

CITRONELLA



NORTH-EAST INSTITUTE OF SCIENCE & TECHNOLOGY
JORHAT : ASSAM : INDIA





AROMATIC PLANTS CULTIVATION IN NORTH EAST INDIA



CITRONELLA



**NORTH-EAST INSTITUTE OF
SCIENCE & TECHNOLOGY**

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A photograph of Large scale citronella cultivation

1. INTRODUCTION

The states of Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland and Tripura constitute the North-Eastern Region (NER) of the country. The North Eastern Region has abundant forest, mineral, agricultural and horticultural resources. Most of the resources are either unutilized or inadequately utilised.

Soon after its establishment in 1961, North-East Institute of Science & Technology (NEIST), Jorhat in conformity with its charter, took up a programme for developing agrotechnologies for commercially important herbs and grasses suited for cultivation in the NER.

The basic objectives were to develop crops that were :

- (i) Suited for cultivation on wasteland/barren land or where Jhum or shifting cultivation was practiced,
- (ii) Rural employment oriented ; and
- (iii) Amenable for value addition locally.

1.1. The Plant

The generic name of citronella grass is *Cymbopogon*. It is recorded that the genus has about 80 species and more than a dozen have been distributed in India. There are two type of citronella i.e. Ceylon citronella and Java citronella. The Java type is known as Java citronella and its scientific name is *Cymbopogon winterianus* Jowitt. The name Java citronella and *Cymbopogon winterianus* was given to a variety of citronella for commemorating Mr. Winter, who was a pioneer oil distiller of Srilanka. The Java citronella is a kind of large tufted grass with culm of 2- 2.5 m high, smooth, glabrous. Leaf blades are about 1 m long, 1-1.5 cm wide, usually light yellow green, glabrous, smooth on the upper surface, slightly rough below and along the margins. Leaf sheath is glabrous, yellowish green, basal sheath glabrous, green to reddish. Ligule is chartreuse, about 1 mm long. Spathate panicle decompound, large, about 1 m long, with many racemese arranged along a zig-zag axis; spahteole 20 mm long and glabrous. Racemes are 20 mm long; rachis internodes and pedicels pilose along the margins, glabrous or puberulous on the back. Sessile spikelet 5 mm long; lower glume oblong-lanceolate, usually flat, narrowly winged, 3-nerved; awn 5 mm long when present. Pedicellate spikelet is 5 mm long and lower glume lanceolate, 7 - nerved.

2. CITRONELLA INDUSTRY IN NER

In 1964, NEIST Jorhat acquired fifty slips of citronella grass (*C. winterianus*) from sister CSIR laboratory CIMPO now CIMAP, Lucknow, for acclimatization and trial cultivation. Through systematic repeated selection and multiplication, an improved variety designated Jorlab-C2, with high geraniol oil content, was developed. Agro-practices were standardized and appropriate designs developed for small distillation plants for extraction of the oil.

As the region lacked dependable equipment fabrication firms, the designs for the distillation units were licensed to a tea machinery manufacturer in the Region.

NEIST Jorhat realized that it would be difficult to convince the cultivators to take up the new crop as the local market for it was not developed. They thus sought to proliferate the cultivation of citronella amongst the established 'Tea Planters' in their vicinity as they had the resource endowments to venture out in the new area and NEIST was available to assistance and monitoring. The agrotechnology practices and saplings were supplied initially to three well known Tea Planters in Assam (Williamson & Magor, Jorhat Tea Company and Consolidated Tea & Land Company). In two years time Williamson & Magor increased the area under citronella cultivation to 100 hectares and commenced extraction and selling of the citronella oil. The success emboldened 50 other tea planters in Assam to take up the cultivation as well. Thus around 1970, NEIST Jorhat felt it was now time to diffuse the crop to rural areas as the risks of introducing it were now manageable. NEIST organised awareness and training camps in remote areas, encouraged and assisted farmers to form cooperatives and above all supplied them with the planting materials. Simultaneously, NEIST sought to create endorsement of the government and marketing agencies for the new crop. The first major assignment to NEIST came from the Government of Nagaland to set up on a turnkey basis, a 500 kg/batch centralized distillation units in Yaongyemsen village. With these development by 1972, over 150 family farmers around Yaongyemsen were cultivating citronella grass covering an area of over 200 ha. Soon, thereafter, the Government of Nagaland sought to dissuade farmers in the hilly districts of Nagaland from Jhum cultivation. NEIST



Massive cultivation of citronella grass at Yaongyimsen village, Nagaland was started in 1970's



A distillation plant at Chumukedima village of Dimapur, Nagaland

assistance was solicited. It mounted its special campaign in Mokokchung District for cultivation of citronella. The result was the stabilization of the population and the crop there.

NEIST then took up on a systematic basis the diffusion of citronella cultivation in Pengeri village area in Tinsukia Sub-division of Assam, an area i.e. surrounded by thick forests. Normal crops could not be grown there due to the fear of marauding elephants. Citronella crop was eminently suited here as its smell is repugnant to the elephants. In 10 year times 250 families on the area were producing and marketing citronella oil valued at Rs 0.6 crores annually. The cultivation of citronella was then extended on a massive scale in Assam, Arunachal Pradesh, Meghalaya and Nagaland with the involvement of State departments and NGOs (Table-3). In the first part of 90's, there was shrinkage of area under Java citronella due to slump in prices and conversion of citronella plantation area into Tea and other commercial crops. It created shortage of citronella oil production in the country in recent years. Subsequently, efforts are being initiated by the institute for resurgence of this industry in this region. In this venture, the State of Mizoram and Tripura also has been brought under this programme along with other North Eastern States.

3. RECOGNITION

The inputs costs at (the then prevailing value of the rupee) were modest totalling to around Rs 70 lakhs of in-house funds over the 35 year period 1964-65 to 2001-2007 and external support of around Rs 120 lakh. As against this the contribution to the economy can be gauged by the indicators mentioned in Table 2. More importantly it is noted that the development has enabled over 2000 hectares of low grade land to be utilized, averted Jhum cultivation in some areas, helped create decentralized employment for over 12,000 people in remote areas and created local resources valued at over Rs 8 crores annually.

NEIST's work was recognized and applauded locally as well as centrally. The government of Arunachal Pradesh, Assam and Nagaland were specially supportive of NEIST's initiatives and afforded it funds for setting up centralized distribution units at several places in their states. NEIST Jorhat was awarded the FICCI Award for Science and Technology in 1982 and FICCI Award for



Once there were around sixty distillation plants like this in Pengeri area of Upper Assam



Women folk busy hoeing in citronella field of Bodoland of Assam

Rural Development in 1985 CSIR is providing NEIST a special grant to proliferate their work further and the Department of Biotechnology, Govt. of India provided a special fund over the period 1997-2007 for a similar purpose and the support is still continuing.

Table 1
Major constituents of citronella oil (average)

Constituents	Wt%
Limonene	6.6
Citronellal	33.3
Citronellol	9.7
Geraniol	18.9
COL acetate	6.3
GOL acetate	11.2
Others	14.0

Table 2

The employment generation and economic gain in NER

Period	Area under cultivation (ha)	Employment provided (no./years)	Prod.of oil (tonnes/years)	Value of oil (Rs in Cr.)
1970-73	850	4,260	30	0.1
1974-78	2350	11,750	50	0.6
1979-83	2770	13,850	200	2.1
1984-88	3260	16,300	250	3.2
1989-93	3770	18,850	335	3.8
1994-98	3320	19,900	445	6.5
1999-03	3260	19,360	436	7.5
2004-07	3400	19,800	360	10.8

Table 3
Some important citronella growing areas in NER

District Assam	Villages	Communities	Beneficiaries(no)
Kamrup	Patpara, Sekhadh ari, Rajapara Dhupguri, Udalpara, Khutabari, Panditpara, Tiplai, Sonapur, Khalabari	Bodos Rabhas Garo, Hajang	1500
Tinsukia	Pengeri area(14 villages)	NGOs & individuals	2000
Udalguri (BTAD)	Simoulibari, Rangagaan Atherikhat, Samguri, Khoirabari, Khagara,	Bodo, Kachari Hajang, Adibashi	250
Loharghat (BTAD)	Ganeshpara, Ranibari, Jimputa, Rangamati, Garitik, No 2 Juphangbari	Rabha, Kachari, Hajang	150
Baska (BTAD Tamulpur)	Kalajhar (East), Parkijulee Kalajhar (West), Horotola, Shukanjuli, Khoirajuli, Sonajuli, Subankhata, Khoirani, Musalpur, Panitanky, Angarkata, Nagapur, Paharpur (1&2), Bogajuli	Bodo, Adibashi	280
Bangaigaon (Sirang Dist.)	Jelkajhar, Kalajher		
Nagrijuli (BTAD Baska)	Jarkhona, Borolipar, Kachukota	Bodos	170
Nalbari	Khatikuchi, Tihu, Baroma, Makhibaha, Nalbari block, Borbori, Panitanky	Indigenous local population	120
Goalpara	Dolgoma, Matia, Upartola, Kodomtola, Sidhabari, Gopalpur	Bodos, Rabhas	120
Sonitpur	Monabari, Jinjia	Tea garden workers	80
Sivasagar	Tiphuk, Atkhel	Indigenous people	5
Arunachal Pradesh	57 Villages (Total) Bhalukpung, Doimukh, Tipi, Bordumsa, Palin, Sonajuli, Jairampur, etc.	Arunachali Tribes	500
Manipur	Mantripukhuri	Indigenous	75
Meghalaya	Umling, Saidan, Lailad,	Khasi tribe	50
Nagaland	Mangolomba, Chingemi, Mongseymiti, Tizit, Kublung, Khenpharma, Sirhima, Ligumi, Lusami, Dhansiripar, Kohima village, Nuiland, etc.	Naga tribes	300

4. TRAINING PROGRAMMES

Besides providing Agro-technologies for cultivation, NEIST Jorhat also provides extensive training to growers. Some of the recent training programmes conducted by NEIST Jorhat during 2000-2005 in NER are -

Assam

Location	District	Beneficiary(No)
Patpara	Kamrup	150
Rajapara	Kamrup	150
Dhupguri	Kamrup	100
Tiplai	Kamrup	50
Rangagaon	Udalguri (BTAD)	150
Simoulibari	Udalguri (BTAD)	100
Khoirabari	Udalguri (BTAD)	250
Khalabari	Kamrup	
Loflong	BTAD	
Lorigaon	BTAD	
Jelkajhar	BTAD	
Ganeshpara	Kamrup	50
Jimputa	Kamrup	80
Rangamati	Kamrup	50
Juphangbari	Kamrup	40
Paharpur	Baska (BTAD)	100
Parkihulee	Baska (BTAD)	145
Jarkhona	Baska (BTAD)	150
Borolipar	Baska (BTAD)	80
Dolgoma	Goalpara	80
Matia	Goalpara	40
Upartola	Goalpara	40
Jingia	Sonitpur	50
Tamulpur	Nalbari	150
Koirara	Nalbari	340
Makhibaha, Jalkhana	Nalbari	206
Khudramakhibaha	Nalbari	105
Masalpur	Baska (BTAD)	65
Adhyapakpara	Nalbari	50
Borbori	Nalbari	50
Gelecky	Sivasagar	40

Tiphuk	Sivasagar	36
Panitanky	BTAD	43
Kumarikata	BTAD	52
17 villages of BTAD & Nalbari district		122

Arunachal Pradesh

Kachubari	Papum Pare	18
Karsingsa	Papum Pare	18
Longding	Tirap	24
BLI	Papum Pare	79
Hime	West Siang	70
Kuntor		23
Balimodel		20
Balijan	Papum Pare	17
Upper Jomi		60
Tawang	Tawang	20
Tipi	West Kameng	78
Yayee	Papum Pare	56
Bhalukpong	West Kameng	28
Sigar	U. Subansiri	28
Maro	U. Subansiri	91
Siga	U. Subansiri	47
Along	West Siang	125
Seppa	East Kameng	15

Nagaland

Dimapur	Dimapur	72
Nuiland	Dimapur	10

5. CITRONELLA PROCESSING UNITS IN NER

NEIST Jorhat developed a design of improved distillation plant for extraction of oil from citronella grass and the design was transferred to a firm in Makum in Assam for fabrication of distillation still to meet the growing demand for extraction of citronella oil. Now, there are number of fabricators in NER who fabricate and supply distillation stills of various capacity to the growers.

Arunachal Pradesh

Hime Aromatic Plant Growers Co-operative Society
Vill: Hime, P.O. Kangku, Dist. West Siang

Gramin Mahila Co-operative Society
Vill: Karsingsa, P.O. Naharlagun, Dist. Papum Pare

Ramghat Welfare Society
Vill. & P.O. Balijan, Dist. Papum Pare

Tippi Aromatic Plants Growers Society
Vill. Tipi, P.O. Bhalukpong, Dist. West Kameng

APS Hypo Dee Society Limited
Vill. Yayee, P.O. Doimukh, Dist. Papum Pare

Maro Welfare Co-operative Society
Vill. Maro, P.O. Daporijo, Dist. Upper Subansiri

Arunachal Pradesh Tribal Development Society
Vill. Siga, P.O. Daporijo, Dist. Upper Subansiri

R K M Memorial Society
Vill. & P.O. Jairampur, Dist. Changlang

Tada Multipurpose Co-operative Society
Vill. & P.O. Sonajuli, Dist. Papum Pare

Assam

Aroma India Limited

Vill. Rajapara, Dist. Kamrup, Assam

Aroma India Limited

Vill. Patpara, Dist. Kamrup, Assam

Kamrup Essential Oil

Vill. Sekhadhari, Dist. Kamrup, Assam

Banjara Khoirabari Atherikhat Rural Development

Vill. Khoirabari, Dist. Udalguri (BTAD), Assam

Purbanchal Aromatics

Vill. Loharghat, Dist. Kamrup

Jharkana Citronella Co-operative Society, Jharkhana

Vill. & P.O. Nagrijulee, Dist. Baska (BTAD), Assam

MO Citronella Industry

Vill. Jingia, Dist. Sonitpur, Assam

Karbi Anglong Citronella Society

Karbi Anglong

Panitanky, BTAD, Baksa District

Meghalaya

Meghalaya Phytochemicals Limited

Umling, Dist. Ribhoi, Meghalaya

Nagaland

Nagaland United Society

Fifth Mile, Ninth Mile and Nuiland

Dist. Dimapur, Nagaland

Department of Industries

Govt. of Nagaland

Kohima, Nagaland

6. AGRO-PRACTICE FOR CITRONELLA

Introduction

Java citronella (*Cymbopogon winterianus* Jowitt) oil is an important source of high grade aroma and extensively used in perfumery industry.

Climate

Java citronella is grown throughout the tropics and its cultivation is extended up to an altitude of 1000 meter. It requires warm and humid climate with temperature fluctuating between 15 - 34°C, the optimum being 32°C and relative humidity ranges from 46 - 98%. The Java citronella crop, however, cannot withstand frost, long and severe drought or water stagnation.

Soil

Java citronella is grown on soil of even land, terraces or in steep sloping areas with pH ranging from 5.0 to 5.5. The crop grows luxuriously on sandy loam soil.

Propagation

RRL Jorhat encourages growers to propagate its high yielding variety i.e. Jor Lab C-2, Bio-13. The plant is propagated by using rooted slips.

Preparation of land

With the onset of north-western monsoon in Feb-March, the land is prepared for plantation.

Planting

One or two healthy rooted slips are planted in a hole during May-June with a spacing of 60 x 60 cms. The slips require anchorage of about 15 cm depth, as the soil is more or less friable. The crop is raised in North Eastern Region as rainfed one, and therefore, irrigation is not essential. In hilly slopes, the plantation is done in narrow strip against the contour.

Weeding & hoeing

Interculture operations are necessary to check unwanted weeds

and for good vegetative growth. Also, herbicides may be applied for control of weeds.

Manure and fertilizer

Compost manure at the rate of 7 tonnes per hectare promotes proper growth. The usual doses recommended 125 kg nitrogen, 60 kg P₂O₅ and 50 kg K₂O per hectare per year. Both P&K are applied as basal doses and nitrogen applied in three split doses. Two or three foliar sprays of copper and boron @ 50ppm at fortnightly interval after first year are recommended to combat deficiency.

Pests and diseases

A fungus *Curvularia eragostoides* causes disease of leaf tips drying particularly in hilly region. Immediate harvesting is necessary to reduce further deterioration of oil content. The disease can be controlled partially by spraying Captan or Captafol or Benomyl at the rate of 0.5 to 1%.

Stemborer is the serious pest of Java citronella. This can be controlled by spraying 0.5% Dimecron or Furadan along with cultural practices like proper weeding and uprooting affected bush in initial infestation.

Span of cultivation

The bushes remain economically viable for 5 years and after that replantation is recommended.

Harvesting

First crop may be ready for harvest after 90 days of planting. Normally, 4 cuttings are possible annually from second year of cultivation. Harvesting before 90 days may reduce the geraniol content of the oil.

Distillation of oil

The distillation of oil from fresh grass is done either by water and steam distillation or direct steam distillation.

Yield

The yield varies widely from tract to tract and from season to season depending upon the agro-climatic condition. The yield varies from 15- 20 tons/ha of citronella grass which on distillation

produce 150-200 kg of oil. On an average, the oil content of citronella grass is about 1%.

Chemical composition of oil

The oil contains total alcohol (geraniol) and aldehyde (citronellal) to the extent of 85 - 90% and 32 - 45% respectively. The main constituents of the oil are citronellal, geraniol, citronellol, geranyl acetate, citronellyl acetate, etc.

Economic utility

Oil of Java citronella is a raw materials for manufacturing aromatic chemicals such as citronellal, hydroxy citronellal, synthetic menthol, ester of geraniol and is therefore, considered more important. This oil is mainly used in manufacturing of soaps, cosmetics and mosquito repellent cream. The oil is found to be effective against certain micro organisms. The deoiled grass is used in mulching, as fuel in distillation unit oil and manufacture of paper boards.

Cost of cultivation	: Rs. 25,000/ha/year
Gross return	: Rs 40,000 - 50,000/ha/year
Net profit	: Rs. 20,000 - 25,000/ha/year

(Profit calculated on the basis of existing price of citronella oil)

7. CITRONELLA OIL BASED PRODUCTS & FIRMS

Room freshners and deodorant

- (1) North East Essential Oil
Maligaon, Guwahati
- (2) Bonjara Khoirabari Atherikhat Rural Development
Khoirabari, Dist. Udalguri, (BTAD, Assam)
- (3) 'Prayaas'
Rangia, Dist. Kamrup, Assam

Liquid deodorant

- (1) Odin Industries
K K Baruah Road, Jorhat-785001, Assam
- (2) Bi-Ti-Sa-Udyog
Nalbari, Assam
- (3) Priyam Products
Lachit Nagar, Dibrugarh, Assam
- (4) S M Industries
Gar Ali, Jorhat-785002, Assam
- (5) Suraj Enterprises
Gar Ali, Jorhat-785002, Assam
- (6) Arun Chemicals
Naharlagon - 791 110, Arunachal Pradesh

Mosquito Repellent Agarbatti

- (1) M/s Premier Agro Products
Sivasagar, Assam

8. MAJOR BUYERS FOR CITRONELLA OIL

01. Desai Chemical Co. Pvt. Ltd
11, Ezra Street (Top Floor), Kolkata - 700 001
02. East India Aromatic Traders
44/45, Ezra Street, II Floor, Kolkata - 700 001
03. Green Acres
C/o. Narayan Das Building (Opp. Apex Bank, Thana Road)
Dist. - Karbianglong P. O. Bokajan - 782 480 (Assam)
04. Henry Bird and Co.
37 Bethane Raw, Kolkata - 700 001
05. Kamrup Essential Oils
Rajapara P.O., Singra, Boko, Kamrup - 781 135 (Assam)
06. National Perfumery House
44, Ezra Street, P.O. Box No. 328, Kolkata - 700 001
07. Paul & Son
G.P.O. Box No. 902, 18, Ezra Street, Kolkata - 700 001
08. Royson
34, Chittranjan Avenue, Jabakusum House,
2nd Floor, Room No. 4, Kolkata - 700 012
09. Swastik Industries
32, Ezra Street, Room No. 321/322, 3rd Floor, Kolkata- 700 001
10. Tulsi Fragrances
17, Ezra Street, G.P.O. Box No. 2491, Kolkata - 700 001
11. Balaji Trading Company
507, Nain Krupa, 118/122, Kazi Sayed Street
Mumbai - 400 003
12. Sony Aromatics
70, Canning Street, Kolkata - 700 001
13. Bhandya Narasimha Vaman Pai
Post Box No. 26, High School Road, Kundapoor - 576 201
14. R K Chemicals
Ramaiah Shopping Complex
21/4, Channarayaswamy Temple St., Medarpet,
Kumbarpet Cross, Bangalore - 560 002
15. AVM Aromatics
G1, Industrial Estate, Pudukkottai - 622 004 (Tamilnadu)
16. Rasiklal and Bros
44, Ezra Street, 1st Floor, Room No. 7, Kolkata - 700 001
17. Aroma Implex



CITRONELLA CULTIVATION

1. Bonfield Lane, 1st Floor, Kolkata - 700 001
18. Rasiklal Hemani Agencies Pvt Ltd.
506, Khari Baoli, Delhi - 110 006
19. Aroma India Ltd
G.S. Road (Opposite IDBI Building)
G S Road, Guwahati - 781005
20. K. K Aromas
No. 428, 10th Cross, Shastrinagar, Bangalore - 560 028
21. Nishant Aromas
Milan Industrial Estate, Off. T. J. Road, Cotton Green (W)
Mumbai - 400033
22. North East Essential Oils
Rajapara, Boko, Assam
23. Purbachanchal Aromatics
Jaynarayan Road, Fanci Bazar, Guwahati- 781 001
24. Jalan Entreprises
G. F Road, Bengenakhowa, Golaghat, Assam
25. Atul Ltd.
ATUL - 396020, Gujrat
26. Green World
Chakraborty Commercial Complex
GNB Road, Silphukhuri
GUWAHATI - 781003



उत्तर-पूर्व विज्ञान तथा प्रौद्योगिकी संस्थान, जोरहाट

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