

Lemongrass (*Cymbopogon flexuosus*) Cultivation, Oil Extraction and Chemical Composition in Kannauj Region (U.P)

Avinash Singh¹, Ajay Kumar²

Ph. D. Student, Department of Biotechnology, Rama University, Kanpur, Uttar Pradesh, India¹

Associate Professor, Department of Biotechnology, Rama University, Kanpur, Uttar Pradesh, India²

ABSTRACT: Kannauj region is famous for the agriculture of aromatic crops. Lemongrass is one of the important aromatic crops for this region. The climatic condition and quality of soil widely affect the production and its oil component. The study explores the production of lemongrass oil and its oil components in Kannauj region. For the present study the farming of lemon grass (*Cymbopogon flexuosus*) CKP-25 was done in 100 square meters then oil was isolated through steam distillation method. This oil was analyzed for its components by GC-MS. The production of lemongrass was about 400 Kg/100 square meters/ year. Whereas the production of lemongrass oil was about 0.77%. The result of the GC-MS reveals that there was 64 different compounds are present in that, the major compounds of lemongrass was β -Myrcene (2.33%), β -ocimene, 2,6-dimethyl (1.76%), β -ocimene (1.84%), 3,3,6-trimethyl-cyclo hex-2-enol (0.56%), Thujone (1.22%), 3-undecyne (1.24%), Neral (30.98%), Geranial (43.67%), 3-undecyne (1.24%), Nerol (3.92%), Geranyl acetate (0.80%), Caryophyllene (1.89%), Cadinene (0.68%), Cadina (0.21%). The overall study suggests that, the production of lemon grass was higher than the country level production and the yield of oil from this grass was equal to the national ratio. The oil of this region contains total 65 chemicals in that the citral content was 74.65%.

KEYWORDS: Citral, Neral, Geranial, steam distillation, GC-MS.

I. INTRODUCTION

Lemongrass is an important aromatic cum medicinal herb. It belongs to the family of *Gramineae* and genus *cymbopogon*, which consist of more than 80 species. *Cymbopogon flexuosus* (CKP-25) is improved variety of lemongrass; the production of the essential oil from CKP-25 is higher up to 0.8%. Basically lemongrass is cultivated in eastern and southern part of India^[1] but now a day it is also cultivated in other part of the India like Kannauj due to grate demand. The soil of the Kannauj region is sandy loamy and the annual rain fall is near 780-825 mm. Due to the change in the climate condition the plant product (production, Quality of the product) can vary^[2]. The effect of seasonal changes in oil content of lemongrass was investigated during the year 1979-1980. The role of many environmental components like temperature, rainfall, relative humidity and soil moisture on the variation of oil content under the agro climatic condition. The monsoon span is characterized by higher oil content, while the winter and autumn by comparatively lower oil content. However, the above major environmental components individually seem to have no direct relationship with the oil content. The influence exerted by the climatic factors is cumulative in exertion^[3]. Short periods above 30°C have little general effect on plants, but severely reduce oil content. The plant is hardy and resistant to draught. Maximum plant height was recorded during rainy season and least during second harvest non-rainy season. The yield of oil fluctuates greatly with the season, the condition of the plant material, its moisture content and the age of planting^[4]. Lemongrass flourishes in a wide variety of soil ranging from rich loam to poor laterite. In sandy loam and red soils, it requires good manuring. Calcareous and water-logged soils are unsuitable for its cultivation^[5]. Basically this study aim to evaluate the production of the lemongrass in Kannauj region and the composition of the oil also.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 7, July 2017

II. LITERATURE SURVEY

Nair and Jayakumar, 1999 reported that the Lemongrass is cultivated on large scale at Western Ghats of India also observed that the Citral content was about (82%)^[6].

Singh, 1999 observe that the Traditionally lemongrass is grown in high rainfall area as a rain fed crop in Kerala state. But under semi-arid tropical conditions, it is grown as irrigated crop. Yield of oil vary with the season, the condition of the plant material, its moisture content and the age of planting^[4].

Weiss, 1997 *C. flexuosus* and *C. citratus* flourish in sunny, warm, humid conditions of the tropics. In Kerala, lemongrass grows well between 900 and 1250 m from mean sea level. Both species produce highest oil yield per tonne of herbage where the rainfall averages 2500-3000mm annually. *C. citratus* is more drought tolerant^[7].

Farooqi and Sreeramu, 2001. Lemongrass can be cultivated in a wide variety of soil ranging from rich loam to poor laterite. For sandy loam and red soils, it requires good manuring. Calcareous and water-logged soils are unsuitable for its cultivation^[8].

Gupta et al 1987 Reported that oil content in lemongrass was 0.29% and 0.63% on fresh and dry weight basis, respectively^[9].

Ranade, 2004 has analyzed the oil component of East Indian lemongrass 75-85% of aldehydes consisting largely of citral. Other constituents in the oil are linalool (1.34%), geraniol (5.00%), citronellol, nerol (2.20%), 1,8 cineole, citronellal (0.37%), linalyl acetate, geranyl acetate (1.95%), α -pinene (0.24%), limonene (2.42%), caryophyllene, β -pinene, β -thujene, myrcene (0.46%), β -ocimene (0.06%), terpenolene (0.05%), methyl heptanone (1.50%) and α -terpineol (0.24%)^[10].

III. METHODOLOGY AND DISCUSSION

This study was conducted for a year. In which selection of the *Cymbopogon flexuosus* slips, cultivation, steam distillation and GC-MS of the isolated essential oil was take place. The basic guidance for cultivation of the Lemongrass was taken from Fragrance and Flavor Development Centre (FFDC), Kannauj, Uttar Pradesh, India.

Selection of lemongrass slips

The people of Kannauj region are using *Cymbopogon flexuosus* (CKP-25) species plant which is an improved variety. The slips were collected from FFDC, Kannauj. These slips were used for the nursery preparation. After nursery preparation the child plants were transferred into the field. Seed were not used to avoid the genetic variation^[11].

Plant husbandry

Cymbopogon flexuosus (CKP-25) can be cultivated on almost every type of the soil. But soil of specific and experimental field of Kannauj was loamy sand, with pH 6.5, organic matter 1.6% and field holding capacity 40%. Planting were done in 100 square meter field. Plants were irrigated according to local common practices, and were fertilized with nitrogen, phosphorus and potassium at a ratio of Annually, 180 kg N, 80 kg P₂O₅ and 50 kg K₂O per hectare were used for plant fertilization. Plants were planted on the distance of 75×60 cm for the proper irrigation^[11].

Isolation of lemongrass essential oil

After 100 to 120 days of planting in field, the lemongrass herbs were harvested and sun dried for 24 hours to reduce the moisture from the plants^[11]. Then these herbs were used for the steam distillation^[7], to isolate the essential oil present in the herbs.

Assessment of oil components

The recognition of the lemongrass essential oil components were carried out by gas chromatography mass spectrometry (GC-MS) on a gas chromatograph Agilent 6890 coupled to selective mass detector Agilent 5976 using ultra performance HP-5Methyl Silicone column (50 m × 0.25 mm i.d; 0.25 μ m film thickness) and a split/splitless injector at 4^o C/ min ramp rate and the Library NIST Mass Spectral Search Program. Split injection ratio 70:1, injecting 0.2 μ l. The test was carried out at 250^oC, the oven at initial 50^oC for 2 minutes increasing 10 ^oC per minute till 200^oC was reached. The flow was of 0.7 μ l/min at a constant speed of 30 cm/s with a 250^oC interface.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 7, July 2017

DISCUSSION

The findings from this study suggest that, the production of the lemon grass was higher than the national ratio and the yield of the oil is equal to the national ratio. There was 64 different chemicals are identified in lemongrass oil, the citral content of the oil was 74.65%.

There was no research available which can conclude the production and the component of lemongrass oil in the Kannauj region. This study can help both farmer and industry to know the chemical composition of the lemongrass oil. Somewhat surprisingly, the production of the lemon grass was higher than the national ratio and the yield of the oil is equal to the national ratio. According to the national horticulture board the yield of the lemon grass is 25 -30 ton/ hectare/ year and the percentage of the oil in the lemongrass was 0.5 - 0.8 per cent^[12].

One must question the mechanism to calculate the yield of the lemon grass, it was taken up to one year only, the production of the crop is increasing in the second year the crop duration. Nair *et al* (1979)^[13] have suggested that first harvest can be taken at 90 days after planting and subsequent harvest at 50-55 days interval up to 5-6 years from the same crop.

In our study we found that the citral concentration of Kannauj region lemongrass oil was about 74.65%. According to Nair the lemongrass essential oil is usually made up of citral at an average of 65 to 80%^[6]. East Indian lemongrass oil contains 75-85% of consisting largely of citral Ranade, (2004)^[10].

IV. RESULTS

The lemongrass was successfully planted in 100 square meter field. In one year total 4 harvesting was done. From these harvesting the total 400 Kg of lemon grass was collected. After harvesting lemongrass were leaved in field for 24 hours to improve the oil content. The lemon grass of kannauj region contains total 0.77% oil.

Assessment of oil component

The lemongrass essential oil was identified with its different types of components through gas chromatography mass spectrometry (GC-MS). There are around 64 chemicals were recorded which are mention in the table. The total percentage of Citral was about 74.65%.

S.No.	RT*	Name of the oil components	Percentage of components
1	1.30	Camphene	0.24
2	1.66	Terpinolene	0.03
3	2.23	Carene	0.01
4	2.53	1,4-hexadiene	0.07
5	2.92	β -Myrcene	2.33
6	5.80	Ocimeide	0.06
7	5.99	Pinene oxide	0.43
8	7.42	1,6-octadiene	0.10
9	8.13	Camphene	0.09
10	10.54	β -ocimene, 2,6-dimethyl	1.76
11	10.96	β -ocimene	1.84
12	11.08	Terpinene	0.10
13	11.20	Tricyclene	0.03
14	11.34	1-octyn-3-ol	0.04
15	12.04	Dodecen-1-ol	0.05
16	12.34	Decen-1-ol	0.04
17	12.89	Limonene	0.25
18	13.00	4-nananone	0.10

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 7, July 2017

19	13.21	1-methyl 4-(1-methyl thylidine)	0.12
20	13.50	Allo-ocimene	0.09
21	14.85	Myrcenol	0.17
22	15.18	Linalod	0.25
23	15.36	Trans-chrysanthemal	0.21
24	16.11	3,3,6-trimethyl-cyclo hex-2-enol	0.56
25	17.35	Citronellal	0.32
26	17.68	Thujone	1.22
27	18.34	3-undecyne	1.24
28	19.03	1-linalod oxide	0.16
29	20.09	Terpenol(α)	0.03
30	20.38	Carene	0.07
31	20.49	Terpenol(δ)	0.09
32	21.34	Neral	30.94
33	21.58	Sesquilavadiol	0.31
34	21.83	Verbenol	0.21
35	22.79	Geranial	43.67
36	22.81	Damascone (Z) α	0.01
37	22.85	Damascone (E) α	0.03
38	22.90	Neryl propenoate	0.13
39	22.96	3-undecyne	1.57
40	23.52	Bisabolene	0.16
41	24.32	Dextro-carvone	0.13
42	24.62	Cycloisolongifolene	0.04
43	25.59	Nerol	3.92
44	26.27	Methyl N-nonyl ketone	0.07
45	26.54	Oxiranmethanol	0.07
46	27.33	Biscyclopentylone	0.05
47	27.51	Gronic acid	0.10
48	28.21	Geranyl acetate	0.80
49	23.23	Caryophyllene	1.89
50	28.72	Caryophyllene	0.17
51	29.50	Bisabolene	0.06
52	29.76	Isoeugenol	0.16
53	29.81	Eugenol	0.06
54	30.06	Cadinene β	0.01
55	30.44	Germacrene	0.10
56	30.76	Copaene	0.05
57	32.54	Cubebene-delta	0.04
58	35.39	Viridiflorol	0.16
59	36.43	Cadinene	0.68
60	36.55	Cadina	0.21
61	37.06	Cadinol	0.04
62	39.20	Muurolo, 3,5-diene	0.04
63	43.73	Farnesylacetate	0.05
64	44.04	Khusimone	0.03

* Retention time

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 7, July 2017

V. CONCLUSION

Overall, this study suggests that, the production of the lemongrass was higher in Kannauj region. And yield of the oil and the citral (Neral+Geranial) content in the oil was also impressive. It must be borne in mind that this study was only conducted on a small area of Kannauj region over a short period of time. Further research is hence needed to calculate the total production of oil in different area of Kannauj region for the longer period of the time.

REFERENCES

1. Purnima Jayasinha, Lemongrass medicinal and aromatic plant series Vol. 9, 1999.
2. S Mark Howden, David H white soils, plant growth and crop production - Climate and its Effects on Crop Productivity and Management - Vol. I, 2007.
3. Handique A K and Gupta R K, *et al*, Variations of oil content in lemongrass (*Cymbopogon flexuosus*) as influenced by seasonal changes and its genetic aspects, *Indian Perfumer*, 28(1),54-63 1984.
4. Singh M and Shivaraj B, Effect of irrigation regimes on growth, herbage and oil yields of lemongrass (*Cymbopogon flexuosus*) under semi-arid tropical conditions, *Indian Journal of Agricultural Sciences*, 69(10), 700-702 1999.
5. Farooqi A A and Sreeramu B S, *Cultivation of Medicinal and Aromatic Crops*, Hyderabad, Universities Press (India) Limited 2001.
6. Nair EVG, Essential oil of East Indian lemongrass: Present position in India and scope of its development. *Cultiv. Util. Med. Aromat. Plants*, pp. 204-206 1977.
7. Weiss E A, *Essential oil crops*, Cambridge, CAB International 1997.
8. Farooqi A A and Sreeramu B S, *Cultivation of Medicinal and Aromatic Crops*, Hyderabad, Universities Press (India) Limited 2001.
9. Gupta R S, Trial cultivation of some medicinal and aromatic plants in Malwa region of Madhya Pradesh (India), Part II Analysis of essential oils, *Indian perfumer*, 31(4), 370-374 1987.
10. Ranade G S, Essential oil (Lemongrass oil), *FAFAI J.*, 6(3), 89.
11. Agriculture of lemongrass and its sustainable management brochure of FFDC Kannauj 2004.
12. <http://nhb.gov.in/model-project-reports/Horticulture%20Crops/Lemongrass/Lemongrass1.htm>
13. Nair E V G, Nair K C, Chinnamma M P, Field Experiments with micronutrients on the yield of grass, oil and citral content of oil of East Indian lemongrass (*C. flexuosus* var. OD-19), *Indian Perfumer*, 23, 55-58 1979.