

Land preparation:

Plough the land deeply and prepare the beds. Organic matter should be incorporated when preparing the land for sowing or transplanting @ 5 to 10 tons per hactare, and also a basal dressing of inorganic fertilizer should be given before sowing or transplanting.

Planting:

The crop can be established in the field by sowing or transplanting.

Direct seeding is done in rows 50 c.m apart. and within rows seeds are 2.5 c.m apart and later thin out 12 to 15 c.m apart. Seedlings are raised in the nursery bed for 21 to 28 days.

Transplanting:

The seedlings are transplanted 40-to 50 c.m between rows and 12 to 15 c.m within rows. Apply mulch between the rows.

Irrigation:

Irrigation is done until the seedlings are established in the field and then if necessary. However sufficient soil moisture condition should be maintained through out the crop period.

Fertilizer application

Apply inorganic fertilizer as a basal application before planting. Apply Urea - 20 grams, TSP - 33 grams and MOP-15 grams per square meter as basal dressing.

Apply urea 25 grams per square meter, as a top dressing. 4 to 5 weeks after planting

Weeding:

Weed the crop when necessary.

Pest & diseases:

Leaf blight, a fungus disease.

carefully and burned and no further plantings made in that bed for several years.

Harvesting:

Parsley may be harvested throughout the growing period. The outer and larger leaves are harvested first. Pick the leaves before they are fully-grown, otherwise they will be rather fibrous. Do not pick too many leaves from any plant until it has become well established. At lower altitudes the plants will continue to produce new leaves for several months, but in the high altitudes this may extend to more than a year. If flower stalk appear, it should be cut off. The entire plant is harvested and dried in later stage of the crop.

Drying:

The surplus leaves may then be dried in a short time in the shade or in the sun until "brittle-dry" and stored in screw jars.

Storage:

Dried leaves are stored in a dry, tight dark container. When parsley leaves loose colour they also loose flavour.

Sweet Marjoram

Family: Labiatae (Lamiaceae)

Botanical name: *Origanum marjorana*. L

Origin: Mediterranean region.

Botany of the herb:

It is an erect branched perennial herb, 30 to 60 c.m in height. Sweet marjoram is frequently grown as an annual. Leaves are broadly oblong oval green and entirely or rarely toothed, which are pungent aromatic, and slightly bitter. The leaves contain protein, fibre, pentosans, ursolic acid, fixed oil, volatile oil and tannins. The volatile oil is a greenish yellow liquid with 40% *terpenes*, especially *terpinene*, and d-a-*terpineel* which contribute to the pleasing fragrance of this herb. Flowers are white with green bracts in corymbose cymes, nutlets smooth brown.

Types:

O.marjoram. - Sweet/knotted marjoram growning up to 20- c.m in height.

O.onites - pot marjoram is growning up to 60 c.m in height.

O.vulgare - wild/common, hardy, perennial growning up to 45 c.m in height.

Economic importance:

The taste of the herb is spicy, warm, pungent and bitter. The herb is used with green vegetable, salads, and soups in herb butter and with various meat and egg dishes. The dried leaves are used as condiment. It contains volatile oil, tannin and a bitter principle. The oil possesses an aromatic, spicy, basil-like odour.

The oil of marjoram is used in cosmetic, soap industry and beverage. Volatile oil is given for diarrhoea, hysteria and applied in tooth ache. Effective remedy for congestion, especially in children, thought to have some remedial effect on digestive, respiratory, and neurological complaints. Oil is used to hasten eruptions in measles, in microscopy.

Propagation:

Seed, cuttings, and root division or crown division are used to propagate marjoram.

Altitude:

Usually grown in all altitudes.

Climate:

It is a temperate herb and performs well in cooler areas.

Soil:

Marjoram could be grown in all types of soil. But well drained light, medium rich soil is preferred for this crop.

Nursery:

The seedlings are raised in seed boxes or on nursery beds, scattering the seeds over the surface of the soil and covering with fine sand. Sweet marjoram seedlings require shade until they grow. Since all varieties are slow growing, they require frequent weeding and cultivation.

Transplanting

Seedlings are transplanted at the spacing of 15 cm x 15 cm when they are 10c.m high, and 15 c.m in the field.

Irrigation:

It is grown in locations where there are sufficient irrigation facilities during dry period to irrigate the crop. This crop suffers during drought period and the symptom being yellowing of the leaves with black spots. Therefore irrigate frequently, to supply sufficient moisture to the crop.

Harvesting:

Leaves are harvested throughout the crop period. When flowers appear, the plants should be cut back to about 10 c.m above ground level to stimulate new growth. The herb may be cut back two or three times in its growing period.

Drying:

The harvested plant should be dried rapidly when dry; the leaves will powder and can be sifted through a screen to remove the woody stems. It may then be stored for late use.

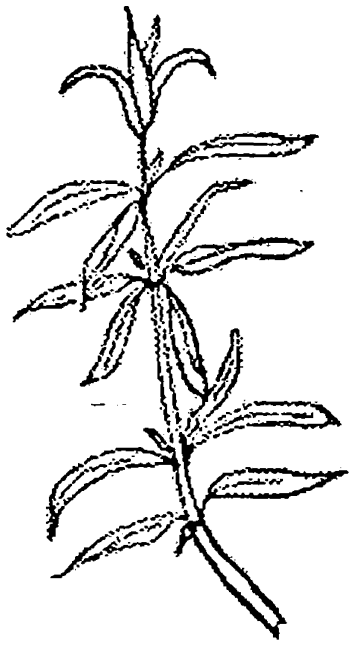
Rosemary

Family: Labiatae.

Botanical name: *Rosemarinus officinalis* Linn

Origin: Mediterranean region on dry rocky hills.

Botany of the herb:



Rosemary is a small perennial shrub that grows 1.5M in height and producing narrow dark green leaves that have a fresh, sweet flavour, and camphoraceous taste. The leaves of rosemary contain resins, tannins, cellulose, fixed oil, and volatile oil. The chief constituents of the oil are *borneol, pinene, camphene and cineole*. Flowers are commonly pale blue, but a deep blue variety has flowers like tiny orchids, in axillaryís racemes. The odour of leaves is spicy, pungently aromatic and taste is warm and piny.

Economical importance:

Tender tops and leaves of the shrub are used for flavouring cold drinks, soup and foodstuffs. Leaves are used as a condiment; especially they are added to meat, fish, egg, sauce and salads. Also be added as an ingredient of mixed herbs. The essential oil extracted from leaves, flowering tops and twigs is carminative and stimulant. The volatile oil contains pinene, camphene, cineol, camphor and borneol. The oil of rosemary is obtained by steam distillation of the leaf.

Medicinally rosemary is thought to be a great stimulant and a remedy for many neurological disorders, relieve cold symptoms. Rosemary tea is used for nervous headache. Eating leaves is a sure way to restore lost appetite. Application of ground powder over the body makes one feel light and merry. The rosemary oil is used in India for burning in hospitals in the belief that it would disinfect the air. Stimulating growth of hair and thus preventing baldness. It is a good shampoo for dandruff. Dried leaves are widely used in confectionary.

Altitude:

This crop will thrive well at medium altitudes and above.

Climate:

This crop is grown in medium to high altitude with dry to moderately moist conditions. The optimum temperature for this crop is between 13 to 14° C. This crop may be grown as an annual, in cold climates. This crop is somewhat sensitive to frost. It likes full sunlight.

Soil:

The optimum soil PH is 6.0 to 7.0. Rosemary is a lime-loving plant and therefore it will not thrive on an acid soil unless a large dressing of lime is provided. Well-drained light soil is suitable for this crop.

Propagation:

Divisions, cuttings, layers and seeds are used to propagate Rosemary. Cuttings produce roots easily. Producing seedlings is not a popular method of propagation in home gardens.

Remove a 15-c.m tip of new growth (flush) and place the lower 10 c.m in sand or vermiculate to produce rooted cuttings.

To produce a new plant by layering, a lower branch of the bush is covered with soil. When the roots have formed on the branch, the new plant is cut from the mother plant.

Nursery:

Seeds should be sown on seedbeds or in a seed box @ 5 grams per 50 square meter.

Freeze seeds for 5 to 7 days before sowing to increase germination rate. Germination takes place in 10 to 11 days. Seedlings take a long period to grow to a cuttable bush.

Land preparation:

During land preparation organic matter is incorporated @ of 10 to 15 tons per hectare. Select a place with good drainage and take care to increase the drainage of the beds.

Transplanting:

Seedlings are transplanted 21 to 28 days after germination. The drainage of the bed must be good and it is advisable to plant out at the highest point in the land.

Cuttings of 12.5 to 15 c.m in length may be taken and planted to two-thirds of their length in to the soil in a shady bed. The planting spacing is 100c.m between rows and 100 c.m within rows

Irrigation:

Irrigate daily until the cuttings or seedlings established well in the field and every 4 days thereafter depending on the rainfall.

Fertilizer application:

Apply inorganic fertilizer as a basal dressing before planting the seedlings or cuttings. Apply Urea - 17 grams, TSP - 32 grams and MOP - 16 grams per square meter as basal dressing.

Apply Urea - 4.5 grams and MOP 2.5 grams per square meter as top dressing 4 to 8 weeks after planting.

Harvesting:

The plants are trimmed several times to harvest the leaves. Cut back the mature plants to half of their height of the plant when required.

Drying and Storing:

The removed leaf and branches should be dried on a screen. Dried leaves should be stored in a tight container.

Sage

Family: Labiatae (Lamiaceae)

Botanical name: *Salvia officinalis* Linn

Origin: Mediterranean region.

Botany of the herb

Sage is a small perennial hardy evergreen shrub of attractive bushy habit, which grows to 40 to 100 c.m height. Leaves are oval, greyish green, hairy and aromatic. The leaves contain protein; CHO, fibre, Ca, P, Vitamins, fixed oil, volatile oil, and tannins. The chief constituents of sage oil are *thujone* and *borneol* which gives the spicy smell. Sage leaves on extraction yield volatile oil, the constituent of which is *carvacrol* a pale yellow liquid with a pungent odour.

Flowers in terminal spikes are light purple and a white flowered variety is beautiful for a white garden. Both are suitable for low hedge in a vegetable or herb garden.

Economic importance:

Both fresh and dried leaves are used for flavouring soups, stews, sauces and beverages. Plant is used medicinally for headache and cold. It is popularly used to cure oral infections and soothe sore throat. It is tonic, astrigent and aromatic. The leaves make an excellent gargle for relaxing throat and tonsils. Oil is used in perfumery. It is grown as an ornamental plant. It produces fragrant purple flowers. It is used as a herbal tea.

Types:

- Purple leaved and variegated forms
- Pineapple sage.

Altitude:

Sage grows best at the higher altitudes but with care can be grown in pots or baskets at the lower altitudes.

Climate:

Dry condition is best for this crop. The optimum temperature for this crop is 13 to 17° C. The crop prefers sunlight.

Soil:

This crop does not thrive on very acid soil. It will grow in well-drained sandy soils. Suitable soil PH range is between 5.5 to 6.8.

Propagation:

Seeds, cuttings or root divisions are used to propagate sage. Propagation by cutting is common. To produce a large number of young plants earth up the centre of old plants and allow the branches to root. Later separate the rooted branches and use for planting. Better to propagate plants that do not tend to flower and choose broader leaf type.

If established plants are not available locally for the supply of cuttings, it will be necessary to start from seed.

Nursery

Seeds may be planted in seed boxes or nursery beds. Freeze seeds for 5 to 7 days before sowing to increase germination rate. Sow seeds 2 c.m deep in rows 20 c.m apart. Seeds germinate in 6 to 10 days time. Thin out the plants later.

Land preparation:

Organic matter is applied sufficiently and the beds are prepared well for transplanting.

Transplanting:

The seedlings may be transplanted when they are 7.5 c.m in high 20 to 27 days after sowing. Transplant the seedlings in the field, 50 c.m between rows and 20 c.m within rows.

Fertilizer application:

Apply inorganic fertilizer as basal dressing before planting the seedlings.

Apply Urea -20 grams, TSP - 33grams and MOP-15 grams per square meter as basal dressing.

Apply Urea - 12.5grams and MOP- 7.5 grams per square meter as top dressing - 4 to 5 weeks after planting

Irrigation:

Irrigate daily till the seedlings are well established in the field, then every 3 to 4 days and thereafter depending on the rain.

Trimming:

During spring the woody growth should be trimmed back severely to eliminate flowering that prevents vegetative growth.

Harvesting:

The top 15 to 20 c.m of growth should be harvested at least twice during the growth season.

Drying:

Sage leaves may also be dried in the shade until they are crisp.

Peppermint

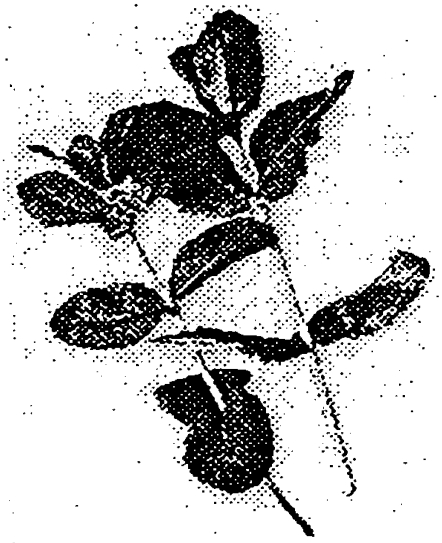
Family: Labiatae

Botanical name: *Mentha piperita.* Linn.

Sinh.- Minchi

Tam. - Puthina

Origin: Europe.



Botany of the herb:

An aromatic semi spreading herb having dark green, oval aromatic leaves. Peppermint is a hardy perennial that grows 90 c.m. in height Peppermint contains a fixed oil, volatile oil, resins, tannins, cellulose, pentosan, pigments and mineral elements. The peppermint oil is pale yellow liquid with a strong peppermint odour caused by *l-menthol* and *l-menthone.*

Economic importance

The leaves are used for flavouring foodstuffs. It has a refreshing odour and a persistent cooling taste. The oil obtained from the leaves is used medicinally as a carminative, stimulant and for ailing nausea, sickness and vomiting. *Menthol* oil is good to treat minor pains associated with certain neurological disorders. The oil is also used in toothpaste, aftershaves, perfume and soap industries.

Altitude

This crop can be grown in all altitudes.

Climate:

Heavy rainfall is essential. These plants do well in the open field, if they have enough moisture.

Soil:

Good fertile and moist soil is required. If mint is grown year after year without applying manure, the ground becomes exhausted and the quality of the mint will deteriorate.

Propagation:

Rooted runners, divisions or seeds are used to propagate peppermint. Seeds germinate well in the first year but the plants produced are often not true to parent plants. The underground stem spreads rapidly and may easily occupy too much garden area.

Mint plants can grow in a container, which limits its spread. It is advisable to dig up the plant and select the underground stems for propagation, those which readily form roots at the nodes. They should be planted in a shallow trench 5 c.m. deep and covered with good soil. New growths will appear after about 3 weeks and the young shoots can be used for field planting.

Land preparation

Field should be ploughed and prepared the bed to get good texture. Apply well-rotted organic manure in good quantity to the beds prepared in the field.

Transplanting

Plant young shoots on the beds 60 c.m. apart. If beds are too crowed after some months thin out by pulling up runners. Organic manure and inorganic fertilizer should be applied to maintain soil fertility. Replant the bed every third year.

Pest and diseases

Mint rust - A fungal disease.
Symptom: Yellow spots appear on leaves and stem. Later the spots darken to deep brown, the leaves dry out and the plants appear to have died.

Control: If the disease is severe lift the plant and wash the roots in cold water and then plunge in to hot water at 40 to 45° C for 10 minutes. The roots may be then planted in new soil.

Harvesting:

Leaves may be harvested through out the year with the best quality leaves being produced in dry periods. The mint is best harvested when it begins to flower or the lower leaves become yellow. The plant can be cut back to 2.5 c.m above the ground and all stems and leaves removed to reduce diseases. Peppermint may be completely harvested twice a season. After the final harvest the plant should be covered with 5 c.m. of compost to provide nutrients for the next season.

Drying:

Peppermint leaves may be removed and dried in warm shade and then stored in a sealed container.

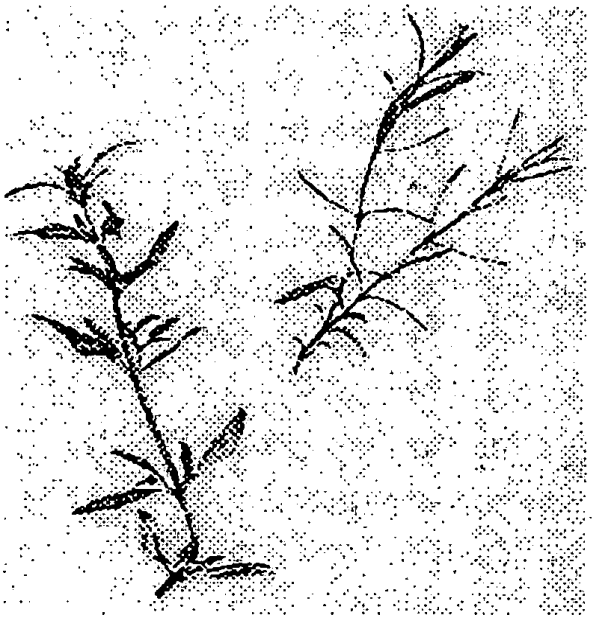
Summer savory

Family: Labiatae (Lamiaceae)

Botanical name: *Satureja hortensis* Linn.

Origin: Mediterranean region.

Botany of the herb:



Savory is an aromatic annual plant, which grows about 45 c.m. heights. Its weak woody stems incline to fall over when mature and get easily beaten down by rain. Plants in flower look as if covered with pinkish snow. Savory contains proteins, celluloses, pentosans, fixed oil, pigments and minerals. A volatile oil of pleasant odour is obtained on steam distillation from the herb.

Economic importance:

The leaves and the tender stems are used for flavouring food products. It is used in dressings, sauces and culinary products. It is used in egg, rice and bean dishes. It is also used in various herb blends and mixtures. Leaves are crushed and used for pains. The volatile oil is employed in preparations used for the treatment of bronchitis and whooping cough. Fresh leaves are rubbed on bee stings to relieve pain. Leaves are also used for aromatic baths.

Climate:

Temperature required for this crop is between 15 to 17°C.

Planting material:

Seeds are used as planting material.

Soil:

Dry moderately rich soil in sun is preferred. Suitable soil PH is between 6.0 to 6.8.

Nursery:

Seeds are sown in the nursery and then transplanted. Germination takes place in 12 to 14 days. Seedlings are transplanted 16 to 20 days after sowing. Freeze the seed for 5 to 7 days before sowing to increase the germination rate.

Land preparation:

Apply organic matter @ of 5 to 10 tons per hectare when preparing the beds in the field.

Planting

Plant seeds 1.0 c.m.deep in rows and 50 c.m. apart. Place seeds in rows 2.5 cm apart and later, thin out the plants to 40 c.m. apart.Seedlings are also transplanted in the field at 50cm x 40cm spacing.

Fertilizer application:

Apply inorganic fertilizer as basal application before planting the seedlings. Apply Urea - 17 grams, TSP - 32 grams and MOP- 16 grams per square meter as basal dressing.

Apply Urea - 15 grams and MOP- 2.5 grams per square meter as top dressing 4 to 8 weeks after planting

Irrigation:

Irrigate daily until seedlings establish well in the filed and thereafter every 3 to 4 days depending on the rain.

Harvesting:

Plants are harvested when they are 15 c.m high and harvesting may continue throughout the growing period. This will delay flowering and promote vegetative growth. When the plant is in flowering stage the entire plant may be harvested.

Drying:

The harvested leaves and stem dry rapidly in warm shade. They may be tied into small bundles and dried on paper or fine screens. Dried leaves are removed and stored in a closed container

Dill.

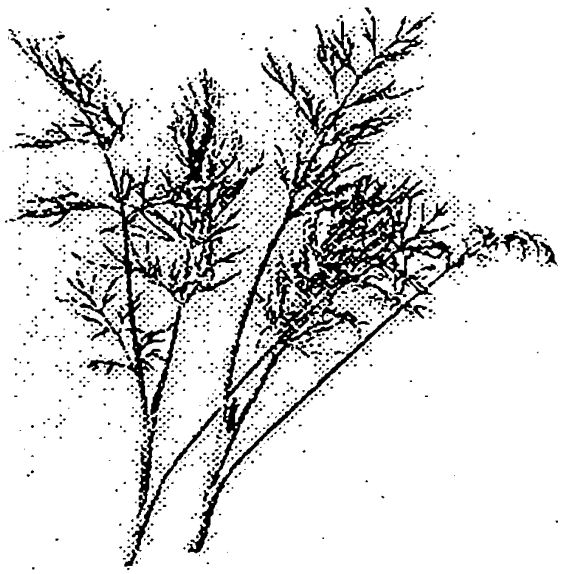
Family: Umbelliferae

Botanical name: *Anethum graveolens*. Linn

Origin: Eurasia.

Botany of the crop:

It is a hardy annual herb; with an erect stem bearing finely divided, light green feathery leaves. Flowers are yellow in colour produced in compound umbels. The schizocarp fruits are oval, light brown, compressed and 3-to5 m.m long. Seed head is an umbrella shaped and resembles wild carrot in appearance. Flowers eventually produce seeds. Dill has an aromatic odour and sharp taste due to the presence of 2 - 4% of volatile oil containing *carvone*, *d-limonene* as its principal constituents.



Economic importance:

The fruits are used as spice and are also used as carminative. It is much used in soups, sauces and for other culinary purposes. Dill oil is also used for flavouring purposes. Both the seed and oil are used in medicine. It was thought that the dill was useful for strengthening of stomach and intestinal complaints. The leaves are used as seasoning and as flavouring substance. Dill water, made from dill seeds, was

always regarded as one of the staple medicine for soothing children off to sleep. It is often used for pickling cucumbers and gherkins

Altitude:

The plant will thrive at all altitudes above 200 M.

Climate:

This crop can be grown under medium to heavy rainfull. The crop grows well at temperature between 13 to 14°C.

Propagation:

By seeds

Seed rate:

5 grams in 90 square meters.

Sowing:

The seeds are sown in rows directly in the field to 6 m.m deep, 60 c. m apart, and the plants thinned out later to 30c.m in the rows. The germination period of the seed is 3 to 8 days. Transplanting is avoided because of its delicate root system. It is a very quick grower and reaches about 90 c.m in height, looking something like a small fennel plant, but more compact looking, with yellow flowers in umbels.

Transplanting:

The seeds are drilled in seed boxes or nursery beds towards the middle of the rain. Transplant the seedlings to another seed box when they are about 5-c.m in height, giving a spacing of 5 c.m apart. Finally, when the plants are about 10-c.m heights they can be transplanted into the herb bed. At all times, provide some shade, as dill does not like full sun.

Cultural practices:

Weeding is important to produce thriving plants. Wind protection is essential. Staking is done when the plants are 45-c.m in height.

Fertilizer application

Apply Urea - 17 grams , TSP - 32 grams and MOP- 16 grams as basal dressing.

Apply Urea - 4.5 grams and MOP - 2.5 grams per square meter 8 weeks after sowing as top dressing.

Irrigation:

Irrigate the crop 2 days per week at the beginning and then irrigate once in every 4 days.

Harvesting:

Harvest could be done 7 weeks after sowing. The ripe seeds should be fully dried on the plant and the whole head removed with care, before it scatters seed, or the plant may become a troublesome weed.

Drying:

Umbels of well - developed fruits are dried on screens in a shady place. Separate and clean the seeds according to usual procedures and store in closed containers. Leaves loose their flavour when they are dried.

Storage:

The whole seed head can be stored in a screw top jar or the seeds can be threshed out and stored in the same way.

Fennel

Family: Umbelliferae.

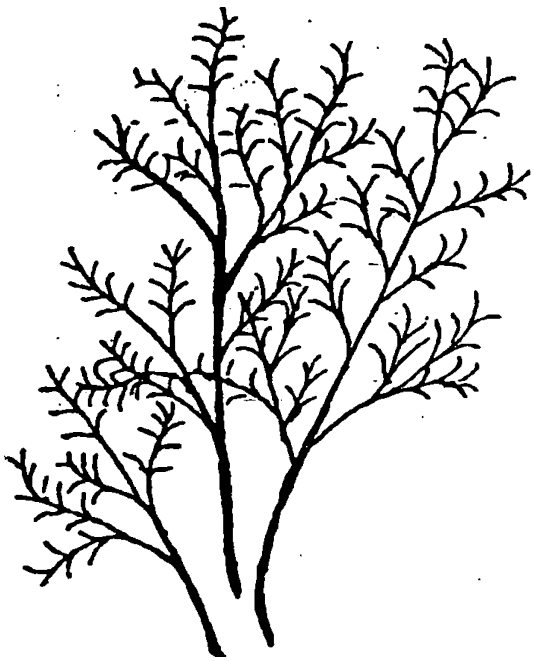
Botanical name: *Foeniculum vulgare*.Mill

Sinh. - Suduru

Tam. - Natseerakam

Origin: Mediterranean region.

Botany of the crop:



Funnel plant is a tall aromatic herb, which has leaf stalks forming a sheath around its base, with finely divided feathery leaves and yellow flowers. The fruits are schizocarp, elongated oval and greenish brown. Common fennel grows to 180 c.m heights. All parts of the plant are aromatic. The sweet, pleasant aroma and taste of the spice is due to its volatile oil containing about 50 to 60% *anethole* and 20% *fenchone.*

Economic importance:

Fennel is a very old flavouring substance. The fruits are used as spice and condiment. They are used in cooking and for candy and liquors. The fruits are also used medicinally as carminative and stimulant. The fennel oil is used in perfumery and as a flavouring agent. The fruits are also used as masticator, alone or with betel nut and betel leaf. The bulbous stem bases can be cooked like celery or eaten raw in salads but for the latter, it is better to blanch them.

Soil:

Light, limy, moderately fertile soil in dry sunny area is preferable.

Altitude:

The plant thrives in most altitudes.

Climate:

The plant is grown in wide range of rainfall. . Cool dry areas are suitable for commercial cultivations. Plant the crop with rains in April/ May or October in up country dry zone and with October rains in low country dry zone.

Propagation:

This crop is propagated by seed.

Planting:

The garden fennel and common fennel once they have been raised from seed will go on for a number of years. The seeds establish themselves very easily and the unwanted seedlings should be taken out before they form long taproots. The seeds should be sown in rows 45 c.m apart, finally thinning out the plants to 45 c.m apart within rows.

Cultural practices:

Tall varieties must be sheltered from the wind, or individual plants staked when 22 to 24 c.m tall. The plant should be earthed up

for swelling the base of leaf stalk about the size of a hen's egg when ready for use. The plant grows up to a height of 105 to 120 c.m.

Harvesting:

For household purposes, the plants should not be allowed to flower, keeping them cut back to within 30 or 60 c.m of the ground. The stems can be peeled and used for salads, while the leaves can be chopped and used in sauce. The bulbous stem bases will be ready for harvesting in about 31/2 months, with the bulb size of an egg.

The plant starts bearing in five months and continues for a period of 4 to 5 months. The fruits are picked as they ripen and dried separately, while the plants are allowed to grow.

Coriander

Family: Umbelliferae

Botanical name: *Coriandrum sativum* Linn Sinh. - Kottamalli

Tam. - Kottamalli

Origin: Mediterranean region.

Botany of the crop:

The plant is an annual, cultivated herb, growing to 60 to 90c.m height, with semi-erect stem bearing decompounded leaves. The leaves are divided into 5 to 7 pinnae each with many lobes, the lobes being narrower on leaves higher up the stem. There are two varieties, one with red petioles, and the other is the more popular one with green petioles. Small white or pinkish flowers are borne in a compound umbel within an involucre of bracts. The small oval and aromatic fruit is a cremocarp, yellowish brown with wavy longitudinal ridges. Between the ridges lie furrows, under which are present special oil ducts known as vitae. The plant has an unpleasant smell until the seeds have started to ripen and in the same way, the seed have a disagreeable taste and smell until they ripe.

The dried ripe fruits contain a high content of fat and protein. The primary quality determinant of the spice is the content and composition of its volatile oil, known as *Coriandrol*, containing *D-linalool* and *hydrocarbons*. Coriander leaves have a high content of Vitamin A & C.

Economic importance:

The leaves have an aromatic, refreshing odour and are used for flavouring food. The dried fruit is used as condiment. The fruit has stimulatory, carminative and antiseptic properties. It is warmed dry on a pan and then boiled with water and given to soothe fevers and colds. It is given for stomach aches. The oil glands secrete a volatile oil, *coriander oil*, which is used in medicine and in flavouring beverages such as gin and whisky.

Climate:

Cool climate with moderate rainfall is suitable for this crop. In Sri Lanka Rahangala is the most suitable area for this crop.

Soil:

Average, dry, light, medium, rich soil in full sun is preferable.

Propagation:

This crop is propagated by seed.

Seed rate:

8-9 kg/ha

Land preparation:

Plough the land and prepare raised beds in the filed Apply organic matter at the rate of 5 to 10 .ton per hectare.

Planting:

Coriander fruit have to be broken in to two segments before sowing. Normally seeds germinate in 10 to 12 days.

The seeds are sown in the field in drills 30 c.m apart and thinned later to 15 c.m apart within rows. The seeds take 8-9 days to germinate.

Fertilizer application:

Apply Urea - 62.5 kg, TSP- 125 Kg.and MOP- 62.5 Kg and /ha.

Apply Urea @ of 62.5 Kg/ha, 3 and 6 weeks after sowing, as top dressing.

Cultural practices:

Weeding and watering should be done when necessary.

Harvesting:

The crop takes 4 months to mature in low country and 4 to 5 months in up country dry zone. The plants are pulled out when the seeds start to ripen and before they are shattered. The harvested plants are dried for 2 to 3 days before beating with sticks or trampling under the feet of bullocks to extract the seed. Then the seeds are cleaned, winnowed, and dried.

Yield

The potential yield under rainfed condition is 452-650 kg/ha.

Garlic

Family: Lilliaceae

Botanical name: *Allium sativum.* Linn

Sinh. - Sudulunu

Tam. - Vellaipoodu

Botany of the crop:

The stem is reduced and the leaves turn fleshy to serve as food storing organs. The bulbous structure consists of a number of small bulblets or "cloves" enclosed within a whitish or pinkish scaly sheath. The one - cloved garlic is more medicinal importance.

Varieties:

There are two types

Purple or Mauve skin.

White skin- more popular.

Economical Importance:

The cloves can be used to flavour salads, sauces, sausages, soups, and stews. And also it is used in medicinal as expectorant, rubifacient, diaphoretic in brochitis, coughs and colds antiseptic. The characteristic odour is due to the presence of enzyme *allinase*. Garlic boiled in oil is used as liniment for nervous disorders, rheumatic pain, scabies etc.

Altitude:

The tropical region suitable except of the very low altitude.

Climate:

Cool climate with good rainfall is essential during vegetative growth. During maturity dry climate is required. Welimada, Palugama, Haputale and Udahewaheta are found to be Suitable for this crop.

Soil:

A sandy well-drained rich moderately moist soil is the best but they will grow on most soil types except heavy clay.

Propagation:

Dividing the mature bulb into its separate sections, which are commonly called "cloves", normally propagates garlic.

Seed rate

500-600 kg/ha.

Planting:

Raised beds are prepared to plant garlic cloves. During the middle of rainy season the cloves are planted, so that the bulbs will mature in the drier period when the bulb is just showing above ground. In Welimada area planting start in May.

Planting spacing - 30 x 10 c.m
Planting depth - 3 to 5 c.m

Cultural practices:

Hoe is used to control weeds.

Irrigation:

If there is no rain, irrigate the crop thrice a week up to 2 weeks before harvesting.

Harvesting:

The bulbs are ready for harvesting after 6 to 9 months when the foliage has completely died down.

Yield:

The average yield is 1100 - 1700 kg/ha

Storing:

Allow drying thoroughly until the white outer membranes become crisp to touch and then store small quantities in bunch in a dry airy shed; larger quantities may be kept in small sacks or on trays.

Ginger

Family: Zingiberaceae

Botanical Name: *Zingiber officinale* Roscoe. Sinh. - Inguru

Tam. - Inchi

Origin: South -East Asia.

Botany of the crop:

The plant is a perennial herb consisting of an underground stem or rhizome bearing erect leafy shoots. The rhizome is large, irregularly lobed, pale, yellowish - brownish in colour and 10 to 20 c.m in size. Brownish scales cover the flesh. The erect pseudostem is about 60 to 90 c.m tall and ensheathed by the bases of large, alternately arranged leaves. The inflorescence is an imbricate spike in which the flowers are borne in the axils of large yellowish bracts.

Ginger contains about starch, crude fibre, lime, oleoresins, and essential volatile oil. The volatile oil is yellowish, viscid liquid, sparingly soluble in water and contains sesquiterpene -*zingerberine* and its alcohol *Zingier* that give the odour to the rhizome. The pungency is due to the oleoresin - *zingeron*e - that gives the sharp, hot taste.

Economic importance:

i. There are two types of ginger preparations:

Green or preserved ginger - the rhizomes are cleaned, scraped, dried and boiled with sugar.

ii. Dried cured ginger - they are peeled, boiled with limewater and dried.

Ginger is used in flavouring meat dishes, baked foods and soft drinks. Medicinally, they dilate the blood vessels, producing warmth and increase perspiration. It has digestive properties and, is used in various pharmaceutical preparations. Tea, prepared with ground ginger is very effective against colds and coughs.

It is used in preparing ginger beer and ginger malt.

Altitude:

It is grown throughout the tropics up to an altitude of about 900 to 1000 M.

Soil:

A rich soil is very necessary.

Climate:

It will tolerate high rainfall but will do better under medium rainfall, well distributed. In Sri lanka low country and mid country wet zone are suitable (specially Kandy, Kegalle, Kurunagale, Kaluthara and Gampaha) for this crop. It thrives under shade, particularly in mixed garden.

Propagation:

Dividing the rhizome in to pieces propagates it. Only well - developed rhizomes from the previous harvest should be used for replanting. It is best to break up the whole rhizomes in to small pieces and plant.

Seed rate

1.25-2.25 mt/ha

Planting:

Planting is generally done in mid March or early April on raised beds at a spacing of 45 c.m between rows and 30 c.m within rows. Plant the crop at a depth of 1-5 c.m.

Planting should be done at the beginning of the rains. The soil is then covered with a thick mulch of straw or dried leaves. The mulch helps to conserve water in the soil and to suppress weeds.

Cultural practices:

Fertilizer application:

The use of fertilizers will depend on the prevailing market condition. If market is good apply potassium sulphate or MOP-@ 2.7kg/ 1000 m^2. The fertilizer should be lightly forked round the plants when they are few centimeters tall.

Harvesting:

The rhizomes take 9 to 10 months to mature, and are harvested when the green, leafy stems turn yellow. Harvesting may be done in stages according to market flactuations. The crop may be sold as green giger or cured ginger. Potential yield is 11mt/ha.

Storing:

Green ginger can be stored up to six months in a cool well-ventilated room. The damaged and decayed rhizomes are removed and the rest heaped to a height of about 60 to 90 c.m. The heap is covered with ginger leaves, which are periodically sprinkled with water. The heap should be examined at fortnight intervals or more often in dry weather. When the temperature in the middle of the heap rises, the heap should be broken up and spread on the floor. After three days the heap is rebuilt.

Curing:

Fibrous roots and the soil adhering to the rhizome should be removed immediately after harvest and the ginger washed thoroughly in water. After washing, the ginger is allowed to soak overnight in a fresh supply of water to facilitate the removal of the outer skin.

The skin cleaning is done without damaging the oil cells below the skin on which the aroma of the best quality of ginger depends. Once rhizomes have been peeled, they are thoroughly washed again and left to soak in limewater overnight. On the following morning, the ginger is first washed in limewater before it is spread out on sacks or coir matting to dry in the sun.

Peeled ginger treated with lime keeps better and longer than untreated ginger. However, the quality of the lime is important in determining the quality of the finished product. The purer the lime the better the quality of the cured product.

Drying should be continued for five or six days. Frequent turning is essential, particularly on the first day, to ensure uniform drying. Cured ginger should not be bagged till it is completely dry or it will become mouldy in storage.

Mustard

Family: Curuciferae

Botanical name:

Brassica juncea. Hook.f.and Thomas. - Indian mustard

B.nigra.Koch - Black mustard

B.alba. Rabench (L) - White mustard

Sinh. - Aba

Tam. - Kaduku

Origin: Eurasia.

Botany of the crop:

White mustard :- The small round seeds are yellow on the outside and white within the seed. The seeds contain a glucoside, *sinalbin.*

Black mustard: - The plant is smaller than the white mustard. It has smooth pods with dark brown seeds; which are yellow inside. The seeds contain a glucoside, *sinigrin*. This glucoside yields on decomposition a volatile oil containing sulphur, which is responsible for the aromatic odour and pungency.

Indian mustard:- The fruit is a silucula bearing numerous small brown coloured seeds. Oil is extracted from the seed.

Mustard is an erect, herbaceous, annual and grows to a height of 90 to 150 c.m and bearing yellow flowers in a terminal raceme. The fruit is a smooth quadrangular siliqua with a short slender beak and containing 6 -8 globular seeds. The seeds are inodorous but emit sharp pungent odour when crushed in water due to formation of *allyl isothiocyanate.* Volatile oil of mustard is responsible for the pungent,

irritating odour and acid taste.

Mustard oil yield 24 to 26 %, which is rich in *oleic* and *erucic* acids. The glucosides *sinalbin* is the most important constituent of mustard seed. In the presence of water and by the action of enzyme *myrosin*, *sinalbin* is decomposed yielding *sinalbin* mustard oil.

Economic importance:

Seeds are used as spice or condiment in cooking. The seeds of various species yield oil. Mustard has a biting & blistering effect on the skin. It is used for plasters and poultices in medicine. The blistering property is due to a volatile oil, which is obtained from seed. The oil is a thin colourless or yellowish liquid with a strong odour causing tears.

Climate:

Mustard can grow in many countries under widely different conditions of climate, from the tropical to the temperate and even in the cold climates. This crop can be cultivated as mixed croping with Kurakkan in rainfed uplands of dry zone. In Sri Lanka Uva district is suitable for this crop. Some areas with could and dry climate in central & Wayamba provinces also suitable for this crop.

Soil:

Medium loams that are slightly alkaline and sandy loams are preferable. Mustard needs fertile soil. Under chena this crop is cultivated in all classes of soil.

Propagation:

By seed.

Seed rate:

3 to 4 Kg/hac.

Land preparation;

Cattle manure is added @ of 40 to 50 Kg/sq.mt during land preparation. Prepare raised beds for mono cropping.

Sowing:

Seeds are drilled in rows about 2.5 c.m deep and 60 c.m apart. Under chena cultivation seeds are broadcasted. Seeds germinate in 2-3 days.

Pest and diseases:

Mildew - *Erysiphae polygone* & *Peranospora parasitica* are the causal fungus species of this disease. Copper fungicide is use to control this disease.

Harvesting:

Harvesting is done 21/2 months after sowing just before the pods open in order to avoid heavy losses from shattering of seeds. Whole plants are harvested, tied together in small bundles & dried.

Yield:

The potential yield in rainfed uplands is 400 kg/ha.

Drying:

Seeds are collected & dried for 2 to 3 days.

Fenugreek

Family: Leguminaceae

Botanical name: *Trigonella graecum.* L

Sinh. - Uluhal
Tam. - Venthayam

Origin: Asia & Europe.

Botany of the crop:

Fenugreek is an annual herb, attaining a height of about 60 c.m and bearing light green, trifoliate, pinnately compound leaves and small white sessile pappilionaceous flowers borne on the leaf axils in single. The fruit is small and bears deeply furrowed seeds. Pods are 7 to 10 c.m long. The plant is very thin, rounded and much branched.

Economic importance:

The seeds are used as spice, condiment and also medicinally as carminative and tonic. The aromatic leaves are used as vegetable and fodder. Fenugreek has a strong sweetish odour and a slightly bitter taste due to the presence of brown coloured and highly odorous volatile oil, the chief constituents of which are *alkaloids choline* and *trigonelline.* The seeds are reputed to increase the flow of milk in cattle.

Climate:

If fenugreek is dry cropped, the crop is grown with early rain. During late season, as it becomes hot the crop has to be irrigated. The crop grows well throughout the tropics. In Sri Lanka Uva district is suitable for this crop.

Soil:

Well-drained loamy soils and light alluvial soils are preferred for this crop.

Propagation:

By seed.

Seed rate:

20-28 Kg/ha.

Planting/Sowing:

Seeds are sown in 30 c.m apart in rows in raised beds and after germination seedlings are thinned out to 24-30 c.m within rows. In Uva district fenugreek is grown during yala season.

Weeding/Watering:

When it is necessary.

Pest and diseases:

Mildew, rust, and **small brown** spots are found in this crop.

Harvesting:

The plants begin to come into flower in 5 weeks. Pods will mature 5 to 6 weeks after flowering. But before flowering stage,

considerable quantities are removed to sell as green vegetable. Plants are uprooted when pods are ripe and dried for 2 to 3 days and the seeds threshed by beating with wooden flats.

Yield:

In local condition the potential yield is 300-400 kg/ha

Cumin

Family: Umbelliferae

Botanical name: *Cumin cyminum.* Linn

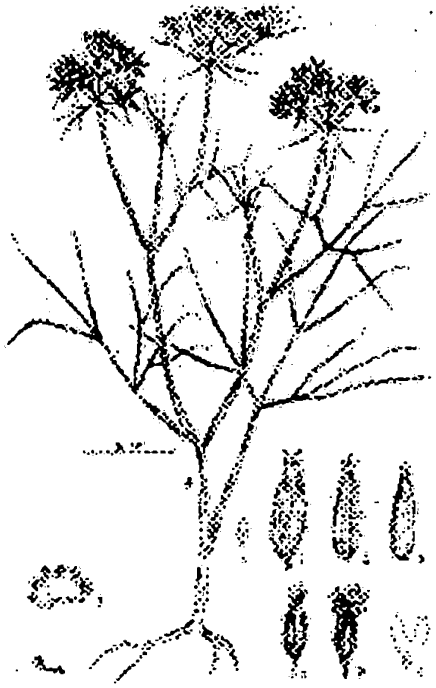
Sinh. - Mahaduru

Tam. - Perumseerakam

Origin: Mediterranean region/Egypt

Botany of the crop:

The plant is a slender little annual herb with small pinkish flowers. The elongated oval fruits are aromatic and light brown in colour. The stem bears many branches from the base and is very thin in size. The plant grows for 30 c.m in height. The leaves are very thin, linear and bluish green in colour; the petiole is sheath at the stem base. The inflorescence is a long stemmed compound umbel. The flowers are white or light red. The fruits are thin and are laterally compressed. The seed contains *cuminol.*or *cumic aldehide* oil. These oils give aromatic odour and special medicinal properties.



Economic importance:

The aromatic fruits are used as spice and condiment. The fruits are used in soup, curries, cake, bread cheese and pickles. The oil of cumin is used for flavouring beverages and other foodstuffs. Cumin has a distinctive flavour and odour due to the presence of volatile oil (2.5 to 4.5%) containing a colourless oily liquid *cumaldehide.* This *cumic aldehide* or *cuminol* has the special medicinal properties.

Altitude:

The crop is capable of being grown from sea level up to an elevation of 300 M.

Climate:

Cumin prefers mild climate rather than the hot plains. It is somewhat a delicate crop and has to be grown under careful garden conditions, with moderate well-regulated irrigation. This crop requires light rainfall during the growing period. As such this crop should be cultivated before the South West monsoon begins or after the heavy rains of the North East monsoon.

Soil:

Deep friable well-drained loamy soil is preferred. Organic manure is added and the soil is thoroughly prepared.

Propagation:

By seed.

Seed rate:

30 to 35 Kg/ha.

Land preparation:

The soil is ploughed to a deep tilth and. organic matter added @ 10 tons/ha. This crop. requires a fine raised seedbed.

Planting:

Seed is broadcasted or sown in rows, which are 30 c.m apart. Seedlings are thinned out later to stand 22 to 30 c.m within rows. The beds are irrigated daily till the plants get well established.

Weeding:

Hand weeding is done 10 days after sowing.

Irrigation:

Regular irrigation at 3 to 4 days interval is essential for rapid growth of the crop. After flowering irrigation is done once in every week.

Pest and Diseases:

Leaf eating caterpillars are found feeding on the leaves. **Plant bugs** are also noticed during flowering time.

Harvesting:

The crop is ready for harvest in 5 months. Plants are pulled out and dried in the sun for 2 to 3 days and the seeds are threshed by beating on a wooden board.

Yield:

Potential yield in local conditior is 200-300 kg/ha.

Curry leaf (L) Spreng

Family: Rutaceae

Botanical name: *Murraya koenigii*

Sinh. - Karapinchaa
Tam. - Karuveppilai

Origin: Sri Lanka

Botany of the crop:

Curry leaf is a small tree with dark gray bark and pubescent branches. Compound leaves somewhat crowded, spreading on 12.25 c.m long rachis, pubescent. Each compound leaf has 15 ñ 25, shortly stalked 2.5 ñ 5.0 c.m long, oblong lanceolate leaflets. Flowers are regular, white, fragrant about 1.2 c.m long on short pedicels and much branched, flat topped. Fruits are globular berries 0.6 to 1.0 c.m long, black when ripe and two seeded and rough with glands.

Economic importance:

The leaves are used in flavouring curries. Leaves are roasted and ground with other spices to make curry powders. Young leaves eaten as salads or extract of leaves is added to porridge. Considered as an excellent remedy for diarrhoea, high blood pressure and removal of cholesterol. Also considered effective in detoxification of system and serpent venom.

The leaf of this plant is the familiar "curry-leaf" used for flavouring soups, vegetables and meat dishes. The leaves are used in flavouring curries. Leaves are roasted and ground with other spices to make curry powders. Young leaves are eaten as salads or extract of leaves is added to porridge. Considered as an excellent remedy for diahorrea, high blood pressure and removal of cholesterol. Also considered effective in detoxification of system and of serpent venom.

Climate:

Low country wet zone and dry zone, Mid country wet zone are suitable for this crop.

Soil:

Light, rich soil is suitable. This plant will thrive up to 650 m elevation.

Propagation:

New plants are emerged from the root of the mother plant when it is established well in the field. These new plants are uprooted and potted in polythene bags. The polythene bags are filled with nursery mixture and planted one new plant in a bag and kept for 6-8 weeks to allow rooting and transplanted in the field.

Planting

Planting holes are made at 60 x 60 x 60 c.m size at the spacing of 1.5 x1.5 m and the holes are filled with compost and top soil mixture. Then the new plants are transplanted.

Cultural practices:

Weeding and irrigation is done when necessary. When the plants are growing they are pruned and trained to a height of 2 meters for easy harvesting. Compost is also added when necessary.

Harvesting:

Six months after transplanting matured and half matured leaves are harvested for the household use or for marketing. Best time for harvesting of fresh leaves for marketing is early in the morning or late in the evening

Processing:

Harvested leaves can be dried thoroughly and stored in airtight container as dried leaves or in powdered form.

Rampeh

Family: Pandanaceae

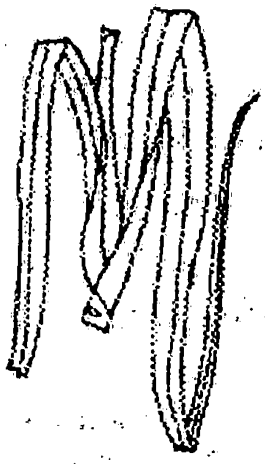
Botanical name: *Pandanus amarillyfolius* (E.S) Sinh. - Rampeh
Tam. - Rampai

Origin: Indonesia

Botany of the crop:

There are two types of rampeh grown in Srilanka.

Type I



Grows up to a height of 1-2 meter. Matured leaves are about 115c.m long, 5 to 6.5c.m wide, apex abruptly rounded, acute, not at all candate, the lateral pleats obsolete, midrib at base rarely with a few short distant prickles, but usually unarmed, margins unarmed except at extreme apex where, as on the ultimate portion of the midrib, there may be a few minute prickles, sheathing base green.

Trunk is round. The stem widened up to 12.5-15c.m.When the stem grows supporting roots are developed from the stem to keep it steady and straight. The plant does not flower or bearing fruits but rarely it flowers.

Type II

This is a small bush type. It grows up to 60-90c.m high. The leaf length is 40-45c.m and 2.5-3.0c.m wide. It produces more suckers with roots and it is easily propagated. The plant stem tends to root in the soil when it grows fully.

Economic importance:

Aromatic, musky scented leaves are commonly used in cooking for curry flavouring.

Climate:

Mid country wetzone, Mid country intermediate zone, Low country dry and wet zone are suitable for this crop.

Propagation:

Stem suckers and stem cuttings are used, but usually suckers are preferred. Suckers with roots are suitable for direct field planting. Stem cuttings should be rooted in a small nursery bed and allow them to root and develop a small plant. Later this plants can be transplanted in the field.

Planting:

30c.m x 10c.m x 10c.m size holes are made at 60c.m x 60c.m distance for bush plants and 60c.m x 60c.m x 60c.m size holes at 2 m x 2m distance for tall plants. Plant holes are filled with topsoil and compost. The rooted suckers are planted in the field and provide shade for 2 weeks. Before planting in the field the half of the leaf blade is cut off to reduce evaporation.

Cultural practices:

Weeding, manuring and watering are done when necessary. Dead leaves and diseased leaves are removed. In tall type, after some years new suckers will be emerged from the base of the main plant. Unwanted

suckers (both in tall and short type) will be removed to avoid crowding. The removed suckers will be used as planting material.

Harvesting:

Moderately matured leaves are harvested for the use.

Lemon grass

(Malabar grass or east Indian type)

Botanical name: *Cymbopogon flexuous* (Nees ex stend) Watts

Family: Graminae

Origin: Malaysia or Sri Lanka

Botany of the crop:

Lemon grass is a tufted robust perennial grass, 2 meter tall and flowers freely. Red stemmed (Choomana poolu) and white-stemmed (Wella poolu) forms are recognized, but the oil is only obtained from the red-stemmed grass. The white-stemmed type is considered as wild type. It grows vigorously. The red stemís aldehide is more solubility and the white stemís aldehide is poor solubility.

The East Indian lemon grass oil contains 75-85% of aldehides consisting largely of citral. This oil is much more soluble in 70% alcohol.

The oil is used to flavour food and beverage such as wines, sauces, confectionary spices, tealeaves and it improves the flavour of stale fish.

Citral is also used in flavouring in cosmetics and for medicinal purposes. The ionized citrol (ionone) is used in manufacturing of vitamin A.

It has antibacterial effect, insecticide action, vibrocidal property and theraphitic action, rubifacient and flatulent. The decoction of leaves with mint, pepper, dried ginger and sugar candy is used for lumbago, chronic rheumatism, neuralgia and sprains.

Lemon oil is used for the treatment of ringworm. It is used as germicide and bactericide in hospitals.

This is suitable crop for soil conservation in sloppy land.

Altitude:

It grows in areas up to 200m.

Climate:

It requires 200-275 mm rainfall, annually. The suitable temperature range is 24-27° c. When the crop is grown in the sun the production content of citral will be more. Shade is not preferred for this crop.

Soil:

Sandy loam and light sandy soil is suitable. The yield of citral is more in sandy soil than fertile soil.

Propagation:

Seed propagates the plant. Suckers and underground stem cuttings are also used for propagation.

Land preparation:

It is not necessary to take much care to prepare land. Before planting organic manure and fertilizer is incorporated @ 0f 15 tons of green manure and 100 Kg of potassium sulphate per hectare. In addition to this 2500 Kg spent grass 875 Kg of wood ash are applied. The spent grass is used as mulch.

Planting:

Seeds are sown in raised seedbeds at 10 x 15c.m spacing. The seeds will germinate in 5 to 6 days.

Field planting:

Seedlings are planted in the fields. In a small scale cultivation suckers can also be used. Seedlings or suckers are planted at 60 c.m x 60-c.m spacing

Cultural practices:

Weeding is done when necessary. When rain is prolonged rust and eye spot disease may appear.

Causal organisms are *Curvularia andropogonis* to rust and *Helminthosporium spps* for eyespot.

Harvesting:

Depending on the soil type and climatic condition the first harvest is done 3 months or 9 months after planting thereafter harvesting is done every 6-8 weeks. When the plants are 120c.m high with 4 leaves, it is preferred to harvest. Leaves are cut at 7.5c.m from the base of the crop. Normally 4 harvests is obtained per year. Even 17 times per year the yield may be obtained. The crop is replanted 9 years after planting.

Yield:

20-23,000 Kg/year. Oil yield is nearly 425 Kg/hac. If the field dry or with vapour pressure the oil content in the leaves is less.

Sera

(West Indian type)

Botanical name: *Cymbopogon citratus*

Family: Graminae

Origin: Sri Lanka

Botany of the crop:

It is a perennial grass that grows up to 1-2 m and flower rarely. Leaves arise from the rhizome. The plant produces more tillers strongly. The base of this plant is less compact when compare with lemon grass. The basal portion of the plant is ash to white in colour. The leaf sheath contains citral and myrcene.

Economic importance:

Basal portion of sera (Stem with the basal leaf sheath) is used in flavouring curries. This crop is grown in small scale and marketed or used for home consumption. This crop can also be used to conserve soil in hilly and sloppy lands.

Climate:

This crop requires warm climate with sufficient rainfall. This crop can be grown successfully in mid country wet zone and intermediate zone, and low country wet zone.

Soil:

Sandy loam and loamy soils are suitable.

Propagation:

Well-grown suckers (tillers) are commonly used to propagate this plant.

Land preparation:

Plough and level the land. 30c.m x 30c.m x 30c.m size-planting holes are made at 60c.m x 60c.m spacing. The planting hoes are filled with topsoil and compost.

Field planting:

Suckers are separated from the mother bush. Before planting in the field, half of the leaf blade is cut off to reduce evaporation. 2 to 3 suckers are planted in every planting hole.

Cultural practices:

Weeding, manuring and watering is done when necessary. Dead leaves and diseased leaves are removed.

Harvesting:

One year after planting well-grown suckers are separated from the bushes, the leaves are removed; the basal portion is cleaned and washed before marketing or for home consumption.

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