BIO-FERTILIZERS

1. INTRODUCTION

This profile proposes to set up a Bio fertilizer unit in a small scale sector with simpler technology and semi- automatic kind of plant set up. The quality of final product would be as per standards laid down and acceptable to the market.

Bio-fertilizers are natural fertilizers which are the preparations containing living cells of micro-organism which when inoculated into soil provide essential nutrients to plants either by working symbiotically with plant roots or though solubilizations of soil nutrients such as phosphorous. Bio-fertilizers can be classified into two major categories.

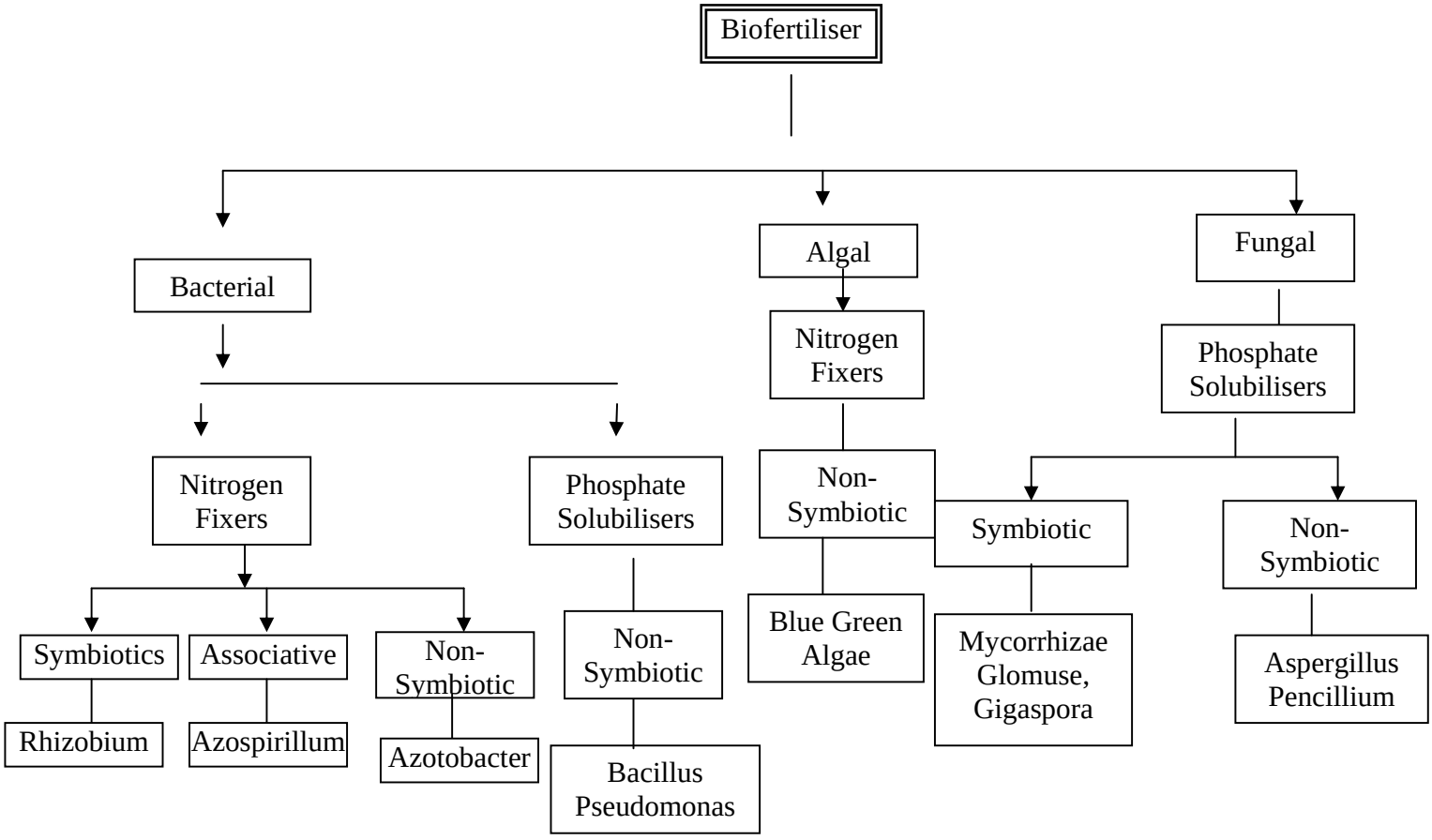
i) Nitrogen fixing bio fertilizers like Rhizobium (for legumes), Azotobacter, Azospirillium, Azolla and blue green algae (for cereals) etc. and

ii) Phosphorous Biofertilizers like the preparation containing phosphate solubilizing micro-organisms such as Bacillus, Pseudomonas, Aspergillus and VA-mycorrhiza.

The most important bio fertilizer is Rhizobium, which has been widely accepted by farmers in recent years. Others also have good potential for exploring. The use of blue green algae in paddy and that of Azotobacter and Azospirillium in wheat, sugar-cane and cotton is being reported with good success

2. PRODUCT AND ITS APPLICATION

CHART: - CLASSIFICATION OF BIOFERTILIZERS



Biofertilizers are biologically active products containing certain strains of bacteria, algae or fungi, as a single or composite culture. Most Biofertilizers have the ability to convert atmospheric nitrogen into forms that are readily usable by plants. Broadly speaking there is two types; symbiotic and free living. The formers, which require symbiotic association with plants, are represented by Rhizobium. The latter, who can fix nitrogen independently, include Azotobacter, Azospirillium, blue green algae (BGA) and Azolla. A list of nitrogen fixing bio-fertilizers and target crops are given in Table 01

Table-01 Nitrogen Fixing Bio fertilizers

Organism	Target Crop
Rhizobium	Pulses, Oilseeds and Fodder crops
Azolla	Rice
Azospirillium	Rice, Sugarcane
Azotobacter	Wheat, Rice, Vegetables
Blue Green Algae (BGA)	Rice

In addition to the nitrogen fixing micro-organisms, there are Biofertilizers, which can improve the availability and uptake of other nutrients. Two types of these are most important. The first consists of certain fungi mycelium, which form a symbiotic relationship with plant roots. The symbiotic relationship, called Vessicular-Arbuscular mycorrhiza (VAM), is considered to be associated with increased plant growth and enhanced accumulation of plant nutrients such as phosphate, zinc and copper.

The second type of non-nitrogen fixing Biofertilizers are phosphate solubilizing micro-organisms. These micro-organisms, which include bacteria, fungi and yeast, excrete organic acids which solubilize rock phosphate and tri-calcium phosphate by decreasing the size of particles to near amorphous form. As mentioned above, Indian soils are characterized by poor to medium phosphorus availability; only about 25-30% of the phosphorus applied to the soils is available for the crops. The presence of phosphate solubilizing microorganisms is reported to increase the availability of phosphorus considerably. An important advantage of these micro-organisms is that they are not crop-specific and can benefit all crops.

1.1 Advantages of Bio-Fertilizer

1) They are cheap and can help to reduce chemical fertilizer consumption
2) They make available biological nitrogen directly to the plant
3) Besides providing nitrogen they solubilize phosphorous and increase phosphorous uptake by the plants
4) They enhance plant growth due to release of hormones, vitamins etc.
5) 10-20% crop yield increases with their use.
6) They control and suppress soil-borne diseases.
7) They help to proliferate and survival of beneficial micro-organisms in soil
8) Improve soil properties and sustain soil fertility.
9) They provide plant nutrients at very low cost.

1.2 Constraint in the use of Biofertilizers

Many constraints have been identified which are responsible for unsatisfactory results of Biofertilizers. There are as follows:

Biological Constraints

1) Presence of native ineffective strains
2) Presence of antagonists which minimize the number of BNF organisms.

Technical Constraints

1. Mutation during fermentation
2. Lack of soil specific strains
3. Inadequate shelf life
4. Competitive inoculate strains

Resource Constraints

1. Farmers unawareness about Bio fertilizers
2. Farmers income

Marketing Constraints

1. Farmers unawareness about Bio fertilizers
2. Inadequate instructions
3. Lack of technical support
4. Working marketing practices.
5. Deficient quality of products
6. Market segmentation
7. Seasonal Demand

Environmental Constraints

1. Poor crop management
2. Poor water management
3. High doses of pesticides and chemical fertilizers
4. Soil conditions which limit N fixation
5. Variation in climate and temperature.

3. DESIRED QUALIFICATION FOR PROMOTER

The promoter should ideally be having formal qualifications in the field of Agricultural science. A formal qualification in bio Technology (agri field) may also do. Further he / she should have experience of working in a unit manufacturing such products

4. INDUSTRY OUTLOOK / TREND

Bio-fertilizers have been introduced in the country since more than two decades.

With increased focus on natural and organic products the trend of using bio fertilizers (and also bio pesticides) is on the rise. An estimated CAGR of @ 10 % in last three years and projected growth rate of @12.00 % is considered.

5 MARKET POTENTIAL AND MARKETING ISSUES, IF ANY

Bio-fertilizers have been introduced in the country since more than two decades. However, bio-fertilizers account for only small percentage of overall chemical fertilizers production and the

market. It is estimated that the total production of our fertilizer in the country is approximately 12000 to 15000 TPA. Number of chemical fertilizer plants also produces bio-fertilizers, however, in small quantities. At the national level apart from the fertilizer plants, M/s. Agro Evo Limited, a joint venture of Hoechst and Schering is one of the major units. In terms of product, Rhizobium accounts for the bulk of the bio-fertilizer production.

In Gujarat, fertilizer companies like GSFC, KRIBCO and GUJCOMASOL produces bio-fertilizers in small quantities. Some of the small scale units include following:

- M/s. Agriland Biotech
- M/s. Ocean Agro Industries
- M/s. Gujarat Life Science Pvt. Ltd.

All of these are located at Baroda.

The demand estimation for bio-fertilizer is quite difficult in view of the lack of organised data as also under development of marketing channels, e.g., the demand for Rhizobium bio-fertilizer is estimated to be anywhere from 30,000 TPA to 35,000 TPA. It is estimated that there is lot of hidden potential, provided systematic production, research and marketing is carried out.

6 RAW MATERIAL REQUIREMENTS

Depending upon the technology and product mix different kind of raw materials is required. The basic requirement is of an efficient microbial strain. The other raw materials required include sources of carbon hydrates, minerals and salts, wood charcoal, etc. The project would also require consumables like plastic bags, glass-wears, Aluminum foils, etc.

7 MANUFACTURING PROCESS

Technology is available from number of sources including Agricultural Universities and Government linked organizations. Following may be contacted for technology:

- BAIF Development Research Foundation, Pune
- Gujarat Life Science Private Limited, Vadodara
- Biotech Consortium Limited, New Delhi

Manufacturing process

The process involves culture preparation and than processing.

- Soil is a natural habitat of variety of agriculturally benef icial microorganisms. Certain soil microorganisms have an ability to absorb and convert atmospheric nitrogen to the readily available form to the plants. Whereas certain soil microorganisms solubilize part of the bound phosphates of the soil and thereby make them available to the plants. Both these attribute make them important to be used as Biofertilizers.
- Nitrogen fixing Bacteria for Leguminous Crops Rhizobium fertilizer contains Rhizobium micro-organisms. These micro-organisms live in association with the roots of leguminous plants in the form of root nodules. These micro-organisms fix the atmospheric Nitrogen in the roots & make it available to plants, which plants can't fix directly and makes the soil fertile & also increases the plant health.
- Phosphate solubilizing micro-organisms for all Crops There are many types of micro-organisms present in soil out of which some microbes & fungi can solubilize the complex insoluble form of phosphorus into simple soluble forms that can be taken up by plants. Generally these micro-organisms are very few in soil. PSB culture contains millions of soil phosphate solubilizing micro-organism per gram. These soil phosphate solubilizing bacteria stay near the roots & make the phosphorus available to plants from soil as well as fertilizers & increase the production drastically.
- Nitrogen fixing Bacteria for all Non –Leguminous Crops This microorganism fixes the atmospheric nitrogen and makes it available to plants in asymbiotic manner. Azotobacter is mainly useful for monocot vegetables. Azotobacter also secretes some fungicides, enzymes but in minute amount. Use of Azotobacter increases the crop production in large scale.
- Nitrogen fixing Bacteria –azospirillum for all Non –Leguminous Crops This microorganism fixes the atmospheric nitrogen and makes it available to plants in asymbiotic manner. Azospirillum is mainly useful for monocot vegetables. Azospirillum bio fertilizer also secretes some fungicides, enzymes but in minute amount. Use of Azospirillum bio fertilizer increases the crop production in large scale.
- ISOLATION OF RHIZOBIUM RHIZOBIUM IS ISOLATED ON CONGO RED MEDIUM The Rhizobium from the freshly crushed root nodule was Gram stained onto a slide and examined at 100X power with oil immersion. The bacteria cells were rods in chains, and clumps that stained Gram negative as indicated by the faint pink red color of the rod membrane walls.

- Samples were collected from different stations viz. Station-1 (Thondi open sea-I), Station-2 (Under the Jetty), Station-3 (Thondi open sea-II), Station-4 (Beach). Sediment samples were collected by sediment sampler (Peterson crab), it was sterilized with alcohol before sampling at each station. The central portion of the top 2 cm sediment samples was taken out with the help of a sterile spatula. The samples were then transferred to a sterile polythene bag and transported the serially diluted samples were plated on Pikovskaya's agar media to isolate the phosphate solubilizing bacteria. The plates were incubated at 28±2 ºC. After 3 days,
- Soil samples were collected during spring and autumn 2000 in different areas of central Italy both from cultivated and uncultivated soils. Samples were withdrawn at a depth of 10 – 15 cm below the surface, collected into sterile vials. AND THEN AZOTOBACTER IS ISOLATED ON JENSEN'S MEDIUM
- The broth is prepared in flasks and inoculum from mother culture is transferred to flasks. The culture is grown under shaking conditions at 30±2°C as submerged culture. The culture is incubated until maximum cell population of 1010 to 1011 cfu/ml is produced. Under optimum conditions this population level could be attained with in 4 to 5 days for Rhizobium; 5 to 7 days for Azospirillum; 2 to 3 days for phosphobacteria and 6-7 days for Azotobacter. The culture obtained in the flask is called starter culture. For large scale production of inoculant, inoculum from starter culture is transferred to large flasks/seed tank fermentor and grown until required level of cell count is reached.
- The carrier material (peat or lignite) is powdered to a fine powder so as to pass through 212 micron IS sieve. The pH of the carrier material is neutralized with the help of calcium carbonate (1:10 ratio); since the peat soil / lignite are acidic in nature (pH of 4 - 5) the neutralized carrier material is sterilized in an autoclave to eliminate the contaminants.
- The neutralized, sterilized carrier material is spread in a clean, dry, sterile metallic or plastic tray. The bacterial culture drawn from the fermentor is added to the sterilized carrier and mixed well by manual (by wearing sterile gloves) or by mechanical mixer. The culture suspension is to be added to a level of 40 – 50% water holding capacity depending upon the population. The inoculant packet of 200 g quantities in polythene bags, sealed with electric sealer and allowed for curing for 2 -3 days at room temperature (curing can be done by spreading the inoculant on a clean floor/polythene sheet/ by keeping in open shallow tubs/ trays with polythene covering for 2 -3 days at room temperature before packaging).

- Use for the non-leguminous crops before the mentioned expiry date. Mix the inoculants uniformly with the seeds gently with the minimum amount of water taking care to avoid damage to seed coat. Dry the inoculated seeds under shade over clean paper or gunny bag and sow immediately. For transplanted crops: Mix the inoculants in bucket of water stir the mixture vigorously. Dip the roots of seedlings in this mixture before transplanting. Transplant as usual. It can be mixed with pit mixture before planting of vegetables / fruit crop. If the seed is to be treated with pesticides; first follow the pesticide treatments and finally treat seeds with Azotobacter inoculant.
- Use for the non-leguminous crops before the mentioned expiry date. Mix the inoculants uniformly with the seeds gently with the minimum amount of water taking care to avoid damage to seed coat. Dry the inoculated seeds under shade over clean paper or gunny bag and sow immediately. For transplanted crops: Mix the inoculants in bucket of water stir the mixture vigorously. Dip the roots of seedlings in this mixture before transplanting. Transplant as usual. It can be mixed with pit mixture before planting of vegetables / fruit crop. If the seed is to be treated with pesticides; first follow the pesticide treatments and finally treat seeds with Azospirillum inoculant. It reduces dose of nitrogenous fertilizers like Urea and Increases the protein content of seeds. It provides nitrogen to the plant and increases the yield.
- Use for the crops before the mentioned expiry date. Mix the inoculants uniformly with the seeds gently with the minimum amount of water taking care to avoid damage to seed coat. Dry the inoculated seeds under shade over clean paper or gunny bag and sow immediately. For transplanted crops: Mix the inoculants in bucket of water stir the mixture vigorously. Dip the roots of seedlings in this mixture before transplanting. Transplant as usual. It can be mixed with pit mixture before planting of vegetables / fruit crop. If the seed is to be treated with pesticides; first follow the pesticide treatments and finally treat seeds with PSB culture. It coverts insoluble complex form of phosphate in to simple soluble form to increases the yield.

8. MANPOWER REQUIREMENTS

Sr. No.	Designation	Number	Approx. Total Salary
1	Manager cum Manufacturing Chemist	3	45000
2	Analytical Chemist	2	20000
3	Sales representative	2	16000
4	Clerk cum Accountant	1	5000

5	Skilled Worker	5	10000
6	Unskilled Worker	3	9000
7	Peon cum Chowkidar	1	4000
	Sub Total		1,08,000/-
	Perks @ 15 %		16000/-
	Total		124,000/-Say 1,25,000/-/-

9. IMPLEMENTATION SCHEDULE

Sr. No	Activity	Time
1	Preparation of Project report	**Six weeks**
2	E M Registration & approval from Director of Ayurveda	One month
3	Financial/Loan from Banker or Financial Institutions	Two months
4	Power connection/Building construction Six months	One month
5	Machinery procurement & Trial run.	Two months
6	Recruitment of Staff & Labour	One month
7	Actual commercial production	One month

10. COST OF PROJECT

The total cost of project is estimated as below:

Sr. No	Component	Particulars	Cost (Rs. Lacs)
1	Land	1000 sq mtrs @ Rs. 500/-	5. 00
2	Building	500 Sq. mtrs @ Rs. 2000/	10.00
3	Plant & Machinery	As per list	45.00
4	Other Assets	-	3.00
5	P & P Expenses	-	1.00
6	Contingencies @ 10 %		5.50
7	WC Margin	As per separate table	5.00
		Total	74.50 Say 75.00

11. MEANS OF FINANCE

- Term Loan : Rs.50.00 lacs
- Promoter own contribution : 25.00 lacs

12. WORKING CAPITAL CALCULATION

Particulars	**Duration**	**Estimated cost (Rs. Lacs)**
Raw materials/ Packing materials	1 month	**8.00**
Working expenses	1 month	**3.00**
Finished goods	15 days	**3.00**
Receivable	7 days	**1.00**
	Total	**15.00**

13. LIST OF MACHINERY REQUIRED & SOURCES

Sr. no.	**Machine**	**Number**	**Approx. Cost** (Rs. Lakhs)
1	Fermentor	1	30.00
2	Mass mixer	2	3.00
3	Wooden vessel for fermentation with lid, Cap. 50 ltrs and 100 ltrs	2	1.50
4	Reactor Vessels -M.S. Vat cap. 750 kg & 1000kgs	2	1.00
6	Tray Driers Cap 96	1	1.00
7	Bottle filling machine	1	0.50
8	Bottle Sealing Machine	1	0.50
9	S.S. mixing Vessel with stirrer Cap. Various capacities	3	1.00
10	Hot Air oven with 24 trays	1	1.00
11	Bottle washing & Drying machine	2	1.00
14	Water treatment plant , 100 liters capacity	1	2.50
15	QC and Testing equipments	-	2.00
		Total	**45 .00**

- MAYO VESSELS & MACHINES PVT. LTD.
  Factory - C - 19, MIDC, Industrial Area,
  Waluj,
  Aurangabad - 411133,
  Maharashtra

- ALLANCE FERTILIZER MACHINERY
  Weiyi Road, Jinshui District,
  Zhengzhou City,
  China

- FERMEX SOLUTIONS LLP
  Mohali, Punjab, India

14. PROFITABILITY CALCULATIONS

At 100 % capacity utilisation (indicative):

- Installed Capacity : 300 TPA
- Sales price (average & indicative) : Rs. 35000/ per ton
- Total Sales turnover: 105.00 lacs
- Cost of production & other expenses : 73.00 lacs
- Profit : 32.00 lacs

PROFITABILITY PROJECTIONS (Indicative only)

Particulars	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Capacity utilisation (%)	60	75	80	80	80
Production (TPA)	180.00	135.00	240.00	240.00	240.00
Sales	63.00	79.00	84.00	84.00	84.00
Expenses	44.00	55.00	58.00	58.00	58.00
Gross profit	19.00	24.00	26.00	26.00	26.00
Profit to Sales (%)	30. 00	32.00	33.00	33.00	33.00

Note: The profitability basis and projections are indicative and on approximate basis only.

Key Assumptions and The basis of profitability calculation:

As mentioned above, The Unit will have capacity of 300 TPA / annum of **Bio Fertilizers.**

The capacity build up is taken considering the sales related from OEM/ Retail network that is built up by the entrepreneur based on his prior experience in the industry.

This project has to have diverse group of **Bio Fertilizers.** The sales prices of these products vary. Accordingly an average sales price of Rs. 35000/ per ton has been assumed. The cost of production, inclusive of major cost heads such as raw materials, labour & power has been considered based on prevailing industry standards and assumed @ 70 %.

On indicative basis, power Costs are considered at Rs 7/- per Kwh and fuel cost is considered at Rs. 50/- to 65/- per litre. The depreciation of plant is taken at 10-12 % and Interest costs are taken at 12 % - 14% depending on type of industry. All these are wherever applicable.

It may be kindly noted that basis / assumptions for such kind and size of the projects in a profile can be on indicative basis only. At the same time it does provide a reasonably accurate scenario.

15 BREAKEVEN ANALYSIS

FC X 100: 35.00 X 100 = 3500

FC + Profit: 35.00 +36.00 = 71

BEP = 48.30 %

16 STATUTORY/ GOVERNMENT APPROVALS

Basic guidelines from Department of Biotechnology is advisable .Further MSME & GST registration, IEC Code for Export of end products and local authority clearance may be required for Shops and Establishment, for Fire and Safety requirement and registration for ESI, PF and Labour laws may be required if applicable and approval from Pollution Control Board.

17 BACKWARD AND FORWARD INTEGRATION

As forward integration, Entrepreneur may think of going for the production of bio pesticides

18 TRAINING CENTERS/COURSES

Large scale govt backed fertilizer plants. Also Fertilizer association of India at New Delhi.

Udyamimitra portal (link : www.udyamimitra.in) can also be accessed for handholding services viz. application filling / project report preparation, EDP, financial Training, Skill Development, mentoring etc.

Entrepreneurship development programs help to run businesses successfully and are available from Institutes like Entrepreneurship Development Institute of India (EDII) and its affiliates all over India.

Disclaimer:

Only few machine manufacturers are mentioned in the profile, although many machine manufacturers are available in the market. The addresses given for machinery manufacturers have been taken from reliable sources, to the best of knowledge and contacts. However, no responsibility is admitted, in case any inadvertent error or incorrectness is noticed therein. Further the same have been given by way of information only and do not carry any recommendation.