



***Cymbopogon winterianus* : An Important Species for Essential Java Citronella Oil and Medicinal Value**

Ranjana Katiyar, Somesh Gupta* and K. R. Yadav

Forest Research Institute, Kanpur

*Email : ftisomesh@gmail.com

Introduction

Citronella was first introduced in India in 1959 from Indonesia (Java Island, hence the name Java citronella) (Kaul *et al.* 1997). Citronella (*Cymbopogon winterianus* Jowitt) is an aromatic grass belonging to the Poaceae family which gives essential oils upon stem distillation. This is used extensively as a source of perfumery, soap, cosmetic and flavoring industry throughout the world. India has been a leading producer of essential oils including oil of citronella. However, it is now facing stiff competition from other developing countries, in several commodities both in quality and price.

At present, it is found in the states of U.P, M.P, Maharashtra and various parts of India. But areas receiving good and distributed rainfalls throughout the year are suitable for cultivation of citronella. Keeping in view the growing demand of essential oils, the present paper proposes the cultivation technique of *Cymbopogon winterianus*.

Materials and method

Description: Although Citronella resembles in appearance to lemon grass and Palmarosa but its clumps are more compact and dense. Citronella is an aromatic perennial herb with fibrous roots. It is erecting over 2 m tall with smooth and shiny leaves which are glabrous at the nodes.

The leaf blades are linear, gradually tapering to a long, membranous, acuminate and upto 1 m long

and 1.5 cm wide, drooping at two-third of its length. The leaf sheath is smooth and glabrous, yellow or purplish-red in color. The inflorescence is very large, erect, finally drooping, consisting of a branched and rebranched axis.

Uses

Citronella oil is commonly known for its natural insect repellent properties, though it has many other uses in aromatherapy. This oil is also known as Java citronella and has a fresh, powerful, lemon like scent. The oil can effectively be used in a nebulizing or humidifying diffuser for its insect repellent properties. Traditional uses has include treatment of fever, intestinal parasites, digestive and menstrual problems. In Chinese medicine, it is used for rheumatic pain. Citronella oil is considered to have warming and activating qualities on both mental and physical levels. It can be used as massage oil for aching joints and muscles. On a mental level, Citronella can be clarifying and balancing. Combining it with Lemon oil can bring even more of a brightening effect to the mind. In addition, the essential oils are natural products that exhibit a variety of biological properties, such as analgesic anticonvulsant and anxiolytic (Almeida *et al.* 2001, 2003, 2004 and Umezu *et al.* 2002). The steam volatile essential oils extracted from its leaves are used in perfumery, cosmetics, pharmaceuticals and flavoring industries. *C. winterianus* essential oil has CNS effect and anticonvulsant properties (Guenther, 1950 and Blanco *et al.* 2007).



Active constituents

C. winterianus essential oil is rich in citronellal, geraniol and citronellol (Cessal and Vergas, 2006). There are other constituents like citronellyl acetate, L-limonene, ellemol and other sesquiterpene alcohols present in citronella.

Flowering:

September- October

Soil and climate

The plant has been found to grow well under varying soil conditions but sandy loam soil with abundant organic matter is most suitable. Citronella thrives well in a range of soil pH ranging from 5.8-8.0. Heavy clay and sandy soils are not suitable as they do not support good growth. The crop is very sensitive to water logging which should be avoided to get optimum yields. It requires abundant moisture and sun shine for its growth. Well distributed rainfall ranging from 200-250 cm and high atmospheric humidity appears to influence the plant growth, yield and quality of oil favourably. The growth of citronella is reported to get restricted when grown on higher altitude above 400 m, resulting in lower yields (Chandra, 1973). Like palmarosa, this crop is hardy and adapts to a range of adverse soil condition including moisture stress conditions. Addition of FYM and spentwash to the sodic soil significantly increases herb and oil yield of Citronella Java (Prasead and Patra, 2004).

Cultivation technique

(i) **Land Preparation:** The land is brought to a fine tilth by ploughing deep and pulverized by criss-cross harrowing and the field is laid out in to 6 m side beds, providing irrigation channels. Ridges and furrows are made at 60 cm intervals. It is also beneficial to add 20-25 t/ha of FYM or compost and mixed properly in the soil at the time of final tillage. 20-25 kg of BHC powder can also be added at the time of final land

preparation to eliminate the risk of infestation of termites in standing crop.

(ii) **Planting:** Viable seeds are not formed because of irregularities in meiosis and therefore these species can be propagated only by vegetative means. For this, one year old or even older clumps are dug out and are split into slips, each containing 2 to 3 tillers. The fibrous roots and leaves should be trimmed of the slips before planting. It is observed that one year old clump, on an average gives about 50 slips.

These slips are planted with the onset of monsoon to ensure better establishment even without irrigation. However, July-August and February-March, have been found ideal time for planting. The slips are planted 8-12 cm deep into the soil maintaining a distance of 60×60 cm apart. As such, about 55,555 slips are required for planting in one hectare. Even a close spacing at 30×30 cm has been found beneficial in keeping the weed growth under check (Rao *et al.* 1993) However, in areas where the soil is very fertile and the climatic condition support luxurious growth, a spacing of 90×90 cm may be followed. It is better if the slips are planted on ridges to avoid water logging.

(iii) **Manures and Fertilizers:** Application of P and K at the rate of 40 kg/ha/year has been recommended as a basal dose. However, the most effective level of phosphorous has been found, as 60 kg/ha. The oil quality also improved due to the application of fertilizer (Munsi and Mukherjee, 1982).

(iv) **Irrigation:** Citronella requires sufficient moisture for good growth and yield of leaves. In the areas where the annual rainfall is about 200-250 cm well distributed over the year and humidity is high, supplemental agriculture is not necessary. In the drier months, however, irrigation may be provided and this increases the



yield. In all, average 25-30 irrigations are required in a given year.

- (v) **Interculture:** Citronella grows slowly initially and therefore susceptible to weeds particularly during the first 60 days after planting. Hand weeding, mulching with spent grass (5 t/ha), close spacing (30 ×30 cm) and application of herbicide like atrazine (1.0 kg ai/ha) and butachlor (1.0 kg ai/ha) produce higher biomass, essential oil content and yield of citronella Java compared to unweeded check (Rao *et al.* 1993 and Singh *et al.* 1996). It is reported that 'diuron' effectively checks the weeds.
- (vi) **Pest and Diseases:** Among the insects, termites are reported to cause most damage to the plants. The termites menace can be controlled by the application of the 25kg per hectare Aldrin to the soil at the time of planting.

Leaf blight disease: It is caused by *Curvularia andropogonis* at the beginning of monsoons. This disease appears in the form of small, brownish spot, which enlarge into long patches and the margins of the leaves. This disease can be controlled by Prophylactic spraying of either Dithane M-45 or Dithane Z-78 (0.3%) at interval of 10-15 days during the growth period (Servar *et al.* 1980).

Another fungus *Colletotrichum graminicola* has been found to affect the crop in Karnataka. The disease can also be controlled by application of above fungicide.

Sheath rot disease: It is caused by *Rhizoctonia solani* in the terai region of U.P. It is controlled by spraying Hexaconazole (5%).

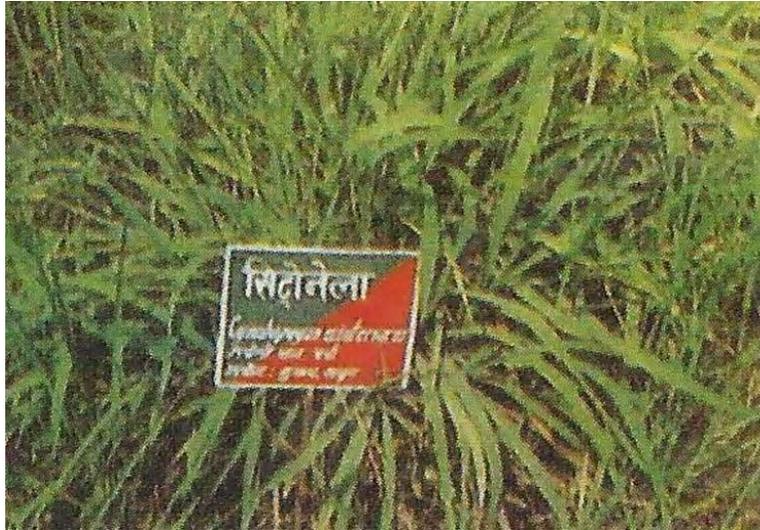
- (vii) **Harvesting, Distillation and Yield:** The crop gets ready for first harvest after about 9 months of planting. Harvesting is done by using an aridary sickle, at about 20-45 cm above the ground. The crop is harvested in the month of March, June and September. The crop flowers

during October- November and the flowering stalks should be nipped off to discourage flowering. If the flowering stalks are allowed to grow, the plants will tend to age very soon and their life span may be reduced. Generally, the crop once planted yield a profitable income for three to four years and should be replanted after this period. Well maintained plantation may thrive longer.

The fresh herbage is steam distilled immediately never later than 24 hours to obtain citronella oil. The oil content of the leaves is affected by various factors, such as the soil, climate, age of the plantation and method of efficiency of distillation. On an average, however, the oil content is about 1% on the basis of fresh rate of leaves. The yield of leaves may range from 15-20 tones per hectare in the first year and 20-25 tones per hectare in the second and third year. The yield of oil obtained during the first year is about 100-150 kg per hectare and, in subsequent years about 200 kg per hectare of oil of citronella may be obtained.

Discussion

Citronella Java is a multicut, perennial aromatic grass belonging to the family Poaceae, Gramineae. The freshly harvested biomass on steam distillation yields an essential oil, the citronella oil, which is a natural source of important perfumery chemicals like citronellol, geraniol etc., which finds extensive uses in soaps, perfumery, cosmetic and flavoring industry throughout the world. Presently, it is cultivated in a number of states of India. Assam accounts for more than 80% of the current production of essential oil. The crop is conventionally grown in north eastern parts of India. However, the area under cultivation is increasing rapidly under subtropical conditions of Northern Indian plains also due to higher benefit: cost ratio. This paper will provide a systematic approach towards cultivation of *Cymbopogon winterianus* in Northern India as well.



Cymbopogon winterianus

References

- Arun Prasad and D.D Patra (2004). Medicinal and aromatic plant for utilization of sodic lands. Indian farming 11-14.
- Almeida, R.N., Navarro, D.S., Barbosa-Filho, J. M., 2001. Plants with central analgesic activity. Phytomedicine 8, 310-322.
- Almeida, R.N., Motta, S.C., Leite, J.R., 2003. Properties of essential oil as anticonvulsants. Bol. Latinoam. Caribe lantas Med. Aromat., 3-6.
- Almeida, R.N., Motta, S.C., Faturi, C.B., Catallani, B., Leite, J.R., 2004. Anxiolytic-like effect of rose oil inhalation on the levated plus maze test in rats. Pharmacol. Biochem. Behav. 77, 361-364.
- Blanco, M.M., Costa, C.A.R.A., Freire, A.O., Santos Jr., J.G., Costa, M., 2007. Neurobehavioral effect of essential oil of Cymbopogon citrates in mice. Phytomedicine, in press, doi: 10.1016/j.phymed.2007.04.007.
- Cassel, E., Vargas, R.M.F., 2006. Experiments and modeling of the Cymbopogon winterianus essential oil extraction by steam distillation. J. Mex. Chem. Soc. 50 (3), 126-129.
- Chandra, V., 1973. Cultivation of Cymbopogon winterianus Jowitt. In India. Indian Perfum. 17:1-8.
- Guenther, E., 1950. In: Guenther, E. (Ed.), Essential oils. Van Nostrand Co., Inc, London.
- Kaul, P.N., Bhattacharya, A.K., and Rajeshwara Rao B.R. 1997. Chemical composition of the essential oil of Java Citronella (*Cymbopogon winterianus* Jowitt) grown in Andhra Pradesh. PAFAI J. 19: 29-33.
- Munsi, P.S. and Mukherjee S.K. 1982. Effect of fertilizer treatment on yield and economics of cultivation of Mentha, citronella and Palmarosa. Indian Perfom. 26:74-80.
- Rajeswara Rao, B.R., Bhattacharya, A.K., Sukhamal Chand and Kaul P.N. 1993. Cultural chemical methods of weed control foe citronella Java (*Cymbopogon winterianus* Jowitt). Indian Perfumer 37: 270-274.
- Sarwar, M., Krishnaswamy, S. and Prameswaram, T.N. 1980. Leaf spot fungi of Cymbopogon winterianus Jowitt. Indian J.Bot. 3:92-97.
- Singh, K., Chowdhury, A., Singh, D.V. 1996. Effect of diuron and nitrogen weed growth, oil, yield and N utilization in citronella Java (*Cymbopogon winterianus*). Indian Perfum. 40: 47-52.
- Umez, T., Ito, H., Nagano, K., Yamakoshi, M., Ouchi, H., Sakaniwa, M., Morita, M., 2002. Anticonflict.