

Lemongrass production



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Lemongrass production



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Part I: General aspects

1. CLASSIFICATION

Scientific name: *Cymbopogon flexuosus* and *Cymbopogon citratus*

Common names: (*C. citratus*) West Indian lemongrass and Madagascar lemongrass, (*C. flexuosus*) East Indian lemongrass, Cochin lemongrass, France Indian verbena and Malabar lemongrass

Family: Gramineae

2. ORIGIN AND DISTRIBUTION

Lemongrass is widely cultivated in the tropics and subtropics. The two species that are mostly cultivated in South Africa are:

- ◆ East Indian lemongrass, *Cymbopogon flexuosus*, which is also known as Cochin or Malabar grass, and is native to India and Sri Lanka.
- ◆ West Indian lemongrass *Cymbopogon citratus*, which is native to southern India and Ceylon, Indonesia and Malaysia.

3. PRODUCTION LEVELS AND AREAS

South Africa

Lemongrass is cultivated in the frost-free areas of South Africa. The South African production figures are not readily available. Owing to the unstable price, the total estimated area is 300 ha.

The yield of oil is less during the first year of establishment and increases in the second year and reaches a maximum in the third and fourth years, after which it declines. For economy, the plantation is maintained only for 6 years. On average, 30 to 50 metric tons of fresh herbage is harvested per hectare per annum, which will yield 100 to 250 kg of oil at an oil yield ranging between 0,2 to 0,5 %. Under irrigated conditions and better management with increased herbage, an oil yield up to 500 kg/ha can be achieved.



(Photo: W.G. Alberts)

Internationally

Lemongrass is grown throughout Africa, in the Democratic Republic of the Congo (DRC), Angola, Gabon, Chad, Central African Republic, Madagascar and Comoros Islands. Guatemala is known to be the leading exporter with about 250 000 kg per year. China produces 80 000 to 100 000 kg per year. The United States of America (USA) and former Union of Soviet Socialist Republic (USSR) import approximately 70 000 kg per year each, the United Kingdom 65 000 kg, France and Japan 35 000 kg each, and West Germany around 20 000 kg per year.

4. MAJOR PRODUCTION AREAS IN SOUTH AFRICA

Lemongrass is mainly grown in the Lowveld of Mpumalanga, KwaZulu-Natal and Limpopo provinces. Limited plantings occur in Gauteng, North West, Eastern Cape and Western Cape wherever the growing conditions are suitable.

Cymbopogon flexuosus grows best at an altitude of up to 2 200 m above sea level.
Cymbopogon citratus grows best at altitude of up to 750 m above sea level.



Cymbopogon citratus
(Photo: W.G. Alberts)



Cymbopogon flexuosus
(Photo: W.G. Alberts)



(Photo: <http://www.hippyshopper.com>)

5. DESCRIPTION OF THE PLANT

Leaves and stem

Cymbopogon flexuosus is a tall, fast-growing, lemon-scented, perennial grass reaching a height of 1,5 m. It has distinct, dark-green foliage and also produces seed.

Cymbopogon citratus is a fast-growing, lemon-scented, perennial grass reaching a height of 1 m. It has distinct bluish-green leaves and usually does not produce seed. Both these grasses produce many bulbous stems that increase the clump diameter as the plants mature.

Essential part

Stalks and leaves. The essential oil is extracted from fresh plant material by means of steam distillation.

6. CULTIVARS/VARIETIES

There are no registered cultivars for lemongrass in South Africa.

There are two known types of *C. flexuosus*: The red-stemmed grass, which is known as the true lemongrass and is recommended for higher oil yields, and the white-stemmed (*C. flexuosus* var. *albiscens*) yields oil of lower citral content.

There are also a few types of *C. citratus* of which some do not yield enough essential oil. Therefore, care must be taken to buy from approved growers.

When selecting suitable plant material for cultivation, the following have to be considered. Select plants that are adapted to a particular area in terms of climate, topography, soil and drainage, and also select the type that will provide the desired chemical properties for a specific crop. Select plants that are proven to be, to some extent, resistant to diseases and pests.

7. CLIMATIC REQUIREMENTS

Temperature

Lemongrass prefers tropical or subtropical climates. It grows well at a temperature range of 10 to 33 °C, and it needs enough sunshine for the development of oil in the plant. The grass is sensitive to cold weather and cannot withstand frost.

Rainfall

The favourable rainfall for dryland growing of lemongrass should range from 700 to 3 000 mm uniformly distributed throughout the year. In the areas where rainfall is less, it can be grown with supplemental irrigation.

8. SOIL REQUIREMENTS

Lemongrass is widely adapted to a range of soils and performs well on sandy to clay loam soils with a pH range of 5,0 to 8,4 and good drainage. The lower the

altitude and more alkaline the soil has, the higher is the citral content of the oil. The variety with high citrates is in demand. Drier and loamier soil yields a higher citral content.

Lemongrass can be an option for consideration in poor soils, alkaline soils, steep slopes, and degraded forests and rehabilitation of nonforest mining and industrial wastelands.

Part II: Cultivation practices

1. PROPAGATION

For better quality and yield of oil, it is recommended to grow lemongrass by slips obtained by dividing well-grown clumps. Tops of clumps should be cut off within 20 to 25 cm of the root. The latter should be divided into slips and the lower brown sheath should be removed to expose young roots. Propagation can be done by seed as well for *C. flexuosus*.



Lemongrass slips ready to be planted
(Photo: W.G. Alberts)

Seeds

C. flexuosus plants are left in the field without harvesting, for collection of seeds, as the yield of seeds from plants subjected to regular harvest is lower. On average, a healthy plant gives about 100 to 200 g of seeds. Seeds germinate in 5 to 6 days if temperature and moisture levels are correct and the seedlings are ready for transplanting when they are about 60 days old.

Raising of seedlings in the nursery

It is advantageous to raise seedlings in a nursery whenever there is not an assured source of irrigation water available. The transplanting of nursery-raised seedlings is better compared to direct sowing of seeds in the land.

2. SOIL PREPARATION

Herbal and essential oil crops grown on natural soils yield products that are of high quality and in demand globally.

General soil preparation guidelines

Soil sampling and analysis

- ◆ Take soil samples according to correct guidelines.
- ◆ Have the soil analysed at a laboratory that will be able to check for mineral deficiencies and excesses, organic status and carbon ratios.
- ◆ A soil analysis will guide the producer in correcting the nutrient status of the soil in order to provide the crop with optimum growing conditions such as a balanced mineral status and correct pH.
- ◆ Soil fertility levels have to be within acceptable ranges before a soil-building programme is started.
- ◆ Correct the soil pH according to analysis and soil type.
- ◆ Fertiliser use has to be planned according to whether the crop will be grown inorganically or organically.
- ◆ Soil preparation has to be done according to good cultivation practices.
- ◆ Follow suitable soil preparation practices according to the farming operation. (rip, plough, disc, harrow, contour, etc.)
- ◆ If mechanical harvesting and weed control is envisaged, prepare row widths adapted to the machinery to be used.
- ◆ Use cover crops to suppress weed growth and promote soil moisture capture.

Producers who treat their soil correctly will have the benefit of producing crops of high value with less input in terms of weed, pest and disease control.

3. PLANTING

Slope

Plants should receive the maximum sunshine for better oil yield, and rows should run east-west if possible, and be planted on the western and northern slopes of hilly areas.



Young lemongrass with organic mulch
(Photo: W.G. Alberts)



Lemongrass and green beans intercropped
(Photo: W.G. Alberts)

Planting density/spacing

Generally, a row spacing of 20 cm with a row width of 40 cm, that will give a total of 125 000 plants per ha in a high rainfall area or under irrigation, is recommended. In areas with lower rainfall, 60 000 plants per ha is an advisable density.

An initial high planting rate can be used and as the plants mature, every second plant can be taken out and divided again for new slips. The space created in this way can then be filled with remaining plants as they mature.

Planting season

Planting of slips can be done as soon as the active growing season commences and during most times of the year when soil moisture is sufficient. Avoid planting during very hot times of the year and during winter when plants are usually dormant.

Planting depth

Slips should be planted at a suitable depth to cover the root zone properly and the soil should be firmed around the plant to remove trapped air pockets.

4. FERTILISATION

Application of fertiliser should be dependent on soil analysis.

Nutrients

All lemongrass plants have a very high potassium (K) requirement compared to phosphate, in some areas exceeding the total nitrogen (N) necessary to produce optimum oil yield.

Research findings in India and Sri Lanka have shown that 50 to 120 kg K/ha applied once a year give good results. Nitrogen usually has no effect on leaf oil content, oil characteristics or composition, however, it has an influence on the citral content from some cultivars and will enhance vegetal growth.

Determining the citral content of lemon grass in fertiliser trails is important because quality is determined by high citral percentage. Phosphate at planting gives a higher stand and healthier plants, which are then able to make maximum use of nitrogenous topdressing.

Application of compost made of refuse, obtained after distillation and mixed with wood-ash, is also beneficial. Organic compost applied as a mulch or at recommended rate according to soil analysis has excellent results. Lemon grass reacts very positively to the application of kraal manure.

Intercropping lemongrass with green beans when the plants are still small will provide the crop with nitrogen, and will assist in weed control. The beans can be cut at ground level during harvesting, leaving the old roots in the soil and the tops as mulch.

5. IRRIGATION

Lemongrass has a high water requirement. Where annual rainfall exceeds 650 mm, irrigation is not necessary. *C. citratus* is more drought tolerant than *C. flexuosus*. Overhead, flood and drip irrigation can be used. Where rust is a problem, overhead irrigation might not be a good option.

6. WEED CONTROL

Hand-weeding and hoeing are very important as weeds affect the yield and quality of the oil. Generally, 2 to 3 weedings are necessary during the year. Inter-row cultivation can be done by a tractor-drawn cultivator or hand hoe.

Distillation waste of this crop applied as organic mulch at 3 000 kg/ha is more effective for controlling weeds in the crop. Exclusion of sunlight is one of the best weeding practices. Therefore lemongrass should be planted so that it forms a canopy quickly.

Weed control guidelines

- ◆ Do not allow weeds to seed in the land.
- ◆ Shade out weeds by plant canopy, high plant density, closer row width, if moisture content of soil and crop specification allow for it.
- ◆ Use manual or mechanical control.
- ◆ Organic control measures such as flame weeding and UV radiation can be used where applicable, and if the crop can tolerate the method.

Use the publication* *A guide to the use of herbicides* – 2004, compiled by Hermien Grobler, J.B. Vermeulen & Kathy van Zyl.

7. PEST CONTROL

Pests that may attack lemongrass

Stem-boring caterpillar

In South East Asia, *Chilotrea* is the most important species infecting lemongrass. The caterpillar is white in colour with a black head and black spots on the body.

DAMAGE

It bores into the stem and remains there, feeding on the shoot. It is usually found at the bottom of the stem. The first symptom of the attack is the drying up of the central leaf. Subsequently, the entire shoot dies, resulting in a significant reduction in the yield of the grass.

* Obtainable from the Resource Centre, Directorate Agricultural Information Services, Private Bag X144, Pretoria, 0001. Tel: 012 319 7141/7085. Fax: 012 319 7260

CONTROL METHODS

- ◆ Burning of the dry stubble during the off-season in summer. The caterpillars lurking inside the stubble are therefore destroyed.
- ◆ The affected shoots are pulled out and destroyed.
- ◆ When attacks are severe, chemical control is needed. Instruction for spraying, etc., should be followed as prescribed by the manufacturer.

Nematodes

Tylenchorhynchus vulgaris (Stunt), *Rotylenchulus reniformis* (Reniform), *Helicotylenchus* (Spiral) spp. and *Pratylenchus* (Lesion) spp. also infect the lemongrass in producing countries.

CONTROL METHODS

Organic compost and mulching has advantages to incorporate soil organisms that are natural enemies of nematodes.

- ◆ Soil solarisation can be achieved by placing a clear sheet of plastic over the soil and leaving it for few days so that the heat of the sun kills the nematodes.
- ◆ Crops such as *Tagetes* can also control nematodes.
- ◆ Nematicidal chemical control should be used as last option owing to its toxicity.

Extension officers from the Department of Agriculture and researchers from agricultural institutes should be contacted for further information on the identification of insects and for recommended control measures.

Use the publication* *A guide for the control of plant pests – 2002*, compiled by Annette Nel, Mareli Krause, Neervana Ramautar & Kathy van Zyl.

8. DISEASE CONTROL

Producers must rely on early recognition and use of cultivation practices such as the use of windbreaks and rain shelters to prevent and manage diseases.

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By recognising the first symptoms of disease, producers can remove diseased plants and continuously monitor fields for signs of pathogen recurrence or spread of disease.

Source: Federation of Indian Chambers of Commerce and Industry (FICCI), 2007.

Long smut

As observed in India, all flowers in the inflorescence are transformed into a slender, tubular to conical cream-coloured mould which peels off at maturity, starting from the tip and hangs in shreds.

Control: Prolific spraying with a recommended fungicide chemical before flowering.

Treat the seeds with fungicides before spraying.

Red leaf spot

The lower surface of the leaves develop brown spots with concentric rings in the centre.

Control: Spraying with recommended fungicide chemical.

Leaf blight

The disease appears in the form of minute, circular, reddish-brown spots mostly on the margins and tip of the leaves. These merge to form elongated reddish-brown necrotic lesions, resulting in premature drying of leaves; older leaves are more susceptible to infection.

Control: Spraying with recommended fungicide chemical.

Rust

Distinct, linear brown uredinia appear on the lower surface of the leaves associated with chlorotic streaks.

Control: Spraying with a recommended fungicide.

Use the publication* *A guide for the control of plant diseases – 2003*, compiled by Annette Nel, Mareli Krause, Neervana Ramautar & Kathy van Zyl.

9. OTHER CULTIVATION PRACTICES

Lemongrass is sometimes planted on contours to assist in soil erosion control.

10. HARVESTING

Maturing time and methods

The first harvest can take place from 6 to 9 months after planting the slips. The grass can then be harvested frequently during the active growing season, up to once every month. Frequent cutting stimulates growth.

The oil yield will be reduced if the plant is allowed to grow too large. The grass should be harvested early in the morning, provided it is not raining and allowing heavy dew to evaporate in order to avoid colour loss during a hot day.

The plants are harvested mechanically or by hand. Cut the grass 10 to 15 cm above ground level. Avoid cutting too low as it will delay regrowth. Prevent splitting of cutting edges by using sharp tools and machinery that make a clear cut. Oil quantity is optimal in the upper parts of the plant. Should the grass be cut too low, there will be less oil in the leaves. Up to three harvests can be obtained in the first year and up to 5 to 10 harvests during each of the 3 to 5 succeeding years, depending on soil moisture status, management and weather.

It is a good practice to let the plants grow out to maturity just before winter to ensure that root reserves are built up. The foliage will also protect the growth points in case of frost in winter. After winter, the grass can be harvested and distilled or used as compost or mulch.



Prepared lemongrass ready for marketing

* Obtainable from the Resource Centre, Directorate Agricultural Information Services, Private Bag X144, Pretoria, 0001. Tel: 012 319 7141/7085. Fax: 012 319 7260

The bulbous part of *C. citratus*, which is used for culinary purposes, can be harvested as it reaches the correct length and diameter.

Lemongrass can be dried and marketed as health tea or in blends. This niche market is increasing and shortages are currently experienced in South East Asia.

The dried grass should have a good green colour and be free of mould. Drying should therefore take place as quickly as possible or a conventional dryer can be used. Prolonged drying in the sun will cause loss of colour and quality of aroma. Currently, dried lemongrass for the health tea industry is imported into South Africa from Zambia. Members of SAEOPA have provided the dried lemongrass at times when the oil price was very low.

Part III: Post-harvest handling

1. SORTING AND DISTILLATION

The harvested leaves can be distilled fresh or stored under shade for 3 days without too adverse effects on the yield or quality of oil. Wilting reduces the moisture content and allows a larger quantity of grass to be packed into the still, thereby economising the fuel use.

The mixture of vapours of water and lemongrass oil passes into the condenser. As the distillation proceeds, the distillate collects in the separator. The oil being insoluble and lighter than water, floats on the top of the separator and is continuously drawn off. The oil is then poured out and filtered manually or by using chemicals.

2. GRADING

The quality of lemongrass oil is determined by the content of citral, a terpene aldehyde, which is mainly used for the manufacturing of vitamin A.



Yellow colour of lemongrass oil
(Photo: [http:// www.dkimages.com](http://www.dkimages.com))



Lemongrass on the fresh market

Lemongrass oil is a yellow or amber, somewhat viscous liquid with a very strong, fresh, grassy, lemon-type, herbaceous or tea-like odour.

3. PACKAGING

Essential oils are volatile and as such have to be handled with care. The grass should be packed firmly as this prevents the formation of steam channels. If the grass is too long it can be cut into smaller lengths to ensure firm packaging.

4. STORAGE

Lemongrass oil should be stored in dark, air-tight, glass bottles. Do not expose it to heat or heavy metals. Once opened, refrigeration and tightly closing the cap will prolong its shelf-life. Deterioration begins if the liquid is much darker or more viscous than normal. Lemongrass oil is very acidic and will destroy plastic and rubber in a short time.

5. MARKETING

The price for lemongrass oil can vary considerably, depending on the supplies on the international market. The international price is dependent on the foreign

exchange rate at the time of sale, and the global supply, which can fluctuate between high demand and oversupply. Although it is bulk oil, it is still grown locally because of its versatility in various applications, both as flavour and fragrance. It is also one of the easier crops to grow.

Essential oil market

The market of essential oils in South Africa is divided into local buyers and international buyers. The local buyers include marketing agents and companies from chemical and pharmaceutical, as well as food and flavouring industries. The international buyers are divided into flavour and fragrance houses, cosmetics and personal health care, aromatherapy and food manufacturers who buy in large quantities.

The major market in the world for essential oils is the United States, followed by Japan and Europe. However, production continues to be concentrated in Europe, with seven of the world's largest essential-oil-processing firms.

In the United States, the major users of essential oils are the soft drink companies. Japan accounts for 10 % of the world demand. The Canadian market is dominated by the United States perfume and flavouring industry. France is dominating the world perfumery market, and Switzerland is one of the leaders in the pharmaceutical field. Britain and India are known to feature strongly in the flavouring sector.

Part IV: Production schedules

Because farming enterprises are so diverse, a very basic schedule is proposed. Producers have to adapt the schedule to their own needs.

As lemongrass is such a vigorous grower, weed control will be a limited operation, usually confined to hand hoeing or pulling out broad-leaf weeds that may occur.

General crop schedule – lemon balm												
Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Field preparation												
Rip and plough												
Disking												
Prepare seedbed												
Planting, cultivation and harvesting												
Plant and transplant												
Weed control												
Pest control												
Disease control												
Irrigate												
Harvest												

Part V: Utilisation

Citral, an ingredient of lemongrass oil, has numerous uses, and can be further processed to possess a violet-like fragrance for perfumery, and as a source of vitamins A and E. Lemongrass oil is also used for deodorants, waxes, polishes, detergents and insecticides where its low cost is attractive.

1. COSMETICS

Lemongrass oil is used as a fragrance component in soaps, detergents, and cosmetics. It is also used in aromatherapy, and it improves circulation and muscle tone. Astringent and toning, a lemongrass facial is administered through steam inhalation. It tightens, refines and firms a sluggish, lacklustre, oily skin. In aromatherapy it is used as tissue toner.

2. PHARMACEUTICAL AND THERAPEUTIC

The grass is considered a diuretic, tonic, antiseptic and stimulant. It promotes good digestion, and a preparation of lemongrass with pepper is used for relief of menstrual troubles and nausea. It induces perspiration, cools the body and reduces a fever. It is used to treat diarrhoea, stomach-ache, headaches, fevers, and flu. It is helpful in treating muscular pain, poor circulation, and muscle tone and slack tissue. The antiseptic oil treats athlete's foot and acne.

Lemongrass fights airborne bacteria when used in a vaporiser for relief of symptoms of colds and flu. A lemongrass foot bath scent refreshes sweaty feet while its antibacterial properties prevent fungal infections. Dilute lemongrass oil and apply directly on topical areas affected by ringworm. In veterinary use it appears in dog and cat shampoos as repellent for fleas, lice and ticks.

3. FOOD AND FLAVOURING

Fresh

The bulbous stem and leaf are used in oriental cooking. With the distinct lemon flavour it is in great demand for a variety of dishes.

Dried

Tea made from the leaf can be used pure, but is mostly used as a blend with Indian and other teas.

4. INDUSTRIAL

- ◆ Insect repellents, candles and waxes.
- ◆ Constituent of organic pesticides.
- ◆ Vitamins A and E are extracted from it.

5. PERFUMERY USES

Bath salts, soap basis, blends well with attar of rose, rose geranium or palmarosa, citrus, lime and orange.

6. SAFETY DATA

Because of sensitising potential, pure undiluted lemongrass essential oil should not be used on any part of the body. Lemongrass can be very acidic in containers with plastic lids as well as on any material in contact. The oil can be harmful if swallowed and should be kept out of children's reach. Essential oils remain potent for 6 months to 2 years with proper care, and if freshness is suspect the oil should be discarded.

REFERENCES*

Area development project for promotion of lemon grass. 2004–2005.
Online: <http://www.nabard.org/roles/ms/ph/lemongrass.htm>.

Aromatherapy and essential oils. 1996–2007. Green Valley aromatherapy.
Online: www.57aromas.com.

* Further information on references could be obtained from members of SAEOPA and KARWYL Consultancy.

ASNAPP Agribusiness in sustainable natural African products (South Africa), Newsletter. 2008. Online: www.asnapp.org.

AZTEC International, available at: www.aztexonline.com.

GERNOT, K. 2002. Franzez Karl Universität – G K spice pages.

Healthline. 2005–2007. Healthline networks, Inc., available at: www.ang-kfunigras.ac.

Henriette's herbal home page. 1995–2007. Henriette Kress, available at: www.henriettesherbal.com.

SIMON, J.E., CHADWICK, A.F. & CRAKER L.E. 1984. *Herbs: An indexed bibliography*. 1971–1980. The scientific literature on selected herbs and aromatic and medicinal plants of the temperate zone. Archon Books, 770 pp., Handem CT. Online: <http://www.hort.purdue.edu/newcrop/med-aro/factsheets/LEMONGRASS.html>.

