Bio Fertilizer Production and Marketing

1 Introduction

Bio-fertilizers are selective live micro-organism like bacteria, fungi and algae. They provide a cost effective, eco-friendly &renewable source of nutrients. Bio-fertilizers improve the nutrient availability to the crops in which biological process is involved. They play a vital role in improving soil fertility and ensure maintaining long term sustainability

Bio-fertilizers become popular to counter the negative impact of indiscriminate use of chemical fertilizers. Chemical fertilizers and pesticides have played a important role in boosting the agricultural production for past 50 years in India, since their introduction during green revolution. Their immediate action and low cost resulted in the widespread acceptance and inclusion in cultivation practices. However their long term application contributed in loss of soil fertility along with addition of salts to the soil. This led to concern for reviving the soil health and use of alternate sources of fertilizers. Thus came the concept of bio-fertilizer, which proved to be a good supplement for chemical fertilizers.

Bio-fertilizer is the need of modern agriculture since demand for safe and residue free food is increasing. In view of the shifting focus towards organic farming and reduction of chemical residues in the environment, it is necessary to promote the production of bio-fertilizers in large scale by the private sector to cater the current demand.

Bio-fertilizers help in fixing atmospheric nitrogen, converting soil phosphate and potash into soluble forms to make them available to plants. Continuous use of bio-fertilizers makes the soil rich in essential nutrients, which promotes good yield. The bio-fertilizer can be manufactured both in solid as well as in liquid form.

Table 1 List of Commonly Produced Bio-Fertilizer in India

NAME	CROPS SUITED	BENEFITS USUALLY SEEN	REMARKS
Rhizobium strains	Legumes like pulses, groundnut, soybean, black bersem, lucern	10-35% yield increase, 50-200 kg N/ha.	Fodders give better results. Leaves residual N in the soil.
Azotobacter	Soil treatment for non- legume crops including dry land crops Mustard, sunflower, Banana, Sugarcane, grapes, papaya, water melon, tomato, ladyfinger, coconut, Spices, fruits, flowers, plantation crops,	10-15% yield increase- adds 20-25 kg N/ha	Also controls certain diseases.

Azospirillum	Non-legumes like maize, barley, oats, sorghum, millet, Sugarcane, rice, wheat etc.	10-20% yield increase	Fodders give higher/enriches fodder response. Produces growth promoting substances. It can be applied to legumes as co-inoculant
Phosphate Solubilizers* (*there are 2 bacterial and 2 fungal species in this group)	Soil application for all crops	5-30% yield increase	Can be mixed with rock phosphate.
Microhizae (VAM)	Many trees, some crops, and some ornamental plants	30-50% yield increase, enhances uptake of P. Zn, S and Water.	Usually inoculated to seedlings.

2 Industry Scenario (National and State)

2.1 National Scenario:

Govt. of India and different State Governments have been promoting use of Bio-fertilizers through grants, extension and subsidies on sales with varying degrees of emphasis. With time farmers are getting training and knowledge about the technology on the basis of agronomic realities of their regions. Thus farmers are being encouraged to adopt the use of Bio fertilizers.

Government of India has been implementing the scheme for the promotion of bio-fertilizers since 7th Five Year Plan. Under this scheme, one national centre-NCOF and six regional centres- RCOFs have been established. The main function of these centres includes the promotion of bio-fertilizer through training, demonstration and supply of 10 efficient culture for production of bio-fertilizers. The scheme also aims for giving grant up to Rs. 40 lakh per unit of 150 tonnes per year to set up bio-fertilizer producing units. Since inception bio-fertilizer production capacity of 10,525 tonnes has been envisaged by setting up 83 bio-fertilizer production units. Out of these units, 9 units have been sanctioned by the Department of Fertilizers under their scheme of providing financial assistance for the purpose and 74 units have been financed by Department of Agriculture & Cooperation. Another 39 units have been set up by different organizations and private entrepreneurs with a production capacity of 7,975 tonnes per year.

The total estimated current demand for bio-fertilizers in India is 18,500 tonnes per year, whereas estimated production is about 10,000 tonnes per year in the country. Moreover Govt. Of India is

focussing on generating additional demand through proper extension and promotion by regularly organizing Seminars on bio-fertilizers and micronutrients.

2.2 State Scenario

In 1988, under full grant-in-aid of Govt. of India OAIC (Odisha Agro Industries Corporation Limited) a Govt. of Odisha undertaking set up a bio-fertilizer production unit at Laxmisagar, Bhubaneswar.Since then the unit has been processing quality bio-fertilizers namely Rhizobium Culture, P.S.B., Azotobactor and Azospirrilum. The unit has also been making constant effort in promoting the use of bio-fertilizer in different crops mainly in paddy, oil seed crops, pulses, vegetables, orchard crops, sugarcane and beetle leafs. The unit uses lignite powder as the main carrier material and is producing50-60 M.T. per year. Besides, the product are also popular in the State like Sikkim, Jharkhand and Chhattisgarh and about 50% of the total product sold to the above States.

3.1 Location analysis

It is advisable to set up one Bio fertilizer production unit in centralized location of each of four geographical parts (North, South, East and West) of the state. Each of these units will thus be able to cater up to approximately 200km^2areas.

The site for setting up of unit should have good road connectivity and supply of electricity with support for uninterrupted power supply.

3.2 Availability of Raw material

Raw materials needed for the production of biofertilizers are as follows:

- Mother cultures
- Carrier material - lignite or bentonite or peat of desired quality in powder form (70-100 mesh)
- Pet bottles of desired quantity, cardboard cortans
- Growth materials - include Manital, sucrose and chemical nutrients**.**

3.2.1 Mother Culture

The pure mother cultures of various strains are being maintained in Agricultural Universities, IARI, some ICAR institutions, NCOF, MoA (Regional bio-fertilizer labs), etc. There are international sources of supply also like NifTAL (Improved Agricultural Productivity through Biological Nitrogen Fixation Technology and Legume Management), IRRI (International Rice Research Institute) etc. The mother culture in test tubes of desired strain can be purchased from the identified sources. They have to be further sub-cultured and maintained for mass production by adopting standard techniques under the supervision of trained microbiologist.

3.2.2 Carrier material

For solid formulations there is a requirement of lignite / bentonite / charcoal / peat of desired quality in powder form (70-100 mesh). However, the solid formulation technology is gradually becoming obsolete because of the issues relating to the quality and stability of the product. The solid state formulation is sensitive to temperature and during mid-summer, in Odisha the microbial count comes below the threshold limit. In comparison the liquid formulation is much stable technology and the self-life of the product can be maintained very well up to 12 months. The production of liquid Bio fertilizer does not need any carrier material for the final product. For production, it requires only water and chemicals. The quantity produced in the Fermenters then directly packed in bottles and sold. Therefore the liquid- biofertilizer will be most suitable.

3.2.3 Growth materials

The liquid formulation needs water and certain chemicals as Manital, sucrose and chemical nutrients as growth medium. These chemicals are easily available through any supplier/ distributor of lab-chemicals.The chemicals required for the production of bio-fertilizer are:

Carbon Source - Malic acid, Sucrose, Glucose, Manitose.

Nitrogen Source - Yield extract, Ammonium sulphate, Peptone.

Micro-Nutrients - Mg sulphate, Zn sulphate, Co nitrate.

Stabilizers/ Surfactant - Polyethylene Glycol, Glycerol, PVP.

Microorganism to be used in the said facility for production of the bio-fertilizer range is as follows:

i. Rhizobium
ii. Azotobacter
iii. Azospirillium
iv. Phosphate Solubilising bacteria (PSB)
v. Potash Mobilizing Bacteria (KMB)
vi. Trichoderma for compost production.

4 Project Details

4.1 Installed Capacity

At the initial stage the installed production capacity of this project will be **250,000 litres** per year of liquid bio-fertilizers. This can be increased afterwards.

4.2 Land

It is required to set up laboratory and other facilities and office. Space may also be required for installing tube well / dug well and parking of vehicles. Approximately 1 acre of land is required for 4etting up a 250,000 litre per year, production facility. Preferably, the entire site should be fenced with barbed wire or compound wall with gates at suitable places. The boundary may be planted with thick and tall growing species like Asoka, to filter air and reduce dust.

4.3 Layout and buildings

The civil works comprises of factory building for laboratory, Carrier preparation and enrichment, sterilisation, Inoculation and quality control, Maturation of culture, Mixing and packing, storage/ staff etc. The total covered area of about 2000 sqm is required for the product manufacturing and other utilities. Rest of the area of land will be enough for future expansion up to 500,000 litres to 1000,000 litre per Annum Building.

4.4 Infrastructure and Facilities

The Bio-Fertilizer unit should have separate suitable Infrastructure with closed type building. The main production unit should have separate channels for microbial lab, production (Fermentation) area, packaging area, storage area and marketing way. In addition there should be rooms with separate entrance for utilities like power, steam generator, ETP and stores. Appropriate design can be adopted in consultation with scientists/engineers.

The design should be suitable for easy movement of material and people, with outer open space for pot culture at the centreof the building. It should facilitate sufficient natural light ventilation.

The production unit should have the following facilities:

- Climate control provisions devices like air-conditioners,
- 5 and 15 ampere plugs in each room and halls,
- Safety system to avoid damages by short circuit,
- Adequate hot and cold water supply
- Working generator, as an alternative to power cut problem,
- Leak proof ceiling and damp proof floors and walls,
- Glazed tiles or polyvinyl mat floors,
- Glass windows and 4'wide doors with auto shutters,
- Three phase power supply for heavy machinery,
- Well functioned drainage system,
- 75 cu.m. water Storage tank(s)
- Ceiling and exhaust fan.

The office should be nearer to entrance to reduce chances of contaminants. Golden duranta border fencing around the building, lawn, and ornamentals in front of the building adds in built up the building. Non – deciduous shrubs and free plantation help in climate control, if planted around the building.

4.5 Plant and Machinery

Manufacture of Bio fertilizers needs a good number of laboratory equipments as well as other production facilities such as Fermenters, culture medium tank, Fermenter assembly, autoclaves, boiler, broth dispensers for sterilisation, demineralising plant, air compressor etc,. The section wise equipment required, their specifications, quantity required and average costs are indicated in the financial aspects. All the machineries are manufactured in the country. Some of the suppliers undertake the installing the units on a turnkey basis.

4.5.1 Equipment:

The main equipment needed for manufacture and lab are listed below. They are available through scientific and lab equipment suppliers. List of equipments mentioned below with quantity required.

- Boiler (3 ton capacity)/steam generator 1 big or 2 small to generate steam for sterilization
- Autoclaves -
  - One horizontal autoclave for carrier/ media sterilization, (50kg)
  - One vertical autoclavesfor smaller quantities and small containers, (100 Kg each)
- Rotary shakers (2 tier- 48x48 platform) for 2 Culture growth
- 2 Auto temperature control Fermenters (one of 2000 litre and other of 500 litre capacity)
- 2 Laminar air flow - Size 6'X2'X2' for inoculation purposes
- BOD incubator 1 for culture growth sterilization
- Hot air oven (1 nos.) for drying of glassware
- Air conditioner 3-4 - (1.5 ton each)
- Refrigerator 2
- Microscope 1
- Electronic Balances (2-3 nos.)
- Liquid Filling machine
- Wet sealing machine
- Shrink tunnel

Lab equipments: For quality control and microbial works

- pH meter 1 - electrode range 0 to 14 pH Accuracy
- Colony counter 1
- Microscope 1
- Fridge 1
- Distiller water unit or 1 set
- Demineralization unit
- Glassware as needed. Conical flasks are the major requirement
- Office furniture as needed

4.6 Production of Bio-fertilizers

The Bio-fertilizers are large population of viable cells of effective strains of specific nitrogen fixing bacteria, that can be either be supplied through carrier based powder form or in liquid formulations for use in farming. Bio fertilizers production technology includes isolation of bacteria, selection of suitable effective strain, preparation of mother or seed culture, isolation of bacteria(inoculants 0, selection of suitable effective strain, preparation of mother or seed culture, inoculants production, carrier preparation and their mixing, followed by curing, packaging, storage and dispatch. The process flow for production of Bio-fertilizers is given below.

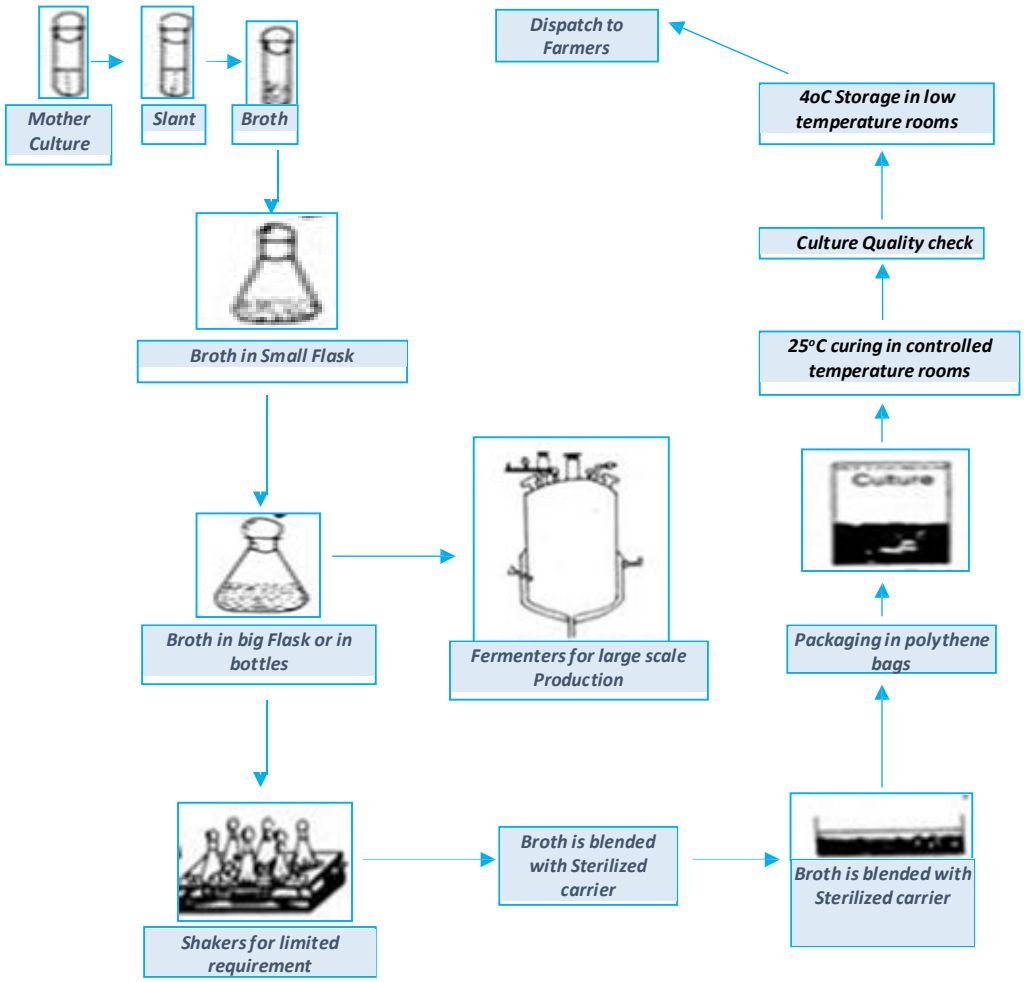

Figure 1 Flow chart for production of Bio Fertilizer

The production of microbial inoculants of Rhizobium, Azotobacter and Azospirillum involves following steps except the broth or liquid medium used is different for different organisms.

4.6.1 Preparation of Mother or Starter Cultures

Starter cultures of selected strains are obtained after ascertaining their performance in green house and at field levels. The pure culture of efficient strain of nitrogen fixing organism is grown on respective agar medium on slant and maintained in the laboratory. A loopful of inoculums from the slant is transferred in a 250 ml capacity conical flask containing liquid medium. Keep the conical flak on rotary shaker for 3-7 days depending whether they are fast growing or slow growing. The content of these flasks usually attain a load of 105- 106 cells per ml called mother culture or starter culture. This mother cultures are further multiplied in larger flasks.

4.6.2 Preparation of Broth Cultures

The liquid growth medium is to be prepared for respective organisms. Then this has to be distributed in equal quantity in big conical flasks (1000 ml). Then the media in the conical flask get sterilized in autoclave for half an hour at 15 lbs pressure. After sterilization each flask containing suitable broth is inoculated with the mother culture in 1:5 proportions aseptically. The flasks are then kept on rotary shaker for 96-120 hours until the viable count per ml reaches to 10^9- 10^{10} cells achieved. The broths become thicker in consistency. This broth culture with population of 10^9- 10^{10}cells per ml should not be stored more than 24 hours or stored at 40C temperature.

4.6.3 Production of final product in Fermenter

Fermenters are used for large scale production of microbial products like Bio-fertilizers and Bio-pesticides. A Fermenter is a device in which the optimum conditions for the microbial growth and activity is established artificially. It may also be used for the growth of microorganisms i.e. production of microorganism itself.

This is the similar way of preparation of broth cultures in liquid media, as mentioned above.

4.6.4 Filling and Packing:

For the production of liquid Bio fertilizer, the broth from the Fermenters directly goes to the automatic filling machine and get packed in 250 ml/ 500ml/ 1 litres pet bottles as per the demand of 0.5 mm thickness leaving 2/3 space open for aeration of the bacteria. Then the bottles

get sealed by automatic sealing machines. The pet bottles used for filling of microbial inoculants should be printed with following information.

a) Name of Inoculants

b) Direction for use

c) Name of crops

d) Date of Manufacture.

e) Date of expiry.

4.6.5 Quality Checking

The microbial count of the inoculants has to be checked at the time of manufacturing. The viable cell count in the inoculants should be maintained as per ISI specifications.

4.6.6 Storage

The inoculants shall be stored by the manufacture in a cool place away from direct heat preferably at a temp of 15°C and not exceeding 30^0C +/- 2^0C for six months. For long survival of microorganisms the bottles need to be stored below 33^0C temp.

4.6.7 Quality Control

Though there are BSI standards for two species viz. Rhizobium (IS: 8268-1976 and Azotobacter (IS: 9138-1979), there is no systematic quality certification system and monitoring mechanism. It is entirely an internal arrangement and voluntary system as of now. As the products being living microorganisms, the quality checkup, certification batch-wise even if it is internal is highly essential. Each unit should have lab infrastructure and plans/arrangements for the same. Each unit, therefore should have the following facilities:

- Adequate microbiological lab and qualified microbiologist.
- Sampling and testing at various stages of production, including the quality of raw materials.
- Specify on the packets all the contents and cell counts. The source of mother culture and the strain name should also be mentioned.
- The unit should fix their quality certificate and batch number, pack the products in proper packing material.
- Store the products in cooler places till they are sold to farmers.
- Ensure to have aseptic conditions, cleanliness and contamination free production lines and housing.
- Preferably use automatic and closed systems.

As per BIS specifications, certain tests are required to be conducted, like no. of cells, colony character, reaction etc. Cell number at the time of manufacture should not be less than 108 and 10^7 per gram of carrier material, respectively for Rhizobium and Azotobacter. Similarly, the number of cell count and permissible contamination at expiry dates are also specified.

As certification arrangements are not in place at present, legislation for quality monitoring and accredited labs for testing may be needed in future to ensure proper quality and promote these products.

4.7 Utilities

Power

Normally a three phase electric supply is required for these plants. The normal requirements of a 250 TPA unit is about 220 KVA depending upon the position of power supply, stand by generator may be needed.

Water

A Bio fertilizer production unit requires water mainly for steam generation for broth preparation and cleaning of equipment's. For liquid formulations, water becomes the main ingredient. Installation of bore well (if piped water supply is not available), and according to the quality of water demineralization equipment's are to be installed. The average per day requirement of water for 250 TPA capacities will be about 3500 to 4000 litres.

Air Compressor

Compressed air is required for various pneumatic operations as well as for controlled air supply to Fermenters, sterilization / cleaning operations etc.

Vehicles

The vehicles are required for procurement of carrier material and distribution of Bio fertilizers as well as for office use. Accordingly one LCV and a jeep have been included in the project. These vehicles' can also be hired from reliable transportation companies.

4.8 Manpower

For a unit manufacturing 250 TPA Bio fertilizers the requirements of manpower is as under:

1 Chief Executive Officer (In fact entrepreneur himself should undertake this role)

2 Chief Biologists / Micro Biologist

3 Sales Officers

4 Accountant and clerical Assistant

5 Drivers (If vehicles are owned by the unit)

6 Floor Supervisors/ Factory Manager

7. Technical Staff (boiler operation, mechanical maintenance, packing machine operations, electrical maintenance)

8 Labour requirements is estimated to be skilled labourers and 4Semi- skilled

5 Financials:

5.1 Cost of project:

The cost of the project is Rs. 296.07 lakhs. The cost is divided into the components of land and site development around Rs. 15.51 lakhs, civil work Rs. 157.50 lakhs, plant and machinery cost will be Rs. 90.60.

Contingencies	Total	Cont.	Total Cost
Land	-	-	-
Site Development	15.01	0.50	15.51
Building	150.00	7.50	157.50
Plant & Machinery	86.28	4.32	90.60
Misc. Fixed Assets	10.26	0.51	10.77
Preoperative Expenses	16.69	-	16.69
Security Deposits	5.00	-	5.00
Total	**283.24**	**12.83**	**296.07**

5.1.1 Land and site Development:

The cost of land and site development will be Rs.15.51 Lakhs. The components are given below:

Particulars	Unit	Unit cost	Cont.	Total
Land Development	LS		0.10	2.10
General Civil Works				
Fencing	RMT	500	0.07	1.38
Gate	LS	50000	0.03	0.53
Drainage	RMT	2000	0.20	4.20
Parking	SQM	800	0.03	0.63
Internal Roads	RMT	800	0.08	1.68
Sub-Total			**0.50**	**15.51**

5.1.2 Plant and Machinery:

The cost of plant and machinery required is as below:

Plant & Machinery	Units	Unit cost	Cont.	Total
Autoclave Horizontal	APQ	5.50	0.28	5.78
Autoclave Vertical 100 Kg	APQ	0.70	0.04	0.74
Autoclave Vertical 50 Kg	APQ	0.55	0.03	0.58
Boiler (3 Ton)	LS	2.00	0.10	2.10
Fermenter 2000 Ltr.	APQ	32.00	1.60	33.60
Fermenter 500 Ltr.	APQ	7.50	0.38	7.88
Laminar Air Flow	APQ	1.76	0.09	1.85
PAN BALANCE (.1 Mg -310gm)	APQ	1.15	0.06	1.21
PAN BALANCE (.1 Mg -120gm)	APQ	0.25	0.01	0.26
Water Distillation Unit	APQ	1.00	0.05	1.05
Air Conditioners	APQ	0.90	0.05	0.95
Trinocular Microscope	APQ	1.00	0.05	1.05
Air Curtain	APQ	7.50	0.38	7.88
Lab Hot Air Oven With Accessories	APQ	7.50	0.38	7.88
Bacteriological Incubators	APQ	0.25	0.01	0.26
Rotary Shakers	APQ	0.25	0.01	0.26
Magnetic Stirrer	APQ	0.12	0.01	0.13
Cyclomixer	APQ	0.15	0.01	0.16
Deep Freezer And Referigerator	APQ	0.45	0.02	0.47
Internal Electrification And Plumbing	LS	15.75	0.79	16.54
Sub-Total		**86.28**	**4.31**	**90.59**

5.2 Revenue:

The revenue generated in first year is Rs. 168.68 lakhs which goes on increasing till 6th year to Rs. 303.63 lakhs.

Revenue											
Revenue Heads	**Column1**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
Capacity Utiliztion	100%	50%	60%	70%	80%	90%	90%	90%	90%	90%	90%
Revenue(In Rs Lakhs)		**168.68**	**202.42**	**236.16**	**269.89**	**303.63**	**303.63**	**303.63**	**303.63**	**303.63**	**303.63**
	337.37										
		168.68	202.42	236.16	269.89	303.63	303.63	303.63	303.63	303.63	303.63
Total	**337.37**	**168.68**	**202.42**	**236.16**	**269.89**	**303.63**	**303.63**	**303.63**	**303.63**	**303.63**	**303.63**

5.3 Cash flow statement:

The profitability of the project is:

PARTICULARS	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
SOURCES								
INCREASE IN SHARE CAPITAL	89.95	-	-	-	-	-	-	-
NET PROFIT	-	52.54	63.37	73.78	84.16	98.08	93.20	88.16
(INTEREST ADDED BACK)								
SUBSIDY	40.00							
DEPRECIATION	-	16.94	16.94	16.94	16.94	16.94	16.94	16.94
PRELIMINARY EXP.W/O	-	5.42	5.42	5.42	5.42	-	-	-
INCREASE IN TERM LOAN	209.88	-	-	-	-	-	-	-
INCREASE IN WC	-	-	-	-	-	-	-	-
TOTAL	**339.83**	**74.91**	**85.73**	**96.15**	**106.53**	**115.03**	**110.14**	**105.11**
DEPLOYMENT								
INCREASE IN FIXED ASSETS	274.37	-	-	-	-	-	-	-
PRELIMINARY EXPENSES	21.69	-	-	-	-	-	-	-
DECREASE IN TERM LOAN		17.49	34.98	34.98	34.98	34.98	34.98	17.49
INCREASE IN CURRENT ASSETS	-	-	-	-	-	-	-	-
INTEREST PAYMENT (WC)	-	30.83	27.37	22.70	18.04	13.37	8.54	3.70
DIVIDEND & DIVIDEND TAX		-	-	-	-	-	-	-
TOTAL	**296.06**	**48.32**	**62.35**	**57.68**	**53.02**	**48.35**	**43.52**	**21.20**
OPENING BALANCE		43.77	70.36	93.74	132.21	185.72	252.39	319.02
SURPLUS/DEFICIT	43.77	26.59	23.38	38.47	53.51	66.68	66.63	83.91
CLOSING BALANCE	43.77	70.36	93.74	132.21	185.72	252.39	319.02	402.93

5.4 Sensitivity analysis:

The sensitivity of the project is:

KEY INDICATORS	Envisaged As per 5th Year
Net Profit After Tax	**84.71**
Internal Rate Of Return	**26.01**
Break Even Point	**32.31**
Pay Back Period (Years)	**4.35**

5.5 Means of finance:

The finance for the project will be generating through equity of Rs. 89.95 Lakhs, subsidy of 40 Lakhs, and term loan of Rs. 169.88.

MEANS OF FINANCE			
Equity	30%	89.95	89.95
Subsidy	13%	40.00	40.00
Unsecured Loan	0%		-
Term Loan	57%	169.88	169.88
Financial Institutions			-
Total		**299.83**	**299.83**

6 Marketing Plan / Strategy:

Some of the marketing strategies as suggested below may work strongly in the marketing of bio fertilizers:

6.1 Field demonstration

The farmers do what they see because 'Seeing is believing' and therefore result as well as method demonstration are very effective tools in promoting Bio fertilizer usage. The producers may synergize their efforts on this front as bio-fertilizers are new and it is very crucial to show the impact of bio-fertilizer usage to farmers and educate them the economics /returns. Therefore a demonstration farm may be developed jointly, at different locations, defining a catchment area,which could be shown to farmers at different crop stages.

6.2 Market Segmentation & Product Positioning

The segmentation is primarily dividing market into various groups of buyers. First of all the organic producers will be the most important buyers as organic production without bio fertilizers will not be possible. Among nonorganic producers, the market can be segmented by "specific crop grower (Fruits/ Vegetable/Oilseed/ Pulses/Sugarcane/Cereals), institutional buyers (Cane/ Tea/ Coffee/ cotton/ oilseeds/pulses federations & research-farms, SFCI, Agro-industries etc).

Bio fertilizers can be easily positioned as environmently friendly growth enhancer manure with long term benefits such as enrichment of soils, similarly other benefits for example: (a) "Save cost through reduced dosage of chemical fertilizers"(b) "Improves resistance power against disease" (c) "Enhance sugar recovery percent in sugarcane" etc. need to be highlighted.

6.3 Pricing

Being price sensitive input, the pricing needs to be kept at penetrative level, slightly lower than the competitors. However, real advantage to the units will come from reduction in logistics costs being near to the consuming areas.

6.4 Publicity & Training

The POS (Point of Sales) material giving details of proper method of application must be made available to all dealer/ distributors and also needs to be ensured that product is displayed visibly. To deploy Extension Executives for promoting bio fertilizers with constant visits and developing a close connect with farmers and undertaking demonstrations with its replication in nearby villages.

6.5 Marketing Linkages

With the promotion of alternate sources of nutrition management, there is already awareness among the farmers related to bio fertilizer and becoming popular gradually. Now Bio fertilizers of many brands are readily available in the market through the regular dealer/ distributor network. Many of these are produced outside Odisha. So it is not very difficult to promote the appropriate crop specific products manufactured inside the state. Moreover these products will have added advantage of lower transportation and marketing cost. The marketing of the products can therefore be done through the existing marketing network. The farmer co-operatives and farmer groups can also be contacted for bulk selling.

The Marketing linkages with Technology providers like "Drip Irrigation" producers may be initiated as Liquid bio-fertilizers have got tremendous potential as its application through this technology. Similarly, tie-up with Export oriented crops like turmeric, ginger, spices, fruits and Vegetable growers could be undertaken as the organic products are being preferred by this segment due to compulsion of importing nation's condition of permissible limits of chemical residues in the produce. Govt. of Odisha is also buying bio fertilizer in bulk for various crops under various schemes and the local products are given preference for the same. This market has to be tapped. There are Sugar Industries who could also be a bulk buyer for Acetobacter and PSM / Potash mobiliser or Zinc & Sulphur Solubilisers.

6.6 Marketing Challenges & Options in bio-fertilizer business

In spite of being cost effective input, the Bio-fertilizers have not been accepted by the farmers completely till now. Some of the reasons/constraints for low acceptance of Bio-fertilizer are narrated below. However, the "Liquid form" has overcome few limitations and has provided opportunities for Marketers

a) Bio-fertilizers are live microorganisms which dies in case of high temperature.

b) The shelf life of bio-fertilizer is limited to 6-12 months in powder form.

c) The Bio-fertilizers are used before sowing and delay in dispatches leads to inventory carry over and expiry of product.

d) Some of the bio-fertilizer are crop specific as well as location specific and therefore its efficacy does not remain same at different locations due to difference in agro-climatic conditions & soil ediphic factors.

e) Soil characteristics like high nitrate, low organic matter, less available phosphate, high soil acidity or alkalinity, high temperature as well as presence of high agro-chemicals or low micro-nutrients contribute to failure of inoculants or adversely affect its efficacy.

g) Supply of Sub-standard or spurious material by some of the manufacturers also adversely affect the credibility of the Bio-fertilizers, being a new product.

h) Some firms are selling organic manures as Bio-fertilizers. Some organizations mention shelf life as two years/one year despite norm of maximum 3- 6 months.

j) Lack of awareness of the farmers regarding benefits of bio-fertilizer.

k) There is no magic effect of bio-fertilizer & its impact is not visible in standing crop and therefore farmer is not convinced with the benefits of bio-fertilizer use.