

COMMERCIAL CULTIVATION & OIL DISTILLATION OF CITRONELLA



1.0 INTRODUCTION

Citronella oil is an essential oil containing citronellal, geraniol and hydroxy citronellol and other high value perfumery bases obtained on steam distillation of citronella grass. Citronella grass is a perennial 1-2m tall bush with green to yellowish green leaves. The oil is used for perfuming soaps, detergents, cosmetics, agarbattis and for making mosquito repellent creams. The oil is also used to isolate citronellol and geraniol. These are in turn converted into citronellal, hydroxy citronellal, synthetic menthol and esters of geraniol and citronellol. These compounds are used for making high grade blended perfumes.

This project profile is for cultivation of citronella and setting up of a distillation unit with total area under plant at 4 hectares.

2.0 MARKET POTENTIAL

The major customers for citronella oil are the manufacturers of cosmetics and perfumes, with major buyers such as Hindustan Unilever Limited. There has been substantial increase in the demand for essential oils due to the spurt in the growth of cosmetics and perfumes, which in turn is related with the growing purchasing power of the Indian middle class. Besides the domestic demand, there is good potential for exports. The quality of essential oils produced in Assam is reported to be better than those produced in Sri Lanka and Indonesia which are the major exporters. Citronella oil is also produced in other north-eastern states of Meghalaya, Arunachal Pradesh,

Nagaland and Manipur. Considering the incentives offered by the Government for exports, export demand for citronella oil is bound to increase.

3.0 PACKAGE OF PRACTICES

(i) Soil & Climate: Citronella grows well in Assam where there is abundant sunshine and high humidity (70 % and above). Temperature range between 20°C to 38°C and well distributed rainfall of 2000-3000 mm are desirable. However, if irrigation is available citronella can be cultivated in regions of low rainfall also.

Citronella grows best in sandy loam soils. Heavy clay soils which tend to water log and light sandy soils are not suitable for this crop. It does not tolerate water stagnation. A good amount of organic matter is desirable. The ideal pH range is 5.0-7.0. Soil testing is important for best fertility management and higher productivity.

(ii) Land preparation: The land is prepared to fine tilt by disking and tilling. Organic, P and K fertilizers are mixed into the soil at this stage. In plains, ridges are made at 45 cm apart. Apply at least 25-30 tons FYM or well decomposed cow dung mixing with the soil.

(iii) Preparation of slips: Citronella is propagated by splitting the clumps of vigorously growing plants of 6 months to one year old into slips. The clump is gently dug out and separated into a number of slips containing 2-3 tillers/slip. The fibrous roots and leaves are trimmed off at 25-30 cm height before planting. An one-year-old clump on an average, gives about 50 slips.



(iv) Planting: The slips are planted at 45 x 45 cm in plain land at 5-8 cm depth on one side of the ridges, half way up the slope in plains or 60 x 45 cm in slopy land. One slip is inserted in each pit, later filled with loose soil and firmly pressed keeping the slip vertical. The soil moisture is maintained till the crop establishes. Casualty should be replaced within the next month. 40,000 slips are required for one hectare area.

(v) Interculture: As the crop is planted during monsoon, it faces serious weed competition in the initial stages and the first 60 days are found to be a critical period. Generally two weeding, one at 20- 25 and another at 40-45 days after planting should be done. Interculture after each harvest is necessary. In order to get satisfactory results, an integrated method that consists of hand weeding, application of weedicides and mulch should be used.

(vi) Fertilizer application: For poor and medium fertility soil N, P205, K20 @ 200:80:75 kg/ha/year should be applied. In the first year, the organic, P and K fertilizers are mixed into the soil at final land preparation. Nitrogen should be applied at 4 equal splits (@ 50 kg N) in the first year with the first application at about one month after planting with weeding and the rest after each harvest. In subsequent years, the basal dose may be applied along with the first dose of N. N as urea is top dressed soon after the regenerated crop is established and thereafter once in every two months. In the subsequent years, N dose may be increased by 50 kg for the additional split application.

(vii) Irrigation: Citronella requires sufficient moisture for good growth and yield of herb. When there is no rain, irrigation is required once in 10-15 days.

(viii) Harvesting: It is advisable to harvest (a partial harvest) after 3 months to induce tillering, In the first year

only 3 cuts besides the partial harvest can be taken, viz., 5 months after planting and 3 months after the previous harvest. From second year onwards, 5-6 harvests can be taken per year at 2 months intervals. Harvesting is done by sickle and cut at 15 cm above the ground. Cutting close to the ground results in mortality of the plant. Harvesting is done preferably before 12 O'clock.

(ix) Crop cycle: The crop can be maintained economically for about 3 years. Then it is to be pulled out and planted with rotational crop. After termination of the crop, green manuring can be done.

(x) Withering of the fresh herb: After cutting, the herb is allowed to wilt for 12-24 hours to remove the excess moisture. This wilting allows better packing in the vessel and saving of steam and fuel. Wilting more than 24 hours results loss of essential oil. Cutting the grass into shorter length also gives 10-15% higher recovery. The harvested grass contains dead leaves, sheaths that should be removed before packing into the vessel.

(xi) Distillation of oil: The grass is steam distilled for better recovery. The distillation equipment consists of a boiler, a distillation vessel, a condenser and two receivers/separators. The economic capacity of the unit is 1.0 ton/batch. Distillation is completed in 4-5 hours under normal pressure starting from the initial condensation of the oil. Prolong distillation deteriorates oil quality.

(xii) Yield: The herb yield is in the range of 10-15 t/ha/harvest. The average oil recovery is 0.7%.

4.0 COST OF THE PROJECT

The estimated project cost is given below.

(Rs. in lacs)	
Particulars	Amount
Land and Site Development	-
Building & Civil Works	4.49
Machinery & Equipment	3.84
Misc. Fixed Assets	0.85
Setting up of Nursery	0.18
Preparation of Seedlings	0.29
Land Preparation	0.20
Planting	0.60
Preliminary & Pre-operative Expenses	0.56
Working Capital	1.56
TOTAL	12.57

4.1 Land & Site Development: No cost has been considered for land & site development. It is assumed that the unit will be set up on existing farmland.

4.2 Building & Civil Works: Details of building & civil works are given below.

Particulars	Area (Sqft)	Rate (Rs)	Amount (Rs)
Distillation Shed (Open shed, CGI sheet roof, kuttcha floor)	400	300	120000
Labour quarter cum Store room (Brick wall, CGI roof, concrete floor)	720	400	288000
Sub total			408000
Add: Electrification, etc @ 10%			40800
TOTAL			448800
Say (Rs. in lacs)			4.49

4.3 Machinery & Equipment: Details of machinery & equipment are given below.

Particulars	Qty	Rate (Rs)	Amount (Rs)
Distillation unit (Hydro-steam and lifting type, capacity 1.0 MT/ batch, made of 304 grade stainless steel with all accessories and tax)	1	320000	320000
Add transportation, installation, etc @ 20%			64000
TOTAL			384000
Say (Rs. in lacs)			3.84

4.4 Misc. Fixed Assets: Details of miscellaneous fixed assets are given below.

Particulars	Qty	Rate (Rs)	Amount (Rs)
Water Supply System (STW boring, storage, 3 hp pump set, pipes & fittings)	1	75000	75000
Miscellaneous items	LS	LS	10000
TOTAL			85000
Say (Rs. in lacs)			0.85

4.5 Setting up of a Nursery: Details of expenses for setting up of a nursery is given below.

Target area for cultivation (in ha)	4			
Area required for raising of mother stock in sqm (1/20 of target area)	2000			
No. of slips required (50,000/ha)	10000			
Particulars	Unit	Quantity	Rate (Rs)	Amount (Rs)
Purchase of slips	Nos	10000	1	10000
Engagement of labor for nursery land preparation	Mandays/ha	25	200	1000
Engagement of labor for planting of seedlings	Mandays/ha	75	200	3000
Cost of FYM	kg/ha	25000	0.20	1000
Sub total				15000
Add: Maintenance of seedlings for 6 months, etc. @ 20%				3000
TOTAL				18000
Say (Rs. in lacs)				0.18

4.6 Preparation of Seedlings: Details of expenses for preparation of seedlings is given below.

No. of slips required per ha	50000			
Target area for cultivation (in ha)	4			
Total No. of seedlings required	200000			
Particulars	Unit	Quantity	Rate (Rs)	Amount (Rs)
Engagement of labour for preparation of seedlings	Mandays/ 1500 Nos	1	200	26667
Add: cost of manures, etc @10%				2667
TOTAL				29333
Say (Rs. in lacs)				0.29

4.7 Land Preparation for Nursery: Details of expenses for preparation of nursery land is given below.

Particulars	Mandays/ha	Rate (Rs)	Area under crop (ha)	Amount (Rs)
Engagement of labour for land preparation	25	200	4	20000
Say (Rs. in lacs)				0.20

4.8. Planting of Slips in Nursery: Details of expenses for planting of slips in nursery is given below.

Particulars	Mandays/ha	Rate (Rs)	Area under crop (ha)	Amount (Rs)
Engagement of labour for planting of slips	75	200	4	60000
Say (Rs. in lacs)				0.60

4.9 Preliminary & Pre-operative Expenses: Details of preliminary & pre-operative expenses are given below. (Rs. In lacs)

Particulars	Amount (Rs)
Travelling expenses	0.20
Interest during implementation	0.26
Miscellaneous expenses	0.10
TOTAL	0.56

4.10 Working Capital: Details of working capital are given below. (Rs. In lacs)

Particulars	Period (Months)	Amount (Rs)		
		Yr 1	Yr 2	Yr 3
Manures & Fertilizers	1	0.04	0.02	0.02
Weed control & Intercultural Operations	1	0.05	0.05	0.05
Harvesting	1	0.08	0.13	0.13
Post Harvest Operations	1	0.08	0.13	0.13
Distillation Cost	1	0.09	0.15	0.15
Power	1	0.01	0.01	0.01
Salary	1	0.09	0.09	0.09
Finished Goods	1	0.45	0.61	0.61
Receivables	1	0.67	1.12	1.12
Total		1.56	2.32	2.32
Working capital margin in Yr 1 (100%)		1.56		

5.0 MEANS OF FINANCE

The means of finance for the project is estimated as below.

(Rs. in lacs)

Particulars	Percent	Amount (Rs)
EQUITY		
A. Equity from Promoters	40%	5.03
B. Subsidy from Central/State Govt.	-	
DEBT		
Term Loan from Banks/FIs	60%	7.54
TOTAL	100%	12.57

6.0 PROFITABILITY STATEMENT

(Rs. in lacs)

Particulars	Yr 1	Yr 2	Yr 3
A. INCOME			
Oil production per annum (in kg)	1008	1680	1680
Oil price (Rs. per kg)	800	800	800
Income from sale of oil	8.06	13.44	13.44

B. OPERATING EXPENSES			
Manures & Fertilizers	0.44	0.24	0.24
Weed control & Intercultural Operations	0.60	0.60	0.60
Harvesting	0.96	1.60	1.60
Post Harvest Operations	0.96	1.60	1.60
Distillation	1.10	1.83	1.83
Power	0.12	0.12	0.12
Salary	1.08	1.08	1.08
Repairs & Maintenance	0.09	0.10	0.11
Miscellaneous Expenses	0.08	0.13	0.13
Total Operating Expenses	5.43	7.30	7.31
Less: Working expenses capitalised	1.56	0.00	0.00
Operating profit	4.20	6.14	6.13
C. FINANCIAL EXPENSES			
Depreciation	0.47	0.47	0.47
Interest on Term Loan	0.60	0.41	0.15
Expenses on nursery written off	0.06	0.06	0.06
Expenses on preparation of seedlings written off	0.10	0.10	0.10
Expenses on land preparation written off	0.07	0.07	0.07
Expenses on planting of slips written off	0.20	0.20	0.20
Net Profit	2.70	4.83	5.08
Net cash accruals	3.60	5.72	5.98
Principal Repayment	0.84	3.35	3.35

6.1 Estimation of Production: Production of oil per annum is estimated as below.

Particulars	Unit	Quantity	
Yield of fresh herbs/hectare/harvest	kg	12000	
Cultivated land under citronella	ha	4	
Total yield of fresh herbs/harvest	kg	48000	
	Yr 1	Yr 2	Yr 3
Number of harvests/year (3 year crop cycle with gestation period of 5 months; subsequent harvests at 2 months interval)	3	5	5
Yield of fresh herbs/year (in kg)	144000	240000	240000
Percentage of oil recovery	0.7%	0.7%	0.7%
Total oil production per annum (in kg)	1008	1680	1680

6.2 Manures & Fertilizers: Expenses on manures & fertilizers per annum is estimated as below.

Particulars	kg/ha	Source	Nutrient %	kg/ha (source)	Cost/kg of source (Rs)	Cost/ha (Rs)	Area under crop (ha)	Amount (Rs)
Expenses on Nitrogen/application	200	Urea	46%	435	5.50	2391	4	9565
Expenses on Phosphorus/application	80	SSP	16%	500	4.00	2000	4	8000
Expenses on Potassium/application	75	MOP	60%	125	12.00	1500	4	6000

	Yr 1	Yr 2	Yr 3
Application of Manures during land preparation in Year 1 (25000 kg/ ha @ Rs 0.20/ kg)	20000		
Application of Nitrogen/annum	1	1	1
Cost (Rs)	9565	9565	9565
Application of Phosphorus/annum	1	1	1
Cost (Rs)	8000	8000	8000
Application Potassium/annum	1	1	1
Cost (Rs)	6000	6000	6000
Expenses on manures & fertilizers per annum (Rs)	43565	23565	23565

6.3 Weed Control & Intercultural Operations: Expenses on weed control & intercultural operations per annum is estimated as below.

Particulars	Mandays/ ha	Rate (Rs)	Area under crop (ha)	Amount (Rs)
Engagement on labour for weed control & intercultural operations	75	200	4	60000

6.4 Harvesting: Expenses on harvesting per annum is estimated as below.

Particulars	Mandays/ ha	Rate (Rs)	Area under crop (ha)	Amount (Rs)
Engagement of labour for harvest of herbs	40	200	4	32000
	Yr 1	Yr 2	Yr 3	
Number of harvests/year (3 year crop cycle with gestation period of 5 months; subsequent harvests at 2 months interval)	3	5	5	
Expenses on harvest per annum (Rs)	96000	160000	160000	

6.5 Post Harvest Operations: Expenses on post harvest operations per annum is estimated as below.

Particulars	Mandays/ ha	Rate (Rs)	Area under crop (ha)	Amount (Rs)
Engagement of labour for post harvest operations	25	200	4	32000
		Yr 1	Yr 2	Yr 3
Number of post harvest operations/year		3	5	5
Expenses on post harvest operations per annum (Rs)		96000	160000	160000

6.6 Distillation: Expenses on distillation per annum is estimated as below.

No. of hours per distillation	4.5		
Fuel (Dry herbage) consumption (kg/hour)	25		
Cost of dry herbage per kg (Rs)	5		
Expenses on fuel/distillation (Rs)	563		
	Yr 1	Yr 2	Yr 3
Yield of fresh herbs/year (in kg)	144000	240000	240000
Capacity of distillation plant/ batch (in kg)	1000	1000	1000
No. of distillations per annum (Average)	144	240	240
Expense on fuel (Rs)	81000	135000	135000
Add: engagement of labour (2 mandays/2 distillations & manday cost of Rs 200)	28800	48000	48000
Expenses on distillation per annum (Rs)	109800	183000	183000

6.7 Power: Expenses on power per annum is estimated as below.

Particulars	Quantity	Power (Kw)	Total (Kw)	Hrs/ day	kwh/ day
3 HP Pumpset	1	2.24	2.24	1	2.24
General Lighting	6	0.10	0.56	8	4.48
Power requirement/ day (Kwh)					6.72
Days/annum			360		
Rate per unit (Rs)			5.00		
Expenses on power per annum			12092		

6.8 Salary: Expenses on salary per annum is estimated as given below.

Particulars of Employees	Numbers	Salary/ Month (Rs)	Cost/ annum (Rs)
Manager (Self)	0	0	0
Helpers	3	3000	108000
Total			108000

6.9 Repair & Maintenance: Expenses on repair & maintenance in the 1st year is estimated as given below. It is assumed that expenses on repair & maintenance will increase @ 10% every subsequent year.

(Rs. in lacs)

Particulars	Cost (Rs)	Rate	Amount (Rs)
Building & Civil Works	4.49	1%	0.04
Machinery & Equipment	3.84	1%	0.04
Misc. Fixed Assets	0.85	1%	0.01
Total			0.09

6.10 Miscellaneous Expenses: Miscellaneous expenses have been assumed at 1% of sales.**6.11 Depreciation:** Depreciation has been calculated by straight line method. The details of calculation are given below.

(Rs in lacs)

Description	Cost (Rs)	Rate	Amount/ annum (Rs)
Building & Civil Works	4.49	3.34%	0.15
Machinery & Equipment	3.84	7.07%	0.27
Misc. Fixed Assets	0.85	6.23%	0.05
TOTAL			0.47

6.12 Interest on Term Loan & Principal Repayment: Interest rate has been assumed at 8%. Duration of loan repayment has been considered for a period of 3 years including moratorium period of 9 months with equal monthly instalments. The details of calculation are given below.

Month	Year	1	2	3
Month 1	Opening balance	7.54	6.70	3.35
	Repayment	0.00	0.28	0.28
	Interest (8%)	0.05	0.04	0.02
	Closing balance	7.54	6.42	3.07
Month 2	Opening balance	7.54	6.42	3.07
	Repayment	0.00	0.28	0.28
	Interest	0.05	0.04	0.02
	Closing balance	7.54	6.15	2.79
Month 3	Opening balance	7.54	6.15	2.79
	Repayment	0.00	0.28	0.28
	Interest	0.05	0.04	0.02
	Closing balance	7.54	5.87	2.51

Month 4	Opening balance	7.54	5.87	2.51
	Repayment	0.00	0.28	0.28
	Interest	0.05	0.04	0.02
	Closing balance	7.54	5.59	2.23
Month 5	Opening balance	7.54	5.59	2.23
	Repayment	0.00	0.28	0.28
	Interest	0.05	0.04	0.01
	Closing balance	7.54	5.31	1.96
Month 6	Opening balance	7.54	5.31	1.96
	Repayment	0.00	0.28	0.28
	Interest	0.05	0.04	0.01
	Closing balance	7.54	5.03	1.68
Month 7	Opening balance	7.54	5.03	1.68
	Repayment	0.00	0.28	0.28
	Interest	0.05	0.03	0.01
	Closing balance	7.54	4.75	1.40
Month 8	Opening balance	7.54	4.75	1.40
	Repayment	0.00	0.28	0.28
	Interest	0.05	0.03	0.01
	Closing balance	7.54	4.47	1.12
Month 9	Opening balance	7.54	4.47	1.12
	Repayment	0.00	0.28	0.28
	Interest	0.05	0.03	0.01
	Closing balance	7.54	4.19	0.84
Month 10	Opening balance	7.54	4.19	0.84
	Repayment	0.28	0.28	0.28
	Interest	0.05	0.03	0.01
	Closing balance	7.26	3.91	0.56
Month 11	Opening balance	7.26	3.91	0.56
	Repayment	0.28	0.28	0.28
	Interest	0.05	0.03	0.00
	Closing balance	6.98	3.63	0.28
Month 12	Opening balance	6.98	3.63	0.28
	Repayment	0.28	0.28	0.28
	Interest	0.05	0.02	0.00
	Closing balance	6.70	3.35	0.00
	Principal Repayment	0.84	3.35	3.35
	Interest	0.60	0.41	0.15

7.0 DEBT SERVICE COVERAGE RATIO (DSCR)

(Rs. in lacs)

Year	1	2	3	TOTAL
Profit After Tax (Net Profit)	2.70	4.83	5.08	
Depreciation	0.47	0.47	0.47	
Interest	0.60	0.41	0.15	
Total	3.77	5.71	5.70	15.19
Interest	0.60	0.41	0.15	
Principle repayment	0.84	3.35	3.35	
Total	1.44	3.77	3.50	8.70
DSCR	2.63	1.52	1.63	

Average DSCR = 1.75

8.0 BREAK EVEN POINT (BEP)

(Rs. in lacs)			
Year	1	2	3
A. Net sales (Rs. lakh)	8.06	13.44	13.44
B. Variable cost			
Manures & Fertilizers	0.44	0.24	0.24
Weed control & Intercultural Operations	0.60	0.60	0.60
Harvesting	0.96	1.60	1.60
Post Harvest Operations	0.96	1.60	1.60
Distillation Cost	1.10	1.83	1.83
Power	0.12	0.12	0.12
Miscellaneous Expenses	0.08	0.13	0.13
Total variable cost	4.26	6.12	6.12
C. Contribution (A-B)	3.81	7.32	7.32
D. Fixed & Semi-fixed Costs			
Salary	1.08	1.08	1.08
Repair & maintenance	0.09	0.10	0.11
Interest on Term Loan	0.60	0.41	0.15
Depreciation	0.47	0.47	0.47
Total fixed cost	2.24	2.07	1.81
E. BREAK EVEN POINT	58.91%	28.26%	24.74%

9.0 INTERNAL RATE OF RETURN (IRR)

(Rs. in lacs)				
Year	0	1	2	3
CASH OUTFLOW				
Capital Expenditure	9.36	0.00	0.00	0.00
Working Capital	0.00	1.56	0.76	0.00
Total (A)	9.36	1.56	0.76	0.00
CASH INFLOW				
Profit After Tax		2.70	4.83	5.08
Add: Depreciation		0.47	0.47	0.47
Add: Interest		0.60	0.41	0.15
Add: Salvage Value				
Total (B)	0.00	3.77	5.71	5.70
NET FLOW (B-A)	-9.36	2.21	4.96	5.70

IRR = 15%

TECHNICAL CONSULTANT

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