

Registration of high citral rich essential oil yielding variety-CIM Jyoti of *Ocimum africanum*

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Article History

Received: July 18th, 2017

Revised: October 4th, 2017

Accepted: November 1st, 2017

Key words

Chemotype

Citral

Geranial content

Lemon scented basil

Ocimum africanum

ABSTRACT

Lemon-scented Ocimum (Ocimum africanum) belongs to the family "Lamiaceae". The essential oil of different Ocimum species is extracted by hydro- or steam distillation from the leaves or whole herb and is used to flavour foods, high grade fragrances, traditional ritual ceremonies and house hold medicines. The cultivar CIM Jyoti of Ocimum africanum has been developed by CSIR-CIMAP through intensive breeding efforts for higher herb and essential oil containing desirable content of citral (76.05%). The variety CIM Jyoti consistently showed these quality attributes in the field evaluation trials. The average herb and oil yield of this variety is 200 q/ha and 150 kg/ha, respectively. The citral (Neral+Geranial) content in its oil ranged from 68–76%. In these days essential oil having high amount of citral is in good demand. The lemongrass crop is the only source of essential oil for the extraction of citral. But lemongrass is a 4-5 years crop and farmers are hesitating to cultivate a long duration crop like lemongrass in their field. They have been demanding a short duration citral yielding crop for this purpose that should not disturb their traditional cereal and other crops cycle. CIM-Jyoti which is a short duration (70-80 days) variety fits very well in crop rotation/ intercropping between wheat and paddy and with other vegetables crops. Leaves of this variety can also be used in lemon teas.

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INTRODUCTION

Ocimum (family Lamiaceae) is a genus of about 35 species of annual and perennial aromatic herbs and shrubs. Most species are native to the tropical and warm temperate regions of the old world, including India. The dry herb (leaves), hydrodistilled essential oil and pure chemical constituents of *Ocimum* oils are exported to

European countries in sizable quantity every year. The total annual export of dry leaves, essential oil and chemical constituents of *Ocimum* from India is to the tune of 10,000 tons. Tulsi has several medicinal properties also. It is rich in carbohydrates, fibres, phosphorous, calcium, protein, iron, beta-carotene, vitamins B1 and B2. Tulsi leaf, when eaten fresh can control thirst, and so was invaluable to weary travellers. It is good for colds and coughs, indigestion, stomach pain, diarrhea, nausea, ulcers, ringworm and asthma. It is also known to lower blood sugar, and increase lactation.

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Doi: <https://doi.org/10.62029/jmaps.v39i4.Lal3>

Ocimum essential oil is also used as anti-perspirant and as fly and mosquito repellent. In these days essential oil having good amount of citral (neral + geranial) is in high demand. The lemongrass crop is the only source of citral enriched essential oil. But, lemongrass is a long-duration perennial grass and farmers are not very willing to engage their field for such a long time for lemongrass cultivation. CSIR-CIMAP has put persistent breeding efforts to fill this gap in the development of a short duration basil variety that is rich in citral (>65% wv) content. This report summarizes the result of our effort in this direction that have led to the development of citral rich short duration variety of *Ocimum africanum*. The details of this new variety are presented here for its official registration and commercial release.

ORIGIN OF VARIETY CIM-JYOTI

CSIR-CIMAP, Lucknow (India) has a collection of nearly 189 genetic stocks of nine *Ocimum* species-*Ocimum sanctum*-Krishna and Shyam tulsi, *O. basilicum*, *O. kilimandscharicum*, *Ocimum africanum*, *O. gratissimum*, *O. tenuiflorum*,

O. viridis and *O. basilicum* (Sweet and French basil). Using half sib selection approach in open population of *O. africanum*, followed by selection for high citral content, 11 genotypes were selected. These 11 genotypes (OAc-1 to OAc-11) were placed in a Initial Evaluation Trial (Table 1) with one local check (IET Ent-11+1 Check RBD, ReP.3, Plot size = 12.50 m²) for two consecutive years. In the IET 7 best performing lines namely, OAc-1, 2, 4, 5, 7, 9 and 11 (selected on the basis of high herbs and oil yields with high citral content) were placed in a Bench Scale Trial (BST) {Entries = 8 (7+one check), RBD, Reps-3, Plot size = 25m²) for another two years. The two best performing genotypes namely, OAc-1 and, OAc-2 along with one check were then placed in a Pilot Scale Trial (PST, Plot size 100 m²) along with check for two subsequent years. The best yielding genotype, OAc-1 always maintained its superiority over the check and others entries for high oil and high citral (total of neral +geranial) content (Table 1-4: Figures 1-3). The elite strain (OAc-1) is now released as variety CIM Jyoti for commercial cultivation.

Table 1: Mean performance of selections in different yield trials for three economic traits in *Ocimum africanum*

Entries	IET, E=12, RBD, Reps-3, plot size=12.50m ²				BST, E=8, RBD, Reps-3, plot size=25.00m ²			PST, E=3, plot size=100.00m ²				
	Fresh herb yield /plot (kg)	Oil Content (%)	Oil yield/ plot (g)	Oil yieldt (kg/ha)	Fresh herb yield/ plot (kg)	Oil Content (%)	Oil yield/ plot (g)	Fresh herb yield/ plot (kg)	Oil Content (%)	Oil yield/ plot (g)	Fresh herb yield (q/ha)	Oil yield kg/ha [expected yield (20% less)]
OAc 1	34.17*	0.75	183.67	146.94	65.22	0.75	507.00	250.80	0.80	200.64	250.80	200.64 (159)
OAc 2	22.17	0.32	70.00	56.00	55.23	0.58	324.57	208.10	0.65	135.27	208.10	135.27 (109)
OAc 3	20.26	0.36	78.30	58.64	-	-	-	-	-	-	-	-
OAc 4	26.10	0.28	80.33	64.26	52.53	0.58	308.00	-	-	-	-	-
OAc 5	25.67	0.40	102.67	82.14	51.25	0.55	278.33	-	-	-	-	-
OAc 6	15.96	0.30	48.00	38.40	-	-	-	-	-	-	-	-
OAc 7	25.73	0.39	100.07	80.54	54.60	0.53	287.67	-	-	-	-	-
OAc 8	17.77	0.33	59.00	47.20	-	-	-	-	-	-	-	-
OAc 9	24.27	0.29	70.30	56.24	48.33	0.52	248.33	-	-	-	-	-
OAc 10	15.23	0.30	49.00	39.20	-	-	-	-	-	-	-	-
OAc 11	18.40	0.33	60.00	48.00	56.67	0.47	263.67	-	-	-	-	-
Check	20.28	0.32	64.00	51.20	49.33	0.62	303.67	175.20	0.65	113.88	175.20	113.88 (91)
CD 5%	3.36	0.053	18.53	-	5.09	0.11	72.76	-	-	-	-	-
CD 1%	4.56	0.071	25.18	-	7.08	0.16	100.96	-	-	-	-	-

*Each value represents mean of two years data

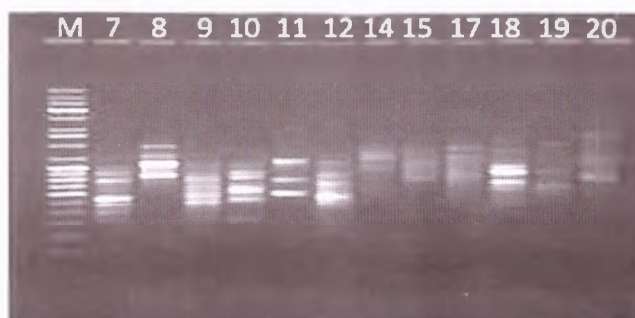
Table 2: Analysis of variance (ANOVA) of IET and BST Yield Trials

Sources of variations	d.f.	Characters M.S.S. IET Yield Trials			Sources of variations	d.f.	Characters M.S.S. BST Yield Trials		
		Fresh herb yield/plot (kg)	Oil Content (%)	Oil yield/plot (g)			Fresh herb yield/plot (kg)	Oil Content (%)	Oil yield/plot (g)
Repl.	2.	6.46	0.014	243.08	Repl.	2	48.79	0.0062	1910.13
Treatment	11	83.62**	0.152**	4098.55**	Treatment	7	84.58**	0.217**	17209.01**
Error	22	3.93	0.0096	119.72	Error	14	8.48	0.0042	1726.60
Total	35				Total	23			

**-P<0.01

Table 3: Mean performance of selected entries with respect to essential oil compositions in BST

Entries	Neral content (%)	Geranial content (%)	Citral (%) Total of Neral+ Geranial	Methyl chevicol content (%)	Geranyl acetate (%)	Linalool content (%)
CIM Jyoti	30.03	46.59	76.62	-	-	-
OAc2	22.82	45.86	68.68	-	11.43	-
OAc3	23.04	41.19	64.23	0.07	13.41	-
OAc4	26.42	35.84	62.26	-	4.56	-
OAc5	25.84	36.22	62.06	11.20	0.19	0.57
OAc6	18.47	37.75	55.82	5.30	-	2.69
Check	3.82	6.78	10.60	52.24	-	28.13

Fig. 1: Field view of high oil and citral chemotype of *Ocimum africanum* - CIM JYOTI

M- Medium range DNA Ruler

UBC 807- 5'-AGA GAG AGA GAG AGA GT-3'
 UBC 808- 5'-AGA GAG AGA GAG AGA GC-3'
 UBC 809- 5'-AGA GAG AGA GAG AGA GG-3'
 UBC 810- 5'-GAG AGA GAG AGA GAG AT-3'
 UBC 811- 5'-GAG AGA GAG AGA GAG AC-3'
 UBC 812- 5'-GAG AGA GAG AGA GAG AA-3'
 UBC 814- 5'-CTC TCT CTC TCT CTC TA-3'
 UBC 815- 5'-CTC TCT CTC TCT CTC TG-3'
 UBC 816- 5'-CAC ACA CAC ACA CAC AT-3'
 UBC 817- 5'-CAC ACA CAC ACA CAC AA-3'
 UBC 818- 5'-CAC ACA CAC ACA CAC AG-3'
 UBC 820- 5'-GTG TGT GTG TGT GTG TC-3'

Fig. 2: ISSR Primer Details and molecular finger print of Variety CIM JYOTI

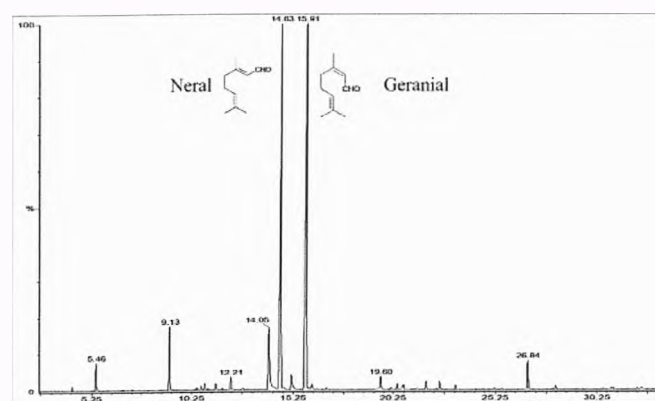


Fig. 3. Chromatogram of the essential oil of variety CIM Jyoti

STATEMENT OF DISTINCTION

Variety CIM Jyoti is a dwarf genotype with light green leaves, light green stem and white flowers in inflorescence. Table.4 summarises other special attributes of this new variety.

Table 4. Description of the Variety CIM Jyoti

Attributes	Variety CIM Jyoti	Check
Growth habit	dwarf, semi open	Semi dwarf, open
Crop ready for harvest (days)	90 (Early)	100 (Medium)
Days to flower (50 %)	70-80	90-100
Flower colour	White	Light purple
Leaf colour (normal view)	Light green	green
Plant height (cm)	75-85	90-100
Primary branches/plant	15	8
Secondary branches/plant	55	42
Tertiary branches/plant	142.50	80
Colour of leaf Green group N 137 FAN 3 R.H.S. (Upper surface)	144b (Yellow-Green group)	143a (Yellow-Green group)
Colour of leaf Green group N 137 FAN 3 R.H.S. (lower side)	144c (green group)	143b (green group)
Length of leaf (cm)	1.65	3.00
Width of leaf	0.85	1.57
Herb yield (ql/ha)	250.80	175.20
Leaves/stem ratio	0.70	0.50
Leaves/plant at full inflorescence stage/ onset of reproductive phase (Mean of the three plants)	1387	1055
100 Seed/ test weight (g)	0.083	0.116
Oil content in fresh herb (%)	0.75-0.80	0.60-0.65
Oil content in fresh leaves (%)	1.10	0.80
Oil content in dry leaves (%)	1.44	0.90
Oil yield (kg/ha)	200.64	113.88
Expected oil yield (kg/ha) (20% Less)	159	91
Citral =Neral +geranial (%)	68.68-76.62	10.60-10.15
Oleanolic acid	0.301	0.103
Ursolic acid	0.576	0.210

RECOMMENDED PRACTICE OF CULTIVATION

1. Precautions: It is advised to grow this strain for seed in isolation because it is highly cross pollinated and crossed with all *Ocimum basilicum* (Sweet, Franch and Indian basil) crops. This strain can however grow with *Ocimum sanctum*.
2. Cultivation of this strain is recommended for North Indian Gangatic plains.
3. Minimum three irrigations are recommended for this strain in Indian Gangatic plains.
4. Crop may be sown in nursery in the month of June or July and planted after 15 days in fields at a spacing of 30 × 30 cm.
5. After planting always irrigate immediately.
6. Crop can be harvested after emerging of inflorescence within 80-90 days.
7. Two sprays of any insecticides are recommended for control of white flies to control viral diseases and Bihar hairy caterpillar. There was no fungal/nematodes infection was seen in this strain.
8. Sandy loam, loam soil with well drainage is particularly more suitable for cultivation of this strain.