COMMERCIAL CULTIVATION & OIL DISTILLATION OF PATCHOULI

1.0 INTRODUCTION

Patchouli is native to the Philippines and grows wild and also cultivated in Malaysia, Indonesia, Singapore, China and India. Leaves constitute the economic part, which contain the oil glands. The plant, an erect, well-branched, pubescent, small aromatic bushy herb attains a height of about 0.5-1.2 m. that yields fragrant leaves containing very sweet smelling oil.

Patchouli, an aromatic herb is grown in the Indo Malaysian and Sino-Japanese regions. The shade dry leaf upon steam distillation yields the Patchouli oil, which is used in perfumery, cosmetics, processed food and is imported into India every year in large quantities. The essential oil is one of the best fixatives for heavy perfumes, which imparts strength, strong character, alluring notes and lasting qualities. Natural fragrances like sandalwood, rose, jasmine, vetiver, agarwood and patchouli are complex mixtures of organic molecules, which cannot be reproduced in the laboratory. Thus, patchouli enjoys an additional importance as aromatic oil. In fact, it is a perfume by itself and is highly valued in perfumes, soaps, cosmetics and flavour industries. Patchouli alcohol (C15H26) will have long-lasting fragrant aroma when blended with other aroma chemicals.

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

2.0 MARKET POTENTIAL

Patchouli oil is an essential ingredient and used as a 'base' material in perfumery industry. There is no synthetic substitute for patchouli oil, which increases its value and demand in the perfumery market. Consumption of Patchouli oil in the world is about 2000 tonnes per annum. In India due to increase in chewing tobacco and pan masala industries, consumption has gone up to about 300 tons per annum while the production is below 50 MT. Hence, the country mostly depends on import mainly from Indonesia and on reconstituted oil.

3.0 PACKAGE OF PRACTICES

(i) Soil & Climate: The land selected for patchouli should be well-drained, loamy fertile soil, rich in organic matter. The land should not be subjected to water stagnation even for a short period. Heavy clay and sandy soils with poor water holding capacity are not suitable for its commercial cultivation. Acidic soil with pH value from 5.5-6.2 is reported to be the ideal. It is advisable to avoid nematode infested areas.

Patchouli prefers warm and humid climate. The crop can be grown successfully on fairly heavy and evenly distributed rainfall ranging from 1500-3000 mm per annum. A temperature of 24-28°C and an average RH of 75 % are taken to be ideal. It grows successfully upto an altitude of 500 m above the mean sea level.

(ii) Propagation: Patchouli is propagated through stem cuttings. Terminal stem cuttings are taken from healthy mother plants growing either in open area or under light shade (less than 30 %). Cuttings obtained from crops growing in shaded area, the internodes become longer with soft stem of which the survival percentage is low. Cuttings with shorter internodes are preferable.

(iii) Nursery raising: Cuttings are rooted in nurseries equipped with provision of shade and water supply before planting in the main field. Rooting is done either in poly bags or directly in beds under the shade. The best time for rooting is during April-September but with precautions, cuttings may be rooted any time of the year. Cuttings are best rooted in poly bags which give highest survival percentage when transplanted in the main field. When rooted directly in raised beds, cuttings are planted at a spacing of 10x10 cm. Cuttings become ready for transplanting in about 30-45 days during April-Sept and 45-60 days during October to March.

Cuttings are prepared during morning or afternoon period. Apical and branch twig of 10-15 cm long with 4-5 nodes is cut away from healthy mother plants. At least two pairs fully developed lower leaves of the cuttings are stripped off before planting in rooting medium. For early rooting cut ends are dipped in IBA hormone solution of 1000-ppm strength (1 g per litre water gives 1000-ppm. This is prepared by dissolving the hormone powder in little alcohol and then made up to volume by cold water) for 5-7 seconds and spread 10 minutes in shade for drying. Hormone powder in ready to use form like Rootex or Seradex etc available in the market in 3 grades of which the 'No.2' or 'B' grade may be used directly Hormone treatment seems to be helpful when seedlings are prepared during winter as hormone enhances root initiation.

(iv) Hardening of Seedlings: Hardening of the seedlings is necessary before planting. This is achieved by gradual reduction in water supply and removing shade from about 7-10 days ahead of planting. Before planting the poly bags are to be watered adequately. This helps rainfed crop in early establishment. Only the selected healthy seedlings of 30-45 days old should be planted.

(v) Spacing: 45 x 45 cm in raised beds in plains and 60 x 45 cm in sloppy lands.

(vi) Manure: 15-20 ton FYM or compost or well decomposed cowdung per hectare should be applied at final land preparation. If organic manure is not available in bulk, green manuring crop should be raised and incorporated in soil. During monsoon period green-manuring crops like Sesbania rostrata or Sesbania aculeata or pulses like Cowpea may be grown in between rows and at 50-60 days of growth may be uprooted and cut into pieces and applied as mulch.

(vii) Fertilizers: A fertilizer dose of 100 kg N, 50 kg P205 and 60 kg K20 per hectare is recommended. Basal application of 330 kg Single super, phosphate (SSP) and 50 kg Muriate of potash (MOP) is done at least 2 days ahead of planting. Total quantity of 220 kg urea /hectare/year in 4 equal splits should be applied. An extra dose of 30 kg K20 as top dressing along with 4th urea application may be done. It is better to avoid application of urea as basal initially. Because it will encourage weed growth and part of it will go waste as the newly planted seedlings remain unable to absorb the available N. The annual dose of NPK for subsequent years should be applied during March when there is irrigation and in May/ June without irrigation.

(viii) Cultural Practices: Compaction of surface soil particularly around root zone is avoided. This is achieved by racking with dry land weeder twice or thrice followed by one hand weeding. Forking and raking besides weeding is found to be beneficial in developing a strong root system. Incorporation of urea with soil is done by racking and hand weeding.

(ix) Irrigation: Immediately after planting light watering daily upto 3-4 days and thereafter irrigation at 10-15 days interval should be applied. Saturation of poly bags before planting in field eliminates watering for 2-3 days. Surface drainage is more important than irrigation in high rainfall plains.

(x) Harvesting: Patchouli should be harvested following selection method. In this method, a partial harvest is taken at 60-65 days after planting. At 90-100 days after planting the first regular harvesting is done by cutting selected matured branches only. Branches so selected should be about 70-90 days old and showing signs of maturity as 1-2 lower leaves turning yellowish. These branches bear 6-7 pairs of leaves. In first harvest, the main branch should be cut back above 3-4 nodes from base depending chances of regrowth. Growing buds in the lower side get suppressed and degenerated in absence of light and apical dominance if harvesting is delayed. If top portion is cut back just above the buds, the growing buds develop

quickly into new branches. Harvesting of mature branches is otherwise encouraging the new shoots from lower sides of each branch. In selected harvesting (pruning) the plant is not getting enough stress and normal metabolic functions continue throughout the growing period. Harvesting and other intercultural operations should be done from the side drains only without disturbing or compacting the root zones. This is necessary for quick regeneration by maintaining soil aeration. The selection of the branch for harvesting can be so planned that a few branches attain this stage at an interval of 35-45 days.

(xi) Drying of Leaves: After harvesting, the fresh herbs should be spread over on bamboo mats or on tarpaulin for drying under shade for 7-10 days. The thickness of the herb should not be more than 2 inches. Turning atleast once in a day is necessary to avoid fermentation and for uniform drying. A drying structure of 30 x 15 ft with 4 tiers racks is sufficient to cope up one-hectare area. The drying house may be constructed by bamboo with thatched roof or tarpaulin roof or may be a semi permanent structure with tiers. The fresh and dry ratio of herb is 5.5:1 at around 12 % moisture.

(xii) Crop cycle: For commercial cultivation, it is advisable to grow the crop as annual.

(xiii) Distillation of oil: Shade dried and cured leaves are subjected to steam distillation for obtaining the oil of patchouli. The distillation unit consists of a boiler, distillation still, condenser and receiver. The distillation still is made up of preferably food grade stainless steel (304 or 316). The vessel has a perforated metal sheet or net above the bottom to support the herb, which is loaded into the still for distillation. Steam is injected through perforated coils that uniformly pass through the material. This steam while passing through takes out the oils by rupturing the oil glands that moves to condenser along with water vapour.

The condenser, which cools the hot vapours received from the still, consists of mainly tubes made up of stainless steel and mounted inside a jacket. The condenser is provided with inlet and outlet for the circulation of cooling water. The hot vapours consisting of steam and essential oil vapours are cooled in the condenser tubes and the condensate then flows out into the receiver. The oil being lighter than water and insoluble flows on the top in the receiver and only the water gets drained out. The oil is drawn off separately at the end of distillation.

The process of distillation consists of loading the dried leaves into the still, closing the lid securely, letting in steam generated in the boiler from the bottom of the still, condensing the vapours in the condenser and collecting the oil in the receiver. It has been noted that interchange of light and low pressures, i.e., 1.4 to 3.5-kg/sq cm produces better yield as more cell walls rupture in this process. The duration of distillation varies from 12- 16 hours. Prolonged distillation gives higher yield and better quality of oil.

(xiv) Yield: On an average a recovery of 3.0 to 3.5 % is obtained which varies largely on drying procedure, leave & stem ratio and curing.

4.0 COST OF THE PROJECT

The estimated project cost is given below.

(Rs. in lacs)

Particulars	Amount (Rs)
Land & Site Development	-
Building & Civil Works	5.04
Plant & Machineries	3.84
Misc. Fixed Assets	0.85
Setting up of Nursery	0.15
Preliminary & Pre-operative Expenses	0.70
Working Capital	2.01
TOTAL	12.59

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
Drying Shed (Open shed with CGI sheet roof)	1000	50	50000
		Sub total	458000
Add: Electrification, etc @ 10%			45800
		TOTAL	503800
		Say (Rs. in lacs)	5.04

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 (ha)				4
Area required for raising mother stock in sqm (1/20 of target area)				2000
No. of seedlings required (40,000/ha)				8000
Particulars	Unit	Qty	Rate (Rs)	Amount (Rs)
Purchase of seedlings	Nos	8000	1	8000
Engagement of labour for nursery land preparation	Manday/ha	25	200	1000
Engagement of labour for planting of seedlings	Manday/ha	75	200	3000
Cost of FYM	kg/ha	18000	0.20	720
			Sub-total	12720
Add: Crop management for 6 months, etc. @ 20%				2544
			TOTAL	15264
			Say (Rs. in lacs)	0.15

4.6 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	0.40
Miscellaneous expenses	0.10
TOTAL	0.70

4.7 Working capital: Details of working capital are given below.

(Rs. in lacs)

Year 1	Period (month)	Amount (Rs)		
		Yr 1	Yr 2	Yr 3
Preparation of Seedlings	1	0.06	0.06	0.06
Land Preparation	1	0.02	0.02	0.02
Planting	1	0.05	0.05	0.05
Manures & Fertilizers	1	0.02	0.02	0.02
Weed Control & Intercultural Operations	1	0.05	0.05	0.05
Harvesting	1	0.11	0.11	0.11
Post Harvest Operations	1	0.11	0.11	0.11
Distillation	1	0.08	0.08	0.08
Power	1	0.01	0.01	0.01
Salary	1	0.09	0.09	0.09
Finished Goods	1	0.55	0.55	0.55
Receivables	1	0.86	0.86	0.86
Total		2.01	2.01	2.01
Working capital margin in Yr 1 (100%)	2.01			

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%	5.04
B. Subsidy from Central/ State Govt.	-	
DEBT		
Term Loan from Banks/ FIs	60%	7.55
TOTAL	100%	12.59

6.0 PROFITABILITY STATEMENT

(Rs. in lacs)

Particulars	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
A. INCOME					
Oil production per annum (in kg)	648	648	648	648	648
Oil price (Rs. per kg)	1600	1600	1600	1600	1600
Income from sale of oil (Rs lakh)	10.37	10.37	10.37	10.37	10.37
B. OPERATING EXPENSES					
Preparation of Seedlings	0.77	0.77	0.77	0.77	0.77
Land Preparation	0.20	0.20	0.20	0.20	0.20
Planting	0.60	0.60	0.60	0.60	0.60
Manures & Fertilizers	0.29	0.29	0.29	0.29	0.29
Weed Control & Intercultural Operations	0.60	0.60	0.60	0.60	0.60
Harvesting	1.28	1.28	1.28	1.28	1.28
Post Harvest Operations	1.28	1.28	1.28	1.28	1.28
Distillation	0.96	0.96	0.96	0.96	0.96
Power	0.12	0.12	0.12	0.12	0.12
Salary	1.08	1.08	1.08	1.08	1.08
Repairs & Maintenance	0.10	0.11	0.12	0.13	0.14
Miscellaneous Expenses	0.10	0.10	0.10	0.10	0.10

Total operating expenses	6.61	6.62	6.63	6.64	6.66
Less: working expenses capitalised	2.01	0.00	0.00	0.00	0.00
Operating profit	5.77	3.75	3.74	3.72	3.71
C. FINANCIAL EXPENSES					
Depreciation	0.49	0.49	0.49	0.49	0.49
Interest on Term Loan	0.60	0.50	0.36	0.22	0.08
Expenses on nursery written off	0.02	0.02	0.02	0.02	0.02
Net Profit	4.65	2.73	2.86	2.99	3.12
Net cash accruals	5.17	3.24	3.37	3.50	3.63
Principal Repayment	0.44	1.78	1.78	1.78	1.78

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

Particulars	Unit	Quantity
Yield of green leaves/hectare/harvest	kg	7500
Cultivated land under patchouli	ha	4
Total yield of green leaves/harvest	kg	30000
Recovery rate of dry leaves from green leaves	%	18%
Yield of dry leaves/harvest	kg	5400

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Number of harvests/year (1 year crop cycle with gestation period of 3 months; subsequent harvests at 35-45 days interval)	4	4	4	4	4
Yield of dry leaves/year (in kg)	21600	21600	21600	21600	21600
Percentage of oil recovery	3.00%	3.00%	3.00%	3.00%	3.00%
Total oil production per annum (in kg)	648	648	648	648	648

6.2 Preparation of Seedlings: Expenses on preparation of seedlings per annum is estimated as below.

No. of seedlings required per ha	40000
Target area for cultivation	4
Total No. of seedlings required	160000
No. of polybags/ kg (4 x 3 inch size)	2000
Quantity of polybags required (in kg)	80

Particulars	Unit	Quantity	Rate (Rs)	Amount (Rs)
Cost of polybags	Kg	80	80	6400
Engagement of labour for polybag filling	Mandays/ 1000 Nos	1	200	32000
Engagement of labour for planting in polybags	Mandays/ 1000 Nos	1	200	32000
			Sub - Total	70400
Add: Cost for manures, etc @ 10%				7040
Annual expenses on preparation of seedlings per annum (Rs)				77440

6.3 Land Preparation: Expenses on land preparation per annum is estimated as below.

Particulars	Mandays/ha	Rate (Rs)	Area under crop (ha)	Amount (Rs)
Engagement of labor for land preparation	25	200	4	20000

6.4 Planting: Expenses on planting per annum is estimated as below.

Particulars	Mandays/ha	Rate (Rs)	Area under crop (ha)	Amount (Rs)
Engagement of labour for planting of seedlings	75	200	4	60000

6.5 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 Manures	18000	FYM/ cowdung	100%	18000	0.20	3600	4	14400
Expenses on Nitrogen	100	Urea	46%	217	5.50	1196	4	4783
Expenses on Phosphorus	50	SSP	16%	313	4.00	1250	4	5000
Expenses on Potassium	60	MOP	60%	100	12.00	1200	4	4800
Annual expenses on manures & fertilizers per annum (Rs)								28983

6.6 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

6.7 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 leaves	40	200	4	32000	
	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Number of harvests/year (1 year crop cycle with gestation period of 3 months; subsequent harvests at 35-45 days interval)	4	4	4	4	4
Expenses on harvest per annum (Rs)	128000	128000	128000	128000	128000

6.8 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	Yr 5
Number of post harvest operations/ year	4	4	4	4	4
Expenses on post harvest operations per annum	128000	128000	128000	128000	128000

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

No. of hours per distillation	14
Fuel (Dry herbage) consumption (kg/hr)	15
Cost of dry herbage per kg (Rs)	5
Expenses on fuel/distillation (Rs)	1050

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5
Yield of dry leaves/year (in kg)	21600	21600	21600	21600	21600
Capacity of distillation plant/batch (in kg) of fresh leaves	1000	1000	1000	1000	1000
Capacity of distillation plant/batch (in kg) of dry leaves (18% of fresh leaves)	180	180	180	180	180
No. of distillations per annum (Average)	120	120	120	120	120
Expenses on fuel (Rs)	126000	126000	126000	126000	126000
Add: engagement of labour (4 mandays/distillation & manday cost of Rs 200)	96000	96000	96000	96000	96000
Expenses on distillation per annum (Rs)	96000	96000	96000	96000	96000

6.10 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

6.11 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

6.12 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	5.04	1%	0.05
Machinery & Equipment	3.84	1%	0.04
Misc. Fixed Assets	0.85	1%	0.01
Total			0.10

6.13 Miscellaneous Expenses: Miscellaneous expenses have been assumed at 1% of sales.

6.14 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	5.04	3.34%	0.17
Machinery & Equipment	3.84	7.07%	0.27
Misc. Fixed Assets	0.85	6.23%	0.05
TOTAL			0.49

6.15 Interest on Term Loan & Principal Repayment: Interest rate has been assumed at 8%. Duration of Loan repayment has been considered for a period of 5 years including moratorium period of 9 months with equal monthly instalments. The details of calculation are given below.

(Rs. in lacs)

Month	Year	1	2	3	4	5
Month 1	Opening balance	7.55	7.11	5.33	3.55	1.78
	Repayment	0.00	0.15	0.15	0.15	0.15
	Interest (8%)	0.05	0.05	0.04	0.02	0.01
	Closing balance	7.55	6.96	5.18	3.41	1.63
Month 2	Opening balance	7.55	6.96	5.18	3.41	1.63
	Repayment	0.00	0.15	0.15	0.15	0.15
	Interest	0.05	0.05	0.03	0.02	0.01
	Closing balance	7.55	6.81	5.04	3.26	1.48
Month 3	Opening balance	7.55	6.81	5.04	3.26	1.48
	Repayment	0.00	0.15	0.15	0.15	0.15
	Interest	0.05	0.05	0.03	0.02	0.01
	Closing balance	7.55	6.66	4.89	3.11	1.33
Month 4	Opening balance	7.55	6.66	4.89	3.11	1.33
	Repayment	0.00	0.15	0.15	0.15	0.15
	Interest	0.05	0.04	0.03	0.02	0.01
	Closing balance	7.55	6.52	4.74	2.96	1.18
Month 5	Opening balance	7.55	6.52	4.74	2.96	1.18
	Repayment	0.00	0.15	0.15	0.15	0.15
	Interest	0.05	0.04	0.03	0.02	0.01
	Closing balance	7.55	6.37	4.59	2.81	1.04
Month 6	Opening balance	7.55	6.37	4.59	2.81	1.04
	Repayment	0.00	0.15	0.15	0.15	0.15
	Interest	0.05	0.04	0.03	0.02	0.01
	Closing balance	7.55	6.22	4.44	2.67	0.89
Month 7	Opening balance	7.55	6.22	4.44	2.67	0.89
	Repayment	0.00	0.15	0.15	0.15	0.15
	Interest	0.05	0.04	0.03	0.02	0.01
	Closing balance	7.55	6.07	4.29	2.52	0.74
Month 8	Opening balance	7.55	6.07	4.29	2.52	0.74
	Repayment	0.00	0.15	0.15	0.15	0.15
	Interest	0.05	0.04	0.03	0.02	0.00
	Closing balance	7.55	5.92	4.15	2.37	0.59
Month 9	Opening balance	7.55	5.92	4.15	2.37	0.59
	Repayment	0.00	0.15	0.15	0.15	0.15
	Interest	0.05	0.04	0.03	0.02	0.00
	Closing balance	7.55	5.78	4.00	2.22	0.44
Month 10	Opening balance	7.55	5.78	4.00	2.22	0.44
	Repayment	0.15	0.15	0.15	0.15	0.15
	Interest	0.05	0.04	0.03	0.01	0.00
	Closing balance	7.40	5.63	3.85	2.07	0.30
Month 11	Opening balance	7.40	5.63	3.85	2.07	0.30
	Repayment	0.15	0.15	0.15	0.15	0.15
	Interest	0.05	0.04	0.03	0.01	0.00
	Closing balance	7.26	5.48	3.70	1.93	0.15

Month 12	Opening balance	7.26	5.48	3.70	1.93	0.15
	Repayment	0.15	0.15	0.15	0.15	0.15
	Interest	0.05	0.04	0.02	0.01	0.00
	Closing balance	7.11	5.33	3.55	1.78	0.00
	Principal Repayment	0.44	1.78	1.78	1.78	1.78
	Interest	0.60	0.50	0.36	0.22	0.08

7.0 DEBT SERVICE COVERAGE RATIO (DSCR)

(Rs. In lacs)

Year ended March 31,	1	2	3	4	5	TOTAL
Profit After Tax (Net Profit)	4.65	2.73	2.86	2.99	3.12	
Depreciation	0.49	0.49	0.49	0.49	0.49	
Interest	0.60	0.50	0.36	0.22	0.08	
Total	5.75	3.73	3.71	3.70	3.69	20.58
Interest repayment	0.60	0.50	0.36	0.22	0.08	
Loan repayment	0.44	1.78	1.78	1.78	1.78	
Total	1.05	2.28	2.14	2.00	1.85	9.31
DSCR	5.50	1.63	1.74	1.85	1.99	

Average DSCR = 2.21

BREAK EVEN POINT (BEP)

(Rs. In lacs)

Year	1	2	3
A. Net sales (Rs. lakh)	10.37	10.37	10.37
B. Variable cost			
Preparation of Seedlings	0.77	0.77	0.77
Land Preparation	0.20	0.20	0.20
Planting	0.60	0.60	0.60
Manures & Fertilizers	0.29	0.29	0.29
Weed Control & Intercultural Operations	0.60	0.60	0.60
Harvesting	1.28	1.28	1.28
Post Harvest Operations	1.28	1.28	1.28
Distillation	0.96	0.96	0.96
Power	0.12	0.12	0.12
Miscellaneous Expenses	0.10	0.10	0.10
Total variable cost	6.21	6.21	6.21
C. Contribution (A-B)	4.16	4.16	4.16
D. Fixed & Semi-fixed Costs			
Salary	1.08	1.08	1.08
Repairs & Maintenance	0.10	0.11	0.12
Interest on Term Loan	0.60	0.50	0.36
Depreciation	0.49	0.49	0.49
Total fixed cost	2.27	2.18	2.05
E. BREAK EVEN POINT	55%	52%	49%

8.0 INTERNAL RATE OF RETURN (IRR)

(Rs. in lacs)

Year	0	1	2	3	4	5
CASH OUTFLOW						
Capital Expenditure	9.73	0.00	0.00	0.00	0.00	0.00
Working Capital	0.00	2.01	0.00	0.00	0.00	0.00
Total (A)	9.73	2.01	0.00	0.00	0.00	0.00
CASH INFLOW						
Profit After Tax		4.65	2.73	2.86	2.99	3.12
Add: Depreciation		0.49	0.49	0.49	0.49	0.49
Add: Interest		0.60	0.50	0.36	0.22	0.08
Add: Salvage Value						
Total (B)	0.00	5.75	3.73	3.71	3.70	3.69
NET FLOW (B-A)	-9.73	3.73	3.72	3.71	3.70	3.69

IRR = 26%

TECHNICAL CONSULTANT

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