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FACULTY OF AGRICULTURAL SCIENCES AND ALLIED INDUSTRIES

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

Importance and chemical composition

- Lemon grass ***(Cymbopogon flexuosus)***, belonging to family Poacea, is the source of lemon grass oil obtained from the leaves and shoots of the plant.
- Lemon grass oil is mainly used in the manufacture of perfumes for soaps, hair oils, scents and medicines. It also has antibacterial properties.
- Ionone prepared from the citral present in lemon grass oil was one of the most important raw materials for the preparation of Vitamin A.
- In addition to its use in perfumery, Ionone is used in certain kinds of confectionary and liquors.
- The oil can be used to improve the flavour of some fish and can be used to flavour wines and sauces. It can be used for headache, tooth aches, baths, and as a diuretic agent for fever.

Origin and distribution

- The species is considered to have originated in India.
- It grows wild in many tropical and subtropical parts of Asia, Africa and America.
- The plant is grown for its oil in the West Indian Islands and also in Central America, South America, Thailand, Bangladesh, the Comoros Islands, Madagascar and China.

- Although the oil has been known since very early times in India, the systematic cultivation and distillation of the grass were started in Kerala only about 90 years ago. At present, it is grown commercially in the Nothern district of Travancore and Cochin (Kerala), Assam, Maharashtra and parts of Uttar Pradesh.

Description, types and varieties of the plant

Lemon grass grows to a height of about 3m. The leaves of the plant are linear, lanceolate, 125cm long and 1.7 cm broad. The plant is spreading, 100 -135 cm tall, slightly hairy.
There are two main types of lemon grass namely,

- The East Indian or true lemon grass (*C. flexuosus*) and
- The West Indian lemon grass *(C. citratus)*

The oil obtained by the distillation of the grass of *C. flexuosus* called the East Indian oil, is the genuine oil of commercial importance. It is produced in Kerala and is popularly called the Cochin oil, since it is shipped mainly from the port of Cochin. A small quantity of oil is also obtained from *C. pendulus*, popularly known as North Indian lemon grass or Jammu lemon grass, since it is grown mainly in Jammu and other North Indian States. The West Indian (South American) oil of *C. citratus* is extracted in Indo-China, Madagascar, Guatemala, Brazil, Congo and West Indies. It is found that the East Indian oil produced in South India is readily soluble in alcohol. Both the type have practically the same citral content (75-86%), but the West Indian oil along with citral contains other aldehydes which lower the quantity of the oil. In *C. flexuosus* the red stemmed plant with chocolate to purple coloured stems, yields the genuine oil, while the white stemmed grass does not. Recently a new species C. khasianus has been discovered which is important for its geraniol content. Some lemon

grass varieties released for cultivation are given below.

Sugandhi (OD-19):

It was released from the Aromatic and Medicinal Plant Research Station (AMPRS) Odakkali, Kerala. This variety is red in colour and is adapted to a wide range of soil and climatic conditions. The plant grows from 1- 1.75 m height and with profuse tillering yields 80-199 kg/ha of oil with 80-88% citral under rain-fed conditions.

Pragathi:

It is a clonal selection from OD-19, evolved at CIMAP, Lucknow. The variety is tall with a dark purple leaf-sheath and is adapted to the North Indian plains and Terai belts of subtropical and tropical climates. The average oil content is 0.63% with 86% being the citral content.

Praman:

Evolved through clonal selection from C.pendulus at the CIMAP, Lucknow, it is a tetraploid plant with a profuse tillering habit. The leaves are erect and medium in size. The variety is reported to yield 227kg/ha/annum of oil with 82% citral content.

RRL- 16:

It is evolved from C. pendulus and released for cultivation from the RRL, Jammu as Jammu lemon grass. The average yield of the herb is 15-20t/ha/annum, giving 100-110 kg of oil. The oil content varies from 0.6 -0.8% with 80% citral content.

CKP- 25:

It is interspecific hybrid between C. khasianus and C. pendulus, developed by the RRL, Jammu. The strain gives herb yield of 80-85 t and 350-400 kg/ha/annum of oil. The citral content in the oil ranges from 80-85%

In addition to the above, OD-408 from the AMPRS, Odakkali, RRL-39 from RRL, Jammu and Kaveri and Krishna from the CIMAP, Regional Station, Bangalore, have been recently released as high

yielding varieties for cultivation. The other varieties under cultivation are SD-68 and GRL-1.

Soil

It flourishes on a wide variety of soils ranging from rich loam to poor laterite. In sandy loam and red soils, it requires good manuring. Calcareous and water logged soils should be avoided as they are unsuitable for its cultivation.

Climate

It requires a warm, humid climate with plenty of sunshine and a rainfall ranging from about 200-250cm, well distributed over the year. In areas where the rainfall is poor, it can be grown with supplemental irrigations. It grows well at altitudes between 1000 - 1200 m.

Propagation

Lemon grass is generally propagated through seeds, vegetative propagation and rooted slips. It is reported that both the seedlings and rooted slips performed equally well, with respect to growth and yield. But due to high cost of transplanting, direct seeding is widely practiced, especially over the plains and the terraced lands in Kerala. For raising the crop by direct seeding a seed rate of 20 to 25 kg/ha is recommended. While sowing, the seeds must be thoroughly mixed with dry river sand in a ratio of 1:3, to ensure the uniform distribution of seeds during storage.

Nursery raising

For raising the seedlings required for planting 1ha of land, a 1000m area is required. The area is well prepared and raised beds of 1 to 1.5m width and convenient length are made. The recommended seed rate is 3 to 4 kg/ha. The seeds are uniformly broadcasted on the beds and are covered with a thin layer of soil, followed by watering at regular intervals.

The seeds collected during the month of January – February are usually sown in the nursery during April – May.

Transplanting

The land is prepared by repeated ploughing and harrowing, and beds of 1 to 1.5 m width and convenient length are made with a spacing of 30 to 50 cm between beds. The beds are made along the contour of the land slopes. Three to four leaved, 50 to 70 days old seedlings are planted during the monsoon season (May- June) in Kerala. A spacing of 30cm x 30cm with a plant density of 1,11,000/ha is recommended. A wider spacing of 60cm x 45cm for seedlings and 90 cm x 60 cm for slips has been recommended for

fertile, irrigated land under North Indian conditions.

Manures and fertilizers

Lemon grass is an exhaustive crop and it requires 275 kg N, 25 kg P2O5 and 175 kg K2O/ha/annum. In order to promote growth and to obtain a higher oil yield the crop is applied with 2t/ha of compost made from spent grass and 2t/ha of wood ash at the time of bed formation. In addition, it has to be supplied with chemical fertilizers. Under Odakkali conditions, it was found that an application of 100kg N in 3 to 4 split doses was found to be optimum, though a response up to 200kg was recorded. The response to P and K was found to be erratic. The application of 50kg ha each P2O5 and K2O as a basal dose gave encouraging results in West Bengal. It is recommended to apply 60:45:35 kg/ha N, P2O5 and K2O as a basal dose and 60kg N in 3 to 4 splits/annum as top dressing during the growing season as an optimum dose. Lemon grass is also reported to respond well to the application of copper, iron, calcium and sulphur.
It is reported from the CIMAP, Lucknow, that a lower dose of boron (2.5ppm) in combination with chloride salts can be beneficial for the crop.

Interculture

The earthing up of the plant after about 4 months of planting and again after every harvest is beneficial, as the root region of lemon grass has a tendency to grow above the soil. The field is kept stubble free. Generally 2-3 weedings are necessary during the year. Among the herbicides Diuran @ 1.5 kg a.i./ha and Oxyfluorfen @ 1.5 kg a.i./ha are effective for weed control. Intercultivation can be done by a tractor drawn cultivator or a handheld hoe in row planted crops. Under rainfed conditions, burning the dry grass and stubble of the standing crop prior to the onset of monsoon is practiced in Kerala to prevent white ant attack and also to rejuvenate the old clump.

Irrigation

After planting if there are no rains, the crop should be irrigated every alternate day for about a month. It is recommended that 4 to 6 irrigations are given during the period February to June under North Indian conditions for an optimum yield.

Pests and diseases

Pest infestation is very low for this crop. Several diseases are reported on lemon grass, but none are serious enough to cause major reduction in oil yield.

The leaf diseases can be controlled by prophylactic sprays of Dithane M-45 and Dithane Z-78 @ 3 g/l thrice at intervals of 15 days.

Harvesting and yield

The crop is perennial in nature and gives good yields for 5 years. Harvesting is done by cutting the grass 10cm above the ground level. During the first year of planting 3 cuttings are obtained and subsequently, 5-6 cuttings per year are taken subject to weather conditions. The harvesting season begins in May and continues till the end of January. The first harvest is done about 90 days after planting. The interval from sowing to harvest exerts a considerable influence on the yield and the quality of oil. Both immature and over mature grass gives a lower quantity of oil. For the local type of lemon grass, the optimum interval is 40-50 days. The optimum period of harvesting, when grown on hill tops and low lying areas are 60 and 55 days, respectively. Herbage yield 15t/harvest and oil recovery about 0.3 – 0.5% from fresh grass can be expected. The oil is obtained by steam distillation. Oil yield of about 350- 400 kg/ha from the second year onwards is considered satisfactory.

Factors influencing the oil –yield:

The factors influencing the oil production during distillation are:

i)Storage of the plant material
ii) Treatment of the material
iii) The method of distillation.

The cut grass is kept in a dry atmosphere with limited air circulation. The grass when stored in the shade can increase the oil recovery up to 96 hours and storage for a further period will only decrease the oil yields. The essential oils are enclosed in the oil glands, oil sacks and

glandular hairs of the plant. Therefore before distillation, the plant material must be cut into small pieces to enable them to directly expose as many oil glands as is practically possible. Once the plant material has been reduced in size it must be distilled immediately. Otherwise, the essential oil being volatile will be lost by evaporation. Dipping the chopped lemon grass in sodium chloride solution for 24 hr at 1-2 % concentration before distillation has been found to increase the citral content.