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Lemongrass an aromatic crop: Boost for farmers income

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Abstract

Lemongrass, cultivated mainly for the economical purpose- an essential oil based on lemongrass has great demand by the aroma industry. This crop provides substantial benefits to the farmers in achieving higher profits, utilization of wastelands and protection of their crops from wild and grazing animals. It provides numerous ecological, medical, agricultural, nutritional and economic benefits. It could bring transformative changes in the aroma sector through desired interventions in area of agriculture.

Keywords: Essential oil, wasteland, citral, distillation

Introduction

Lemongrass commonly known as 'East Indian Lemongrass' is a perennial and multicut aromatic grass. The prefix 'lemon' owes to its typical lemon like odour, which is mainly due to the presence of citral, a cyclic monoterpene. It is a tropical perennial plant (Joy *et al.*, 2006) [7]. It originated in Asia and Australia. Lemongrass oil of commerce is also popularly known as Cochin oil in the world trade, since ninety percent of it is shipped from Cochin port. The annual world production of lemongrass is around 1000 tons from an area of 16000 ha. In India, it is cultivated in an area of 4000 ha and the annual production is around 250 tons. It is one of the aromatic crops under the Aroma Mission launched by the Union Ministry of Science & Technology, GOI through the Council of Scientific & Industrial Research (CSIR).

Species and varieties: Lemongrass belongs to family Graminae (Poaceae) and the genus *Cymbopogon*. The term *Cymbopogon* is derived from the Greek words 'Kymbe' (boat) and 'pogon' (beard), referring to the flower spike arrangement. Generally, its three species are identified (Gupta, 1969; Chandra and Narayanan, 1971) [6, 2].

a) *Cymbopogon flexuosus* (2n= 20, 40)

It is known as East Indian, Cochin or Malabar grass. It is a tufted robust perennial grass of about 2m height. The leaves are linear and lanceolate. The inflorescence is very large and highly branched terminal drooping panicle bearing paired spikes on tertiary branches. The spikes bear spikelets in pairs of which one is sessile and the other pedicellate. The sessile spikelet is an awned bisexual floret whereas the pedicellate is an awnless staminate floret (Ganjewala *et al.*, 2013) [4]. Under this species two varieties or types are identified based on the colour of stem.

- *C. flexuosus* var. *flexuosus* – It is red grass. The stem and leaf sheath are reddish or purple in colour. It is recognized as the true lemongrass. The essential oil contains more than 75-80% citral, exhibits good solubility in alcohol and hence superior in quality (Guenther, 1950).
- *C. flexuosus* var. *albescens* – This white grass is characterized by the white colour of the stem. The plant is normally seen wild. The essential oil contains less than 65-70% citral, exhibits poor alcohol solubility and is hence considered inferior in quality.

b) *Cymbopogon citratus* (2n = 40, 60)

It is known as West Indian or American lemongrass. It is a stemless perennial grass with numerous stiff tillers arising from short rhizomatous rootstock, making large tussocks. It seldom flowers under cultivation. Leaf blade is narrow, linear, glaucous, drooping with scabrous margin, ligule truncate, inflorescence rarely produced, a large loose panicle; spathe bracts long and narrow, sessile spikelets, awnless, linear, lanceolate. The essential oil contains 74-76% citral and exhibits poor solubility.

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c) *Cymbopogon pendulus*

It is Jammu lemongrass and is white stemmed and dwarf in nature. The plant is frost resistant and suited to Sub-Himalayan areas of North India. The essential oil contains around 75-80% citral and exhibits medium solubility in alcohol (Joy *et al.*, 2001) [8].

Cultivated varieties

Lemongrass varieties released for cultivation are Sugandhi (OD-19), Pragati (LS-48), Praman (Clone-29), RRL-16, CKP-25, RRL-39, Kavary, Krishna, SD-68, GRL-1, SB-9, Chirharit, RLJ-TC-7, RLJ-TC-8, RLJ-TC-11, Jama rosa and OD-408.

Growing and potential belts

Lemongrass is widely cultivated in the states of Kerala, Karnataka, Tamil Nādu in the southern region, parts of Uttar Pradesh and Uttarakhand in the northern region and Assam in the north-eastern region. It can be cultivated throughout Andhra Pradesh either as rainfed or irrigated crop (Singh, 1999) [10].

Agro-climatic requirements

The crop grows well in both tropical and sub-tropical climates at an elevation up to 900 m (above MSL). However, ideal conditions for growing lemongrass are warm and humid climate with sufficient sunshine and 250-330 cm rainfall per annum, evenly distributed over most part of the year. A temperature ranging from 20-30°C and good sunshine throughout the year is conducive to high crop yield. Lemongrass can also be grown in semi-arid regions receiving low to moderate rainfall. Well drained sandy loam is most suitable for the growth of the plant. It can be grown on a variety of soils ranging from loam to poor laterite. Calcareous and waterlogged soils should be avoided as they are unsuitable for cultivation (Farooqi and Sreeramu, 2001) [3]. Soils of pH 5.5 to 7.5 are utilized.

Manuring

The crop requires 10 tonnes/ha of compost and 275 kg N, 50 kg P₂O₅ and 175 kg K₂O/ha/annum.

Plantation/Propagation

The crop is propagated in a better way through seed raised in nurseries. 2.5 kg of the fresh seed produces enough seedling for planting of 1 ha land. It could also be propagated vegetatively by splitting the clumps into slips (Anonymous, 1981) (Fig. 1(a)). These are planted at spacing of 60 x 80cm (Fig. 1(b)). About 20,800, slips are required for one ha. Fig. 3 (c) shows the field view of lemongrass. Lemongrass is generally propagated through seeds. Seed is mixed with dry river sand in the ratio of 1:3 and sown in the field at the rate of 20 to 25 kg/ha. Alternatively, seedlings can be raised in a nursery in one-tenth of the area of the main field and transplanted after 45 days.



Fig 1: a) Splitting of lemongrass slips, b) Plantation of lemongrass slips & c) Field view of lemongrass

Harvesting and processing

The harvesting season of lemongrass begins in May and continues till the end of January. Sunny days are more preferable, since cloudy and misty conditions tend to depress leaf oil content. The plants are cut about 10-20 cm above the ground level (Fig. 2(a)). About 2-3 harvests are possible during the first year and 3-4 in subsequent years (Subramanyam and Gajanana, 2001) [11]. The first harvest can be taken 75 days after planting, second harvest, 30-40 days after first harvest and third, 40-50 days after second harvest. The herbage yield is 3-4 tonnes/acre/harvest and the average oil yield is 50-70 kg/acre/year. After harvesting, the herbage needs to be processed before distillation (Fig. 2(b)). In case of larger distillation assembly the herbage can also be used directly without chopping into smaller pieces.



Fig 2: a) Harvested sample, b) Processing before distillation, c) Distillation assembly

Distillation: The lemongrass essential oil is collected by either hydro-distillation or steam distillation (Fig. 2 (c)) of the herbage for 2-3 hours. The herbage can be distilled either fresh or after wilting (Ranade, 2004) [9].

Purification and storage

Freshly distilled oil contains some impurities and moisture. For the removal of moisture in the oil, anhydrous sodium sulphate at the rate of 2g/kg oil has to be added and kept overnight. The oil then can be filtered through filter paper. The essential oil is caustic in nature and volatile under ambient temperature. It is viscous liquid, yellow to dark yellow or dark amber in colour (Fig. 3(b)). Component analysis is done by using GC-MS (Gas Chromatography-Mass Spectrometry) assembly (Fig. 3 (a)). Citral or 3,7-dimethyl-2,6-octadienal (both E- and Z- isomer) is the major compound in the lemongrass oil (Weiss, 1997; Ranade, 2004) [12, 9]. Geranial (E) and neral (Z) are the two important isomers of citral. During storage, oil should be filled up to the brim and containers should be kept away from direct heat and sunlight.



Fig 3: a) GC-MS (Gas Chromatography-Mass Spectrometry) assembly, b) Lemongrass oil

Seed production

The crop flowers during Nov-Dec and seeds mature in next

two months *viz.* February and March. For collection of seeds, the plants are maintained in good health as the yield of seeds from plants subjected to regular harvest is low. On an average, a healthy plant gives about 100-200g of seeds. At the time of seed collection, the whole inflorescence is cut and sun dried for 2-3 days. These are then threshed and seeds are again dried in sun and the seeds remain attached with fluffy mass which is removed by beating of seed bag at sowing. These dry seed lots are stored in gunny bags lined with polyethene. The seeds lose their viability if stored for a period more than one year.

Functional properties and benefits

Cymbopogon species provides numerous ecological, medical, agricultural, nutritional and economic benefits.

- It has a well ramified root system which helps in soil and water conservation.
- In low-lying tropical areas where periodic flooding brings water-borne diseases, plantations of lemongrass help disperse the flooded fields by drawing moisture upward and evaporating it from the leaves, thereby removing the primary source of illnesses.
- Its essential oil is used in flavours, cosmetics, perfumes,

bactericide, as insect repellent and in medicine.

- Essential oil contains powerful antibiotic, antiviral and antifungal properties that are used effectively against infectious and inflammatory symptoms.
- The spent grass is fed to cows to increase their production of healthy milk, which in turn strengthens human immunity.
- Its leaves are used in the manufacturing of paper and cardboard.
- Grass when used as mulch in gardens and orchards, increases the fertility of the soil.
- It controls obesity.
- It cures stomach disorders.
- It maintains cholesterol levels
- It boosts nervous and immune system
- It reduces fever
- It cleanses harmful toxic wastes
- It treats various types of cancer
- It treats infections with antiseptic properties.

Pests and diseases and their management

Following Table no.1 presents pests and diseases occurring in cultivation of lemongrass and its management.

Table 1: Pest and diseases in lemongrass and their management

Pest	Stage of pest/ symptom of damage	Management measures
Termites	Drying of clumps	Localized drenching of chlorpyrifos 2-3ml/L
Mealy bug <i>Dysmicoccus brevipes/ Pseudococcus bromeliae</i>	Adults and nymphs colonize near base of clumps	Sanitary measures to be adopted. Localised application of neem oil garlic emulsion (2%)
Stem borer <i>Chilothea sp.</i>	Caterpillar- death of tillers	Mercaptothion 50EC spray @ 0.2%
Spittle bug <i>Clovioa bipunctata</i>	Adults and nymphs- stunted growth	Not serious
Nematodes <i>Tylenchorrhynchus vulgaris</i> <i>Rotylenchus reniformis</i> <i>Helicotylenchus spp.</i> <i>Pratylenchus spp.</i>	Adults and nymphs- root damage resulting in stunted growth	Not serious
Disease		
Little leaf	Virus	Destruction of affected plants and control of vector
Leaf rust	<i>Puccinia nakanishikii</i>	Spray mancozeb 0.3%
Leaf spot	<i>Helminthosporium cymbopogi</i>	Spray Bordeaux mixture 1% or Copper oxychloride 0.2%
Blight Curvularia leaf blight Leaf blight Grey blight	<i>Curvularia andropogonia</i> <i>Rhizoctonia solani</i> <i>Pestalotiopsis magniferae</i>	Spray Bordeaux mixture 1% or Zineb 0.3%

Cost - benefit analysis

Table 2: Following section discusses cost-benefit analysis of cultivation of lemongrass per hectare.

Sr. No	Items	Cost (Rs)
Fixed Cost (A)		
1)	Construction of a distillation shed with dimensions 6 x 4.5 x 4.5 meter suitable for a hectare cultivation of lemongrass	1,00,000
2)	Water tank (4.3 m height with a capacity of 2000 litres) and pump set (5 hp)	60,000
3)	Distillation unit (Capacity 1 MT)	3,20,000
4)	Installation charges	50,000
	Sub-Total	5,30,000
	Fixed cost per year (A)	75,714
Variable cost (B)		
1)	Cultivation of lemongrass (includes cost of planting, fertilizers, labour charge and harvesting)	2,72,000
2)	Cost of distillation	90,000
	Sub-Total (B)	3,62,000
	Total Expenditure per year (C) = (A)+(B)	4,37,714
Income (D)		
1)	Total Oil production per hectare	450 Litres
2)	Income from farm (Average selling price of Rs 1200/litre)	5,40,000
	Net Profit per year (E) = (D) - (C)	1,02,286

Cost benefit analysis presented above indicate that cultivation of lemongrass could earn a profit of Rs 1,02,286/- per hectare per year. It has substantial initial investment cost which in long term is compensated by the profit margins. Farmers can avail loans from various commercial banks supported by National Bank for Agriculture and Rural Development (NABARD). National Horticulture Board (NHB) also offers subsidy schemes for aromatic crops which when combined with state subsidies can significantly reduce initial cost to farmers. Hence, Lemongrass can avail a sustainable livelihood support for farmers with least maintenance and care as once planted, it can produce up to 7 years. The cultivation of lemongrass is also supported by Aroma Mission promoted by Council of Scientific & Industrial Research (CSIR).

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