

COMMERCIAL CULTIVATION & OIL DISTILLATION OF LEMONGRASS



1.0 INTRODUCTION

Lemongrass is a perennial aromatic grass. The prefix 'lemon' owes to its typical lemon like odour, which is mainly due to the presence of citral, a cyclic monoterpene.

Lemongrass is the source of Lemongrass oil, a good source of natural Citral, which is used as a basic raw material for synthesis of B-ionone used for synthesis of a number of useful aromatic compounds and Vitamin-A. Lemongrass is thus used as a main substitute for 'Cod liver oil'. Citral itself is used in perfumery for various grades of soaps, detergents, cosmetics and flavour agent for soft drinks.

In India, Lemongrass is cultivated along the Western Ghats (Maharashtra, Kerala), Karnataka and Tamil Nadu states besides the foot-hills of the North Eastern states. It was introduced in India about a century back and is now commercially cultivated in these areas.

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

2.0 MARKET POTENTIAL

Lemongrass is one of most important aromatic plants which can become a crop of future India due to its application for derivatives like Vitamins, which require Citral which is major component of this oil. Traditionally Citral was produced from Lemongrass till the 1960's and India was exporting more than 1500 mt/annum to meet the demand of the world market. Large scale capacities in

India were operational by pharma cos. like Glaxo, Roche and Intermediates for export by Industrial perfumes.

Due to advancement in petrochemical science, Citral was derived from C-5 fractions of Petrochemical through Isoprene building block. Volume of Lemongrass and other Citral rich essential oils went down gradually as production cost increased and cheap substitutes were available in the form of synthetically derived material based on petroleum feed stock.

However, with the rise in consumption of petroleum and rising prices of petroleum and petroleum based products, there is scope for production of natural Citral, particularly so, due to environmental concerns and sustainability and people's preference for natural products.

3.0 PACKAGE OF PRACTICES

(i) Soil & Climate: Lemongrass flourishes in a wide variety of soils ranging from rich barns to poor laterite; also suitable to 'jhum fallow', hill slopes and flood free degraded land, best suited to well drain sandy loam. Water logged conditions should be avoided as they are unsuitable for its cultivation. It requires a warm humid climate with plenty of sunshine and rainfall ranging from 1800 to 3000 mm. High temperature and sunshine are conducive to the development of oil in the plant.

(ii) Preparation of root slips: It is propagated vegetative by slips obtained from well-grown clumps. Tops of culms are cut off within 20-25 cm above ground. The Culm (root portion) is divided into slips containing 2-3 tillers. The

lower sheath is removed to expose young roots and the old roots are clipped off keeping the slip 25-30 cm long.

(iii) Spacing: 45 x 45 cm in plains or 60 x 45 cm in sloping land with a requirement of slips 45,000 - 50,000/ha.

(iv) Planting: Planting is done during May-June. However, with irrigation, planting can be done during any month of the year except December-January. One or two slips are planted into each hole, about 58 cm deep. It is better to plant on ridges in high rainfall areas. Plants get established well within 25-30 days after planting.

(v) Manure & fertilizer application: FYM 10 t/ha to be applied and mixed well at the time of final land preparation.

Fertilizer: N, P205 & K2O-I50: 60: 60 kg/ha/year should be applied along with adequate quantity of organic matter. Before planting, the field is thoroughly prepared and the full dose of phosphorus and potash is incorporated. The nitrogen is applied in six equal split doses at two monthly intervals.

(vi) Irrigation: Irrigation is given immediately after planting when planting is done in dry days. Irrigations are given at 10 days interval to establish the crop. During dry season, after each harvest and subsequent application of recommended fertiliser dose, one irrigation is given for optimum herb production.

(vii) Weeding & Interculture: Lemongrass has the weed suppression capacity. One hand weeding at 25-30 days followed by one hoeing at 40-60 days after planting is enough to control weeds. After each harvest a nominal weeding and earthing up of plants is beneficial for the next flush.

(viii) Harvesting: The first harvest is taken at 5 months of the crop and subsequent harvests are at 2-3 months intervals. Harvesting is done by cutting the grass 10 cm above the ground level. During the first year, 3 cuttings and subsequently 5 cuttings per year can be taken, subject to weather conditions and irrigation management. Both immature and over mature crops give low yield and oil of poor quality. The optimum period of harvesting when grown on hilltop or upper slopes is 75 days while at foothill and plains it is 60 days.

(ix) Crop cycle: The crop can be maintained economically for about 4 years.

(x) Distillation of oil: The oil is extracted from the wilted herb by steam distillation in stainless steel units. The factors influencing the oil production during distillation are: (i) Storage of the plant material, (ii) Treatment (wilting and cutting into pieces) of the material and (iii) The method of distillation. The major source of loss is by oxidation and resinification of the essential oil. So if the material is to be stored before processing, it should be kept in a dry atmosphere with limited air circulation. The essential oils are present in the oil glands, oil sacks and glandular hairs of the plant. Therefore, before distillation, the day wilted plant material is cut into small pieces enable them to expose directly as many oil glands as is possible. Once the plant material has been reduced in size, it must be distilled immediately to avoid oil loss.

The wilted leaves are steam distilled which takes about 4-5 hours.

(xi) Yield: The yield of herb is in the range of 20 t/ha/harvest. The average oil recovery is 0.6%.

4.0 COST OF THE PROJECT

The estimated project cost is given below.

(Rs. In lacs)	
Particulars	Amount (Rs)
Land and Site Development	-
Building & Civil Works	4.49
Machinery & Equipment	3.84
Misc. Fixed Assets	0.85
Setting up of a Nursery	0.17
Preparation of Seedlings	0.29
Land Preparation	0.20
Planting	0.60
Preliminary & Pre-operative Expenses	0.72
Working Capital	1.70
TOTAL	12.87

4.1 Land & Site Development: No cost has been considered for land & site development. It is assumed that the unit will be set up in 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 roofings, kuttcha Floor)	400	300	120000
Labour quarter cum Store room (Brick wall, CGI sheet 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		Quantity	Rate (Rs)	Amount (Rs)
Purchase of slips	Nos.	10000	1	10000
Engagement of labour for nursery land preparation	Mandays/ha	25	200	1000
Engagement of labour for planting of seedlings	Mandays/ha	75	200	3000
Cost of FYM	kg/ha	10000	0.20	400
Sub total				14400
Add: Crop management for 6 months, etc. @ 20%				2880
TOTAL				17280
Say (Rs. in lacs)				0.17

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.

Particulars	(Rs. In lacs)
Travelling expenses	0.20
Interest during implementation	0.42
Miscellaneous Expenses	0.10
TOTAL	0.72

4.10 Working Capital: Details of working capital are given below.

	Period (month)	Amount (Rs)		
		Yr 1	Yr 2	Yr 3
Manures & Fertilizers	1	0.02	0.01	0.01
Weed Control & Intercultural Operations	1	0.05	0.05	0.05
Harvesting	1	0.08	0.11	0.11
Post Harvest Operations	1	0.08	0.11	0.11
Distillation	1	0.15	0.20	0.20
Power	1	0.01	0.01	0.01
Salary	1	0.09	0.09	0.09
Finished Goods	1	0.50	0.60	0.60
Receivables	1	0.72	0.96	0.96
Total		1.70	2.14	2.14
Working capital margin in Yr 1 (100%)	1.70			

5.0 MEANS OF FINANCE

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

(Rs. In lacs)

Particulars	Percent	Amount
<u>EQUITY</u>		
A. Equity from Promoters	40%	5.15
B. Subsidy from Central/ State Govt.	-	
<u>DEBT</u>		
Term Loan from Banks/ FIs	60%	7.72
TOTAL	100%	12.87

6.0 ROFITABILITY STATEMENT

(Rs. in lacs)

Particulars	Yr 1	Yr 2	Yr 3	Yr 4
<u>A. INCOME</u>				
Oil production per annum (in kg)	1440	1920	1920	1920
Oil price (Rs. per kg)	600	600	600	600
Income from sale of oil	8.64	11.52	11.52	11.52
<u>B. OPERATING EXPENSES</u>				
Manures & Fertilizers	0.26	0.18	0.18	0.18
Weed Control & Intercultural Operations	0.60	0.60	0.60	0.60
Harvesting	0.96	1.28	1.28	1.28
Post Harvest Operations	0.96	1.28	1.28	1.28
Distillation	1.83	2.44	2.44	2.44
Power	0.12	0.12	0.12	0.12
Salary	1.08	1.08	1.08	1.08
Repairs & Maintenance	0.09	0.10	0.11	0.12
Miscellaneous Expenses	0.09	0.12	0.12	0.12
Total Operating Expenses	5.99	7.20	7.21	7.22
Less: operating expenses capitalised	1.70	0.00	0.00	0.00
Operating profit	4.35	4.32	4.31	4.30
<u>C. FINANCIAL EXPENSES</u>				
Depreciation	0.47	0.47	0.47	0.47
Interest on Term Loan	0.61	0.48	0.29	0.10
Expenses on nursery written off	0.04	0.04	0.04	0.04
Expenses on preparation of seedlings written off	0.07	0.07	0.07	0.07
Expenses on land preparation written off	0.05	0.05	0.05	0.05
Expenses on planting of slips written off	0.15	0.15	0.15	0.15
Net Profit	2.95	3.05	3.23	3.41
Net Cash Accruals	3.74	3.84	4.02	4.20
Principal Repayment	0.59	2.38	2.38	2.38

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

Particulars	Unit	Quantity		
Yield of fresh herbs/hectare/harvest	kg	20000		
Cultivated land under lemongrass	ha	4		
Total yield of fresh herbs/harvest	kg	80000		
	Yr 1	Yr 2	Yr 3	Yr 4
Number of harvests/year (4 year crop cycle; gestation period of 5 months; subsequent harvests at 3 months interval)	3	4	4	4
Yield of fresh herbs/year (in kg)	240000	320000	320000	320000
Percentage of oil recovery	0.6%	0.6%	0.6%	0.6%
Total oil production per annum (in kg)	1440	1920	1920	1920

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

Particulars	kg/ ha	Source	Nutrient %	kg/ ha (Source)	Cost/ kg (Source)	Cost/ ha (Rs)	Area under crop (ha)	Amount (Rs)
Expenses on Nitrogen/ application	150	Urea	46%	326	5.50	1793	4	7174
Expenses on Phosphorus/ application	60	SSP	16%	375	4.00	1500	4	6000
Expenses on Potassium/ application	60	MOP	60%	100	12.00	1200	4	4800
					Yr 1	Yr 2	Yr 3	Yr 4
Application of manures during land preparation in Year 1 (10000 kg/ ha @ Rs 0.20/ kg)					8000			
Application of Nitrogen/ annum					1	1	1	1
Cost (Rs)					7174	7174	7174	7174
Application of Phosphorus/ annum					1	1	1	1
Cost (Rs)					6000	6000	6000	6000
Application of Potassium/ annum					1	1	1	1
Cost (Rs)					4800	4800	4800	4800
Expenses on manures & fertilizers (Rs)					25974	17974	17974	17974

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	Yr 4
Number of harvests/year (4 year crop cycle; gestation period of 5 months; subsequent harvests at 3 months interval)	3	4	4	4
Expenses on harvest per annum (Rs)	96000	128000	128000	128000

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	40	200	4	32000
	Yr 1	Yr 2	Yr 3	Yr 4
Number of post harvest operations/ year	3	4	4	4
Expenses on post harvest operations per annum (Rs)	96000	128000	128000	128000

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	Yr 4
Yield of fresh herbs/year (in kg)	240000	320000	320000	320000
Capacity of distillation plant/batch (in kg)	1000	1000	1000	1000
No. of distillations per annum (Average)	240	320	320	320
Expenses on fuel (Rs)	135000	180000	180000	180000
Add: engagement of labour (2 mandays/2 distillations & manday cost of Rs 200)	48000	64000	64000	64000
Expenses on distillation per annum (Rs)	183000	244000	244000	244000

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		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 4 years including moratorium period of 9 months with equal monthly instalments. The details of calculation are given below.

(Rs in lacs)

Month		1 Year	2	3	4
Month 1	Opening balance	7.72	7.13	4.75	2.38
	Repayment	0.00	0.20	0.20	0.20
	Interest (8%)	0.05	0.05	0.03	0.02
	Closing balance	7.72	6.93	4.55	2.18
Month 2	Opening balance	7.72	6.93	4.55	2.18
	Repayment	0.00	0.20	0.20	0.20
	Interest	0.05	0.05	0.03	0.01
	Closing balance	7.72	6.73	4.35	1.98
Month 3	Opening balance	7.72	6.73	4.35	1.98
	Repayment	0.00	0.20	0.20	0.20
	Interest	0.05	0.04	0.03	0.01
	Closing balance	7.72	6.53	4.16	1.78
Month 4	Opening balance	7.72	6.53	4.16	1.78
	Repayment	0.00	0.20	0.20	0.20
	Interest	0.05	0.04	0.03	0.01
	Closing balance	7.72	6.33	3.96	1.58
Month 5	Opening balance	7.72	6.33	3.96	1.58
	Repayment	0.00	0.20	0.20	0.20
	Interest	0.05	0.04	0.03	0.01
	Closing balance	7.72	6.14	3.76	1.39
Month 6	Opening balance	7.72	6.14	3.76	1.39
	Repayment	0.00	0.20	0.20	0.20
	Interest	0.05	0.04	0.03	0.01
	Closing balance	7.72	5.94	3.56	1.19
Month 7	Opening balance	7.72	5.94	3.56	1.19
	Repayment	0.00	0.20	0.20	0.20
	Interest	0.05	0.04	0.02	0.01
	Closing balance	7.72	5.74	3.36	0.99
Month 8	Opening balance	7.72	5.74	3.36	0.99
	Repayment	0.00	0.20	0.20	0.20
	Interest	0.05	0.04	0.02	0.01
	Closing balance	7.72	5.54	3.17	0.79
Month 9	Opening balance	7.72	5.54	3.17	0.79
	Repayment	0.00	0.20	0.20	0.20
	Interest	0.05	0.04	0.02	0.01
	Closing balance	7.72	5.34	2.97	0.59
Month 10	Opening balance	7.72	5.34	2.97	0.59
	Repayment	0.20	0.20	0.20	0.20
	Interest	0.05	0.04	0.02	0.00

	Closing balance	7.52	5.15	2.77	0.40
Month 11	Opening balance	7.52	5.15	2.77	0.40
	Repayment	0.20	0.20	0.20	0.20
	Interest	0.05	0.03	0.02	0.00
	Closing balance	7.32	4.95	2.57	0.20
Month 12	Opening balance	7.32	4.95	2.57	0.20
	Repayment	0.20	0.20	0.20	0.20
	Interest	0.05	0.03	0.02	0.00
	Closing balance	7.13	4.75	2.38	0.00
	Principal Repayment	0.59	2.38	2.38	2.38
	Interest	0.61	0.48	0.29	0.10

7.0 DEBT SERVICE COVERAGE RATIO (DSCR)

(Rs. lacs)

Year	1	2	3	4	TOTAL
Profit After Tax (Net Profit)	2.95	3.05	3.23	3.41	
Depreciation	0.47	0.47	0.47	0.47	
Interest	0.61	0.48	0.29	0.10	
Total	4.04	4.01	4.00	3.99	16.03
Interest	0.61	0.48	0.29	0.10	
Principle repayment	0.59	2.38	2.38	2.38	
Total	1.21	2.86	2.67	2.48	9.21
DSCR	3.34	1.40	1.50	1.61	

Average DSCR = 1.74

8.0 BREAK EVEN POINT (BEP)

(Rs. In lacs)

Year	1	2	3
A. Net sales (Rs. lakh)	8.64	11.52	11.52
B. Variable cost			
Manures & Fertilizers	0.26	0.18	0.18
Weed Control & Intercultural Operations	0.60	0.60	0.60
Harvesting	0.96	1.28	1.28
Post Harvest Operations	0.96	1.28	1.28
Distillation	1.83	2.44	2.44
Power	0.12	0.12	0.12
Miscellaneous Expenses	0.09	0.12	0.12
Total variable cost	4.82	6.02	6.02
C. Contribution (A-B)	3.82	5.50	5.50
D. Fixed & Semi-fixed Costs			
Salary	1.08	1.08	1.08
Repair & Maintenance	0.09	0.10	0.11
Interest on Term Loan	0.61	0.48	0.29
Depreciation	0.47	0.47	0.47
Total fixed cost	2.26	2.14	1.96
E. BREAK EVEN POINT	59%	39%	36%

9.0 INTERNAL RATE OF RETURN (IRR)

(Rs. in lacs)

Year	0	1	2	3	4
CASH OUTFLOW					
Capital Expenditure	9.18	0.00	0.00	0.00	0.00
Working Capital	0.00	1.70	0.44	0.00	0.00
Total (A)	9.18	1.70	0.44	0.00	0.00
CASH INFLOW					
Profit After Tax		2.95	3.05	3.23	3.41
Add: Depreciation		0.47	0.47	0.47	0.47
Add: Interest		0.61	0.48	0.29	0.10
Add: Salvage Value					
Total (B)	0.00	4.04	4.01	4.00	3.99
NET FLOW (B-A)	-9.18	2.33	3.57	4.00	3.98

IRR = 17%

TECHNICAL CONSULTANT

- (a) NEDFi R & D Centre,
Khetri, Kamrup,
Assam-782403