



## Masamvit group

### Agri Project Report

#### Project Report, Detailed Project Report and Feasibility Study Report

The Detailed Project Report, Project Report and Feasibility Study Report are Mainly Two type: Product Based and Services Based, Here We talk about the Content and what we are covering in of Product Based Detailed Project Report. The services Based Detailed Project Report may have minor Changes in term of Services. You can co relate with the both of them according to your product or services. If you are interested in any Product or Services based Business. Please ask us the Content of your Detailed Project Report, Project Report and Feasibility Study Report

#### About The Detailed Project Report, Project Report and Feasibility Study Report

Detailed Project Report, Product Project Report, Product Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.

Detailed Project Report Including context in which Business Operate. It will enhance the Business Planning Process and teach a lot about the Business that you are like to learn, you will Identify Future Trouble area and Opportunity and help to Run Organization smoothly.

You can also use the Product Manufacturing Detailed Project Report to find Funding for your Project. It is Valuable Tool for fulfil your vision, Goal and Objectives.

Detailed Project Report covers every aspect of Product Manufacturing business and all need of business.

Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Provide the deeper understanding of Business, Market and Industry Trend.

Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Include the property, various Standards and Specifications Requirement for the Project according to the Country Specific, Project Use and Application.

Project Reports include Market Scenario, History of Market, Present Market Demand, Future Growth of the Project and Complete Market Analysis.

It's also including Detailed Manufacturing Process and Technology of Project, Product Manufacturing Units, Machinery and its Accessories Requirement, Electricity and Water Requirement.

Project Reports include Raw Material costing and its Specifications, Manpower Requirement, land and Buildings, Capital Formulation, Cost of Production and Profit

Analysis, Break Even Analysis, Depreciation, Cash Flow Statement and projecting the Balance Sheet etc.

Product Manufacturing Detailed Project Report contains.

## Introduction:

In This Section of Detailed Project Report and brief Introduction of Product Project, Opportunity and Feature of Business is covered.

## Product Properties:

In This Section of Detailed Project Report all the Product scientific Data, Physical and Chemical properties of Product Covered. If you want to start this business you should know Properties aspects of Product so you can Produce Better Quality end Products.

## Product Standard and Specifications Requirement:

In Detailed Project Report Here all the standard and Specifications Requirement According to the Country where Product Made and also Product export and import country's Standard and there Specifications is covered. It is very important to know Standard and specification of your products and Products should be made according to the Country Market where you want to sell your Product.

## Product Uses and Applications:

Detailed Project Report here all the uses and applications of Product according to industry, end user and other uses are covered. If you are new in this business you should know uses and Applications area Product, so you can focus to cover that Area.

## Product Present Market Position:

In Detailed Project Report Here we cover present market status of Product in Domestic market and international market and its statistical data. It is very important aspect of project you should know all the Present Market Demand statistic, Numeric Data and present market facts so it will help to you know statistic Present market Status and you will take better Decisions.

## **Product Future Demand:**

In Detailed Project Report Here we cover Future market status, Future Demand of Product in Domestic market and international market and its statistical data, Demand and Supply Gap. It will help you to explore Product future Demand so you can decide your Project Capacity according to the Market Product Demand and supply gap.

## **Product Manufacturing Process and Technology:**

In Detailed Project Report Here we cover Commercial Product Manufacturing Process, Technology and its formulation. Latest Proven Process and Technology is used for Product Manufacturing. We will also arrange the Technology transfer. It is the Core your business total business is Depend on Product Manufacturing Process and Technology. Some Major aspects of your Business is based on Manufacturing Process and Technology these are following

Your Manufacturing Machinery costs are Depend on it. You will choose the Machinery according to Manufacturing Process and Technology.

Your Product Manufacturing Costs are Totally Depend on it.

You're Manpower Need and cost is Depend on it. You will choose Manpower requirement according to your Manufacturing Machinery and Project Need.

Your Product Manufacturing Cost its Dependent on it.

Land and Building Requirements are according to Manufacturing Machinery.

That's why we call it is Core part of your business. Latest Proven Process and Technology should be used for Product Manufacturing. We carefully chose and help to choose better Process and Technology to give higher output and great Result.

## **Product Manufacturing Process Flow Sheet Diagram:**

In Detailed Project Report Here the Process flow Diagram according to the Machinery is covered with brief Details of Each and Every Process. It is Important to know the Process Flow of your project.

## **Names and Addresses of Product Manufacturing Units:**

In Detailed Project Report Here we provide you the Name and Address of Existing Manufacturer of Product. It is important to know the Existing Product Manufacturers, Major Players and Competitors and there Capacity and there Market status. They will be buyers of your Products.

## **Pollution Control and Energy Conservation:**

In Product Manufacturing Detailed Project Report Here we Cover Pollution Control and Energy Conservation aspect of Project. Pollution Control and Energy Conservation is important aspect in Project it depend on Product to Product, Machinery and Manufacturing Process.

## **Product Manufacturing Capacity Utilization:**

In Detailed Project Report here we Cover Product Manufacturing Capacity Utilization aspect of Project. The Capacity Utilization is Carefully Designed for Better Utilization of Project Capacity and Machinery.

### **Product Manufacturing Basis and Presumptions:**

In Detailed Project Report Here we cover all the Basis and Presumptions of Project like, Working Hours per Shift, Number of shift/day, Number of Working days per year, working efficiency and Operative period etc.

### **Product Manufacturing Implementation Schedule:**

In Detailed Project Report Here we cover Project Implementation Schedule so you can achieve the target and start the project in less time.

### **List of Manufacturing Machinery for Product Manufacturing:**

In Detailed Project Report Here we provide Cost of all the Plant and Machinery Details used for Product Manufacturing. We confirm the Cost of Plant and Machinery by the Plant and Machinery Manufacturers. The Product Manufacturing Machinery is Carefully Chosen According to the Project Capacity and Process and Technology.

### **Miscellaneous Items Requirement:**

In Product Manufacturing Detailed Project Report Here we cover Cost of all the Miscellaneous Items and Instruments which is used to Product Manufacturing. We confirm the Cost of Plant and Machinery by Miscellaneous Items Requirement Manufacturers.

### **Laboratory Equipment's and Accessories:**

In Product Manufacturing Detailed Project Report Here we cover cost all the Laboratory Equipment's and Accessories which is used to Product Manufacturing. We confirm the Cost of Plant and Machinery by Laboratory Equipment's and Accessories Manufacturers.

### **Product Manufacturing Electrification:**

In Detailed Project Report Here we cover Electrification cost of Project. The Electrification cost is Depend on the Product Capacity and Machinery. It is your Fixed Cost.

### **Product Manufacturing Electric Load and Water Requirements:**

In Detailed Project Report Here we Cover Electric Load and Water Requirements in Project or Business. The Cost of Electric Load and Water Requirements in your Project is Depend on your End Product, Product Capacity, Manufacturing Process, Manpower and Machinery.

### **Product Manufacturing Unit Maintenance:**

In Detailed Project Report Here we cover the Maintenance cost required in your Project or Business. The maintenance cost of your Project is Depend on your Machinery, Building and Office etc.

### **Raw Materials Requirement for Product Manufacturing:**

In this section of Detailed Project Report we cover all Raw Materials and Packaging Material Requirements of Project according to Project Capacity.

### **Availability, Cost and Rates of Raw Materials:**

In Product Manufacturing Detailed Project Report Here we cover the Availability of Raw Materials in Market, Quality, Quantity and Cost of Raw Materials. The Quality is verified and checks by our Consultants and Experts.

#### **Requirement of Staff & Manpower:**

In Product Manufacturing Detailed Project Report Here we cover Staff & Manpower Requirement, skilled Manpower, Un Skilled Manpower, Salary and Wages Cost according to the Machinery and Project Capacity.

#### **Personnel Management:**

In Product Manufacturing Detailed Project Report Here we cover Personnel Management Requirement cost in Product Manufacturing Business.

#### **Land Requirement and land Cost:**

In Product Manufacturing Detailed Project Report Here we cover Construction Cost and Land requirement for Total area, office area, Covered area, Industry Shade, Building, Storage, and Open area.

#### **Cost of Manufacturing Machinery:**

In Product Manufacturing Detailed Project Report Here we cover Cost of Manufacturing Machinery, Equipment's, Accessories, Machinery Installation Cost and other Contingency Cost.

#### **Fixed Capital Investment Product Manufacturing:**

In Detailed Project Report Here we cover Fixed Capital Investment Product Manufacturing. Fixed Capital Include assets such as Property, Machinery, Equipment and Accessories which need for Business Operations.

#### **Working Capital Requirement for Product Manufacturing:**

In Detailed Project Report Here we cover Working Capital Requirement such as Raw Material, working Operations, accounts receivable, Expanses. Inventory and other assets.

#### **Product Manufacturing Total Project Cost:**

In Detailed Project Report Here we cover total project Cost used for Product Manufacturing.

#### **Capital Formation:**

In Product Manufacturing Detailed Project Report Here we cover Capital Formation in various sources such as Promoters Contributions, Bank Loan, investors and other source.

#### **Term Loan Requirements for Product Manufacturing:**

In Detailed Project Report Here we cover the Term Loan Requirement in Project.

#### **Product Manufacturing Repayment Schedule:**

In Detailed Project Report Here we cover Repayment Schedule, Interest on Term loan and Instalments etc.

#### **Depreciation Chart:**

In Product Manufacturing Detailed Project Report Here we cover Depreciation in various assets such as Building, Machinery, Equipment's and other assets.

#### **Product Manufacturing Cost:**

In Detailed Project Report Here we cover the manufacturing cost, Packaging, Transportation Cost, Marketing Cost and other Costs of Products.

### **Break Even Analysis:**

In Product Manufacturing this section of Detailed Project Report Break Even and its efficiency is calculated. Through Break Even Analysis you will know how much time is required to reach in Break Even.

### **Profitability Analysis:**

In Product Manufacturing this section of Detailed Project Report we calculate all the Profitability parameters like Rate of Return on investment, return, interest rate, taxes and earnings before interest and tax (EBIT) etc

### **Cash Flow Statement:**

In Product Manufacturing this section of Detailed Project Report we Cover Cash flow statement in Project. In Cash flow Statement the financial statement of balance sheet accounts, income affect cash, cash equivalents, investing and financing activities.

### **Debt service coverage ratio:**

In Product Manufacturing this section of Detailed Project Report we Cover Debt service coverage ratio. DSCR is a measurement of cash flow. It is used in analyzing Net operating income and Total Debt Services.

### **Projected Balance Sheet:**

In this section of Product Manufacturing Detailed Project Report we Cover Balance Sheet. It is the financial statement of Assets, Liabilities, and Shareholders Equity.

### **Product Manufacturing Plant and Machinery Manufacturers:**

In Detailed Project Report Here we will provide you the Name and Address of Product Manufacturing Plant and Machinery Manufacturers. It is important to know all the Manufacturing Plant and Machinery Manufacturers So you can chose there Machinery. We will provide you Best Quality Plant and Machinery Manufacturers and Suppliers. Their Quality is verified and checks buy our Consultants and Experts.

### **Product Manufacturing Raw Material Manufacturer and Suppliers:**

In Detailed Project Report Here we will provide you the Name and Address of Product Manufacturing Raw Material Manufacturer and Suppliers. Raw Material is regularly used in your Project so you should have all Raw Material Manufacturer and Suppliers Details. You should meet them and know there Raw Material Quality. We will provide you Best Quality Raw Material Manufacturer and Suppliers. Their Quality is verified and checks buy our Consultants and Experts.

The following are the key questions answered by this Detailed Project Report, Project Report and Feasibility Study Report:

What are the Market Opportunities in Product Manufacturing Business?

What are the Market Challenges in Product Manufacturing Business?

How to setup Product Manufacturing Business

What is the property of Product?

What is the Product Use and application area?

What is the Feature of Product Manufacturing?

What is the Standard and Specifications for Product Manufacturing Business?

What is the Technical Feasibility of Product Manufacturing Business?

What is the Financial Feasibility of Product Manufacturing Business?

What is the Present Market of Product?

What is the Domestic Market of Product?

What is the Exports and Import Potential?

What is the Demand and Supply Gap?

What is the Competition in this Industry sector?

What is the Structure of the Product Manufacturing industry sector?

Who is the Major Product Manufacture in the Sector?

How is Product Manufacturing Process and Technology?

Which machinery is used for Product Manufacturing?

Who are the Manufacturers and Suppliers of Machinery?

Which type raw material is need for Product Manufacturing Business?

How much land is required for Product Manufacturing Business?

What is the Construction Cost of office, Building , Storage and Other infrastructure Costs?

What are the machinery requirements for Product manufacturing?

What is the transportation Cost?

How Much manpower requirements for Product manufacturing Business?

How much fixed Capital Cost for Product manufacturing Business?

How much Working Capital is required?

What are the utility and overhead for Product manufacturing?

What is the total Project Cost?

What is the Break-Even Analysis Product Manufacturing?

What will be the income and expenditures for Product manufacturing Business?

What is the Profitability of Product Manufacturing Business?

What is the Insurance Cost?

What is the Interest rate?

What is profit and margin in the Product Manufacturing?

What is the DSCR in Project?

What is the Projected Balance Sheets of a Product Manufacturing?

Soil and Water Testing Lab Detailed Project Report, Soil and Water Testing Project Report, Soil and Water Testing Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.

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It's also includes Detailed Lab Process and Technology of Project, Product Lab Units, Machinery and its Accessories Requirement, Electricity and Water Requirement.

Soil and Water Testing Lab Project Reports include Raw Material costing and its Specifications, Manpower Requirement, land and Buildings, Capital Formulation, Cost of Production and Profit Analysis, Break Even Analysis, Depreciation, Cash Flow Statement and projecting the Balance Sheet etc.

## **Soil and Water Testing Lab Detailed Project Report contains.**

### **Introduction: -**

In This Section of Soil and Water Testing Lab Detailed Project Report and brief Introduction of Soil and Water Testing Project, Opportunity and Feature of Business is covered.

### **Soil and Water Testing Properties: -**

In This Section of Soil and Water Testing Lab Detailed Project Report all the Soil and Water Testing scientific Data, Physical and Chemical properties of Soil and Water Testing Covered. If you want to start this business you should know Properties aspects of Soil and Water Testing so you can Produce Better Quality End Products.

### **Soil and Water Testing Lab Standard and Specifications Requirement: -**

In Detailed Project Report Here all the standard and Specifications Requirement According to the Country where Soil and Water Testing Made and also Soil and Water Testing export and import country's Standard and their Specifications is covered. It is very important to know Standard and specification of your products and Products should be made according to the Country Market where you want to sell your Product.

### **Soil and Water Testing Lab Uses and Applications: -**

Detailed Project Report here all the uses and applications of Soil and Water Testing according to industry, end user and other uses are covered. If you are new in this business, you should know uses and Applications area Soil and Water Testing, so you can focus to cover that, Area.

### **Soil and Water Testing Present Market Position: -**

In Detailed Project Report Here we cover present market status of Soil and Water Testing in Domestic market and international market and its statistical data. It is very important aspect of project you should know all the Present Market Demand statistic, Numeric Data and present market facts so it will help to you know statistic Present market Status and you will take better Decisions.

### **Soil and Water Testing Lab Future Demand: -**

In Detailed Project Report Here we cover Future market status, Future Demand of Soil and Water Testing in Domestic market and international market and its statistical data, Demand and Supply Gap. It will help you to explore Soil and Water Testing future Demand so you can decide your Project Capacity according to the Market Soil and Water Testing Demand and supply gap.

### **Soil and Water Testing Lab Process and Technology: -**

In Detailed Project Report Here we cover Commercial Soil and Water Testing Lab Process, Technology and its formulation. Latest Proven Process and Technology is used for Soil and Water Testing Lab. We will also arrange the Technology transfer.

It is the Core your business total business is Depend on Soil and Water Testing Lab Process and Technology. Some Major aspects of your Business is based on Lab Process and Technology these are following

Your Lab Machinery costs are Depend on it. You will choose the Machinery according to Lab Process and Technology.

Your Soil and Water Testing Lab Costs are Totally Depend on it.

You're Manpower Need and cost is Depend on it. You will choose Manpower requirement according to your Lab Machinery and Project Need.

Your Soil and Water Testing Lab Cost its Dependent on it.

Land and Building Requirements are according to Lab Machinery.

That's why we call it is Core part of your business. Latest Proven Process and Technology should be used for Soil and Water Testing Lab. We carefully chose and help to choose better Process and Technology to give higher output and great Result.

### **Soil and Water Testing Lab Process Flow Sheet Diagram: -**

In Detailed Project Report Here the Process flow Diagram according to the Machinery is covered with brief Details of Each and Every Process. It is Important to know the Process Flow of your project.

### **Names and Addresses of Soil and Water Testing Lab Units: -**

In Detailed Project Report Here we provide you the Name and Address of Existing Manufacturer of Soil and Water Testing. It is important to know the Existing Soil and Water Testing Manufacturers, Major Players and Competitors and their Capacity and their Market status. They will be buyers of your Products.

### **Pollution Control and Energy Conservation: -**

In Soil and Water Testing Lab Detailed Project Report Here we Cover Pollution Control and Energy Conservation aspect of Project. Pollution Control and Energy Conservation is important aspect in Project it depends on Product to Product, Machinery and Lab Process.

### **Soil and Water Testing Lab Capacity Utilization: -**

In Detailed Project Report here we Cover Soil and Water Testing Lab Capacity Utilization aspect of Project. The Capacity Utilization is Carefully Designed for Better Utilization of Project Capacity and Machinery.

### **Soil and Water Testing Lab Basis and Presumptions: -**

In Detailed Project Report Here we cover all the Basis and Presumptions of Project like, Working Hours per Shift, Number of shift/days, Number of Working days per year, working efficiency and Operative period etc.

### **Soil and Water Testing Lab Implementation Schedule: -**

In Detailed Project Report Here we cover Project Implementation Schedule so you can achieve the target and start the project in less time.

### **List of Lab Machinery for Soil and Water Testing Lab: -**

In Detailed Project Report Here we provide Cost of all the Lab and Machinery Details used for Soil and Water Testing Lab. We confirm the Cost of Lab and Machinery by the Lab and Machinery Manufacturers. The Soil and Water Testing Lab Machinery is Carefully Chosen According to the Project Capacity and Process and Technology.

## **Miscellaneous Items Requirement: -**

In Soil and Water Testing Lab Detailed Project Report Here we cover Cost of all the Miscellaneous Items and Instruments which is used to Soil and Water Testing Lab. We confirm the Cost of Lab and Machinery by Miscellaneous Items Requirement Manufacturers.

## **Laboratory Equipment's and Accessories: -**

In Soil and Water Testing Lab Detailed Project Report Here we cover cost all the Laboratory Equipment's and Accessories which is used to Soil and Water Testing Lab. We confirm the Cost of Lab and Machinery by Laboratory Equipment's and Accessories Manufacturers.

## **Soil and Water Testing Lab Electrification: -**

In Detailed Project Report Here we cover Electrification cost of Project. The Electrification cost is Depend on the Soil and Water Testing Capacity and Machinery. It is your Fixed Cost.

## **Soil and Water Testing Lab Electric Load and Water Requirements: -**

In Detailed Project Report Here We Cover Electric Load and Water Requirements in Project or Business. The Cost of Electric Load and Water Requirements in your Project is Depend on your End Soil and Water Testing, Soil and Water Testing Capacity, Lab Process, Manpower and Machinery.

## **Soil and Water Testing Lab Unit Maintenance: -**

In Detailed Project Report Here we cover the Maintenance cost required in your Project or Business. The maintenance cost of your Project is Depend on your Machinery, Building and Office etc.

## **Raw Materials Requirement for Soil and Water Testing Lab: -**

In this section of Detailed Project Report, we cover all Raw Materials and Packaging Material Requirements of Project according to Project Capacity.

## **Availability, Cost and Rates of Raw Materials: -**

In Soil and Water Testing Lab Detailed Project Report Here we cover the Availability of Raw Materials in Market, Quality, Quantity and Cost of Raw Materials. The Quality is verified and checks buy our Consultants and Experts.

## **Requirement of Staff & Manpower: -**

In Soil and Water Testing Lab Detailed Project Report Here we cover Staff & Manpower Requirement, skilled Manpower, Un Skilled Manpower, Salary and Wages Cost according to the Machinery and Project Capacity.

### **Personnel Management: -**

In Soil and Water Testing Lab Detailed Project Report Here we cover Personnel Management Requirement cost in Soil and Water Testing Lab Business.

### **Land Requirement and land Cost: -**

In Soil and Water Testing Lab Detailed Project Report Here we cover Construction Cost and Land requirement for Total area, office area, Covered area, Industry Shade, Building, Storage, and Open area.

### **Cost of Lab Machineries: -**

In Soil and Water Testing Lab Detailed Project Report Here we cover Cost of Lab Machineries, Equipment's, Accessories, Machinery Installation Cost and other Contingency Cost.

### **Fixed Capital Investment Soil and Water Testing Lab: -**

In Detailed Project Report Here we cover Fixed Capital Investment Soil and Water Testing Lab. Fixed Capital Include assets such as Property, Machinery, Equipment and Accessories which need for Business Operations.

### **Working Capital Requirement for Soil and Water Testing Lab: -**

In Detailed Project Report Here we cover Working Capital Requirement such as Raw Material, working Operations, accounts receivable, Expanses. Inventory and other assets

### **Soil and Water Testing Lab Total Project Cost: -**

In Detailed Project Report Here we cover total project Cost used for Soil and Water Testing Lab.

### **Capital Formation: -**

In Soil and Water Testing Lab Detailed Project Report Here we cover Capital Formation in various sources such as Promoters Contributions, Bank Loan, investors and other source.

### **Term Loan Requirements for Soil and Water Testing Lab: -**

In Detailed Project Report Here we cover the Term Loan Requirement in Project.

### **Soil and Water Testing Lab Repayment Schedule: -**

In Detailed Project Report Here we cover Repayment Schedule, Interest on Term loan and Instalments etc.

### **Depreciation Chart: -**

In Soil and Water Testing Lab Detailed Project Report Here we cover Depreciation in various assets such as Building, Machinery, Equipment's and other assets.

### **Soil and Water Testing Lab Cost: -**

In Detailed Project Report Here we cover the Lab cost, Packaging, Transportation Cost, Marketing Cost and other Costs of Products.

### **Break Even Analysis: -**

In Soil and Water Testing Lab this section of Detailed Project Report Break Even and its efficiency is calculated. Through Break Even Analysis you will know how much time is required to reach in Break Even.

### **Profitability Analysis: -**

In Soil and Water Testing Lab this section of Detailed Project Report we calculate all the Profitability parameters like Rate of Return on investment, return, interest rate, taxes and earnings before interest and tax (EBIT) etc.

### **Cash Flow Statement: -**

In Soil and Water Testing Lab this section of Detailed Project Report we Cover Cash flow statement in Project. In Cash flow Statement the financial statement of balance sheet accounts, income affect cash, cash equivalents, investing and financing activities.

### **Debt service coverage ratio: -**

In Soil and Water Testing Lab this section of Detailed Project Report we Cover Debt service coverage ratio. DSCR is a measurement of cash flow. It is used in analyzing Net operating income and Total Debt Services.

### **Projected Balance Sheet: -**

In this section of Soil and Water Testing Lab Detailed Project Report We Cover Balance Sheet. It is the financial statement of Assets, Liabilities, and Shareholders Equity.

### **Soil and Water Testing Lab Lab and Machinery Manufacturers: -**

In Detailed Project Report Here we will provide you the Name and Address of Soil and Water Testing Lab Lab and Machinery Manufacturers. It is important to know all the Lab Lab and Machinery Manufacturers So you can choose their Machinery. We will provide you Best Quality Lab and Machinery Manufacturers and Suppliers. Their Quality is verified and checks buy our Consultants and Experts.

### **Soil and Water Testing Lab Raw Material Manufacturer and Suppliers: -**

In Detailed Project Report Here we will provide you the Name and Address of Soil and Water Testing Lab Raw Material Manufacturer and Suppliers. Raw Material is regularly used in your Project so you should have all Raw Material Manufacturer and Suppliers Details. You should meet them and know their Raw Material Quality. We will provide you Best Quality Raw Material Manufacturer and Suppliers. Their Quality is verified and checks buy our Consultants and Experts.

## **RAJANIGANDHA CULTIVATION PROJECTS**

Rajnigandha Cultivation Detailed Project Report, Rajnigandha Project Report, Rajnigandha Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.

Rajnigandha Cultivation Detailed Project Report Including context in which Business Operate. It will enhance the Rajnigandha Cultivation Business Planning Process and teach a lot about the Business that you are like to learn, you will Identify Future Trouble area and Opportunity and help to Run Rajnigandha Cultivation Business smoothly and make it Profitable Venture.

You can also use the Rajnigandha Cultivation Detailed Project Report to find Funding for your Project. It is Valuable Tool for fulfill your Rajnigandha Cultivation Business vision, Goal and Objectives.

Rajnigandha Cultivation Detailed Project Report covers every aspects of Rajnigandha Cultivation business and all need of business.

Rajnigandha Cultivation Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Provide the deeper analysis and understanding of Business, Market and Industry Trend.

Rajnigandha Cultivation Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Include the Rajnigandha property, Standards and Specifications Requirement for Rajnigandha according to the buyers, Sellers and Country Specific, Rajnigandha Use and Application area in the Industry.

Detailed Project Reports include Rajnigandha Market Scenario, History of Market, Present Market Demand, Future Growth of the Project and Complete Rajnigandha Cultivation Project's Market Analysis.

It's also includes Detailed Rajnigandha Cultivation Process, Existing Cultivation individuals, Organizations and Company, Machinery and its Accessories Requirement, Electricity and Water Requirement.

Rajnigandha Cultivation Project Reports include Raw Material costing and it's Specifications, Manpower Requirement, land and Buildings, Capital Formulation, Cost of Production and Profit Analysis, Break Even Analysis, Depreciation etc.

### **Rajnigandha Cultivation Detailed Project Report contains.**

*Introduction*

*Rajnigandha Properties*

*Rajnigandha Standard and Specifications Requirement:-*

Rajnigandha Uses and Applications

Rajnigandha Present Market Position

Rajnigandha Future Demand

Rajnigandha Cultivation Process

Names and Addresses of Rajnigandha Cultivation Company.

Rajnigandha Cultivation Project's Basis and Presumptions

Rajnigandha Cultivation Project's Implementation Schedule:-

List of Cultivation Machinery for Rajnigandha Cultivation

Miscellaneous Items Requirement for Rajnigandha Cultivation

Rajnigandha Cultivation Project's Equipment's and Accessories

Rajnigandha Cultivation Project's Electrification

Rajnigandha Cultivation Project's Electric Load and Water Requirements

Rajnigandha Cultivation Project's Maintenance

Raw Materials Requirement for Rajnigandha Cultivation

Availability, Cost and Rates of Raw Materials

Requirement of Staff & Manpower for Rajnigandha Cultivation Project's

Personnel Management for Rajnigandha Cultivation

Rajnigandha Cultivation Project's Land Requirement and land Cost

Cost of Cultivation Machineries

Fixed Capital Investment for Rajnigandha Cultivation

Rajnigandha Cultivation Project's Working Capital Requirement

Total Project Cost of Rajnigandha Cultivation

Rajnigandha Cultivation Project's Capital Formation

Term Loan Requirements for Rajnigandha Cultivation

Rajnigandha Cultivation Project's Repayment Schedule

Rajnigandha Cultivation Project's Depreciation Chart

Rajnigandha Cultivation Cost

Rajnigandha Cultivation Project's Break Even Analysis

Rajnigandha Cultivation Project's Profitability Analysis

Projected Balance Sheet for Rajnigandha Cultivation Business

Rajnigandha Cultivation Plant and Machinery Manufacturers

Rajnigandha Cultivation Raw Material Manufacturer and Suppliers

## VANILA CULTIVATION PROJECTS

Vanilla Cultivation Detailed Project Report, Vanilla Project Report, Vanilla Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business

Vanilla is a highly sought-after spice that has a unique taste and aroma. It is primarily used in the food industry as a flavoring agent in various sweet dishes, including ice creams, chocolates, and cakes. Vanilla cultivation is a highly lucrative business that is gaining popularity in major countries around the world.

The demand for vanilla has been increasing steadily over the years, mainly due to its diverse applications in the food industry. According to recent market research, the global vanilla market is expected to grow at a CAGR of 4.4% during the forecast period of 2021-2026.

Madagascar, Indonesia, and Uganda are some of the major vanilla-producing countries. Madagascar alone accounts for over 80% of the world's vanilla production. Other countries, including India, Sri Lanka, and Papua New Guinea, are also emerging as significant producers of vanilla.

Vanilla cultivation requires specific climatic conditions and soil types. The crop grows well in tropical and subtropical regions, where the temperature ranges from 20-30°C and the humidity levels are high. The crop prefers well-drained soil with a pH range of 6-7.5. Vanilla cultivation is a labor-intensive process that requires a considerable amount of effort and expertise.

The process of vanilla cultivation starts with the propagation of vanilla vines through cuttings. The cuttings are planted in a nursery for about a year, and once they have grown sufficiently, they are transplanted into the main field. The vines need support from a trellis or stake to grow properly.

After transplantation, the vines require regular care, including watering, fertilization, and pruning. Vanilla flowers appear after two to three years of planting, and pollination is done manually using a toothpick. The flowers are hand-pollinated one by one, which is a time-consuming process. Once pollinated, the flowers develop into long pods, which take around six to nine months to mature fully.

After harvesting, the pods are sorted, cured, and processed to obtain the final product. The curing process involves keeping the pods in the sun for several hours during the day and wrapping them in blankets at night. This process is repeated for several weeks until the pods turn dark brown and acquire the distinct vanilla aroma.

In conclusion, vanilla cultivation is a profitable business with high demand in major countries around the world. The process of vanilla cultivation requires specific climatic conditions and soil types and is a labor-intensive process. However, with proper care and expertise, vanilla cultivation can yield high-quality and profitable results.

Vanilla Cultivation Detailed Project Report Including context in which Business Operate. It will enhance the Vanilla Cultivation Business Planning Process and teach a lot about the Business that you are like to learn, you will Identify Future Trouble area and Opportunity and help to Run Vanilla Cultivation Business smoothly and make it Profitable Venture.

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Vanilla Cultivation Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Include the Vanilla property, Standards and Specifications Requirement for Vanilla according to the buyers, Sellers and Country Specific, Vanilla Use and Application area in the Industry.

Detailed Project Reports include Vanilla Market Scenario, History of Market, Present Market Demand, Future Growth of the Project and Complete Vanilla Cultivation Project's Market Analysis.

It's also includes Detailed Vanilla Cultivation Process, Existing Cultivation individuals, Organizations and Company, Machinery and its Accessories Requirement, Electricity and Water Requirement.

Vanilla Cultivation Project Reports include Raw Material costing and it's Specifications, Manpower Requirement, land and Buildings, Capital Formulation, Cost of Production and Profit Analysis, Break Even Analysis, Depreciation etc.

Vanilla Cultivation Detailed Project Report contains.

Introduction

Vanilla Properties

Vanilla Standard and Specifications Requirement:-

Vanilla Uses and Applications

Vanilla Present Market Position

Vanilla Future Demand

Vanilla Cultivation Process

Names and Addresses of Vanilla Cultivation Company.

Vanilla Cultivation Project's Basis and Presumptions

Vanilla Cultivation Project's Implementation Schedule: -

List of Cultivation Machinery for Vanilla Cultivation

Miscellaneous Items Requirement for Vanilla Cultivation

Vanilla Cultivation Project's Equipment's and Accessories

Vanilla Cultivation Project's Electrification

Vanilla Cultivation Project's Electric Load and Water Requirements

Vanilla Cultivation Project's Maintenance

Raw Materials Requirement for Vanilla Cultivation

Availability, Cost and Rates of Raw Materials

Requirement of Staff & Manpower for Vanilla Cultivation Project'

Personnel Management for Vanilla Cultivation

Vanilla Cultivation Project's Land Requirement and land Cost

Cost of Cultivation Machineries

Fixed Capital Investment for Vanilla Cultivation

Vanilla Cultivation Project's Working Capital Requirement

Total Project Cost of Vanilla Cultivation

Vanilla Cultivation Project's Capital Formation

Term Loan Requirements for Vanilla Cultivation

Vanilla Cultivation Project's Repayment Schedule

Vanilla Cultivation Project's Depreciation Char

Vanilla Cultivation Cost

Vanilla Cultivation Project's Break Even Analysis

Vanilla Cultivation Project's Profitability Analysis

Projected Balance Sheet for Vanilla Cultivation Business

Vanilla Cultivation Plant and Machinery Manufacturers

Vanilla Cultivation Raw Material Manufacturer and Suppliers

*Detailed Project Report*

*On*

*Safed Musli Cultivation*



Safed Musli Cultivation Detailed Project Report, Safed Musli Project Report, Safed Musli Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.

Safed Musli Cultivation Detailed Project Report Including context in which Business Operate. It will enhance the Safed Musli Cultivation Business Planning Process and teach a lot about the Business that you are like to learn, you will Identify Future Trouble area and Opportunity and help to Run Safed Musli Cultivation Business smoothly and make it Profitable Venture.

You can also use the Safed Musli Cultivation Detailed Project Report to find Funding for your Project. It is Valuable Tool for fulfill your Safed Musli Cultivation Business vision, Goal and Objectives.

Safed Musli Cultivation Detailed Project Report covers every aspects of Safed Musli Cultivation business and all need of business.

Safed Musli Cultivation Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Provide the deeper analysis and understanding of Business, Market and Industry Trend.

Safed Musli Cultivation Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Include the Safed Musli property, Standards and Specifications Requirement for Safed Musli according to the buyers, Sellers and Country Specific, Safed Musli Use and Application area in the Industry.

Detailed Project Reports include Safed Musli Market Scenario, History of Market, Present Market Demand, Future Growth of the Project and Complete Safed Musli Cultivation Project's Market Analysis.

It's also includes Detailed Safed Musli Cultivation Process, Existing Cultivation individuals, Organizations and Company, Machinery and its Accessories Requirement, Electricity and Water Requirement.

Safed Musli Cultivation Project Reports include Raw Material costing and it's Specifications, Manpower Requirement, land and Buildings, Capital Formulation, Cost of Production and Profit Analysis, Break Even Analysis, Depreciation etc.

## **Safed Musli Cultivation Detailed Project Report contains.**

*Introduction*

*Safed Musli Properties*

*Safed Musli Standard and Specifications Requirement:-*

*Safed Musli Uses and Applications*

*Safed Musli Present Market Position*

*Safed Musli Future Demand*

*Safed Musli Cultivation Process*

*Names and Addresses of Safed Musli Cultivation Company.*

*Safed Musli Cultivation Project's Basis and Presumptions*

*Safed Musli Cultivation Project's Implementation Schedule:-*

*List of Cultivation Machinery for Safed Musli Cultivation*

*Miscellaneous Items Requirement for Safed Musli Cultivation*

*Safed Musli Cultivation Project's Equipment's and Accessories*

*Safed Musli Cultivation Project's Electrification*

*Safed Musli Cultivation Project's Electric Load and Water Requirements*

*Safed Musli Cultivation Project's Maintenance*

*Raw Materials Requirement for Safed Musli Cultivation*

*Availability, Cost and Rates of Raw Materials*

*Requirement of Staff & Manpower for Safed Musli Cultivation Project's*

*Personnel Management for Safed Musli Cultivation*

*Safed Musli Cultivation Project's Land Requirement and land Cost*

*Cost of Cultivation Machineries*

*Fixed Capital Investment for Safed Musli Cultivation*

*Safed Musli Cultivation Project's Working Capital Requirement*

*Total Project Cost of Safed Musli Cultivation*

*Safed Musli Cultivation Project's Capital Formation*

*Term Loan Requirements for Safed Musli Cultivation*

*Safed Musli Cultivation Project's Repayment Schedule*

*Safed Musli Cultivation Project's Depreciation Chart*

*Safed Musli Cultivation Cost*

*Safed Musli Cultivation Project's Break-Even Analysis*

*Safed Musli Cultivation Project's Profitability Analysis*

*Projected Balance Sheet for Safed Musli Cultivation Business*

*Safed Musli Cultivation Plant and Machinery Manufacturers*

*Safed Musli Cultivation Raw Material Manufacturer and Suppliers*

## ETHANOL PROJECTS

Ethanol, a biofuel derived from renewable sources such as corn, sugarcane, and wheat, has gained significant popularity as an alternative to traditional fossil fuels. With its ability to reduce greenhouse gas emissions and promote energy security, ethanol has emerged as a promising solution for combating climate change and achieving sustainability goals. This article explores the market demand for ethanol in major countries and highlights the factors driving its growth.

The United States stands as one of the largest consumers and producers of ethanol globally. The Renewable Fuel Standard (RFS), mandates the blending of ethanol in gasoline, driving market demand. The policy requires a certain volume of renewable fuels to be blended into transportation fuels, which has resulted in a steady increase in ethanol production and consumption. The U.S. also benefits from abundant corn production, making it a key feedstock for ethanol production.

Brazil is another major player in the ethanol market, primarily producing ethanol from sugarcane. The country has successfully implemented a comprehensive biofuels program, promoting the use of ethanol as a substitute for gasoline. Flexible-fuel vehicles (FFVs) that can run on both gasoline and ethanol are widespread in Brazil. The government's commitment to renewable energy sources, coupled with its focus on reducing dependence on imported oil, has propelled the growth of the ethanol market.

In the European Union (EU), the Renewable Energy Directive sets targets for the use of renewable energy in transport, including the promotion of biofuels like ethanol. The EU has implemented sustainability criteria to ensure that biofuels used in the region meet certain environmental standards. As countries strive to meet their renewable energy goals, the demand for ethanol as a low-carbon fuel option is expected to rise significantly in the coming years.

China, with its increasing energy demand and environmental concerns, has recognized the potential of ethanol as a clean and renewable fuel. The Chinese government has introduced policies to promote the production and consumption of ethanol. China's large agricultural sector provides ample feedstock resources for ethanol production, including corn and cassava. The blending of ethanol with gasoline has become mandatory in several provinces, fostering market growth.

India has been gradually embracing ethanol as an alternative fuel to reduce its heavy dependence on imported crude oil. The government has implemented the Ethanol Blended Petrol Program (EBP), which mandates the blending of ethanol with gasoline. India's vast sugarcane production serves as a key source for ethanol production, and the country is actively exploring other feedstocks such as rice and sorghum. The growing demand for ethanol in India is driven by both energy security and environmental concerns.

Ethanol's market demand is experiencing significant growth in major countries worldwide. The push for renewable energy sources, coupled with the need to reduce greenhouse gas emissions and promote energy security, has led to increased adoption of ethanol as a cleaner alternative to fossil fuels. The United

States, Brazil, the European Union, China, and India are actively promoting ethanol production and consumption through policy frameworks and incentives. As the world continues to prioritize sustainability, ethanol is expected to play a crucial role in meeting energy demands while reducing environmental impact.

Ethanol Plant Detailed Project Report, Ethanol Project Report, Ethanol Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.

Ethanol Plant Detailed Project Report Including context in which Business Operate. It will enhance the Business Planning Process and teach a lot about the Business that you like to learn, you will Identify Future Trouble area and Opportunity and help to Run Organization smoothly.

You can also use the Ethanol Plant Detailed Project Report to find Funding for your Project. It is Valuable Tool for fulfill your vision, Goal and Objectives.

Ethanol Plant Detailed Project Report cover every aspects of Ethanol Plant business and all need of business.

Ethanol Plant Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Provide the deeper understanding of Business, Market and Industry Trend.

Ethanol Plant Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Include the property, various Standards and Specifications Requirement for the Project according to the Country Specific, Project Use and Application.

Ethanol Plant Project Reports include Market Scenario, History of Market, Present Market Demand, Future Growth of the Project and Complete Market Analysis.

It's also includes Detailed Plant Process and Technology of Project, Product Plant Units, Machinery and its Accessories Requirement, Electricity and Water Requirement.

Ethanol Plant Project Reports include Raw Material costing and its Specifications, Manpower Requirement, land and Buildings, Capital Formulation, Cost of Production and Profit Analysis, Break Even Analysis, Depreciation, Cash Flow Statement and projecting the Balance Sheet etc.

## **Ethanol Plant Detailed Project Report contains.**

### **Introduction: -**

In This Section of Ethanol Plant Detailed Project Report and brief Introduction of Ethanol Project, Opportunity and Feature of Business is covered.

### **Ethanol Properties: -**

In This Section of Ethanol Plant Detailed Project Report all the Ethanol scientific Data, Physical and Chemical properties of Ethanol Covered. If you want to start this business you should know Properties aspects of Ethanol so you can Produce Better Quality End Products.

### **Ethanol Plant Standard and Specifications Requirement: -**

In Detailed Project Report Here all the standard and Specifications Requirement According to the Country where Ethanol Made and also Ethanol export and import country's Standard and their Specifications is covered. It is very important to know Standard and specification of your products and Products should be made according to the Country Market where you want to sell your Product.

### **Ethanol Plant Uses and Applications: -**

Detailed Project Report here all the uses and applications of Ethanol according to industry, end user and other uses are covered. If you are new in this business, you should know uses and Applications area Ethanol, so you can focus to cover that Area.

### **Ethanol Present Market Position: -**

In Detailed Project Report Here we cover present market status of Ethanol in Domestic market and international market and its statistical data. It is very important aspect of project you should know all the Present Market Demand statistic, Numeric Data and present market facts so it will help to you know statistic Present market Status and you will take better Decisions.

### **Ethanol Plant Future Demand:**

In Detailed Project Report Here we cover Future market status, Future Demand of Ethanol in Domestic market and international market and its statistical data, Demand and Supply Gap. It will help you to explore Ethanol future Demand so you can decide your Project Capacity according to the Market Ethanol Demand and supply gap.

### **Ethanol Plant Process and Technology: -**

In Detailed Project Report Here we cover Commercial Ethanol Plant Process, Technology and its formulation. Latest Proven Process and Technology is used for Ethanol Plant. We will also arrange the Technology transfer. It is the Core your business total business is Depend on Ethanol Plant Process and Technology. Some Major aspects of your Business is based on Plant Process and Technology these are following

Your Plant Machinery costs are Depend on it. You will choose the Machinery according to Plant Process and Technology.

Your Ethanol Plant Costs are Totally Depend on it.

You're Manpower Need and cost is Depend on it. You will choose Manpower requirement according to your Plant Machinery and Project Need.

Your Ethanol Plant Cost its Dependent on it.

Land and Building Requirements are according to Plant Machinery.

That's why we call it is Core part of your business. Latest Proven Process and Technology should be used for Ethanol Plant. We carefully chose and help to choose better Process and Technology to give higher output and great Result.

### **Ethanol Plant Process Flow Sheet Diagram: -**

In Detailed Project Report Here the Process flow Diagram according to the Machinery is covered with brief Details of Each and Every Process. It is Important to know the Process Flow of your project.

### **Names and Addresses of Ethanol Plant Units: -**

In Detailed Project Report Here we provide you the Name and Address of Existing Manufacturer of Ethanol. It is important to know the Existing Ethanol Manufacturers, Major Players and Competitors and their Capacity and their Market status. They will be buyers of your Products.

### **Pollution Control and Energy Conservation: -**

In Ethanol Plant Detailed Project Report Here We Cover Pollution Control and Energy Conservation aspect of Project. Pollution Control and Energy Conservation is important aspect in Project it depends on Product to Product, Machinery and Plant Process.

### **Ethanol Plant Capacity Utilization: -**

In Detailed Project Report here we Cover Ethanol Plant Capacity Utilization aspect of Project. The Capacity Utilization is Carefully Designed for Better Utilization of Project Capacity and Machinery.

### **Ethanol Plant Basis and Presumptions: -**

In Detailed Project Report Here we cover all the Basis and Presumptions of Project like, Working Hours per Shift, Number of shift/days, Number of Working days per year, working efficiency and Operative period etc.

### **Ethanol Plant Implementation Schedule: -**

In Detailed Project Report Here we cover Project Implementation Schedule so you can achieve the target and start the project in less time.

### **List of Plant Machinery for Ethanol Plant: -**

In Detailed Project Report Here we provide Cost of all the Plant and Machinery Details used for Ethanol Plant. We confirm the Cost of Plant and Machinery by the Plant and Machinery Manufacturers. The Ethanol Plant Machinery is Carefully Chosen According to the Project Capacity and Process and Technology.

### **Miscellaneous Items Requirement: -**

In Ethanol Plant Detailed Project Report Here we cover Cost of all the Miscellaneous Items and Instruments which is used to Ethanol Plant. We confirm the Cost of Plant and Machinery by Miscellaneous Items Requirement Manufacturers.

### **Laboratory Equipment's and Accessories: -**

In Ethanol Plant Detailed Project Report Here we cover cost all the Laboratory Equipment's and Accessories which is used to Ethanol Plant. We confirm the Cost of Plant and Machinery by Laboratory Equipment's and Accessories Manufacturers.

### **Ethanol Plant Electrification: -**

In Detailed Project Report Here we cover Electrification cost of Project. The Electrification cost is Depend on the Ethanol Capacity and Machinery. It is your Fixed Cost.

### **Ethanol Plant Electric Load and Water Requirements: -**

In Detailed Project Report Here We Cover Electric Load and Water Requirements in Project or Business. The Cost of Electric Load and Water Requirements in your Project is Depend on your End Ethanol, Ethanol Capacity, Plant Process, Manpower and Machinery.

### **Ethanol Plant Unit Maintenance: -**

In Detailed Project Report Here we cover the Maintenance cost required in your Project or Business. The maintenance cost of your Project is Depend on your Machinery, Building and Office etc.

### **Raw Materials Requirement for Ethanol Plant: -**

In this section of Detailed Project Report, we cover all Raw Materials and Packaging Material Requirements of Project according to Project Capacity.

### **Availability, Cost and Rates of Raw Materials: -**

In Ethanol Plant Detailed Project Report Here we cover the Availability of Raw Materials in Market, Quality, Quantity and Cost of Raw Materials. The Quality is verified and checks buy our Consultants and Experts.

### **Requirement of Staff & Manpower: -**

In Ethanol Plant Detailed Project Report Here we cover Staff & Manpower Requirement, skilled Manpower, Un Skilled Manpower, Salary and Wages Cost according to the Machinery and Project Capacity.

### **Personnel Management: -**

In Ethanol Plant Detailed Project Report Here we cover Personnel Management Requirement cost in Ethanol Plant Business.

### **Land Requirement and Land Cost: -**

In Ethanol Plant Detailed Project Report Here we cover Construction Cost and Land requirement for Total area, office area, Covered area, Industry Shade, Building, Storage, and Open area.

### **Cost of Plant Machineries: -**

In Ethanol Plant Detailed Project Report Here we cover Cost of Plant Machineries, Equipment's, Accessories, Machinery Installation Cost and other Contingency Cost.

### **Fixed Capital Investment Ethanol Plant: -**

In Detailed Project Report Here we cover Fixed Capital Investment Ethanol Plant. Fixed Capital Include assets such as Property, Machinery, Equipment and Accessories which need for Business Operations.

### **Working Capital Requirement for Ethanol Plant: -**

In Detailed Project Report Here we cover Working Capital Requirement such as Raw Material, working Operations, accounts receivable, Expanses. Inventory and other assets.

### **Ethanol Plant Total Project Cost: -**

In Detailed Project Report Here we cover total project Cost used for Ethanol Plant.

### **Capital Formation: -**

In Ethanol Plant Detailed Project Report Here we cover Capital Formation in various sources such as Promoters Contributions, Bank Loan, investors and other source.

### **Term Loan Requirements for Ethanol Plant: -**

In Detailed Project Report Here we cover the Term Loan Requirement in Project.

### **Ethanol Plant Repayment Schedule: -**

In Detailed Project Report Here we cover Repayment Schedule, Interest on Term loan and Instalments etc.

### **Depreciation Chart: -**

In Ethanol Plant Detailed Project Report Here we cover Depreciation in various assets such as Building, Machinery, Equipment's and other assets.

### **Ethanol Plant Cost: -**

In Detailed Project Report Here we cover the Plant cost, Packaging, Transportation Cost, Marketing Cost and other Costs of Products.

### **Break Even Analysis: -**

In Ethanol Plant this section of Detailed Project Report Break Even and its efficiency is calculated. Through Break Even Analysis you will know how much time is required to reach in Break Even.

### **Profitability Analysis: -**

In Ethanol Plant this section of Detailed Project Report we calculate all the Profitability parameters like Rate of Return on investment, return, interest rate, taxes and earnings before interest and tax (EBIT) etc.

### **Cash Flow Statement: -**

In Ethanol Plant this section of Detailed Project Report We Cover Cash flow statement in Project. In Cash flow Statement the financial statement of balance sheet accounts, income affect cash, cash equivalents, investing and financing activities.

### **Debt service coverage ratio: -**

In Ethanol Plant this section of Detailed Project Report We Cover Debt service coverage ratio. DSCR is a measurement of cash flow. It is used in analysing Net operating income and Total Debt Services.

### **Projected Balance Sheet: -**

In this section of Ethanol Plant Detailed Project Report, we Cover Balance Sheet. It is the financial statement of Assets, Liabilities, and Shareholders Equity.

### **Ethanol Plant and Machinery Manufacturers: -**

In Detailed Project Report Here we will provide you the Name and Address of Ethanol Plant and Machinery Manufacturers. It is important to know all the Plant and Machinery Manufacturers So you can choose their Machinery. We will provide you Best Quality Plant and Machinery Manufacturers and Suppliers. Their Quality is verified and checks buy our Consultants and Experts.

### **Ethanol Plant Raw Material Manufacturer and Suppliers: -**

In Detailed Project Report Here we will provide you the Name and Address of Ethanol Plant Raw Material Manufacturer and Suppliers. Raw Material is regularly used in your Project so you should have all Raw Material Manufacturer and Suppliers Details. You should meet them and know their Raw Material Quality. We will provide you Best Quality Raw Material Manufacturer and Suppliers. Their Quality is verified and checks buy our Consultants and Experts.

## **Coco Peat Briquette Unit**

Coco peat briquettes are an excellent alternative to traditional peat moss, which is obtained by extracting peat from bogs. Coco peat briquettes are made from the fibrous husk of the coconut, which is a renewable

resource. These briquettes are used as a soil amendment to improve the texture and structure of the soil, as well as to retain moisture and nutrients.

Coco peat briquette units are specialized manufacturing plants that produce high-quality coco peat briquettes. The process of manufacturing coco peat briquettes involves several steps, including sourcing the raw material, processing it, and compressing it into briquettes.

The first step in the manufacturing process is the sourcing of the raw material. The husk of the coconut is the outer layer that covers the fruit. It is a fibrous material that is often considered a waste product. Coco peat briquette units source this raw material from coconut processing plants or coconut farms.

The next step in the manufacturing process is the processing of the raw material. The husk is first separated from the coconut fruit and then shredded into small pieces. The shredded husk is then washed to remove any dirt or debris. After washing, the husk is left to dry in the sun or a dryer.

Once the husk is dry, it is ground into a fine powder using a grinder. This fine powder is then mixed with water and compressed into briquettes using a briquetting machine. The briquettes are then dried in the sun or a dryer to reduce their moisture content.

Coco peat briquette units produce briquettes of different sizes and shapes. The most common sizes of briquettes are 5kg, 650g, and 500g. The briquettes can also be made in different shapes, such as blocks, discs, or pellets, depending on the requirements of the customers.

Coco peat briquettes have many advantages over traditional peat moss. They are renewable, biodegradable, and sustainable. They have a high water-holding capacity and can retain nutrients for a long time. They are also lightweight and easy to handle, which makes them ideal for use in landscaping, gardening, and horticulture.

In conclusion, coco peat briquette units are important manufacturing plants that produce high-quality coco peat briquettes. The process of manufacturing coco peat briquettes involves several steps, including sourcing the raw material, processing it, and compressing it into briquettes. Coco peat briquettes are an excellent alternative to traditional peat moss and have many advantages, such as being renewable, biodegradable, and sustainable.

Coco Peat Briquette Unit Detailed Project Report, Coco Peat Briquette Project Report, Coco Peat Briquette Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.

Coco Peat Briquette Unit Detailed Project Report Including context in which Business Operate. It will enhance the Business Planning Process and teach a lot about the Business that you are like to learn, you will Identify Future Trouble area and Opportunity and help to Run Organization smoothly.

You can also use the Coco Peat Briquette Unit Detailed Project Report to find Funding for your Project. It is Valuable Tool for fulfil your vision, Goal and Objectives.

Coco Peat Briquette Unit Detailed Project Report cover every aspects of Coco Peat Briquette Unit business and all need of business.

Coco Peat Briquette Unit Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Provide the deeper understanding of Business, Market and Industry Trend.

Coco Peat Briquette Unit Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Include the property, various Standards and Specifications Requirement for the Project according to the Country Specific, Project Use and Application.

Coco Peat Briquette Unit Project Reports include Market Scenario, History of Market, Present Market Demand, Future Growth of the Project and Complete Market Analysis.

It's also includes Detailed Unit Process and Technology of Project, Product Unit Units, Machinery and its Accessories Requirement, Electricity and Water Requirement.

Coco Peat Briquette Unit Project Reports include Raw Material costing and its Specifications, Manpower Requirement, land and Buildings, Capital Formulation, Cost of Production and Profit Analysis, Break Even Analysis, Depreciation, Cash Flow Statement and projecting the Balance Sheet etc.

Coco Peat Briquette Unit Detailed Project Report contains.

#### Introduction: -

In This Section of Coco Peat Briquette Unit Detailed Project Report and brief Introduction of Coco Peat Briquette Project, Opportunity and Feature of Business is covered.

#### Coco Peat Briquette Properties:-

In This Section of Coco Peat Briquette Unit Detailed Project Report all the Coco Peat Briquette scientific Data, Physical and Chemical properties of Coco Peat Briquette Covered. If you want to start this business you should know Properties aspects of Coco Peat Briquette so you can Produce Better Quality End Products.

#### Coco Peat Briquette Unit Standard and Specifications Requirement: -

In Detailed Project Report Here all the standard and Specifications Requirement According to the Country where Coco Peat Briquette Made and also Coco Peat Briquette export and import country's Standard and their Specifications is covered. It is very important to know Standard and specification of your products and Products should be made according to the Country Market where you want to sell your Product.

#### Coco Peat Briquette Unit Uses and Applications: -

Detailed Project Report here all the uses and applications of Coco Peat Briquette according to industry, end user and other uses are covered. If you are new in this business, you should know uses and Applications area Coco Peat Briquette, so you can focus to cover that, Area.

#### Coco Peat Briquette Present Market Position: -

In Detailed Project Report Here we cover present market status of Coco Peat Briquette in Domestic market and international market and its statistical data. It is very important aspect of project you should know all the Present Market Demand statistic, Numeric Data and present market facts so it will help to you know statistic Present market Status and you will take better Decisions.

#### Coco Peat Briquette Unit Future Demand: -

In Detailed Project Report Here we cover Future market status, Future Demand of Coco Peat Briquette in Domestic market and international market and its statistical data, Demand and Supply Gap. It will help you to explore Coco Peat Briquette future Demand so you can decide your Project Capacity according to the Market Coco Peat Briquette Demand and supply gap.

#### Coco Peat Briquette Unit Process and Technology: -

In Detailed Project Report Here we cover Commercial Coco Peat Briquette Unit Process, Technology and its formulation. Latest Proven Process and Technology is used for Coco Peat Briquette Unit. We will also arrange the Technology transfer. It is the Core your business total business is Depend on Coco Peat Briquette Unit Process and Technology. Some Major aspects of your Business is based on Unit Process and Technology these are following

- Your Unit Machinery costs are Depend on it. You will choose the Machinery according to Unit Process and Technology.
- Your Coco Peat Briquette Unit Costs are Totally Depend on it.
- You're Manpower Need and cost is Depend on it. You will choose Manpower requirement according to your Unit Machinery and Project Need.
- Your Coco Peat Briquette Unit Cost its Dependent on it.
- Land and Building Requirements are according to Unit Machinery.

That's why we call it is Core part of your business. Latest Proven Process and Technology should be used for Coco Peat Briquette Unit. We carefully chose and help to choose better Process and Technology to give higher output and great Result.

#### Coco Peat Briquette Unit Process Flow Sheet Diagram: -

In Detailed Project Report Here the Process flow Diagram according to the Machinery is covered with brief Details of Each and Every Process. It is Important to know the Process Flow of your project.

#### Names and Addresses of Coco Peat Briquette Unit Units: -

In Detailed Project Report Here we provide you the Name and Address of Existing Manufacturer of Coco Peat Briquette. It is important to know the Existing Coco Peat Briquette Manufacturers, Major Players and Competitors and their Capacity and their Market status. They will be buyers of your Products.

#### Pollution Control and Energy Conservation: -

In Coco Peat Briquette Unit Detailed Project Report Here We Cover Pollution Control and Energy Conservation aspect of Project. Pollution Control and Energy Conservation is important aspect in Project it depends on Product to Product, Machinery and Unit Process.

#### Coco Peat Briquette Unit Capacity Utilization: -

In Detailed Project Report here we Cover Coco Peat Briquette Unit Capacity Utilization aspect of Project. The Capacity Utilization is Carefully Designed for Better Utilization of Project Capacity and Machinery.

#### Coco Peat Briquette Unit Basis and Presumptions: -

In Detailed Project Report Here we cover all the Basis and Presumptions of Project like, Working Hours per Shift, Number of shift/days, Number of Working days per year, working efficiency and Operative period etc.

#### Coco Peat Briquette Unit Implementation Schedule: -

In Detailed Project Report Here we cover Project Implementation Schedule so you can achieve the target and start the project in less time.

#### List of Unit Machinery for Coco Peat Briquette Unit: -

In Detailed Project Report Here we provide Cost of all the Unit and Machinery Details used for Coco Peat Briquette Unit. We confirm the Cost of Unit and Machinery by the Unit and Machinery Manufacturers. The Coco Peat Briquette Unit Machinery is Carefully Chosen According to the Project Capacity and Process and Technology.

## Miscellaneous Items Requirement: -

In Coco Peat Briquette Unit Detailed Project Report Here we cover Cost of all the Miscellaneous Items and Instruments which is used to Coco Peat Briquette Unit. We confirm the Cost of Unit and Machinery by Miscellaneous Items Requirement Manufacturers.

## Laboratory Equipment's and Accessories: -

In Coco Peat Briquette Unit Detailed Project Report Here we cover cost all the Laboratory Equipment's and Accessories which is used to Coco Peat Briquette Unit. We confirm the Cost of Unit and Machinery by Laboratory Equipment's and Accessories Manufacturers.

## Coco Peat Briquette Unit Electrification: -

In Detailed Project Report Here we cover Electrification cost of Project. The Electrification cost is Depend on the Coco Peat Briquette Capacity and Machinery. It is your Fixed Cost.

## Coco Peat Briquette Unit Electric Load and Water Requirements: -

In Detailed Project Report Here We Cover Electric Load and Water Requirements in Project or Business. The Cost of Electric Load and Water Requirements in your Project is Depend on your End Coco Peat Briquette, Coco Peat Briquette Capacity, Unit Process, Manpower and Machinery.

## Coco Peat Briquette Unit Maintenance: -

In Detailed Project Report Here we cover the Maintenance cost required in your Project or Business. The maintenance cost of your Project is Depend on your Machinery, Building and Office etc.

## Raw Materials Requirement for Coco Peat Briquette Unit: -

In this section of Detailed Project Report, we cover all Raw Materials and Packaging Material Requirements of Project according to Project Capacity.

## Availability, Cost and Rates of Raw Materials: -

In Coco Peat Briquette Unit Detailed Project Report Here we cover the Availability of Raw Materials in Market, Quality, Quantity and Cost of Raw Materials. The Quality is verified and checks buy our Consultants and Experts.

## Requirement of Staff & Manpower: -

In Coco Peat Briquette Unit Detailed Project Report Here we cover Staff & Manpower Requirement, skilled Manpower, Un Skilled Manpower, Salary and Wages Cost according to the Machinery and Project Capacity.

## Personnel Management: -

In Coco Peat Briquette Unit Detailed Project Report Here we cover Personnel Management Requirement cost in Coco Peat Briquette Unit Business.

## Land Requirement and land Cost: -

In Coco Peat Briquette Unit Detailed Project Report Here we cover Construction Cost and Land requirement for Total area, office area, Covered area, Industry Shade, Building, Storage, and Open area.

## Cost of Unit Machineries: -

In Coco Peat Briquette Unit Detailed Project Report Here we cover Cost of Unit Machineries, Equipment's, Accessories, Machinery Installation Cost and other Contingency Cost.

## Fixed Capital Investment Coco Peat Briquette Unit: -

In Detailed Project Report Here we cover Fixed Capital Investment Coco Peat Briquette Unit. Fixed Capital Include assets such as Property, Machinery, Equipment and Accessories which need for Business Operations.

## Working Capital Requirement for Coco Peat Briquette Unit: -

In Detailed Project Report Here we cover Working Capital Requirement such as Raw Material, working Operations, accounts receivable, Expanses. Inventory and other assets

## Coco Peat Briquette Unit Total Project Cost: -

In Detailed Project Report Here we cover total project Cost used for Coco Peat Briquette Unit.

## Capital Formation: -

In Coco Peat Briquette Unit Detailed Project Report Here we cover Capital Formation in various sources such as Promoters Contributions, Bank Loan, investors and other source.

## Term Loan Requirements for Coco Peat Briquette Unit: -

In Detailed Project Report Here we cover the Term Loan Requirement in Project.

## Coco Peat Briquette Unit Repayment Schedule: -

In Detailed Project Report Here we cover Repayment Schedule, Interest on Term loan and Instalments etc.

## Depreciation Chart:-

In Coco Peat Briquette Unit Detailed Project Report Here we cover Depreciation in various assets such as Building, Machinery, Equipment's and other assets.

## Coco Peat Briquette Unit Cost: -

In Detailed Project Report Here we cover the Unit cost, Packaging, Transportation Cost, Marketing Cost and other Costs of Products.

## Break Even Analysis: -

In Coco Peat Briquette Unit this section of Detailed Project Report Break Even and its efficiency is calculated. Through Break Even Analysis you will know how much time is required to reach in Break Even.

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In Detailed Project Report Here we will provide you the Name and Address of Coco Peat Briquette Unit and Machinery Manufacturers. It is important to know all the Unit and Machinery Manufacturers So you can choose their Machinery. We will

provide you Best Quality Unit and Machinery Manufacturers and Suppliers. Their Quality is verified and checks buy our Consultants and Experts.

## Coco Peat Briquette Unit Raw Material Manufacturer and Suppliers: -

In Detailed Project Report Here we will provide you the Name and Address of Coco Peat Briquette Unit Raw Material Manufacturer and Suppliers. Raw Material is regularly used in your Project so you should have all Raw Material Manufacturer and Suppliers Details. You should meet them and know their Raw Material Quality. We will provide you Best Quality Raw Material Manufacturer and Suppliers. Their Quality is verified and checks buy our Consultants and Experts.

## Coco Peat Blocks Unit

Coco peat, also known as coir pith, is a byproduct of the coconut industry that has gained popularity as an alternative to traditional peat moss for use as a soil amendment. Coco peat blocks are becoming increasingly popular due to their ease of use and environmental benefits. In this article, we will discuss the manufacturing process of coco peat blocks and their benefits.

Manufacturing Process of Coco Peat Blocks:

**The manufacturing process of coco peat blocks involves several steps:**

**Collection and Processing of Raw Material:** The raw material used for the production of coco peat blocks is the outer layer of coconut husk, which is processed to extract the fibres. This process involves soaking the husks in water for several months until the fibres can be separated from the outer shell.

**Cleaning and Drying:** Once the fibres are separated, they are cleaned and dried in the sun to remove any dirt and impurities.

**Grinding:** The dried fibres are then ground into a fine powder using a grinding machine.

**Sieving:** The ground powder is then sieved to remove any large particles or impurities.

**Mixing with Water:** The sieved powder is mixed with water in a ratio of 1:5 and left to soak for several hours.

**Pressing:** The soaked coco peat is then pressed into blocks using a hydraulic press. The blocks are then left to dry in the sun.

**Packaging:** Once the blocks are dry, they are packed into bags and stored for shipment.

## Benefits of Coco Peat Blocks:

**Environmentally Friendly:** Coco peat blocks are an eco-friendly alternative to traditional peat moss. They are made from a renewable resource and do not harm the environment.

**High Water Retention:** Coco peat blocks have excellent water retention properties, making them ideal for use in gardening and agriculture.

**Good Drainage:** Coco peat blocks also have good drainage properties, which helps to prevent waterlogging and root rot.

**pH Neutral:** Coco peat blocks have a neutral pH, which means they do not affect the acidity or alkalinity of the soil.

**Lightweight:** Coco peat blocks are lightweight and easy to handle, making them ideal for use in small gardens and containers.

Coco peat blocks are a sustainable and effective alternative to traditional peat moss. The manufacturing process is simple and environmentally friendly, and the resulting product has numerous benefits for gardening and agriculture. With increasing awareness of environmental concerns, coco peat blocks are gaining popularity as a sustainable soil amendment that can help to reduce our impact on the planet.

Coco Peat Blocks Unit Detailed Project Report, Coco Peat Blocks Project Report, Coco Peat Blocks Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.

Coco Peat Blocks Unit Detailed Project Report Including context in which Business Operate. It will enhance the Business Planning Process and teach a lot about the Business that you are like to learn, you will Identify Future Trouble area and Opportunity and help to Run Organization smoothly.

You can also use the Coco Peat Blocks Unit Detailed Project Report to find Funding for your Project. It is Valuable Tool for fulfil your vision, Goal and Objectives.

Coco Peat Blocks Unit Detailed Project Report cover every aspect of Coco Peat Blocks Unit business and all need of business.

Coco Peat Blocks Unit Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Provide the deeper understanding of Business, Market and Industry Trend.

Coco Peat Blocks Unit Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Include the property, various Standards and Specifications Requirement for the Project according to the Country Specific, Project Use and Application.

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It's also including Detailed Unit Process and Technology of Project, Product Unit Units, Machinery and its Accessories Requirement, Electricity and Water Requirement.

Coco Peat Blocks Unit Project Reports include Raw Material costing and its Specifications, Manpower Requirement, land and Buildings, Capital Formulation, Cost of Production and Profit Analysis, Break Even Analysis, Depreciation, Cash Flow Statement and projecting the Balance Sheet etc.

**Coco Peat Blocks Unit Detailed Project Report contains.**

#### **Introduction: -**

In This Section of Coco Peat Blocks Unit Detailed Project Report and brief Introduction of Coco Peat Blocks Project, Opportunity and Feature of Business is covered.

#### **Coco Peat Blocks Properties: -**

In This Section of Coco Peat Blocks Unit Detailed Project Report all the Coco Peat Blocks scientific Data, Physical and Chemical properties of Coco Peat Blocks Covered. If you want to start this business you should know Properties aspects of Coco Peat Blocks so you can Produce Better Quality End Products.

#### **Coco Peat Blocks Unit Standard and Specifications Requirement: -**

In Detailed Project Report Here all the standard and Specifications Requirement According to the Country where Coco Peat Blocks Made and also Coco Peat Blocks export and import country's Standard and their Specifications is covered. It is very important to know Standard and specification of your products and Products should be made according to the Country Market where you want to sell your Product.

#### **Coco Peat Blocks Unit Uses and Applications: -**

Detailed Project Report here all the uses and applications of Coco Peat Blocks according to industry, end user and other uses are covered. If you are new in this business, you should know uses and Applications area Coco Peat Blocks, so you can focus to cover that, Area.

#### **Coco Peat Blocks Present Market Position: -**

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Numeric Data and present market facts so it will help to you know statistic Present market Status and you will take better Decisions.

#### **Coco Peat Blocks Unit Future Demand: -**

In Detailed Project Report Here we cover Future market status, Future Demand of Coco Peat Blocks in Domestic market and international market and its statistical data, Demand and Supply Gap. It will help you to explore Coco Peat Blocks future Demand so you can decide your Project Capacity according to the Market Coco Peat Blocks Demand and supply gap.

## Coco Peat Blocks Unit Process and Technology: -

In Detailed Project Report Here we cover Commercial Coco Peat Blocks Unit Process, Technology and its formulation. Latest Proven Process and Technology is used for Coco Peat Blocks Unit. We will also arrange the Technology transfer. It is the Core your business total business is Depend on Coco Peat Blocks Unit Process and Technology. Some Major aspects of your Business is based on Unit Process and Technology these are following

- Your Unit Machinery costs are Depend on it. You will choose the Machinery according to Unit Process and Technology.
- Your Coco Peat Blocks Unit Costs are Totally Depend on it.
- You're Manpower Need and cost is Depend on it. You will choose Manpower requirement according to your Unit Machinery and Project Need.
- Your Coco Peat Blocks Unit Cost its Dependent on it.
- Land and Building Requirements are according to Unit Machinery.

That's why we call it is Core part of your business. Latest Proven Process and Technology should be used for Coco Peat Blocks Unit. We carefully chose and help to choose better Process and Technology to give higher output and great Result.

## Coco Peat Blocks Unit Process Flow Sheet Diagram: -

In Detailed Project Report Here the Process flow Diagram according to the Machinery is covered with brief Details of Each and Every Process. It is Important to know the Process Flow of your project.

## Names and Addresses of Coco Peat Blocks Unit Units: -

In Detailed Project Report Here we provide you the Name and Address of Existing Manufacturer of Coco Peat Blocks. It is important to know the Existing Coco Peat Blocks Manufacturers, Major Players and Competitors and their Capacity and their Market status. They will be buyers of your Products.

## Pollution Control and Energy Conservation: -

In Coco Peat Blocks Unit Detailed Project Report Here We Cover Pollution Control and Energy Conservation aspect of Project. Pollution Control and Energy Conservation is important aspect in Project it depends on Product to Product, Machinery and Unit Process.

## Coco Peat Blocks Unit Capacity Utilization: -

In Detailed Project Report here we Cover Coco Peat Blocks Unit Capacity Utilization aspect of Project. The Capacity Utilization is Carefully Designed for Better Utilization of Project Capacity and Machinery.

## Coco Peat Blocks Unit Basis and Presumptions: -

In Detailed Project Report Here we cover all the Basis and Presumptions of Project like, Working Hours per Shift, Number of shift/days, Number of Working days per year, working efficiency and Operative period etc.

## Coco Peat Blocks Unit Implementation Schedule: -

In Detailed Project Report Here we cover Project Implementation Schedule so you can achieve the target and start the project in less time.

## List of Unit Machinery for Coco Peat Blocks Unit: -

In Detailed Project Report Here we provide Cost of all the Unit and Machinery Details used for Coco Peat Blocks Unit. We confirm the Cost of Unit and Machinery by the Unit and Machinery Manufacturers. The Coco Peat Blocks Unit Machinery is Carefully Chosen According to the Project Capacity and Process and Technology.

## Miscellaneous Items Requirement: -

In Coco Peat Blocks Unit Detailed Project Report Here we cover Cost of all the Miscellaneous Items and Instruments which is used to Coco Peat Blocks Unit. We confirm the Cost of Unit and Machinery by Miscellaneous Items Requirement Manufacturers.

## Laboratory Equipment's and Accessories: -

In Coco Peat Blocks Unit Detailed Project Report Here we cover cost all the Laboratory Equipment's and Accessories which is used to Coco Peat Blocks Unit. We confirm the Cost of Unit and Machinery by Laboratory Equipment's and Accessories Manufacturers.

## Coco Peat Blocks Unit Electrification: -

In Detailed Project Report Here we cover Electrification cost of Project. The Electrification cost is Depend on the Coco Peat Blocks Capacity and Machinery. It is your Fixed Cost.

## Coco Peat Blocks Unit Electric Load and Water Requirements: -

In Detailed Project Report Here We Cover Electric Load and Water Requirements in Project or Business. The Cost of Electric Load and Water Requirements in your Project is Depend on your End Coco Peat Blocks, Coco Peat Blocks Capacity, Unit Process, Manpower and Machinery.

## Coco Peat Blocks Unit Maintenance: -

In Detailed Project Report Here we cover the Maintenance cost required in your Project or Business. The maintenance cost of your Project is Depend on your Machinery, Building and Office etc.

## Raw Materials Requirement for Coco Peat Blocks Unit: -

In this section of Detailed Project Report, we cover all Raw Materials and Packaging Material Requirements of Project according to Project Capacity.

## Availability, Cost and Rates of Raw Materials: -

In Coco Peat Blocks Unit Detailed Project Report Here we cover the Availability of Raw Materials in Market, Quality, Quantity and Cost of Raw Materials. The Quality is verified and checks buy our Consultants and Experts.

## Requirement of Staff & Manpower: -

In Coco Peat Blocks Unit Detailed Project Report Here we cover Staff & Manpower Requirement, skilled Manpower, Un Skilled Manpower, Salary and Wages Cost according to the Machinery and Project Capacity.

#### **Personnel Management: -**

In Coco Peat Blocks Unit Detailed Project Report Here we cover Personnel Management Requirement cost in Coco Peat Blocks Unit Business.

#### **Land Requirement and land Cost: -**

In Coco Peat Blocks Unit Detailed Project Report Here we cover Construction Cost and Land requirement for Total area, office area, Covered area, Industry Shade, Building, Storage, and Open area.

#### **Cost of Unit Machineries: -**

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#### **Fixed Capital Investment Coco Peat Blocks Unit: -**

In Detailed Project Report Here we cover Fixed Capital Investment Coco Peat Blocks Unit. Fixed Capital Include assets such as Property, Machinery, Equipment and Accessories which need for Business Operations.

#### **Working Capital Requirement for Coco Peat Blocks Unit: -**

In Detailed Project Report Here we cover Working Capital Requirement such as Raw Material, working Operations, accounts receivable, Expanses. Inventory and other assets

#### **Coco Peat Blocks Unit Total Project Cost: -**

In Detailed Project Report Here we cover total project Cost used for Coco Peat Blocks Unit.

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In Coco Peat Blocks Unit Detailed Project Report Here we cover Capital Formation in various sources such as Promoters Contributions, Bank Loan, investors and other source.

#### **Term Loan Requirements for Coco Peat Blocks Unit: -**

In Detailed Project Report Here we cover the Term Loan Requirement in Project.

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## Coco Peat Discs Manufacturing

Coco peat discs are an increasingly popular growing medium for plants. They are made from the fibrous husk of coconuts and offer several advantages over traditional soil-based mediums. Coco peat discs are often used in hydroponic systems or as seed starting mediums. The manufacturing process for coco peat discs involves several steps, including collection and extraction, cleaning and buffering, and pressing.

### Collection and Extraction

The first step in the manufacturing process of coco peat discs is the collection and extraction of coconut husks. The husks are collected from the coconut industry and then processed to remove the fibres. This process is known as decortication and involves separating the fibres from the outer shell of the coconut. The fibers are then collected and stored for further processing.

## Cleaning and Buffering

The next step in the manufacturing process is cleaning and buffering the fibers. The fibres are washed to remove any impurities, and then treated to adjust the pH level. This is an important step to ensure that the coco peat discs are a high-quality growing medium. The pH level of the coco peat must be within a specific range to promote healthy plant growth.

## Pressing

Once the fibres have been cleaned and buffered, they are pressed into disc-shaped forms. This is done using a specialized machine that compresses the fibers into a compact shape. The discs are then placed in a mold to give them their final shape.

## Drying

The pressed coco peat discs are then dried to reduce their moisture content. This is done using a drying oven or other specialized equipment. The drying process is important to ensure that the discs are stable and do not break apart during handling and transportation.

## Packaging

The final step in the manufacturing process is packaging the coco peat discs for distribution. The discs are typically packaged in plastic or other protective materials to prevent moisture absorption and damage during transportation and storage. The discs can be easily rehydrated with water when ready to use.

## Advantages of Coco Peat Discs

Coco peat discs offer several advantages over traditional soil-based mediums, including:

**Sustainable:** Coco peat is a sustainable alternative to traditional peat moss, which is often harvested from fragile ecosystems.

**High-quality growing medium:** Coco peat discs provide excellent water retention and aeration, making them ideal for plant growth.

**Easy to use:** Coco peat discs are easy to handle and transport, and can be rehydrated with water to expand into a ready-to-use growing medium.

**Versatile:** Coco peat discs can be used in a variety of applications, including hydroponics and seed starting.

Coco peat disc manufacturing is an important process that transforms coconut husks into a sustainable and high-quality growing medium. The manufacturing process involves collecting and extracting the fibres,

cleaning and buffering, pressing, drying, and packaging. Coco peat discs offer several advantages over traditional soil-based mediums, including sustainability, high-quality growing medium, ease of use, and versatility. As more people become aware of the benefits of coco peat discs, they are likely to become increasingly popular among gardeners and farmers.

Coco Peat Discs Manufacturing Detailed Project Report, Coco Peat Discs Project Report, Coco Peat Discs Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.

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In Detailed Project Report Here we provide Cost of all the Plant and Machinery Details used for Coco Peat Discs Manufacturing. We confirm the Cost of Plant and Machinery by the Plant and Machinery Manufacturers. The Coco Peat Discs Manufacturing Machinery is Carefully Chosen According to the Project Capacity and Process and Technology.

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their Raw Material Quality. We will provide you Best Quality Raw Material Manufacturer and Suppliers. Their Quality is verified and checks buy our Consultants and Experts.



## Dehydrated onion flakes

Dehydrated onion flakes are a popular ingredient used in various food products such as soups, sauces, and seasoning blends. Dehydrated onion flakes are made from fresh onions that have been dried and then processed into flakes. Here is a detailed article on dehydrated onion flakes unit.

### **Preparation**

The first step in dehydrated onion flakes unit is to prepare the onions. Fresh onions are harvested, cleaned, and peeled. The onions are then sliced into thin pieces, and the outer layer is removed. The sliced onions are then dried in a dehydrator or oven until they are crispy and brittle.

### **Grinding and Processing**

Once the onions are dried, they are ground into small pieces using a hammer mill or a food processor. The onion pieces are then sifted to remove any large pieces that were not ground properly. The flakes are then sorted according to their size and shape.

### **Quality Control**

Dehydrated onion flakes unit requires strict quality control measures to ensure the production of high-quality flakes. The quality of dehydrated onion flakes is affected by various factors, including the quality of onions used, the drying process, and the grinding process. Quality control measures include regular testing of the product for moisture content, microbial contamination, and colour consistency.

### **Packaging and Storage**

Once the dehydrated onion flakes are produced, they are packaged in airtight containers to preserve their flavour and aroma. The containers are then stored in a cool, dry place away from sunlight. Proper storage is important to prevent the growth of bacteria and fungi that can affect the quality of the flakes.

Dehydrated onion flakes unit is an essential part of the food industry. The unit involves preparing, drying, grinding, and processing fresh onions into flakes. Quality control measures are crucial to ensure the production of high-quality dehydrated onion flakes.

The flakes have a long shelf life and are a convenient way to add flavour and aroma to various dishes.

Dehydrated Onion Flakes Unit Detailed Project Report, Dehydrated Onion Flakes Project Report, Dehydrated Onion Flakes Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business

Dehydrated Onion Flakes Unit Detailed Project Report Including context in which Business Operate. It will enhance the Business Planning Process and teach a lot about the Business that you are like to learn, you will Identify Future Trouble area and Opportunity and help to Run Organization smoothly.

You can also use the Dehydrated Onion Flakes Unit Detailed Project Report to find Funding for your Project. It is Valuable Tool for fulfill your vision, Goal and Objectives.

Dehydrated Onion Flakes Unit Detailed Project Report cover every aspects of Dehydrated Onion Flakes Unit business and all need of business.

Dehydrated Onion Flakes Unit Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Provide the deeper understanding of Business, Market and Industry Trend.

Dehydrated Onion Flakes Unit Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Include the property, various Standards and Specifications Requirement for the Project according to the Country Specific, Project Use and Application.

Dehydrated Onion Flakes Unit Project Reports include Market Scenario, History of Market, Present Market Demand, Future Growth of the Project and Complete Market Analysis.

It's also including Detailed Unit Process and Technology of Project, Product Unit Units, Machinery and its Accessories Requirement, Electricity and Water Requirement.

Dehydrated Onion Flakes Unit Project Reports include Raw Material costing and its Specifications, Manpower Requirement, land and Buildings, Capital Formulation, Cost of Production and Profit Analysis, Break Even Analysis, Depreciation, Cash Flow Statement and projecting the Balance Sheet etc.

**Dehydrated Onion Flakes Unit Detailed Project Report contains.**

#### **Introduction: -**

In This Section of Dehydrated Onion Flakes Unit Detailed Project Report and brief Introduction of Dehydrated Onion Flakes Project, Opportunity and Feature of Business is covered.

#### **Dehydrated Onion Flakes Properties: -**

In This Section of Dehydrated Onion Flakes Unit Detailed Project Report all the Dehydrated Onion Flakes Scientific Data, Physical and Chemical properties of Dehydrated Onion Flakes Covered. If you want to start this business you should know Properties aspects of Dehydrated Onion Flakes so you can Produce Better Quality End Products.

### **Dehydrated Onion Flakes Unit Standard and Specifications Requirement:-**

In Detailed Project Report Here all the standard and Specifications Requirement According to the Country where Dehydrated Onion Flakes Made and also Dehydrated Onion Flakes export and import country's Standard and their Specifications is covered. It is very important to know Standard and specification of your products and Products should be made according to the Country Market where you want to sell your Product.

### **Dehydrated Onion Flakes Unit Uses and Applications: -**

Detailed Project Report here all the uses and applications of Dehydrated Onion Flakes according to industry, end user and other uses are covered. If you are new in this business, you should know uses and Applications area Dehydrated Onion Flakes, so you can focus to cover that, Area.

### **Dehydrated Onion Flakes Present Market Position: -**

In Detailed Project Report Here we cover present market status of Dehydrated Onion Flakes in Domestic market and international market and its statistical data. It is very important aspect of project you should know all the Present Market Demand statistic, Numeric Data and present market facts so it will help to you know statistic Present market Status and you will take better Decisions.

### **Dehydrated Onion Flakes Unit Future Demand: -**

In Detailed Project Report Here we cover Future market status, Future Demand of Dehydrated Onion Flakes in Domestic market and international market and its statistical data, Demand and Supply Gap. It will help you to explore Dehydrated Onion Flakes Future Demand so you can decide your Project Capacity according to the Market Dehydrated Onion Flakes Demand and supply gap.

### **Dehydrated Onion Flakes Unit Process and Technology: -**

In Detailed Project Report Here we cover Commercial Dehydrated Onion Flakes Unit Process, Technology and its formulation. Latest Proven Process and Technology is used for Dehydrated Onion Flakes Unit. We will also arrange the Technology transfer. It is the Core your business total business is Depend on Dehydrated Onion Flakes Unit Process and Technology. Some Major aspects of your Business is based on Unit Process and Technology these are following

Your Unit Machinery costs are Depend on it. You will choose the Machinery according to Unit Process and Technology.

Your Dehydrated Onion Flakes Unit Costs are Totally Depend on it.

You're Manpower Need and cost is Depend on it. You will choose Manpower requirement according to your Unit Machinery and Project Need.

Your Dehydrated Onion Flakes Unit Cost its Dependent on it.

Land and Building Requirements are according to Unit Machinery.

That's why we call it is Core part of your business. Latest Proven Process and Technology should be used for Dehydrated Onion Flakes Unit. We carefully chose and help to choose better Process and Technology to give higher output and great Result.

### **Dehydrated Onion Flakes Unit Process Flow Sheet Diagram: -**

In Detailed Project Report Here the Process flow Diagram according to the Machinery is covered with brief Details of Each and Every Process. It is Important to know the Process Flow of your project.

### **Names and Addresses of Dehydrated Onion Flakes Unit Units: -**

In Detailed Project Report Here we provide you the Name and Address of Existing Manufacturer of Dehydrated Onion Flakes. It is important to know the Existing Dehydrated Onion Flakes Manufacturers, Major Players and Competitors and their Capacity and their Market status. They will be buyers of your Products.

### **Pollution Control and Energy Conservation: -**

In Dehydrated Onion Flakes Unit Detailed Project Report Here We Cover Pollution Control and Energy Conservation aspect of Project. Pollution Control and Energy Conservation is important aspect in Project it depends on Product to Product, Machinery and Unit Process.

### **Dehydrated Onion Flakes Unit Capacity Utilization: -**

In Detailed Project Report here we Cover Dehydrated Onion Flakes Unit Capacity Utilization aspect of Project. The Capacity Utilization is Carefully Designed for Better Utilization of Project Capacity and Machinery.

### **Dehydrated Onion Flakes Unit Basis and Presumptions: -**

In Detailed Project Report Here we cover all the Basis and Presumptions of Project like, Working Hours per Shift, Number of shift/days, Number of Working days per year, working efficiency and Operative period etc.

### **Dehydrated Onion Flakes Unit Implementation Schedule: -**

In Detailed Project Report Here we cover Project Implementation Schedule so you can achieve the target and start the project in less time.

### **List of Unit Machinery for Dehydrated Onion Flakes Unit: -**

In Detailed Project Report Here we provide Cost of all the Unit and Machinery Details used for Dehydrated Onion Flakes Unit. We confirm the Cost of Unit and Machinery by the Unit and Machinery Manufacturers. The Dehydrated Onion Flakes Unit Machinery is Carefully Chosen According to the Project Capacity and Process and Technology.

### **Miscellaneous Items Requirement: -**

In Dehydrated Onion Flakes Unit Detailed Project Report Here we cover Cost of all the Miscellaneous Items and Instruments which is used to Dehydrated Onion Flakes Unit. We confirm the Cost of Unit and Machinery by Miscellaneous Items Requirement Manufacturers.

### **Laboratory Equipment's and Accessories: -**

In Dehydrated Onion Flakes Unit Detailed Project Report Here we cover cost all the Laboratory Equipment's and Accessories which is used to Dehydrated Onion Flakes Unit. We confirm the Cost of Unit and Machinery by Laboratory Equipment's and Accessories Manufacturers.

### **Dehydrated Onion Flakes Unit Electrification: -**

In Detailed Project Report Here we cover Electrification cost of Project. The Electrification cost is Depend on the Dehydrated Onion Flakes Capacity and Machinery. It is your Fixed Cost.

### **Dehydrated Onion Flakes Unit Electric Load and Water Requirements: -**

In Detailed Project Report Here We Cover Electric Load and Water Requirements in Project or Business. The Cost of Electric Load and Water Requirements in your Project is Depend on your End Dehydrated Onion Flakes, Dehydrated Onion Flakes Capacity, Unit Process, Manpower and Machinery.

### **Dehydrated Onion Flakes Unit Maintenance: -**

In Detailed Project Report Here we cover the Maintenance cost required in your Project or Business. The maintenance cost of your Project is Depend on your Machinery, Building and Office etc.

### **Raw Materials Requirement for Dehydrated Onion Flakes Unit: -**

In this section of Detailed Project Report, we cover all Raw Materials and Packaging Material Requirements of Project according to Project Capacity.

### **Availability, Cost and Rates of Raw Materials: -**

In Dehydrated Onion Flakes Unit Detailed Project Report Here we cover the Availability of Raw Materials in Market, Quality, Quantity and Cost of Raw Materials. The Quality is verified and checks buy our Consultants and Experts

### **Requirement of Staff & Manpower: -**

In Dehydrated Onion Flakes Unit Detailed Project Report Here we cover Staff & Manpower Requirement, skilled Manpower, Un Skilled Manpower, Salary and Wages Cost according to the Machinery and Project Capacity.

### **Personnel Management: -**

In Dehydrated Onion Flakes Unit Detailed Project Report Here we cover Personnel Management Requirement cost in Dehydrated Onion Flakes Unit Business.

### **Land Requirement and land Cost: -**

In Dehydrated Onion Flakes Unit Detailed Project Report Here we cover Construction Cost and Land requirement for Total area, office area, Covered area, Industry Shade, Building, Storage, and Open area.

### **Cost of Unit Machineries: -**

In Dehydrated Onion Flakes Unit Detailed Project Report Here we cover Cost of Unit Machineries, Equipment's, Accessories, Machinery Installation Cost and other Contingency Cost.

### **Fixed Capital Investment Dehydrated Onion Flakes Unit: -**

In Detailed Project Report Here we cover Fixed Capital Investment Dehydrated Onion Flakes Unit. Fixed Capital Include assets such as Property, Machinery, Equipment and Accessories which need for Business Operations.

### **Working Capital Requirement for Dehydrated Onion Flakes Unit: -**

In Detailed Project Report Here we cover Working Capital Requirement such as Raw Material, working Operations, accounts receivable, Expanses. Inventory and other assets

### **Dehydrated Onion Flakes Unit Total Project Cost:-**

In Detailed Project Report Here we cover total project Cost used for Dehydrated Onion Flakes Unit.

### **Capital Formation: -**

In Dehydrated Onion Flakes Unit Detailed Project Report Here we cover Capital Formation in various sources such as Promoters Contributions, Bank Loan, investors and other source.

### **Term Loan Requirements for Dehydrated Onion Flakes Unit: -**

In Detailed Project Report Here we cover the Term Loan Requirement in Project

### **Dehydrated Onion Flakes Unit Repayment Schedule: -**

In Detailed Project Report Here we cover Repayment Schedule, Interest on Term loan and Instalments etc.

### **Depreciation Chart: -**

In Dehydrated Onion Flakes Unit Detailed Project Report Here we cover Depreciation in various assets such as Building, Machinery, Equipment's and other assets.

### **Dehydrated Onion Flakes Unit Cost: -**

In Detailed Project Report Here we cover the Unit cost, Packaging, Transportation Cost, Marketing Cost and other Costs of Products.

### **Break Even Analysis: -**

In Dehydrated Onion Flakes Unit this section of Detailed Project Report Break Even and its efficiency is calculated. Through Break Even Analysis you will know how much time is required to reach in Break Even.

### **Profitability Analysis: -**

In Dehydrated Onion Flakes Unit this section of Detailed Project Report we calculate all the Profitability parameters like Rate of Return on investment, return, interest rate, taxes and earnings before interest and tax (EBIT) etc.

### **Cash Flow Statement: -**

In Dehydrated Onion Flakes Unit this section of Detailed Project Report we Cover Cash flow statement in Project. In Cash flow Statement the financial statement of balance sheet accounts, income affect cash, cash equivalents, investing and financing activities.

### **Debt service coverage ratio: -**

In Dehydrated Onion Flakes Unit this section of Detailed Project Report we Cover Debt service coverage ratio. DSCR is a measurement of cash flow. It is used in analysing Net operating income and Total Debt Services.

### **Projected Balance Sheet: -**

In this section of Dehydrated Onion Flakes Unit Detailed Project Report, we Cover Balance Sheet. It is the financial statement of Assets, Liabilities, and Shareholders Equity.

### **Dehydrated Onion Flakes Unit and Machinery Manufacturers: -**

In Detailed Project Report Here we will provide you the Name and Address of Dehydrated Onion Flakes Unit and Machinery Manufacturers. It is important to know all the Unit and Machinery Manufacturers So you can choose there

Machinery. We will provide you Best Quality Unit and Machinery Manufacturers and Suppliers. Their Quality is verified and checks buy our Consultants and Experts.

### **Dehydrated Onion Flakes Unit Raw Material Manufacturer and Suppliers: -**

In Detailed Project Report Here we will provide you the Name and Address of Dehydrated Onion Flakes Unit Raw Material Manufacturer and Suppliers. Raw Material is regularly used in your Project so you should have all Raw Material Manufacturer and Suppliers Details. You should meet them and know their Raw Material Quality. We will provide you Best Quality Raw Material Manufacturer and Suppliers. Their Quality is verified and checked by our Consultants and Experts.

Onion powder is a popular spice used in cooking and seasoning. It is made by grinding dried onions into a fine powder. Onion powder manufacturing is a process that involves harvesting, drying, and processing onions into powder form. Here is a detailed article on onion powder manufacturing.

#### **Harvesting and Drying**

The first step in onion powder manufacturing is harvesting the onions. Onions are usually harvested when the leaves start to dry and fall over. The onions are then left in the field for a few days to dry out further. Once the onions are dry, the roots and tops are cut off, and the outer layers of the onion are removed. The onions are then cleaned and washed thoroughly.

After cleaning, the onions are sliced into small pieces and placed in a dehydrator or oven for drying. The drying process takes several hours, and the onions are dried until they become crispy and brittle. Proper drying is important to prevent the growth of bacteria and fungi, which can affect the quality of the onion powder.

#### **Grinding and Processing**

Once the onions are dried, they are ground into a fine powder using a hammer mill or a food processor. The powder is then sifted to remove any large pieces that were not

ground properly. The onion powder is then packaged and stored in airtight containers to preserve its flavour and aroma.

#### **Quality Control**

Onion powder manufacturing requires strict quality control to ensure the production of high-quality onion powder. The quality of onion powder is affected by various factors, including the quality of onions used, the drying process, and the grinding process. Quality control measures include regular testing of the product for moisture content, microbial contamination, and colour consistency.

Onion powder is a popular spice used in various cuisines worldwide. The manufacturing process involves harvesting, drying, and grinding onions into a fine powder. Quality control measures are crucial to ensure the production of high-quality

onion powder. Onion powder has a long shelf life and is a convenient way to add flavour and aroma to dishes.

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**In This Section of Onion Powder Manufacturing Detailed Project Report and brief Introduction of Onion Powder Project, Opportunity and Feature of Business is covered.**

**Onion Powder Properties: -**

**In This Section of Onion Powder Manufacturing Detailed Project Report all the Onion Powder scientific Data, Physical and Chemical properties of Onion Powder Covered. If you want to start this business you should know Properties aspects of Onion Powder so you can Produce Better Quality End Products.**

**Onion Powder Manufacturing Standard and Specifications Requirement: -**

**In Detailed Project Report Here all the standard and Specifications Requirement According to the Country where Onion Powder Made and also Onion Powder export and import country's Standard and their Specifications is covered. It is very important to know Standard and specification of your products and Products should be made according to the Country Market where you want to sell your Product.**

## **Onion Powder Manufacturing Uses and Applications: -**

Detailed Project Report here all the uses and applications of Onion Powder according to industry, end user and other uses are covered. If you are new in this business, you should know uses and Applications area Onion Powder, so you can focus to cover that Area.

## **Onion Powder Present Market Position: -**

In Detailed Project Report Here we cover present market status of Onion Powder in Domestic market and international market and its statistical data. It is very important aspect of project you should know all the Present Market Demand statistic, Numeric Data and present market facts so it will help to you know statistic Present market Status and you will take better Decisions.

## **Onion Powder Manufacturing Future Demand: -**

In Detailed Project Report Here we cover Future market status, Future Demand of Onion Powder in Domestic market and international market and its statistical data, Demand and Supply Gap. It will help you to explore Onion Powder future Demand so you can decide your Project Capacity according to the Market Onion Powder Demand and supply gap.

## **Onion Powder Manufacturing Process and Technology: -**

In Detailed Project Report Here we cover Commercial Onion Powder Manufacturing Process, Technology and its formulation. Latest Proven Process and Technology is used for Onion Powder Manufacturing. We will also arrange the Technology transfer. It is the Core your business total business is Depend on Onion Powder Manufacturing Process and Technology. Some Major aspects of your Business is based on Manufacturing Process and Technology these are following

Your Manufacturing Machinery costs are Depend on it. You will choose the Machinery according to Manufacturing Process and Technology.

Your Onion Powder Manufacturing Costs are Totally Depend on it.

You're Manpower Need and cost is Depend on it. You will choose Manpower requirement according to your Manufacturing Machinery and Project Need.

Your Onion Powder Manufacturing Cost its Dependent on it.

Land and Building Requirements are according to Manufacturing Machinery.

That's why we call it is Core part of your business. Latest Proven Process and Technology should be used for Onion Powder Manufacturing. We carefully chose and help to choose better Process and Technology to give higher output and great Result.

## **Onion Powder Manufacturing Process Flow Sheet Diagram: -**

In Detailed Project Report Here the Process flow Diagram according to the Machinery is covered with brief Details of Each and Every Process. It is Important to know the Process Flow of your project.

## **Names and Addresses of Onion Powder Manufacturing Units: -**

In Detailed Project Report Here we provide you the Name and Address of Existing Manufacturer of Onion Powder. It is important to know the Existing Onion Powder Manufacturers, Major Players and Competitors and their Capacity and their Market status. They will be buyers of your Products.

### **Pollution Control and Energy Conservation: -**

In Onion Powder Manufacturing Detailed Project Report Here We Cover Pollution Control and Energy Conservation aspect of Project. Pollution Control and Energy

Conservation is important aspect in Project it depends on Product to Product, Machinery and Manufacturing Process.

### **Onion Powder Manufacturing Capacity Utilization: -**

In Detailed Project Report here we Cover Onion Powder Manufacturing Capacity Utilization aspect of Project. The Capacity Utilization is Carefully Designed for Better Utilization of Project Capacity and Machinery.

### **Onion Powder Manufacturing Basis and Presumptions: -**

In Detailed Project Report Here we cover all the Basis and Presumptions of Project like, Working Hours per Shift, Number of shift/days, Number of Working days per year, working efficiency and Operative period etc.

### **Onion Powder Manufacturing Implementation Schedule: -**

In Detailed Project Report Here we cover Project Implementation Schedule so you can achieve the target and start the project in less time.

### **List of Manufacturing Machinery for Onion Powder Manufacturing: -**

In Detailed Project Report Here we provide Cost of all the Plant and Machinery Details used for Onion Powder Manufacturing. We confirm the Cost of Plant and Machinery by

the Plant and Machinery Manufacturers. The Onion Powder Manufacturing Machinery is Carefully Chosen According to the Project Capacity and Process and Technology.

### **Miscellaneous Items Requirement: -**

In Onion Powder Manufacturing Detailed Project Report Here we cover Cost of all the Miscellaneous Items and Instruments which is used to Onion Powder Manufacturing. We confirm the Cost of Plant and Machinery by Miscellaneous Items Requirement Manufacturers.

### **Laboratory Equipment's and Accessories: -**

In Onion Powder Manufacturing Detailed Project Report Here we cover cost all the Laboratory Equipment's and Accessories which is used to Onion Powder Manufacturing. We confirm the Cost of Plant and Machinery by Laboratory Equipment's and Accessories Manufacturers.

### **Onion Powder Manufacturing Electrification: -**

In Detailed Project Report Here we cover Electrification cost of Project. The Electrification cost is Depend on the Onion Powder Capacity and Machinery. It is your Fixed Cost.

## **Onion Powder Manufacturing Electric Load and Water Requirements: -**

In Detailed Project Report Here We Cover Electric Load and Water Requirements in Project or Business. The Cost of Electric Load and Water Requirements in your Project is Depend on your End Onion Powder, Onion Powder Capacity, Manufacturing Process, Manpower and Machinery.

## **Onion Powder Manufacturing Unit Maintenance: -**

In Detailed Project Report Here we cover the Maintenance cost required in your Project or Business. The maintenance cost of your Project is Depend on your Machinery, Building and Office etc.

## **Raw Materials Requirement for Onion Powder Manufacturing: -**

In this section of Detailed Project Report, we cover all Raw Materials and Packaging Material Requirements of Project according to Project Capacity.

## **Availability, Cost and Rates of Raw Materials: -**

In Onion Powder Manufacturing Detailed Project Report Here we cover the Availability of Raw Materials in Market, Quality, Quantity and Cost of Raw Materials. The Quality is verified and checks buy our Consultants and Experts.

## **Requirement of Staff & Manpower: -**

In Onion Powder Manufacturing Detailed Project Report Here we cover Staff & Manpower Requirement, skilled Manpower, Un Skilled Manpower, Salary and Wages Cost according to the Machinery and Project Capacity.

## **Personnel Management: -**

In Onion Powder Manufacturing Detailed Project Report Here we cover Personnel Management Requirement cost in Onion Powder Manufacturing Business.

## **Land Requirement and land Cost: -**

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## **Fixed Capital Investment Onion Powder Manufacturing: -**

In Detailed Project Report Here we cover Fixed Capital Investment Onion Powder Manufacturing. Fixed Capital Include assets such as Property, Machinery, Equipment and Accessories which need for Business Operations.

## **Working Capital Requirement for Onion Powder Manufacturing: -**

In Detailed Project Report Here we cover Working Capital Requirement such as Raw Material, working Operations, accounts receivable, Expanses. Inventory and other assets

## **Onion Powder Manufacturing Total Project Cost: -**

In Detailed Project Report Here we cover total project Cost used for Onion Powder Manufacturing.

### **Capital Formation: -**

In Onion Powder Manufacturing Detailed Project Report Here we cover Capital Formation in various sources such as Promoters Contributions, Bank Loan, investors and other source.

### **Term Loan Requirements for Onion Powder Manufacturing: -**

In Detailed Project Report Here we cover the Term Loan Requirement in Project.

### **Onion Powder Manufacturing Repayment Schedule: -**

In Detailed Project Report Here we cover Repayment Schedule, Interest on Term loan and Instalments etc.

### **Depreciation Chart: -**

In Onion Powder Manufacturing Detailed Project Report Here we cover Depreciation in various assets such as Building, Machinery, Equipment's and other assets.

### **Onion Powder Manufacturing Cost: -**

In Detailed Project Report Here we cover the manufacturing cost, Packaging, Transportation Cost, Marketing Cost and other Costs of Products.

### **Break Even Analysis: -**

In Onion Powder Manufacturing this section of Detailed Project Report Break Even and its efficiency is calculated. Through Break Even Analysis you will know how much time is required to reach in Break Even.

### **Profitability Analysis: -**

In Onion Powder Manufacturing this section of Detailed Project Report we calculate all the Profitability parameters like Rate of Return on investment, return, interest rate, taxes and earnings before interest and tax (EBIT) etc.

### **Cash Flow Statement: -**

In Onion Powder Manufacturing this section of Detailed Project Report we Cover Cash flow statement in Project. In Cash flow Statement the financial statement of balance sheet accounts, income affect cash, cash equivalents, investing and financing activities.

### **Debt service coverage ratio: -**

In Onion Powder Manufacturing this section of Detailed Project Report we Cover Debt service coverage ratio. DSCR is a measurement of cash flow. It is used in analyzing Net operating income and Total Debt Services.

### **Projected Balance Sheet: -**

In this section of Onion Powder Manufacturing Detailed Project Report, we Cover Balance Sheet. It is the financial statement of Assets, Liabilities, and Shareholders Equity.

### **Onion Powder Manufacturing Plant and Machinery Manufacturers: -**

In Detailed Project Report Here we will provide you the Name and Address of Onion Powder Manufacturing Plant and Machinery Manufacturers. It is important to know all the Manufacturing Plant and Machinery

Manufacturers So you can choose their Machinery. We will provide you Best Quality Plant and Machinery Manufacturers and Suppliers. Their Quality is verified and checks buy our Consultants and Experts.

### **Onion Powder Manufacturing Raw Material Manufacturer and Suppliers: -**

In Detailed Project Report Here we will provide you the Name and Address of Onion Powder Manufacturing Raw Material Manufacturer and Suppliers. Raw Material is regularly used in your Project so you should have all Raw Material Manufacturer and Suppliers Details. You should meet them and know their Raw Material Quality. We will provide you Best Quality Raw Material Manufacturer and Suppliers. Their Quality is verified and checks buy our Consultants and Experts.



# TURMERIC PROJECTS

Turmeric, also known as "haldi" in Hindi, is a popular spice in Indian cuisine and is used as a natural remedy in traditional Indian medicine practices. Turmeric is also cultivated globally for its health benefits and culinary uses. Here is a detailed article on Turmeric cultivation in India and globally.

## Turmeric Cultivation in India

India is the largest producer of turmeric in the world, accounting for over 80% of the global production. Turmeric is mainly cultivated in the southern and eastern states of India, including Andhra Pradesh, Tamil Nadu, Telangana, and Odisha. The ideal climate for turmeric cultivation is warm and humid, with temperatures between 20-30°C.

Turmeric is generally grown as a monocrop or intercropped with other crops like sugarcane, maize, and coconut. The planting season for turmeric in India is from June to August, and the harvesting season is from December to February. The soil for turmeric cultivation should be well-drained and rich in organic matter.

After planting, the turmeric field is irrigated, and the crop is weeded to prevent the growth of unwanted plants. The turmeric plant takes around 7-10 months to mature, and the leaves turn yellow, indicating that the turmeric rhizomes are ready for harvesting. After harvesting, the rhizomes are boiled, dried, and polished to obtain the turmeric powder.

## Turmeric Cultivation Globally

Turmeric cultivation is not limited to India; it is grown in various other countries worldwide. Some of the major turmeric-producing countries besides India include Indonesia, China, Bangladesh, Nigeria, and Myanmar.

The cultivation practices and climatic conditions vary in different countries, and hence the quality of turmeric produced also differs. The demand for turmeric has been increasing globally due to its health benefits, culinary uses, and cosmetic applications.

Turmeric Cultivation Detailed Project Report, Turmeric Project Report, Turmeric Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.

Turmeric Cultivation Detailed Project Report Including context in which Business Operate. It will enhance the Turmeric Cultivation Business Planning Process and teach a lot about the Business that you are like to learn, you will Identify Future Trouble area and Opportunity and help to Run Turmeric Cultivation Business smoothly and make it Profitable Venture.

You can also use the Turmeric Cultivation Detailed Project Report to find Funding for your Project. It is Valuable Tool for fulfil your Turmeric Cultivation Business vision, Goal and Objectives.

Turmeric Cultivation Detailed Project Report covers every aspect of Turmeric Cultivation business and all need of business.

Turmeric Cultivation Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Provide the deeper analysis and understanding of Business, Market and Industry Trend.

Turmeric Cultivation Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Include the Turmeric property, Standards and Specifications Requirement for Turmeric according to the buyers, Sellers and Country Specific, Turmeric Use and Application area in the industry.

Detailed Project Reports include Turmeric Market Scenario, History of Market, Present Market Demand, Future Growth of the Project and Complete Turmeric Cultivation Project's Market Analysis.

It's also including Detailed Turmeric Cultivation Process, Existing Cultivation individuals, Organizations and Company, Machinery and its Accessories Requirement, Electricity and Water Requirement.

Turmeric Cultivation Project Reports include Raw Material costing and it's Specifications, Manpower Requirement, land and Buildings, Capital Formulation, Cost of Production and Profit Analysis, Break Even Analysis, Depreciation etc.

Turmeric Cultivation Detailed Project Report contains.

## Introduction

Turmeric Properties

Turmeric Standard and Specifications Requirement: -

Turmeric Uses and Applications

Turmeric Present Market Position

Turmeric Future Deman

Turmeric Cultivation Process

Names and Addresses of Turmeric Cultivation Company.

Turmeric Cultivation Project's Basis and Presumptions

Turmeric Cultivation Project's Implementation Schedule:

List of Cultivation Machinery for Turmeric Cultivation

Miscellaneous Items Requirement for Turmeric Cultivation

Turmeric Cultivation Project's Equipment's and Accessories

Turmeric Cultivation Project's Electrification

Turmeric Cultivation Project's Electric Load and Water Requirements

Turmeric Cultivation Project's Maintenance

Raw Materials Requirement for Turmeric Cultivation

Availability, Cost and Rates of Raw Materials

Requirement of Staff & Manpower for Turmeric Cultivation Project's

Personnel Management for Turmeric Cultivation

Turmeric Cultivation Project's Land Requirement and land Cost

Cost of Cultivation Machineries

Fixed Capital Investment for Turmeric Cultivation

Turmeric Cultivation Project's Working Capital Requirement

Total Project Cost of Turmeric Cultivation

Turmeric Cultivation Project's Capital Formation

Term Loan Requirements for Turmeric Cultivation

Turmeric Cultivation Project's Repayment Schedule

Turmeric Cultivation Project's Depreciation Chart

Turmeric Cultivation Cost

Turmeric Cultivation Project's Break-Even Analysis

Turmeric Cultivation Project's Profitability Analysis

Projected Balance Sheet for Turmeric Cultivation Business

Turmeric Cultivation Plant and Machinery Manufacturers

Turmeric Cultivation Raw Material Manufacturer and Suppliers

Turmeric powder is a popular spice commonly used in Indian and Middle Eastern cuisine. Turmeric has a distinctive bright yellow color and a warm, earthy flavor. Turmeric powder manufacturing involves several steps, from selecting high-quality raw materials to packaging and shipping the final product.

## Raw Materials

The primary raw material used in the production of turmeric powder is turmeric root. Turmeric root is typically sourced from turmeric farms and is processed to remove the

outer layer and impurities. High-quality turmeric root is selected to ensure the powder has a vibrant colour and potent flavour.

## Production Process

The production process of turmeric powder involves several stages, including cleaning, boiling, drying, and grinding. In cleaning, the turmeric root is washed and scrubbed to remove any dirt or debris. The cleaned turmeric root is then boiled to soften it and make it easier to grind.

After boiling, the turmeric root is dried either in the sun or in a dryer. The dried turmeric root is then ground into a fine powder using a grinding machine. The powder is sifted to remove any coarse particles and ensure the powder is fine and uniform in texture.

Finally, the turmeric powder is packaged and shipped to retailers or directly to customers. Packaging can be done using a variety of methods, such as plastic or paper bags, depending on the manufacturer's preference.

## Applications

Turmeric powder is a versatile spice that can be used in a variety of applications, including cooking, natural remedies, and cosmetic products. Turmeric powder is often used in traditional medicine practices to treat a variety of ailments, including inflammation, pain, and digestive issues.

Turmeric Powder Manufacturing Detailed Project Report, Turmeric Powder Project Report, Turmeric Powder Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.

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Turmeric Powder Manufacturing Project Reports include Raw Material costing and its Specifications, Manpower Requirement, land and Buildings, Capital Formulation, Cost of Production and Profit Analysis, Break Even Analysis, Depreciation, Cash Flow Statement and projecting the Balance Sheet etc.

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In This Section of Turmeric Powder Manufacturing Detailed Project Report all the Turmeric Powder scientific Data, Physical and Chemical properties of Turmeric Powder Covered. If you want to start this business you should know Properties aspects of Turmeric Powder so you can Produce Better Quality End Products.

#### **Turmeric Powder Manufacturing Standard and Specifications Requirement: -**

In Detailed Project Report Here all the standard and Specifications Requirement According to the Country where Turmeric Powder Made and also Turmeric Powder export and import country's Standard and their Specifications is covered. It is very important to know Standard and specification of your products and Products should be made according to the Country Market where you want to sell your Product.

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In Detailed Project Report Here the Process flow Diagram according to the Machinery is covered with brief Details of Each and Every Process. It is Important to know the Process Flow of your project.

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In Detailed Project Report Here we provide you the Name and Address of Existing Manufacturer of Turmeric Powder. It is important to know the Existing Turmeric Powder Manufacturers, Major Players and Competitors and their Capacity and their Market status. They will be buyers of your Products.

### Pollution Control and Energy Conservation: -

In Turmeric Powder Manufacturing Detailed Project Report Here we Cover Pollution Control and Energy Conservation aspect of Project. Pollution Control and Energy Conservation is important aspect in Project it depend on Product to Product, Machinery and Manufacturing Process.

### Turmeric Powder Manufacturing Capacity Utilization: -

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In Detailed Project Report Here we cover Electrification cost of Project. The Electrification cost is Depend on the Turmeric Powder Capacity and Machinery. It is your Fixed Cost.

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## **Turmeric Powder Manufacturing Total Project Cost: -**

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## **Capital Formation: -**

In Turmeric Powder Manufacturing Detailed Project Report Here we cover Capital Formation in various sources such as Promoters Contributions, Bank Loan, investors and other source.

## **Term Loan Requirements for Turmeric Powder Manufacturing: -**

In Detailed Project Report Here we cover the Term Loan Requirement in Project.

## **Turmeric Powder Manufacturing Repayment Schedule: -**

In Detailed Project Report Here we cover Repayment Schedule, Interest on Term loan and Instalments etc.

## **Depreciation Chart: -**

In Turmeric Powder Manufacturing Detailed Project Report Here we cover Depreciation in various assets such as Building, Machinery, Equipment's and other assets.

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Material Quality. We will provide you Best Quality Raw Material Manufacturer and Suppliers. Their Quality is verified and checks buy our Consultants and Experts.

Curcumin is a natural compound found in turmeric, a popular spice commonly used in Indian and Middle Eastern cuisine. Curcumin has a wide range of health benefits, including anti-inflammatory and antioxidant properties. Curcumin extraction from turmeric involves several steps, from selecting high-quality raw materials to isolating and purifying the curcumin compound.

## Raw Materials

The primary raw material used in the production of curcumin is turmeric root. Turmeric root is typically sourced from turmeric farms and is processed to remove the outer layer and impurities. High-quality turmeric root is selected to ensure the curcumin content is sufficient for extraction.

## Extraction Process

The extraction process of curcumin involves several stages, including grinding, extraction, and purification. In grinding, the turmeric root is ground into a fine powder, making it easier to extract the curcumin compound. The powdered turmeric root is then mixed with a solvent, such as ethanol or hexane, which helps to dissolve the curcumin compound.

After extraction, the mixture is filtered to remove any solid impurities, leaving behind a curcumin-rich solution. The solution is then subjected to various purification techniques, such as chromatography or crystallization, to isolate and purify the curcumin compound.

Finally, the purified curcumin compound is dried and packaged for use in a variety of applications, such as dietary supplements or natural food colourings.

## Applications

Curcumin has a wide range of applications, including dietary supplements, food colourings, and cosmetic products. Curcumin is often used in traditional medicine practices to treat a variety of ailments, including inflammation, pain, and digestive issues.

Curcumin Extraction from Turmeric Detailed Project Report, Curcumin Project Report, Curcumin Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.

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Curcumin Extraction from Turmeric Detailed Project Report contains.

## Introduction

Curcumin Properties

Curcumin Extraction Standard and Specifications Requirement

Curcumin Uses and Applications

Curcumin Market Position

Curcumin Future Demand

Curcumin Extraction from Turmeric Process and Technology

Curcumin Extraction from Turmeric Process Flow Sheet Diagram

## Names and Addresses of Curcumin Extraction Units: -

Pollution Control and Energy Conservation

Curcumin Extraction Project's Capacity Utilization

Curcumin Extraction Project's Basis and Presumption

## Curcumin Extraction Project's Implementation Schedule: -

List of Extraction Machinery for Curcumin Extraction

Miscellaneous Items Requirement for Curcumin Extraction

Curcumin Extraction Project's Laboratory Equipment's and Accessories

Curcumin Extraction Project's Electrification

Curcumin Extraction Project's Electric Load and Water Requirements

Curcumin Extraction Project's Maintenance

Raw Materials Requirement for Curcumin Extraction

Availability, Cost and Rates of Raw Materials

Requirement of Staff & Manpower for Curcumin Extraction Project's

Personnel Management for Curcumin Extraction

Curcumin Extraction Project's Land Requirement and land Cost

Cost of Extraction Machineries

Fixed Capital Investment for Curcumin Extraction

Curcumin Extraction Project's Working Capital Requirement

Total Project Cost of Curcumin Extraction

Curcumin Extraction Project's Capital Formation

Term Loan Requirements for Curcumin Extraction

Curcumin Extraction Project's Repayment Schedule

Curcumin Extraction Project's Depreciation Chart

Curcumin Extraction Cost

Curcumin Extraction Project's Break-Even Analysis

Curcumin Extraction Project's Profitability Analysis

Curcumin Extraction Project's Cash Flow Statement

Curcumin Extraction Project's Debt service coverage ratio

Projected Balance Sheet for Curcumin Extraction Business

Curcumin Extraction Plant and Machinery Manufacturer

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## COTTON SWABS

Cotton swabs, also known as Q-tips, are a popular household item used for personal hygiene and cleaning. Cotton swab manufacturing involves several steps, from selecting high-quality materials to packaging and shipping the final product.

## Raw Materials

The primary raw material used in the production of cotton swabs is cotton fiber. The cotton fibre is typically sourced from cotton farms and is processed to remove the seeds and impurities. High-quality cotton fiber is selected to ensure the swab is soft, absorbent, and can be used without causing any harm.

## Production Process

The production process of cotton swabs involves several stages, including carding, winding, and tipping. In carding, the cotton fiber is cleaned, straightened, and formed into a thin layer. The thin layer of cotton is then wound around a plastic or paper stick, creating the swab's body.

After winding, the swab can be tipped, which involves dipping the ends of the cotton swab into a liquid solution to provide additional absorbency or cleaning properties. The tipping process can be customized to meet the specific needs and preferences of the customer.

Finally, the swab is packaged and shipped to retailers or directly to customers. Packaging can be done using a variety of methods, such as plastic or paper boxes, depending on the manufacturer's preference.

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Cotton bags are an eco-friendly alternative to plastic bags, providing a reusable and sustainable option for carrying groceries, books, and other items. Cotton bag manufacturing involves several steps, from selecting high-quality materials to printing and finishing the bag.

### Raw Materials

The primary raw material used in the production of cotton bags is cotton fabric. The cotton fabric is typically sourced from cotton farms and is processed to remove the seeds and impurities. High-quality cotton fabric is selected to ensure the bag is durable, strong, and can withstand repeated use.

### Production Process

The production process of cotton bags involves several stages, including cutting, sewing, printing, and finishing. In cutting, the cotton fabric is cut to the desired size and shape of the bag. The fabric is then sewn together, creating the bag's body and handles.

After sewing, the bag can be printed with a variety of designs, logos, and messages. Printing can be done using a variety of methods, such as screen printing or digital printing. The printing process can be customized to meet the specific needs and preferences of the customer.

Finally, the bag is finished, which involves trimming any loose threads, adding any necessary closures, and ensuring the bag meets the desired specifications. The finished bag is then packaged and shipped to retailers or directly to customers.

### Types of Cotton Bags

Cotton bags come in a wide range of styles, sizes, and colors. Some common types of cotton bags include:

Tote bags: These bags are known for their versatility and can be used for carrying groceries, books, or other items.

Drawstring bags: These bags have a drawstring closure, making them ideal for carrying small items, such as jewelry or cosmetics.

Backpacks: These bags have two straps and are worn on the back, making them ideal for carrying heavier items or for outdoor activities.

Cotton Bags Manufacturing Detailed Project Report, Cotton Bags Project Report, Cotton Bags Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.

Cotton Bags Manufacturing Detailed Project Report Including context in which Business Operate. It will enhance the Business Planning Process and teach a lot about the Business that you are like to learn, you will Identify Future Trouble area and Opportunity and help to Run Organization smoothly.

You can also use the Cotton Bags Manufacturing Detailed Project Report to find Funding for your Project. It is Valuable Tool for fulfil your vision, Goal and Objectives.

Cotton Bags Manufacturing Detailed Project Report cover every aspect of Cotton Bags Manufacturing business and all need of business.

Cotton Bags Manufacturing Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Provide the deeper understanding of Business, Market and Industry Trend.

Cotton Bags Manufacturing Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Include the property, various Standards and Specifications Requirement for the Project according to the Country Specific, Project Use and Application.

Cotton Bags Manufacturing Project Reports include Market Scenario, History of Market, Present Market Demand, Future Growth of the Project and Complete Market Analysis.

It's also including Detailed Manufacturing Process and Technology of Project, Product Manufacturing Units, Machinery and its Accessories Requirement, Electricity and Water Requirement.

Cotton Bags Manufacturing Project Reports include Raw Material costing and its Specifications, Manpower Requirement, land and Buildings, Capital Formulation, Cost of Production and Profit Analysis, Break Even Analysis, Depreciation, Cash Flow Statement and projecting the Balance Sheet etc.

Cotton Bags Manufacturing Detailed Project Report contains.

#### **Introduction:** -

In This Section of Cotton Bags Manufacturing Detailed Project Report and brief Introduction of Cotton Bags Project, Opportunity and Feature of Business is covered.

#### **Cotton Bags Properties:** -

In This Section of Cotton Bags Manufacturing Detailed Project Report all the Cotton Bags scientific Data, Physical and Chemical properties of Cotton Bags Covered. If you want to start this business you should know Properties aspects of Cotton Bags so you can Produce Better Quality End Products.

#### **Cotton Bags Manufacturing Standard and Specifications Requirement:** -

In Detailed Project Report Here all the standard and Specifications Requirement According to the Country where Cotton Bags Made and also Cotton Bags export and import country's Standard and their Specifications is covered. It is very important to know Standard and specification of your products and Products should be made according to the Country Market where you want to sell your Product.

#### **Cotton Bags Manufacturing Uses and Applications:** -

Detailed Project Report here all the uses and applications of Cotton Bags according to industry, end user and other uses are covered. If you are new in this business you

should know uses and Applications area Cotton Bags, so you can focus to cover that Area.

## Cotton Bags Present Market Position: -

In Detailed Project Report Here we cover present market status of Cotton Bags in Domestic market and international market and its statistical data. It is very important aspect of project you should know all the Present Market Demand statistic, Numeric Data and present market facts so it will help to you know statistic Present market Status and you will take better Decisions.

## Cotton Bags Manufacturing Future Demand: -

In Detailed Project Report Here we cover Future market status, Future Demand of Cotton Bags in Domestic market and international market and its statistical data, Demand and Supply Gap. It will help you to explore Cotton Bags future Demand so you can decide your Project Capacity according to the Market Cotton Bags Demand and supply gap.

## Cotton Bags Manufacturing Process and Technology: -

In Detailed Project Report Here we cover Commercial Cotton Bags Manufacturing Process, Technology and its formulation. Latest Proven Process and Technology is used for Cotton Bags Manufacturing. We will also arrange the Technology transfer. It is the Core your business total business is Depend on Cotton Bags Manufacturing Process and Technology. Some Major aspects of your Business is based on Manufacturing Process and Technology these are following

Your Manufacturing Machinery costs are Depend on it. You will choose the Machinery according to Manufacturing Process and Technology.

Your Cotton Bags Manufacturing Costs are Totally Depend on it.

You're Manpower Need and cost is Depend on it. You will choose Manpower requirement according to your Manufacturing Machinery and Project Need.

Your Cotton Bags Manufacturing Cost its Dependent on it.

Land and Building Requirements are according to Manufacturing Machinery.

That's why we call it is Core part of your business. Latest Proven Process and Technology should be used for Cotton Bags Manufacturing. We carefully chose and help to choose better Process and Technology to give higher output and great Result.

## Cotton Bags Manufacturing Process Flow Sheet Diagram:

In Detailed Project Report Here the Process flow Diagram according to the Machinery is covered with brief Details of Each and Every Process. It is Important to know the Process Flow of your project.

## Names and Addresses of Cotton Bags Manufacturing Units: -

In Detailed Project Report Here we provide you the Name and Address of Existing Manufacturer of Cotton Bags. It is important to know the Existing Cotton Bags Manufacturers, Major Players and Competitors and their Capacity and there Market status. They will be buyers of your Products.

## Pollution Control and Energy Conservation: -

In Cotton Bags Manufacturing Detailed Project Report Here We Cover Pollution Control and Energy Conservation aspect of Project. Pollution Control and Energy Conservation is important aspect in Project it depends on Product to Product, Machinery and Manufacturing Process.

## **Cotton Bags Manufacturing Capacity Utilization: -**

In Detailed Project Report here we Cover Cotton Bags Manufacturing Capacity Utilization aspect of Project. The Capacity Utilization is Carefully Designed for Better Utilization of Project Capacity and Machinery.

## **Cotton Bags Manufacturing Basis and Presumptions: -**

In Detailed Project Report Here we cover all the Basis and Presumptions of Project like, Working Hours per Shift, Number of shift/days, Number of Working days per year, working efficiency and Operative period etc.

## **Cotton Bags Manufacturing Implementation Schedule: -**

In Detailed Project Report Here we cover Project Implementation Schedule so you can achieve the target and start the project in less time.

## **List of Manufacturing Machinery for Cotton Bags Manufacturing: -**

In Detailed Project Report Here we provide Cost of all the Plant and Machinery Details used for Cotton Bags Manufacturing. We confirm the Cost of Plant and Machinery by the Plant and Machinery Manufacturers. The Cotton Bags Manufacturing Machinery is Carefully Chosen According to the Project Capacity and Process and Technology.

## **Miscellaneous Items Requirement: -**

In Cotton Bags Manufacturing Detailed Project Report Here we cover Cost of all the Miscellaneous Items and Instruments which is used to Cotton Bags Manufacturing. We confirm the Cost of Plant and Machinery by Miscellaneous Items Requirement Manufacturers.

## **Laboratory Equipment's and Accessories: -**

In Cotton Bags Manufacturing Detailed Project Report Here we cover cost all the Laboratory Equipment's and Accessories which is used to Cotton Bags Manufacturing.

We confirm the Cost of Plant and Machinery by Laboratory Equipment's and Accessories Manufacturers.

## **Cotton Bags Manufacturing Electrification: -**

In Detailed Project Report Here we cover Electrification cost of Project. The Electrification cost is Depend on the Cotton Bags Capacity and Machinery. It is your Fixed Cost.

## **Cotton Bags Manufacturing Electric Load and Water Requirements: -**

In Detailed Project Report Here We Cover Electric Load and Water Requirements in Project or Business. The Cost of Electric Load and Water Requirements in your Project is Depend on your End Cotton Bags, Cotton Bags Capacity, Manufacturing Process, Manpower and Machinery.

## **Cotton Bags Manufacturing Unit Maintenance: -**

In Detailed Project Report Here we cover the Maintenance cost required in your Project or Business. The maintenance cost of your Project is Depend on your Machinery, Building and Office etc.

## **Raw Materials Requirement for Cotton Bags Manufacturing: -**

In this section of Detailed Project Report, we cover all Raw Materials and Packaging Material Requirements of Project according to Project Capacity.

## **Availability, Cost and Rates of Raw Materials: -**

In Cotton Bags Manufacturing Detailed Project Report Here we cover the Availability of Raw Materials in Market, Quality, Quantity and Cost of Raw Materials. The Quality is verified and checks buy our Consultants and Experts.

## **Requirement of Staff & Manpower: -**

In Cotton Bags Manufacturing Detailed Project Report Here we cover Staff & Manpower Requirement, skilled Manpower, Un Skilled Manpower, Salary and Wages Cost according to the Machinery and Project Capacity.

## **Personnel Management:-**

In Cotton Bags Manufacturing Detailed Project Report Here we cover Personnel Management Requirement cost in Cotton Bags Manufacturing Business.

## **Land Requirement and land Cost: -**

In Cotton Bags Manufacturing Detailed Project Report Here we cover Construction Cost and Land requirement for Total area, office area, Covered area, Industry Shade, Building, Storage, and Open area.

## **Cost of Manufacturing Machineries: -**

In Cotton Bags Manufacturing Detailed Project Report Here we cover Cost of Manufacturing Machineries, Equipment's, Accessories, Machinery Installation Cost and other Contingency Cost.

## **Fixed Capital Investment Cotton Bags Manufacturing: -**

In Detailed Project Report Here we cover Fixed Capital Investment Cotton Bags Manufacturing. Fixed Capital Include assets such as Property, Machinery, Equipment and Accessories which need for Business Operations.

## **Working Capital Requirement for Cotton Bags Manufacturing: -**

In Detailed Project Report Here we cover Working Capital Requirement such as Raw Material, working Operations, accounts receivable, Expanses. Inventory and other assets

## **Cotton Bags Manufacturing Total Project Cost: -**

In Detailed Project Report Here we cover total project Cost used for Cotton Bags Manufacturing.

## **Capital Formation: -**

In Cotton Bags Manufacturing Detailed Project Report Here we cover Capital Formation in various sources such as Promoters Contributions, Bank Loan, investors and other source.

## **Term Loan Requirements for Cotton Bags Manufacturing: -**

In Detailed Project Report Here we cover the Term Loan Requirement in Project.

## **Cotton Bags Manufacturing Repayment Schedule: -**

In Detailed Project Report Here we cover Repayment Schedule, Interest on Term loan and Instalments etc.

## Depreciation Chart: -

In Cotton Bags Manufacturing Detailed Project Report Here we cover Depreciation in various assets such as Building, Machinery, Equipment's and other assets.

## Cotton Bags Manufacturing Cost: -

In Detailed Project Report Here we cover the manufacturing cost, Packaging, Transportation Cost, Marketing Cost and other Costs of Products.

## Break Even Analysis: -

In Cotton Bags Manufacturing this section of Detailed Project Report Break Even and its efficiency is calculated. Through Break Even Analysis you will know how much time is required to reach in Break Even.

## Profitability Analysis: -

In Cotton Bags Manufacturing this section of Detailed Project Report we calculate all the Profitability parameters like Rate of Return on investment, return, interest rate, taxes and earnings before interest and tax (EBIT) etc.

## Cash Flow Statement: -

In Cotton Bags Manufacturing this section of Detailed Project Report we Cover Cash flow statement in Project. In Cash flow Statement the financial statement of balance sheet accounts, income affect cash, cash equivalents, investing and financing activities.

## Debt service coverage ratio: -

In Cotton Bags Manufacturing this section of Detailed Project Report we Cover Debt service coverage ratio. DSCR is a measurement of cash flow. It is used in analyzing Net operating income and Total Debt Services.

## Projected Balance Sheet: -

In this section of Cotton Bags Manufacturing Detailed Project Report we Cover Balance Sheet. It is the financial statement of Assets, Liabilities, and Shareholders Equity.

## Cotton Bags Manufacturing Plant and Machinery Manufacturers: -

In Detailed Project Report Here we will provide you the Name and Address of Cotton Bags Manufacturing Plant and Machinery Manufacturers. It is important to know all the Manufacturing Plant and Machinery Manufacturers So you can choose there Machinery. We will provide you Best Quality Plant and Machinery Manufacturers and Suppliers. Their Quality is verified and checks buy our Consultants and Experts.

## Cotton Bags Manufacturing Raw Material Manufacturer and Suppliers:-

In Detailed Project Report Here we will provide you the Name and Address of Cotton Bags Manufacturing Raw Material Manufacturer and Suppliers. Raw Material is regularly used in your Project so you should have all Raw Material Manufacturer and Suppliers Details. You should meet them and know there Raw Material Quality. We will provide you Best Quality Raw Material Manufacturer and Suppliers. Their Quality is verified and checks buy our Consultants and Expert.

## **Jatropha (bio fuel)**

**Jatropha Plantation Detailed Project Report, Jatropha Project Report, Jatropha Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.**

**Jatropha Plantation Detailed Project Report Including context in which Business Operate. It will enhance the Jatropha Plantation Business Planning Process and teach a lot about the Business that you are like to learn, you will Identify Future Trouble area and Opportunity and help to Run Jatropha Plantation Business smoothly and make it Profitable Venture.**

**You can also use the Jatropha Plantation Detailed Project Report to find Funding for your Project. It is Valuable Tool for fulfil your Jatropha Plantation Business vision, Goal and Objectives.**

**Jatropha Plantation Detailed Project Report covers every aspect of Jatropha Plantation business and all need of business.**

**Jatropha Plantation Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Provide the deeper analysis and understanding of Business, Market and Industry Trend.**

**Jatropha Plantation Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Include the Jatropha property, Standards and Specifications Requirement for Jatropha according to the buyers, Sellers and Country Specific, Jatropha Use and Application area in the industry.**

**Detailed Project Reports include Jatropha Market Scenario, History of Market, Present Market Demand, Future Growth of the Project and Complete Jatropha Plantation Project's Market Analysis.**

**It's also including Detailed Jatropha Plantation Process, Existing Plantation individuals, Organizations and Company, Machinery and its Accessories Requirement, Electricity and Water Requirement.**

**Jatropha Plantation Project Reports include Raw Material costing and it's Specifications, Manpower Requirement, land and Buildings, Capital Formulation, Cost of Production and Profit Analysis, Break Even Analysis, Depreciation etc.**

**Jatropha Plantation Detailed Project Report contains.**

### ***Introduction***

### ***Jatropha Properties***

### ***Jatropha Standard and Specifications Requirement: -***

### ***Jatropha Uses and Applications***

### ***Jatropha Present Market Position***

### ***Jatropha Future Demand***

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### ***Names and Addresses of Jatropha Plantation Company.***

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Goat Farming Detailed Project Report contains

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DEPRECIATION CHART

PROFIT ANALYSIS & CASH FLOW STATEMENT

PROJECTED BALANCE SHEET

Detailed Project Reports on Goat Farming cover all the aspects of Goat Farming business, from analyzing the Goat market, confirming availability of various necessities such as Raw Material, Govt Subsidy. The

scope of the report includes assessing market potential, negotiating with collaborators, investment etc. in a very planned manner by financial aspects by estimating the cost of raw material, cash flow statement, projecting the balance sheet etc.

## Angora Rabbit Farming

Angora Rabbit Farming Detailed Project Report, Angora Rabbit Project Report, Angora Rabbit Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business

Angora Rabbit Farming Detailed Project Report Including context in which Business Operate. It will enhance the Angora Rabbit Farming Business Planning Process and teach a lot about the Business that you are like to learn, you will Identify Future Trouble area and Opportunity and help to Run Angora Rabbit Farming Business smoothly and make it Profitable Venture.

You can also use the Angora Rabbit Farming Detailed Project Report to find Funding for your Project. It is Valuable Tool for fulfil your Angora Rabbit Farming Business vision, Goal and Objectives.

Angora Rabbit Farming Detailed Project Report covers every aspect of Angora Rabbit Farming business and all need of business.

Angora Rabbit Farming Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Provide the deeper analysis and understanding of Business, Market and Industry Trend.

Angora Rabbit Farming Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Include the Angora Rabbit property, Standards and Specifications Requirement for Angora Rabbit according to the buyers, Sellers and Country Specific.

Detailed Project Reports include Angora Rabbit Market Scenario, History of Market, Present Market Demand, Future Growth of the Project and Complete Angora Rabbit Farming Project's Market Analysis.

It's also including Detailed Angora Rabbit Farming Process, Existing Farming individuals, Organizations and Company, Machinery and its Accessories Requirement, Electricity and Water Requirement.

Angora Rabbit Farming Project Reports include Raw Material costing and its Specifications, Manpower Requirement, land and Buildings, Capital Formulation, Cost of Production and Profit Analysis, Break Even Analysis, Depreciation etc.

Angora Rabbit Farming Detailed Project Report contains.

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FEEDING MANAGEMENT

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Detailed Project Reports on Rabbit Farming cover all the aspects of Rabbit Farming business, from analysing the Rabbit market, confirming availability of various necessities such as Raw Material, Govt Subsidy. The scope of the report includes assessing market potential, negotiating with collaborators, investment etc. in a very planned manner by financial aspects by estimating the cost of raw material, cash flow statement, projecting the balance sheet etc.

### Cattle Rearing

The Cattle Rearing business is used to raise cattle in large scale for selling animals, raise dairy cattle for milk and improving the milking Capacity of animal. Sometime some farmers also Raising Cattle for fairs and local events and family use.

Many people are raising cattle for their personal. This project can be start for commercial Dairy or also start with some animal to serve local demand of Milk and Breeds. Milk and milk Products always high in Demand.

Cattle Rearing is one of the most common and profitable animal farming business. Although this business comes with its own challenges. So, anyone can start with a minimum number of animals and expand gradually. For starting the This Business, you need to do deep market research, economic and cost analysis and definitely feasibility studies.

For starting cattle Rearing farm and Running this business successfully, you will need to select farm location and land, funds for Project, farm equipment's, fencing around the farm, animal Shed and living quarter for your manpower.

Detailed Project Report contains

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About the Detailed Project Report

Cattle Rearing Detailed Project Reports, Project Reports, Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.

Including context in which Business Operate. It will enhance the Business Planning Process and teach a lot about the Business that you are like to learn, you will Identify Future Trouble area and Opportunity and help to Run Organization smoothly.

You can also use the Cattle Rearing Detailed Project Report to find Funding for your Project. It is Valuable Tool for fulfil your vision, Goal and Objectives.

Cattle Rearing Detailed Project Reports cover every aspect of Cattle Rearing business and all need of business.

Detailed Project Reports, Project Reports, Feasibility Study Report and Business Plan Provide the deeper understanding of Business, Market and Industry Trend.

Detailed Project Reports, Project Reports, Feasibility Study Report and Business Plan Include the property, various Standards and Specifications Requirement for the Project according to the Country Specific, Project Use and Application.

Cattle Rearing Project Reports include Market Scenario, History of Market, Present Market Demand, Future Growth of the Project and Complete Market Analysis.

## Buffalo Farming

Buffalo Farming Detailed Project Report, Buffalo Project Report, Buffalo Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.

Buffalo Farming Detailed Project Report Including context in which Business Operate. It will enhance the Buffalo Farming Business Planning Process and teach a lot about the Business that you are like to learn, you will Identify Future Trouble area and Opportunity and help to Run Buffalo Farming Business smoothly and make it Profitable Venture.

You can also use the Buffalo Farming Detailed Project Report to find Funding for your Project. It is Valuable Tool for fulfil your Buffalo Farming Business vision, Goal and Objectives.

Buffalo Farming Detailed Project Report covers every aspect of Buffalo Farming business and all need of business.

Buffalo Farming Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Provide the deeper analysis and understanding of Business, Market and Industry Trend.

Buffalo Farming Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Include the Buffalo property, Standards and Specifications Requirement for Buffalo according to the buyers, Sellers and Country Specific.

Detailed Project Reports include Buffalo Market Scenario, History of Market, Present Market Demand, Future Growth of the Project and Complete Buffalo Farming Project's Market Analysis.

It's also includes Detailed Buffalo Farming Process, Existing Farming individuals, Organizations and Company, Machinery and its Accessories Requirement, Electricity and Water Requirement.

Buffalo Farming Project Reports include Raw Material costing and it's Specifications, Manpower Requirement, land and Buildings, Capital Formulation, Cost of Production and Profit Analysis, Break Even Analysis, Depreciation etc.

Buffalo Farming Detailed Project Report contains.

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Detailed Project Reports on Cow Farming cover all the aspects of Cow Farming business, from analyzing the Cow market, confirming availability of various necessities such as Raw Material, Govt Subsidy. The scope of the report includes assessing market potential, negotiating with collaborators, investment etc. in a very planned manner by financial aspects by estimating the cost of raw material, cash flow statement, projecting the balance sheet etc.

## Rice Beer Manufacturing

Rice beer is a traditional alcoholic beverage that is popular in many countries, particularly in Asia. It is made from fermented rice, water, and yeast, and has a distinct taste and aroma. The demand for rice beer is increasing in major countries due to its unique taste, health benefits, and cultural significance.

In India, rice beer is known as "Handia" and is a traditional drink in many states, including Odisha, Chhattisgarh, and Jharkhand. It is also popular in the northeast region of the country, where it is known as "Chang" or "Zu". The demand for rice beer is increasing in India due to its perceived health benefits, which include aiding digestion and boosting the immune system.

In Japan, rice beer is known as "Sake" and is a popular drink at formal events and ceremonies. It is made from polished rice, water, and yeast, and has a complex flavor and aroma. The demand for sake is increasing in Japan and around the world, due to its unique taste and cultural significance.

In China, rice beer is known as "Baijiu" and is a traditional drink that is popular at banquets and social gatherings. It is made from fermented grains, including rice, and has a high alcohol content. The demand for baijiu is increasing in China due to its cultural significance and its association with wealth and prosperity.

The rice beer manufacturing industry is an important contributor to the economies of many countries, particularly in Asia. Many companies are investing in research and development to create new and innovative Flavors and varieties of rice beer, which are attracting a wider range of customers. Some companies are also focusing on sustainable and environmentally friendly practices, such as using renewable energy sources and reducing waste.

In conclusion, the demand for rice beer is increasing in major countries due to its unique taste, health benefits, and cultural significance. The rice beer manufacturing industry is an important contributor to the economies of many countries, particularly in Asia, and is constantly evolving to meet the changing demands of customers. As the demand for rice beer continues to grow, the industry is expected to play an increasingly important role in the global alcoholic beverage market.

Rice Beer Manufacturing Detailed Project Report, Rice Beer Project Report, Rice Beer Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.

Rice Beer Manufacturing Detailed Project Report Including context in which Business Operate. It will enhance the Business Planning Process and teach a lot about the Business that you are like to learn, you will Identify Future Trouble area and Opportunity and help to Run Organization smoothly.

You can also use the Rice Beer Manufacturing Detailed Project Report to find Funding for your Project. It is Valuable Tool for fulfil your vision, Goal and Objectives.

Rice Beer Manufacturing Detailed Project Report cover every aspect of Rice Beer Manufacturing business and all need of business.

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In Detailed Project Report Here we cover Commercial Rice Beer Manufacturing Process, Technology and its formulation. Latest Proven Process and Technology is used for Rice Beer Manufacturing. We will also arrange the Technology transfer. It is the Core your business total business is Depend on Rice Beer Manufacturing Process and Technology. Some Major aspects of your Business is based on Manufacturing Process and Technology these are following

- Your Manufacturing Machinery costs are Depend on it. You will choose the Machinery according to Manufacturing Process and Technology.
- Your Rice Beer Manufacturing Costs are Totally Depend on it.
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That's why we call it is Core part of your business. Latest Proven Process and Technology should be used for Rice Beer Manufacturing. We carefully chose and help to choose better Process and Technology to give higher output and great Result.

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### Grain Based Alcohol Plant Detailed Project Report

Grain Based Alcohol Project Report, Grain Based Alcohol Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.

Grain Based Alcohol Plant Detailed Project Report Including context in which Business Operate. It will enhance the Business Planning Process and teach a lot about the Business that you are like to learn, you will Identify Future Trouble area and Opportunity and help to Run Organization smoothly.

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In Alcohol from Rice Plant this section of Detailed Project Report we calculate all the Profitability parameters like Rate of Return on investment, return, interest rate, taxes and earnings before interest and tax (EBIT) etc.

## **Cash Flow Statement: -**

In Alcohol from Rice Plant this section of Detailed Project Report We Cover Cash flow statement in Project. In Cash flow Statement the financial statement of balance sheet accounts, income affect cash, cash equivalents, investing and financing activities.

## Debt service coverage ratio: -

In Alcohol from Rice Plant this section of Detailed Project Report We Cover Debt service coverage ratio. DSCR is a measurement of cash flow. It is used in analysing Net operating income and Total Debt Services.

## Projected Balance Sheet: -

In this section of Alcohol from Rice Plant Detailed Project Report We Cover Balance Sheet. It is the financial statement of Assets, Liabilities, and Shareholders Equity.

## Alcohol from Rice Plant and Machinery Manufacturers: -

In Detailed Project Report Here we will provide you the Name and Address of Alcohol from Rice Plant and Machinery Manufacturers. It is important to know all the Plant and Machinery Manufacturers So you can chose there Machinery. We will provide you Best Quality Plant and Machinery Manufacturers and Suppliers. Their Quality is verified and checks buy our Consultants and Experts.

## Alcohol from Rice Plant Raw Material Manufacturer and Suppliers: -

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## Poultry Hatchery

Detailed Project Report, Poultry Project Report, Poultry Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.

Poultry Hatchery Detailed Project Report Including context in which Business Operate. It will enhance the Business Planning Process and teach a lot about the Business that you are like to learn, you will Identify Future Trouble area and Opportunity and help to Run Organization smoothly.

You can also use the Poultry Hatchery Detailed Project Report to find Funding for your Project. It is Valuable Tool for fulfil your vision, Goal and Objectives.

Poultry Hatchery Detailed Project Report cover every aspects of Poultry Hatchery business and all need of business.

Poultry Hatchery Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Provide the deeper understanding of Business, Market and Industry Trend.

Poultry Hatchery Detailed Project Report, Project Reports, Feasibility Study Report and Business Plan Include the property, various Standards and Specifications Requirement for the Project according to the Country Specific, Project Use and Application.

Poultry Hatchery Project Reports include Market Scenario, History of Market, Present Market Demand, Future Growth of the Project and Complete Market Analysis.

It's also including Detailed Hatchery Process and Technology of Project, Product Hatchery Units, Machinery and its Accessories Requirement, Electricity and Water Requirement.

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In This Section of Poultry Hatchery Detailed Project Report and brief Introduction of Poultry Project, Opportunity and Feature of Business is covered.

### **Poultry Properties: -**

In This Section of Poultry Hatchery Detailed Project Report all the Poultry scientific Data, Physical and Chemical properties of Poultry Covered. If you want to start this business you should know Properties aspects of Poultry so you can Produce Better Quality End Products.

### **Poultry Hatchery Standard and Specifications Requirement: -**

In Detailed Project Report Here all the standard and Specifications Requirement According to the Country where Poultry Made and also Poultry export and import country's Standard and their Specifications is covered. It is very important to know Standard and specification of your products and Products should be made according to the Country Market where you want to sell your Product.

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### **Poultry Hatchery Future Demand: -**

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### **Poultry Hatchery Process and Technology: -**

In Detailed Project Report Here we cover Commercial Poultry Hatchery Process, Technology and its formulation. Latest Proven Process and Technology is used for Poultry Hatchery. We will also arrange the Technology transfer. It is the Core your business total business is Depend on Poultry Hatchery Process and Technology. Some Major aspects of your Business is based on Hatchery Process and Technology these are following

Your Hatchery Machinery costs are Depend on it. You will choose the Machinery according to Hatchery Process and Technology.

Your Poultry Hatchery Costs are Totally Depend on it.

You're Manpower Need and cost is Depend on it. You will choose Manpower requirement according to your Hatchery Machinery and Project Need.

Your Poultry Hatchery Cost its Dependent on it Land and Building Requirements are according to Hatchery Machinery.

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#### **Poultry Hatchery Process Flow Sheet Diagram: -**

In Detailed Project Report Here the Process flow Diagram according to the Machinery is covered with brief Details of Each and Every Process. It is Important to know the Process Flow of your project.

#### **Names and Addresses of Poultry Hatchery Units: -**

In Detailed Project Report Here we provide you the Name and Address of Existing Manufacturer of Poultry. It is important to know the Existing Poultry Manufacturers, Major Players and Competitors and their Capacity and their Market status. They will be buyers of your Products.

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In Poultry Hatchery Detailed Project Report Here We Cover Pollution Control and Energy Conservation aspect of Project. Pollution Control and Energy Conservation is important aspect in Project it depends on Product to Product, Machinery and Hatchery Process.

#### **Poultry Hatchery Capacity Utilization: -**

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#### **Poultry Hatchery Basis and Presumptions: -**

In Detailed Project Report Here we cover all the Basis and Presumptions of Project like, Working Hours per Shift, Number of shift/days, Number of Working days per year, working efficiency and Operative period etc.

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In Detailed Project Report Here we cover Project Implementation Schedule so you can achieve the target and start the project in less time.

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In Detailed Project Report Here we provide Cost of all the Plant and Machinery Details used for Poultry Hatchery. We confirm the Cost of Plant and Machinery by the Plant and Machinery Manufacturers. The Poultry Hatchery Machinery is Carefully Chosen According to the Project Capacity and Process and Technology.

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In Poultry Hatchery Detailed Project Report Here we cover Cost of all the Miscellaneous Items and Instruments which is used to Poultry Hatchery. We confirm the Cost of Plant and Machinery by Miscellaneous Items Requirement Manufacturers.

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In Poultry Hatchery Detailed Project Report Here we cover cost all the Laboratory Equipment's and Accessories which is used to Poultry Hatchery. We confirm the Cost of Plant and Machinery by Laboratory Equipment's and Accessories Manufacturers.

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In Detailed Project Report Here we cover Electrification cost of Project. The Electrification cost is Depend on the Poultry Capacity and Machinery. It is your Fixed Cost.

#### Poultry Hatchery Electric Load and Water Requirements: -

In Detailed Project Report Here We Cover Electric Load and Water Requirements in Project or Business. The Cost of Electric Load and Water Requirements in your Project is Depend on your End Poultry, Poultry Capacity, Hatchery Process, Manpower and Machinery.

#### Poultry Hatchery Unit Maintenance: -

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#### Raw Materials Requirement for Poultry Hatchery: -

In this section of Detailed Project Report, we cover all Raw Materials and Packaging Material Requirements of Project according to Project Capacity.

#### Availability, Cost and Rates of Raw Materials: -

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#### Requirement of Staff & Manpower:

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#### Cost of Hatchery Machineries: -

In Poultry Hatchery Detailed Project Report Here we cover Cost of Hatchery Machineries, Equipment's, Accessories, Machinery Installation Cost and other Contingency Cost.

### Fixed Capital Investment Poultry Hatchery: -

In Detailed Project Report Here we cover Fixed Capital Investment Poultry Hatchery. Fixed Capital Include assets such as Property, Machinery, Equipment and Accessories which need for Business Operations.

### Working Capital Requirement for Poultry Hatchery: -

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### Poultry Hatchery Total Project Cost: -

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### Capital Formation: -

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### Term Loan Requirements for Poultry Hatchery: -

In Detailed Project Report Here we cover the Term Loan Requirement in Project.

### Poultry Hatchery Repayment Schedule: -

In Detailed Project Report Here we cover Repayment Schedule, Interest on Term loan and Instalments etc.

### Depreciation Chart: -

In Poultry Hatchery Detailed Project Report Here we cover Depreciation in various assets such as Building, Machinery, Equipment's and other assets.

### Poultry Hatchery Cost: -

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## Fish Hatchery

Fish farming has become a major industry around the world, and fish hatcheries play an essential role in the development of the industry. A fish hatchery is a place where fertilized fish eggs are hatched and raised to a size where they can be released into rivers, lakes, or oceans. The hatcheries provide a controlled environment for the eggs and young fish, ensuring their growth and survival rates are optimized.

The global demand for fish and seafood has been increasing steadily over the years. According to a report by the Food and Agriculture Organization of the United Nations (FAO), the world fish production reached a record high of 179 million tonnes in 20xx, with aquaculture contributing to almost half of the production. With the rising demand, the fish hatchery industry is poised to grow as well.

Major countries, such as China, India, Japan, the United States, and European countries, have a significant demand for fish and seafood. In China, for example, the fish hatchery industry has been growing rapidly, and it is now the world's largest producer of farmed fish. China has over 20,000 fish hatcheries, and its production of fish and seafood continues to rise. Similarly, in India, the demand for fish and seafood has been increasing, and the country is the second-largest producer of fish in the world after China. The Indian government has been encouraging the development of fish hatcheries to boost fish production.

Japan has a long tradition of fish farming, and the country has over 3,000 fish hatcheries. The Japanese hatcheries specialize in the production of high-quality fish for consumption and export. The United States is another significant player in the fish hatchery industry, with over 100 federal, state, and tribal hatcheries producing millions of fish annually for recreational fishing, conservation, and research purposes.

The European countries, such as Norway, Scotland, and Spain, also have a significant demand for fish and seafood, and the fish hatchery industry is a vital component of the industry. Norway, for example, is the world's largest producer of Atlantic salmon, and the country's fish hatcheries are responsible for producing millions of salmon smolt every year.

Fish hatcheries use various technologies and techniques to optimize fish production. For example, the hatcheries use incubation trays, hatching jars, and troughs to simulate the natural environment for the eggs and young fish. The hatcheries also use advanced water management systems, such as recirculating

aquaculture systems (RAS), to conserve water and reduce environmental impacts. The RAS technology has gained popularity in recent years due to its high efficiency and low environmental impact.

the fish hatchery industry is a critical component of the global fish and seafood industry. With the increasing demand for fish and seafood, major countries, such as China, India, Japan, the United States, and European countries, are investing in the development of fish hatcheries to boost production. The industry employs advanced technologies and techniques to optimize fish production while reducing environmental impacts. As the global demand for fish and seafood continues to rise, the fish hatchery industry is poised for significant growth in the coming years.

Fish Hatchery Detailed Project Report, Fish Project Report, Fish Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.

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### Fish Hatchery Process Flow Sheet Diagram: -

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## **Fish Hatchery Electrification: -**

In Detailed Project Report Here we cover Electrification cost of Project. The Electrification cost is Depend on the Fish Capacity and Machinery. It is your Fixed Cost.

## **Fish Hatchery Electric Load and Water Requirements: -**

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## **Term Loan Requirements for Fish Hatchery:**

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In Detailed Project Report Here we cover Repayment Schedule, Interest on Term loan and Installments etc.

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## **Shrimp Farming**

Shrimp farming has become a popular industry in many countries, including India. The demand for shrimp has increased globally, leading to the growth of the shrimp farming industry. In this article, we will discuss shrimp farming in India and major shrimp farming countries.

India is the world's second-largest producer of farmed shrimp, with a production of approximately 6,00,000 metric tons. The major shrimp farming states in India are Andhra Pradesh, Tamil Nadu, Gujarat, and West Bengal. Shrimp farming in India began in the 1980s, and since then, it has grown significantly.

The primary species of shrimp farmed in India are the Indian white shrimp, black tiger shrimp, and the Pacific white shrimp. Shrimp farming in India is mostly done in coastal regions, with Andhra Pradesh being the leading state in shrimp farming. The state has over 2,000 shrimp farms and accounts for approximately 40% of India's total shrimp production.

Shrimp farming in India is done in both traditional and modern methods. In traditional methods, shrimp farmers rely on tidal flow systems, while modern methods use aeration and water treatment systems. The modern methods are more efficient and have higher yields.

### **Major shrimp farming countries:**

Apart from India, there are other countries where shrimp farming is a significant industry. The top five shrimp farming countries in the world are:

**China:** China is the world's largest producer of farmed shrimp, with a production of over 1.5 million metric tons. The major shrimp farming provinces in China are Guangdong, Fujian, and Zhejiang.

**Indonesia:** Indonesia is the world's third-largest producer of farmed shrimp, with a production of over 500,000 metric tons. The major shrimp farming provinces in Indonesia are West Java, Central Java, and East Java.

**Vietnam:** Vietnam is the world's fourth-largest producer of farmed shrimp, with a production of over 300,000 metric tons. The major shrimp farming provinces in Vietnam are Bac Lieu, Soc Trang, and Ca Mau.

**Thailand:** Thailand is the world's fifth-largest producer of farmed shrimp, with a production of over 200,000 metric tons. The major shrimp farming provinces in Thailand are Samut Sakhon, Chanthaburi, and Trat.

**Ecuador:** Ecuador is the world's second-largest exporter of farmed shrimp, with a production of over 200,000 metric tons. The major shrimp farming provinces in Ecuador are Manabi, Guayas, and El Oro.

Shrimp Farming Detailed Project Report, Shrimp Project Report, Shrimp Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.

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It's also including Detailed Shrimp Farming Process, Existing Farming individuals, Organizations and Company, Machinery and its Accessories Requirement, Electricity and Water Requirement.

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Shrimp Standard and Specifications Requirement: -

Shrimp Present Market Position

Shrimp Future Demand

Features of Shrimp Farming

Shrimp Farming Management

Grower management for Shrimp Farming

Breeder management for Shrimp Farming

Healthcare and management for Shrimp Farming

Nutrient requirements for Shrimp Farming

Shrimp Farming Process

Names and Addresses of Shrimp Farming Units.

Shrimp Farming Project's Basis and Presumptions

Shrimp Farming Project's Implementation Schedule: -

List of Farming Machinery for Shrimp Farming

Miscellaneous Items Requirement for Shrimp Farming

Shrimp Farming Project's Equipment's and Accessories

Shrimp Farming Project's Electrification

Shrimp Farming Project's Electric Load and Water Requirements

Shrimp Farming Project's Maintenance

Raw Materials Requirement for Shrimp Farming

Availability, Cost and Rates of Raw Materials

Requirement of Staff & Manpower for Shrimp Farming Project's

Personnel Management for Shrimp Farming

Shrimp Farming Project's Land Requirement and land Cost

## Cost of Farming Machineries

Fixed Capital Investment for Shrimp Farming

Shrimp Farming Project's Working Capital Requirement

Total Project Cost of Shrimp Farming

Shrimp Farming Project's Capital Formation

Term Loan Requirements for Shrimp Farming

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## Prawn Farming

Prawn farming, also known as shrimp farming, is a rapidly growing industry worldwide. The demand for prawns is increasing in major countries due to their delicious taste, nutritional value, and versatility in cooking. Prawn farming has become an important source of livelihood for many farmers and fishermen, as well as a significant contributor to the economy of many countries.

In the United States, the demand for prawns is driven by the high consumption of seafood among the population. Prawns are considered a premium seafood item, with a high price point, making them popular among consumers who are willing to pay a premium for high-quality products. The US prawn farming industry is concentrated in southern states such as Louisiana, Texas, and Florida.

In China, the demand for prawns is driven by the country's large population and growing middle class. Prawns are a popular delicacy in the country, with many local dishes featuring prawns as a key ingredient. The Chinese prawn farming industry is one of the largest in the world, with many small-scale farmers and large commercial operations producing prawns for domestic consumption and export.

In India, the demand for prawns is driven by the country's rich coastal regions and long tradition of fishing. Prawn farming is a popular form of aquaculture in the country, with many small-scale farmers and large commercial operations producing prawns for domestic consumption and export. Prawns are a popular item in many local dishes, as well as in international cuisine.

The prawn farming industry is constantly evolving to meet the changing demands of consumers. Many companies are investing in research and development to create new and innovative farming methods that increase productivity and reduce environmental impact. Some companies are also focusing on sustainable and environmentally friendly practices, such as using renewable energy sources and reducing waste.

The demand for prawns is increasing in major countries worldwide due to their delicious taste, nutritional value, and versatility in cooking. The prawn farming industry is a significant contributor to the economies of many countries and an important source of livelihood for many farmers and fishermen. The industry is constantly evolving to meet the changing demands of consumers, with a focus on innovation, quality, and

sustainability. As the demand for prawns continues to grow, the prawn farming industry is expected to play an increasingly important role in the global seafood market.

Prawn Farming Detailed Project Report, Prawn Project Report, Prawn Feasibility Study Report and Business Plan Helps to Take Comprehensive look at most Important Fact of Business.

Prawn Farming Detailed Project Report Including context in which Business Operate. It will enhance the Prawn Farming Business Planning Process and teach a lot about the Business that you are like to learn, you will Identify Future Trouble area and Opportunity and help to Run Prawn Farming Business smoothly and make it Profitable Venture.

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Detailed Project Reports include Prawn Market Scenario, History of Market, Present Market Demand, Future Growth of the Project and Complete Prawn Farming Project's Market Analysis.

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## Oyster Mushroom Cultivation

Oyster mushroom cultivation is gaining popularity as a lucrative business in many countries around the world. The cultivation process is relatively simple and can be done on a small or large scale, making it accessible for individuals or businesses to enter the market. Oyster mushrooms are highly nutritious and have many health benefits, including being low in calories and high in protein, vitamins, and minerals.

Major countries such as China, India, the United States, and Europe have seen a rise in demand for oyster mushrooms due to their popularity as a food source and their health benefits. In China, oyster mushrooms are a traditional delicacy and are commonly used in stir-fry dishes and soups. India has also seen an increase in demand for oyster mushrooms due to their nutritional value and versatility in cooking. In the

United States and Europe, oyster mushrooms are popular in vegan and vegetarian diets as a meat alternative.

The demand for oyster mushrooms has also increased due to their medicinal properties. Studies have shown that oyster mushrooms have anti-inflammatory and anti-cancer properties and can boost the immune system. As more people become aware of the health benefits of oyster mushrooms, the demand for them is expected to increase in the coming years.

Oyster mushroom cultivation requires minimal investment and can be done in small spaces such as a garage or basement. The process involves inoculating a substrate such as straw, sawdust, or coffee grounds with mushroom spores and providing the ideal growing conditions of temperature, humidity, and ventilation. Oyster mushrooms grow quickly, and a single mushroom can produce up to 10,000 spores, making it a highly productive crop.

In addition to their health benefits and ease of cultivation, oyster mushrooms have a high market value, making them a profitable business venture. Oyster mushrooms can be sold fresh, dried, or canned, and are used in a variety of dishes, making them a versatile product for the food industry. They are also used in the production of dietary supplements and cosmetics.

Overall, the demand for oyster mushrooms is on the rise due to their nutritional value, health benefits, and versatility in cooking. With minimal investment and a growing market, oyster mushroom cultivation is an attractive business opportunity in many countries. As the demand for healthy and sustainable food options continues to grow, oyster mushrooms are likely to remain a popular choice for consumers.

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## Button Mushroom Cultivation

Button mushroom cultivation has become increasingly popular in recent years due to its numerous health benefits and culinary uses. With a high demand for button mushrooms in various countries, mushroom farming has become a lucrative business opportunity.

Button mushrooms, also known as Agaricus bisporus, are a type of edible mushroom that are commonly used in cooking. They are low in calories and are a good source of vitamins and minerals such as potassium, selenium, and vitamin B. These mushrooms are also known to contain antioxidants that help to reduce the risk of various diseases.

Button mushroom cultivation involves growing mushrooms in a controlled environment, typically in a room with specific temperature and humidity levels. The process starts with the preparation of a substrate or growing medium, which usually consists of a blend of materials like straw, corn cobs, and poultry manure. The substrate is then pasteurized to kill any harmful microorganisms before the mushroom spawn is added to it. The spawn is a mixture of mushroom mycelium and a substrate, which is used to colonize the growing medium.

After the spawn is added, the substrate is placed in a growing room with controlled conditions of temperature, humidity, and lighting. The mushrooms start to grow and develop within a few days, and after a few weeks, they are harvested by cutting the stem at the base of the cap.

Button mushroom cultivation is a popular business in many countries, including the United States, China, India, and the United Kingdom. In the United States, mushroom farming is concentrated in states like Pennsylvania, California, and Florida. The global button mushroom

market was valued at USD 16.67 billion in 2022 and is expected to grow at a CAGR of 8.3% from 2023 to 2028.

The increasing demand for button mushrooms can be attributed to various factors, including their nutritional value, easy availability, and low cost. These mushrooms are used in a variety of dishes, from soups and salads to main course meals, making them a versatile ingredient in the kitchen. Additionally, button mushrooms are also used in the production of mushroom extracts, which are used in the pharmaceutical and cosmetic industries.

Button mushroom cultivation is a profitable business opportunity due to the high demand for these mushrooms in various countries. With the right equipment and knowledge, anyone can start a button mushroom farm and tap into this growing market. As the demand for healthy and natural foods continues to rise, button mushrooms are likely to remain a popular choice among consumers.

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Project Report on Cotton Mill

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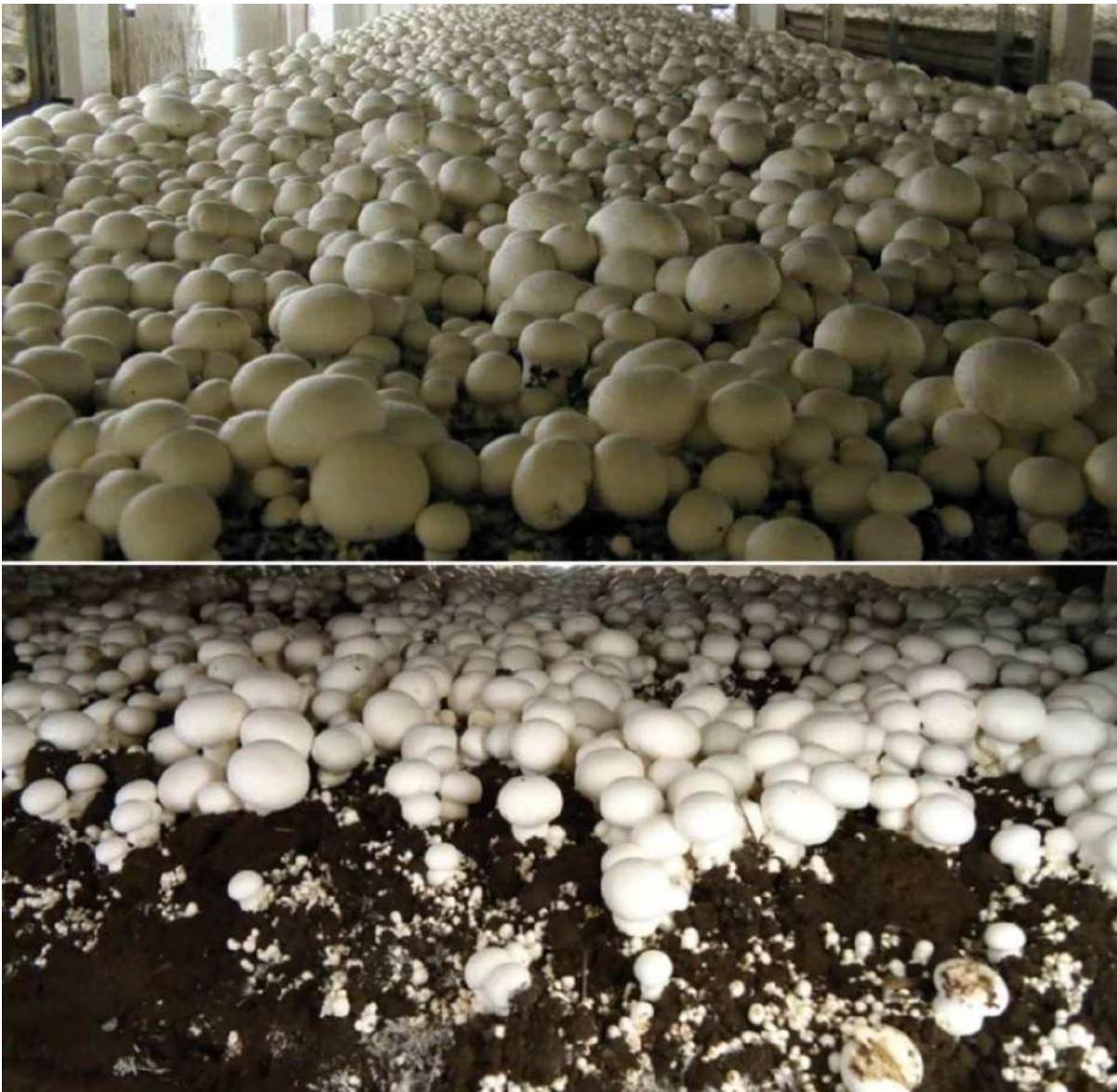
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# Vegan detail project report

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vegetarianism and vegan cuisines since time immemorial, has been witnessing a swift growth in the plant-based food market over the last few years. It has become a sunrise sector with tremendous opportunities. India's market for plant-based meat is forecasted to increase dramatically, from a current estimate of \$30-40 million to \$500 million. Meanwhile, the plant-based dairy sector is expected to see a rise from \$21 million to \$63.9 million by 2024, with a compound annual growth rate of 20.7%. The overall vegan food market is expected to have a compound annual growth rate of 11.32% between 2022 and 2027.

Going by the consumer preference trends, sales volume, and private and public investment, the plant-based industry has gained acceptance and

interest, even among consumers who do not identify as vegetarians or vegans, which is crucial for its growth. The volume of questions received by Vegan First from young health conscious non vegans, flexitarians and transitioning vegans is testament to the growing curiosity and interest in the plant-based movement.

The export market for India's plant-based sector is projected to be significant by 2030. The plant-based meat market is projected to range from \$283 million to \$880 million (Rs. 2194 crore to 6824 crore), whereas the plant-based milk market is projected to range from \$59

million to \$244 million (Rs. 459 crore to 1889 crore).

India, the largest populated country in the world, also faces the greatest threat in terms of food insecurity and its associated challenges. 70% of people in India consume meat. The production of animal-derived products such as meat, dairy, and eggs has significant environmental consequences. The demand for animal meat also leads to land conversion for feed crops and grazing, using up a lot of water and resources. This negatively impacts local communities and ecosystems.

Thus, it's crucial to have a sustainable food system and consumption. Our food systems rely heavily on animal agriculture, which leads to climatic pressure. To reduce this, we need to diversify. A plant-based diet is a solution that addresses various problems in today's agricultural system, such as unethical farming practices, mistreatment of animals, and unsustainability. Adopting a vegan or more plant-based diet can improve both human and planetary health.

There are multiple approaches to decreasing the environmental effects of animal agriculture that don't require giving up animal products entirely. One approach is to select animal products produced with sustainable and ethical methods, such as grass-fed beef or free-range chicken. These production methods can use fewer resources and have less negative impact on the environment and local communities. Another way is to decrease the consumption of animal products by either eating them less often or choosing more environmentally friendly alternatives.

Additionally, given that resource consumption, population growth, climate change and the looming disease epidemics will only continue to escalate, the region is in urgent need of innovation in sustainable mass protein production as a means to combat these issues. In India, the current talent pool needs to acquire essential skills and technical knowledge for more advanced products in the sustainable food space. Supporting the acquisition of technical and professional skills through education and training will help close the widely recognized skill gap and contribute to the overall development of the nation.

A solid foundation needs to be built for the relatively new industry by substantially stronger research and development investment for both product attributes and manufacturing methods. Plant-based food innovation, particularly one that capitalizes on the strong points of Indian crop production and biodiversity of our millets, will necessitate government-led evaluation and approval of novel ingredients.

Given the industry's multifaceted benefits, including significant economic opportunity, the Government of India must ensure that this process is efficient while also safeguarding consumer safety. The Central Government needs to prioritize funding to support the Food Safety and Standards Authority of India's

critical work on plant-based foods. Efficiency in this aspect will reduce the time between R&D and return on investment, allowing for faster and more robust sector growth.

Strategic support is being given to the plant-based industry by the Ministry of Food Processing Industry, and this work should be kept up and expanded. The Pradhan Mantri Kisan Sampada Yojana (PMKSY) provides a good framework for upcoming work. The success of the market for plant-based products, both now and in the future, depends on all of these initiatives, better investments and food technologies combined.

The future looks promising for the sunrise sector, as a large fraction of consumers are looking to make healthier, planet-friendly choices and are open to new and more sustainable proteins. Expansion of the plant-based market is certain, though its course is still being determined. We predict that homegrown alternative protein companies will overtake US and European brands due to growing demand and innovations in the coming years.

## What is veganism

majority of the country's population has thrived on a diet devoid of meat for centuries, owing to spiritual and ethical beliefs. The concept of veganism emerged in India more recently, as awareness of health, the environment and animal welfare manifolded. With the rising trend, a large section of the non-vegan community also grew curious about the lifestyle and began to embrace it occasionally.

## Backed by strong ethical reasons and to end animal

suffering, the vegan movement spread far and wide, without taking much time to reach India. A person who has adopted veganism neither consumes nor uses any animal products as part of their lifestyle. In

terms of food habits, animal products like dairy products, eggs, honey, meat and gelatin are avoided. Animal-derived materials like leather, wool, fur, silk and personal care products tested on animals are also not used as part of veganism. This has taken the vegan market beyond food and led to several fashion and beauty brands offering vegan solutions.

## Plant based foods

Traditionally, a lot of regional Indian cuisines and everyday meals have predominantly been plant-based by default - from the humble idli, dosa, appam and idiyappam to fruits, vegetables, dal chawal, rotis and poha. There are many types of naturally plant-based foods that have been a part of India's rich and diverse cuisines. Some of the most common plant-based foods in India include:

**Lentils and legumes:** Lentils and legumes such as moong dal, chana dal, and kidney beans are staple ingredients in many Indian dishes.

**Rice and grains:** Rice, wheat, jowar, bajra and other grains are staple foods in India and are often served with curries.

**Vegetables:** A variety of vegetables such as potatoes, tomatoes, okra, and eggplant are used in common Indian dishes everyday.

**Spices and herbs:** A variety of spices and herbs such as turmeric, cumin, coriander, and garam masala are commonly used in Indian cooking to add flavor and aroma to dishes.

**Street food:** Street food in India often features plant-based options, such as Pani Puri, Vada Pav, and Bhel Puri.

**Sweets and desserts:** Many traditional Indian sweets and desserts such as Mysore Pak, Kaju Barfi and Jalebi are made using nuts, lentils, and wheat flours.

However, food preferences have also been evolving, leading to the need of aping a good chicken-based dish or dairy. Thus, new plant-based meat, poultry, seafood, dairy and honey substitutes entered the food business, some of which can be categorized as ultra-processed plant-based foods.

### Processed plant-based Foods

Processed plant-based foods include vegan chicken nuggets, vegan mutton kebabs, plant-based cheese

plant-based ghee alternatives, etc. These readily available foods have been made possible with new advancements in food technology, machinery and manufacturing processes, which help mimic the textures and colors of non-vegan foods.

Though health conscious consumers raise concerns around certain processed plant-based foods, they can be made healthier and delicious with the use of cleaner ingredients and less saturated fats with minimal to no cholesterol.

Brazil was the first nation in the world to publish dietary recommendations based on the degree of food processing, and it created the Nova classification in 2014.<sup>2</sup> In this approach, which is known as NOVA (Portuguese for 'new'), minimally processed foods

were divided from processed foods and ultra-processed foods.

### Whole Foods plant-based

A whole-food plant-based (WFPB) diet is one that primarily consists of unprocessed or minimally processed vegan foods. The goal of a WFPB diet is to consume as many nutrient-dense plant foods as possible, which includes a lot of vegetables, fruits, beans, peas, lentils, soybeans, seeds, nuts and whole grains like wheat.

Due to the WFPB diet's low fat and high fiber content, several studies have emphasized the advantages of utilizing it in the diagnosis and treatment of lifestyle disorders like high blood pressure, weight gain, diabetes (type 2), etc. The World Health Organization's 2015 report 'Cancer: Carcinogenicity of the consumption of red meat and processed meat' has classified meat as carcinogenic. The report's working group considered more than 800 different studies on cancer in humans (some studies provided data on both types of meat; in total more than 700 epidemiological studies provided data on red meat and more than 400 epidemiological studies provided data on processed meat)

### CONSUMER INSIGHTS AND BEHAVIOUR

Plant-based foods are the fastest-growing category in many grocery shops, and the industry is celebrating a record-breaking year. According to Google Trends statistics, searches for vegan-related topics have reached an all-time high this year due to growing global interest in the topic. Additionally, consumers worldwide are beginning to become more interested in the health advantages of plant-based diets, particularly after the pandemic. Indian consumers have also started to embrace western concepts like salamis, hot dogs, cold cuts as well as native concepts like jackfruit meat and coconut milk.

According to a recent GFI survey, 77% of Indian consumers are open to trying plant-based meat products, with the early adopter market showing a particularly high level of positive attitude.<sup>6</sup> Since the initial products debuted in 2015, this shows a positive progression.

Opportunities to optimize the manufacturing chain are abundant, because the plant-based industry is still in its infancy, especially in places like India. Developing nations like India need to start realizing their potential in this sector.

### Catalyzing events that impact consumer behavior

Respondents might have gone through certain particular catalytic experiences that would have encouraged a complete shift of lifestyle. A catalytic experience is the encounter that exposes the person to some aspect of cruelty to animals and leads to repression or becoming oriented (the desire to understand more, make a choice or do both). Additionally, this has caused varied social networks to reconsider eating meat.

We anticipate the emergence of plant-based substitutes for almost all food categories as the business develops further. The drive towards plant-based foods is here to stay as a result of



consumer demand.

A survey conducted by Rakuten Insight late last year stated that 47.54% of the participants in India ate plant-based food owing to animal welfare

concerns, while 44.49% were in it to follow a vegan or vegetarian diet.<sup>7</sup> Here's a detailed result of the survey:

## TOP REASONS FOR CHOOSING PLANT-BASED FOOD

ETICS- 47.54%

FOLLOWING VEGETARIAN / VEGAN DIET- 44.49%

HEALTH- 41.76%

FOOD ALLERGIES- 33.13%

ENVIRONMENTAL CONCERNs- 29.37%

TASTE- 25.71%

TO FOLLOW NEW TREND- 24.36 %

OTHERS- 7.81%.

### Categories of plant-based consumers and their motivations

There are multiple categories of plant-based consumers who follow the diet for various reasons. Some of them are as listed below:

**1) Flexitarians** - This group makes a vast majority of consumers, who follow a predominantly plant-based diet but occasionally consume animal products. They include pescatarians, who follow a plant-based diet but include fish and seafood, pollotarians, who eat plant-based foods but include chicken and other poultry products, as well as reductarians. These are individuals who are committed to reducing the amount of animal products they consume by gradually reducing meat, dairy, eggs, and other animal products in their diet and choosing plant-based alternatives instead.

**2) Whole food plant-based** - This diet is followed by consumers mainly for health reasons or by people who have food allergies. Their diet primarily consists of whole, unrefined, or minimally processed foods. It emphasizes a variety of fruits, vegetables, whole grains, legumes, nuts, and seeds and minimizes or eliminates the consumption of animal products, processed foods, and added oils. Their focus is on eating a variety of foods in their natural state, rather than relying on processed or packaged options, in order to maximize nutrient intake and overall health benefits.

**3) Curious non-vegans** - These are individuals who are not following a vegan diet, but are interested in learning more about it and exploring the potential benefits of incorporating more

plant-based foods into their diet. They may be motivated by concerns for their health, the environment, or animal welfare, and may be considering transitioning to a fully vegan diet, or just incorporating more plant-based foods into their meals.

4) **Vegans** - They do not consume or use animal products in any form. This includes meat, dairy, eggs, honey, and other animal-derived ingredients. They adhere to a plant-based diet and lifestyle, and often do so for ethical, environmental, or health reasons. Vegans also typically avoid products that have been tested on animals, and may choose to wear clothing and use personal care products that are free of animal products.

All the above categories of plant-based consumers are motivated by different reasons such as animal rights, sustainability, etc. While some of them follow a vegan lifestyle for ethical reasons and to avoid any form of animal exploitation, there are others who desire to contribute to the environment, lessen their impact on deforestation and minimize greenhouse emissions caused by the animal agricultural industry, which is the second largest contributor of environmental pollution.

Many plant-based consumers also follow the diet to improve their health. "Health is now the second largest motivator for so many people adopting veganism," Veganuary CEO Simon Winch said. These consumers understand that excess red meat consumption may pose health risks. Those with lactose

sensitivity may also decide to follow a vegan diet. In India and parts of Asia, there are also spiritual vegans who choose their dietary preferences based on their spiritual convictions and principles of nonviolence. For instance, many Jains strictly adhere to a vegan diet in order to avoid participating in violence of any form.

There is a crucial need for reducing our dependency on animal-based products and switching to more plant-based alternatives. In India, plant-based foods play an essential role for a number of key reasons:

- 1) **Environmental sustainability:** Plant-based foods require less water, land, and other resources to produce compared to animal-based foods, making them a more sustainable option for the environment. Animal agriculture is resource intensive and is also a significant contributor to greenhouse gas emissions, deforestation, and other environmental problems.
- 2) **Health benefits:** A Whole Food Plant-based food diet is rich in nutrients, fiber, and antioxidants, and if planned right, could even help prevent several lifestyle disorders such as diabetes (type 2), hyperthyroidism, blood pressure and PCOS.
- 3) **Addresses food security:** India has a large and growing population, and traditional animal-based food sources are becoming increasingly unsustainable to meet the demand for food. By prioritizing plant-based foods, India can help to ensure that everyone has access to nutritious and sustainable food sources, contributing to food security for its growing population.
- 4) **Cultural and spiritual traditions:** Many communities in India have beliefs that promote vegetarianism and non-violence, making plant-based foods an integral part of their diet.

- 
- 5) **Ethics:** Some people choose plant-based products for ethical reasons, such as avoiding animal cruelty or reducing their impact on wildlife habitats.
  - 6) **Affordability:** Naturally occurring plant-based foods are often less expensive than animal-based foods, making them more accessible to people with limited incomes.
  - 7) **Preserve biodiversity and reduce species extinction:** Every year more than 80 billion animals are killed for food and lifestyle products.<sup>9</sup> This is unsustainable. By reducing demand for animal-based foods, there is less pressure on these habitats and the species that rely on them.
  - 8) **Create export opportunities:** By leveraging its strong tradition of plant-based foods, cost-effective production, unique ingredients, and investment in the industry, India has the potential to create export opportunities in the growing global market for plant-based foods.

Alternative proteins, also known as smart proteins, are food items that can predictably replace the consumption of meat, eggs, and dairy products derived from animals. These next-generation foods aim to give consumers and producers a viable alternative to foods derived from animals by flawlessly recreating the sensory experience. It goes well beyond the soy-based nuggets and fake meats that have been around for a while.

According to a report from the Food and Agriculture Organization of the United Nations that recommends severe reductions in meat consumption to slow climate change, livestock are responsible for 14.5% of the world's human-induced greenhouse gas emissions. Additionally, cattle consume around 15% of the planet's land—primarily grasslands and rangelands—for grazing and about 40% of it for growing their feed.<sup>11</sup> Alternative proteins help reduce such emissions.

## I. Need for sustainability & food security in the next decade

Globally, there are a rising number of people who are severely food insecure and who require immediate assistance with their diets, livelihoods, and other necessities. Without the dangers associated with conventional meat, eggs, and dairy, plant-based diets offer a sustainable and moral way to address these severe nutritional shortages.

Thus, several non-vegan brands have transitioned to introduce a vegan range or completely switch to being 100% vegan, in response to market demand and ethical concerns. Ben & Jerry's is a well-known nice cream brand that has introduced a range of vegan ice cream flavors. Unilever, a multinational consumer goods company, has introduced vegan mayonnaise. The company has also made a commitment to increase the availability of plant-based products and reduce its carbon footprint. Similarly, Nestlé is a multinational food and beverage company that has introduced a range of plant-based products, including vegan burgers and plant-based milk alternatives.

The market for plant-based foods in India has already attracted hundreds of SMEs and FMCGs, who are producing vegan alternatives to dairy, meat, eggs, seafood, and pet food.<sup>12</sup>

Growing demand for plant-based meals offers farmers a

tremendous opportunity to boost their income while addressing issues like food insecurity, hunger, climate change, and public health risks.

India has the ability to play a significant role on a global stage by growing and processing plant-based products, and by developing its natural, social, and economic advantages. One of the top five nations in the world for producing chickpeas, lentils, millet, peas, rice, soybeans, and wheat is India. Additionally, early indications suggest that the nation's market for plant-based foods has a substantial opportunity for expansion. Consumer demand is high, private sector businesses are entering the market quickly, and the agricultural sector's strength offers a solid platform for expansion.

India can produce an abundance of nutrient-dense plant-based foods both domestically and abroad without compromising the wellbeing and future of its ecosystem. Optimism breaks through in the face of the existential risks posed by climate change and the difficulty of feeding a growing global population. This industry's power and influence has the ability to change the food system while offering solutions that reduce our global warming impact and improve food security for the entire world's population.

### Growth of the market globally

The global market has been burgeoning constantly over the last few years, with several plant-based businesses flourishing. According to a report by Bloomberg Intelligence, the vegan food market could take up 7.7% of the world protein market by 2030, valued at \$162 billion. Moreover, the global animal and dairy protein demand is estimated to reach \$1.2 by 2030.<sup>13</sup>

Major global brands like Beyond Meat, Oatly and Impossible Foods have been partnering with restaurants, which is resulting in a significant increase in the availability of vegan food options for consumers. The industry also received a sweeping boost in 2019 when Beyond Meat went public with an IPO of \$25 per share. A much older Turkey alternative brand Tofurky, present since 1995, has been witnessing an all-time high sales during Thanksgiving since 2020. It's interesting to note that most of these brands were once subjected to mockery among the masses.

Other legacy brands like Nestle and Kellogg have also started offering plant-based products, driving further market boom and an increase in options. Especially in North America, Europe, and China, investor and consumer interest in plant-based foods has skyrocketed.

## BLOOMBERG'S REGION-WISE PLANT-BASED PROTEIN MARKET PROJECTIONS BY 2030



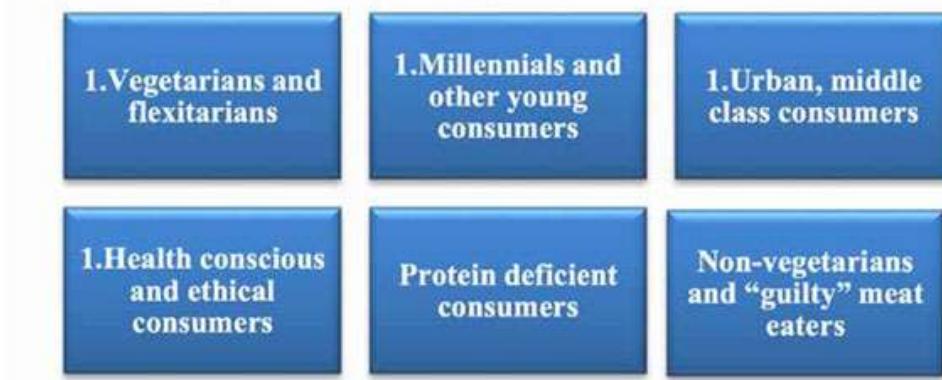
## I. Humble Beginnings to Exponential Growth in India

In a country where a majority of the population had never heard of veganism until a few years ago, market activity in the plant-based category has significantly picked up steam over the past 18 months. Indian consumer cohorts' familiarity and engagement in these products have also increased. Young urban Indian consumers have been displaying interest in consuming processed plant-based meats to fulfill their protein requirements and enjoy the taste of animal meat guilt free.<sup>14</sup>



**Mahasamvit International Ltd.**

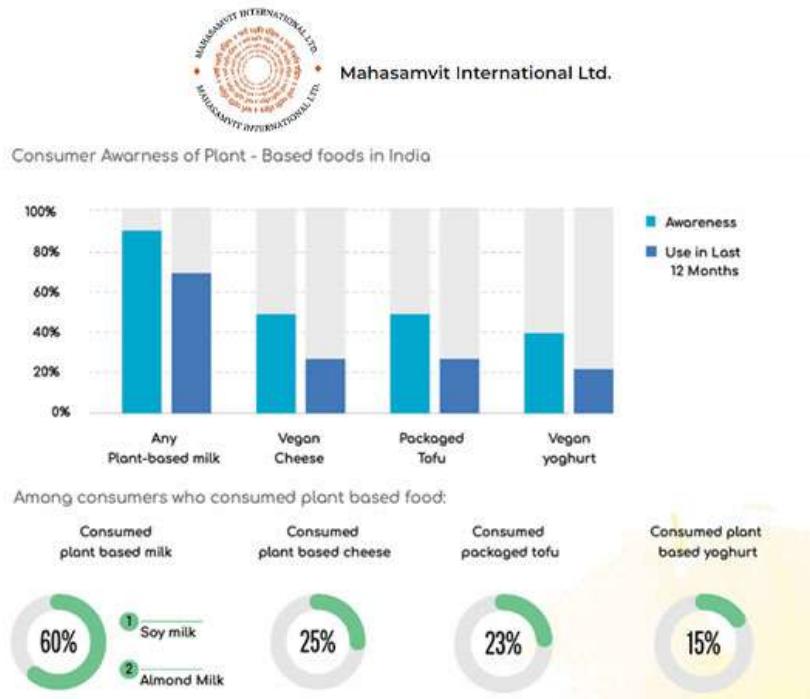
**Figure 1. Target Consumer Groups for Plant-Based Meat Substitutes**



Countless numbers of SMEs and FMCGs have now entered India's plant-based food market, offering plant-based alternatives to meat, poultry, sea food, dairy and vegan meals for dogs and cats.<sup>15</sup> The growth of the plant-based foods industry offers farmers significant opportunities to increase their income while addressing food insecurity, climate change obstacles, hunger, and public health risks. Furthermore, given India's diverse crop output, advanced F&B sector, research institutes, significant R&D successes, and expanding private equity sector, there is an opportunity for growth.

In January 2022, Indian delivery giant Swiggy, the largest ordering and delivery platform in the country, announced a partnership with GoodDot to make animal-free foods easier to source. A study by Kerry, released in December 2021, revealed that India is a high-growth location for plant-based nutrition, with poll results demonstrating a generally open mind to plant-based options, plus a willingness to buy them regularly. The study highlighted that 41% of people already eat a minimum of six types of plant protein, with a willingness to add more, including plant-based meats.<sup>16</sup>

Industry projections point to a much bigger market in the next few years. India's plant-based meat market is estimated to jump from \$30-40 million to \$500 million. The plant-based dairy market is expected to grow from \$21 million to \$63.9 million at a CAGR of 20.7%. The rising demand for vegan snacks and confectionery is further boosting the growth of India's vegan market. Overall, the vegan food market will showcase a CAGR of 11.32% during 2023-2027 as per industry reports.<sup>17</sup> organizations, and individuals to shift towards more sustainable and ethical food systems that rely on plant-based sources of protein.



in India, alternatives to milk (such as almond milk and coconut milk) and meat (such as jackfruit and soy) have been around for decades. Soya chaap has become popular amongst 'guilty non-vegetarians' or newly turned vegetarians. Globally, tofu, tempeh, and soy milk have been used as replacements for animal-based products. More recently, plant-based milk alternatives have started gaining acceptance and are being embraced by flexitarians, vegetarians, vegans, and non-vegetarians alike. But until recently, the market for plant-based meat has remained small and stagnant.

On the contrary, the market for plant-based meat worldwide has grown considerably over the past 5 years as businesses such as Beyond Meat created plant-based meats that are indistinguishable from traditional

meat. With the 2016 launch of the Impossible Burger and the Beyond Burger, both of which were successful in major fast-food outlets, this “biomimicry” approach has become increasingly popular. Fast forward to 2023, plant-based meat alternatives have not only started to mimic the texture, but also the flavor, cultural references, and fragrance.

Plant-based alternatives could use single-hero ingredients or take a hybrid approach while developing their products. Some brands like Only Earth and Alt Co. have taken a purist approach in their offerings as they stick to pure almond-based or oat-based ingredients. However, there are other brands like One Good that use hybrid ingredients by combining oats, cashews, and emulsifiers to mimic the taste and texture of dairy milk.

India's first plant-based egg brand Plant Made follows a proprietary approach as they use proteins from indigenous grains to make their liquid egg. Companies such as Katharos and Break of Dawn have fermented almond feta cheese alternatives, which do not mimic dairy-based cheeses or butters. On the other hand, the White Cub dairy-free butter range closely mimics the texture and flavor of dairy-based butter.

### I. Types of alternatives

Plant based alternatives can be derived from 3 methods:

- **Plant-based food processing**

Plant-based meat is artificial meat produced by using ingredients derived from plants. The taste, texture, and physical properties of animal-derived meat can be replicated to a large extent by processing plant-derived (in some cases - fungi) ingredients. Plant-based meats take significantly less resources and produce less emissions as compared to animal-based meat. It also drastically reduces the land and water pollution caused by animal agriculture as there are no animals involved in the production. The applications of plant-based meat are the same as animal-based meat - in salads, curries, burgers, finger food, and gourmet dishes.

Plant based dairy comprises plant-based replacements for dairy milk as well as dairy products such as curd, yogurt, cheese, butter, cream, and ghee. Each segment faces the challenge of direct comparison of taste and physical properties of dairy products with plant-based ones. Despite that, plant-based chefs on wide reaching platforms are introducing new and innovative methods to replace dairy based ingredients. For eg. Aquafaba is the leftover water from boiling chickpeas and can be successfully used as a creamer for desserts.

- **Fermentation**

Microorganisms such as yeast and bacteria are used to ferment plant-based ingredients to create plant-based cheeses and meat alternatives. Micro-organisms such as algae or fungi are a very promising source of alternative meat products. While cheese and tempeh are classic examples of fermented plant-based foods, a number of startups are working on perfecting the sensory aspects of plant-based protein. Fermented plant-based alternatives can be usually consumed directly and are as delicious, sustainable and nutritious. They are also used as ‘host systems’ to produce other ingredients of interest - like egg or milk proteins.

A growing field of fermentation derived foods delivering next-generation meat and dairy alternatives is biomass fermentation. It uses fast-growing, high protein microorganisms to produce large quantities of protein in bioreactors, which can be further used in the final product.<sup>22</sup>

- **Cultivated or cell-based**

This technology involves culturing animal cells in a lab to create meat alternatives, without the need for animal slaughter. The ‘meat’ is artificially produced by cultivating a small sample of animal cells taken via non-invasive methods. By farming the cells directly instead of raising and slaughtering animals, a highly wasteful process involving cruelty, antibiotics, and fecal contamination is replaced by engineering a

product which exactly mimics the properties of flesh. Cultivated meat is also called ‘cultured’, ‘cell-based’, or ‘clean’ meat.

It must be noted that cell-based meats are neither vegan nor vegetarian. However, these meats might be a good substitute for consumers who focus on lessening the total impact of animal suffering but would still like to enjoy the same sensory pleasure of eating meat.

## II. Common technologies in use today -

There are several time-tested and traditional as well as new and advanced technologies that are being used for plant-based food production.

Homogenization or blending is commonly used to make plant-based milk alternatives. The base ingredients such as nuts and seeds are soaked, ground, and mixed with water to create a homogenous mixture. This mixture is then filtered to remove solids and create a smooth, consistent liquid. This process is commonly used by home chefs who prefer to make their plant milk from scratch. Some plant-based milk beverages may also undergo additional processing steps such as heating, sterilization, and fortification - to improve.

their texture, taste, and nutrient profile. High Pressure Processing (HPP) may also be used to extend the shelf life of some plant-based milk alternatives.

Plant-based butters are typically made using a process similar to that of plant-based milks, with some additional steps. The ingredients, such as nuts, seeds, or oils, are ground into a paste, then mixed and emulsified to create a spreadable consistency similar to dairy butter. The mixture may also be flavored, sweetened, or fortified with vitamins and minerals, depending on the desired end product. Some plant-based butters may also undergo additional processing steps, such as heating or cooling, to improve their physical properties such as spreadability and boiling point.

Plant-based meats are typically made using a combination of food processing techniques, including extrusion, high-pressure homogenization, and heating/cooling. The ingredients, such as soy, pea protein, wheat gluten, or legumes, are first ground and mixed to create a dough-like mixture. This mixture is then processed using extrusion technology to create the desired texture and shape of the final product. Existing technologies are being adapted and new technologies are being introduced to advance protein alternatives.

High-pressure homogenization is used to create a meat-like texture, and heating and cooling may be used to further improve the texture and mimic the behavior of animal-based meats when cooked. Additional ingredients, such as oils, flavorings, and colorings, may also be added to improve the taste and appearance of the final product. The resulting plant-based meat can be used as a substitute for traditional meat in a variety of dishes.

The latest extrusion technology for both wet and dry textured vegetable protein (TVP) continues to evolve and improve as the demand for plant-based meat alternatives increases. Some of the latest advancements in extrusion technology for TVP production include:

- Dual-screw extrusion: This technology uses two interlocking screws to more efficiently mix and homogenize the ingredients, resulting in improved texture and consistency.
- Co-rotating twin-screw extrusion: This technology uses two interlocking screws that rotate in the same direction, producing a more uniform and consistent product compared to single-screw extrusion.
- High-temperature short-time (HTST) extrusion: This technology combines high temperature and short processing times to produce a more tender and flavorful product.
- Membrane extrusion: This technology uses a porous membrane to separate the extruded product from the screw and barrel, reducing wear and tear on the extruder and improving efficiency.

It's important to note that the specific extrusion technology used may vary depending on the product requirements and the desired end result, and the most appropriate technology may also depend on

the type and form of the starting ingredients.

Frequently, High Pressure Processing (HPP) is also used to preserve the taste and texture of plant-based foods. High Pressure Processing (HPP) is a food preservation method that uses high hydrostatic pressure to inactivate pathogens, extend the shelflife and maintain the quality of food products.<sup>23</sup>

These technologies are helping to improve the taste and texture of plant-based foods, making them more appealing to a wider range of consumers and driving the growth of the plant-based food industry.

Future alternate meat consumption will likely include a variety of meats, including plant-based, microbial fermentation-based, and cell-cultured meat - with newer and kinder meats as advancements further in food technologies. Some of them could include cultivated fat to mimic the succulence of animal-based meat.

### III.Creating a successful plant-based meat alternative

Creating a successful plant-based meat alternative requires:

1. Ingredient selection: The choice of ingredients is crucial in creating a plant-based meat alternative that closely mimics the taste, texture, and mouthfeel of animal-based meat. The right combination of plant-based proteins, starches, and oils can help create a product that is similar to traditional meat in terms of taste, texture, and appearance.
2. Processing technology: The choice of processing technology is also crucial in creating a successful plant-based meat alternative. Techniques such as extrusion, high-pressure homogenization, and heating/cooling are often used to create the desired texture and mouthfeel of the product.
3. Flavor and seasoning: Creating a delicious and appealing flavor profile is essential for a successful plant-based meat alternative. The use of natural flavorings and seasonings, such as spices and herbs, can help create a product that is appealing to a wide range of consumers.
4. Nutritional value: Plant-based meat alternatives should provide a similar or improved nutritional profile compared to traditional meat, and be free from harmful additives and preservatives.
5. Marketing and branding: Effective marketing and branding can help create consumer awareness and demand for the product. The product must be presented in a way that appeals to the target audience and effectively communicates the benefits and qualities of the plant-based meat alternative.
6. Packaging and distribution: The product must be packaged and distributed in a way that is convenient for consumers and extends the shelf life of the product.

In summary, creating a successful plant-based meat alternative requires a combination of careful ingredient selection, advanced processing

technology, and effective marketing and branding strategies.

### III. How to introduce new innovations to the consumer

The consumer group and category for plant based milks is more evolved and accepted than other alternatives such as meats, poultry and seafood. This is due to several reasons such as the quality of innovations, price parity and product benefits.

Creating mass awareness about a new category of products like plant-based meats would require significant efforts towards creating brand awareness. In some cases, for D2C brands, Indian celebrities and cricketers have been promoting the idea of cruelty free, sustainable and kinder innovations.

Another approach which has proved to be successful is B2B partnerships. Working with an established QSR chain or mainstream aggregators that customers are familiar with and love is one of the quickest methods to get a brand in front of them.

In order to make it simpler to make cruelty-free delicacies accessible to everyone, the largest ordering and delivery platform in India, Swiggy, announced a partnership with GoodDot in January 2022.<sup>24</sup> BVeg Foods announced a strategic alliance with the market-leading manufacturer of industrial equipment in Switzerland, Bühler, in April of last year, making it one of the first major facilities in the nation to offer high moisture extrusion technology. Additionally, Starbucks India announced in June 2022 that it will collaborate with Imagine Meats to create a variety of vegan menu dishes to be provided at its cafes in ten key cities.

### Plant-based products and their retail availability

Nowadays, stores in a number of Tier-I and Tier-II cities, including Foodhall, Nature's Basket, and D Mart stock vegan dairy and meat alternatives. With the expansion of shelf-stable plant-based food products on the market and improvement in packaging technology, it is projected that consumer access will improve dramatically. At present, startups are struggling to survive on the retail shelves as a result of the hefty listing charge. Plant-based food items can be made more widely available to customers with the help of the government, retail forums, product breakthroughs, and the creation of retailer rules.

According to a recent YouGov poll, more than 65% of Indians want to eat more vegan meals this year. This shift in viewpoint is driven by environmental concerns and health benefits. Industry giants in the FMCG sector like ITC and Tata Consumer Products have launched products to take advantage of the opportunity and drive industry transformation.

	SEITAN	TOFU	TEMPEH	TVP	QUORN	INSECT	FAKE MEAT	FISH PROTEIN
Protein Content (per 100g)	50-80%	5-12%	15-30%	40-90%	40-50%	20-70%	20-30%	15-40%
Stage of Development	Emerging	Developed	Emerging	Developed	Emerging	Emerging	Testing	Emerging
Market Penetration	Emerging	Mainstream	Emerging	Mainstream	Emerging	Future	Future	Emerging
Cost of Production	Low	Low	Medium	Low	Medium	Medium	High	High
Innovation/Technology	Medium	High	Medium	High	Medium	Medium	Medium	Medium

Source: Future Market Insights

## I. Addressing the nutritional concerns of plant-based alternatives via fortification

Plant-based foods are fortified by adding vitamins D3 and B12, macronutrients such as calcium, iron, and protein. This is typically done by mixing the nutrients into the food during the production process, or by coating the food with a nutrient-rich powder. Common examples of fortified plant-based foods include plant milks, breakfast cereals, and meat alternatives. Due to absence of guidelines on having a balanced diet and achieving a complete nutrition profile, most people suffer from nutritional deficiencies.

While it is possible to obtain these nutrients from other plant-based sources, fortified foods can help ensure adequate intake. However, not all plant-based foods need to be fortified and it depends on an individual's diet and their specific nutrient needs. It is always a good idea to consult a healthcare professional to determine the best approach for meeting your nutritional needs.

#### IV. Innovation in the Indian plant-based sector

The entrance of new innovations and technologies is certainly helping the segment grow. This aspect of the industry is paving the way for its expansion and increasing the accessibility of plant-based products. It can tackle the major factors determining the acceptability of plant-based foods by the average Indian consumer – taste and texture, affordability and convenience.

### I. Policy and Vegan Logo by FSSAI

**A**ccording to the FSSAI Regulations, Food Business Operators (FBO) are required to make sure that the proper precautions have been taken in accordance with Good Manufacturing Practices at all stages of production, processing, and distribution in order to avoid the unintended presence of any non-vegan substance. Before producing vegan products, a thorough cleaning or comparable steps in compliance with manufacturing practices must be taken if a production line is shared with non-vegan products or ingredients.

In order to maintain the integrity of vegan meals, food ingredients, or food products on a timely basis, the FBO must obediently adhere to any additional standards outlined by the food authority. Since the format provided by the authority is accepted, no vegan food products are imported unless accompanied by a certificate issued by the recognised authorities of the exporting nations.

As per the requirements of the Food Safety and Standards (Vegan Foods) Regulations, 2022, the Food Safety and Standards Authority of India, or FSSAI, recently released instructions for the submission of a proposal for the endorsement of the vegan emblem.<sup>28</sup> In September 2021, the FSSAI unveiled a new logo to make it simpler for customers to recognise and distinguish vegan meals from other types of food. It is a square box with a

green "V" in the center, a little plant on top, and the words "vegan" written at the bottom. It is similar to the contemporary vegetarian and non-vegetarian food and product emblem, which is a dot in the center of a square.

Comparable to the kosher mark for food, the FSSAI Vegan Logo is a registered trademark that is recognised worldwide. This makes vegan items and foods readily apparent to customers interested in them and makes it easier for vegans to shop without having to look through ingredient lists. It aids businesses in recognising a burgeoning vegan market and the popular lifestyle it represents.

No food may be produced, packaged, sold, offered for sale, marketed, distributed, or imported as vegan food unless it complies with the FSSAI regulations. The provisions of the packaging regulations must be followed by every packaging material used for vegan goods. According to the FSSAI regulations, the seller of vegan food must store and display such food in a way that is identifiable from any non-vegan food, whether they are selling it separately or as part of retail items. Additionally, after receiving clearance, every package of vegan food must bear a particular FSSAI mark.<sup>29</sup>

## Items Qualifying for the FSSAI Vegan Logo

According to the FSSAI Regulations on Vegan Foods, a food or food ingredient is considered vegan if it does not contain any animal-derived ingredients, including additives, flavorings, enzymes, carriers, or processing aids. These ingredients must also not have been used at any point during the production or processing of the food. Additionally, vegan food products must not have undergone animal testing for any reason, including safety evaluation, unless specified by a regulatory authority.

## II. Understanding of Labels & novel Ingredients

### A deeper insight into reading the labels on vegan food

Consumers must first start by scanning the food package for a vegan label. Shopping has never been easier, and they may save time by not having to read through a long list of ingredients because many supermarkets and home food companies now choose to designate their products as being vegan. However, a word of caution - "vegan" doesn't always mean "dairy-free," "lactose-free," or "free from." All of the following substances—glycerin(e)/ glycerol, lactic acid, mono or diglycerides, and stearic acid—may be derived from animal fat, but can also be vegan.<sup>30</sup> If they are plant-derived, the label ought to state as much.

### Animal products included on food labeling

It's crucial to read the food label and look for substances made from animals. This is a list of animal products that can be added to food and that we should be aware of:

- Milk protein called casein
- Lactose (a milk sugar)
- Whey (a by-product of milk)
- Collagen (found in connective tissues, bones, and skin of animals like cows, chickens, pigs, and fish)<sup>31</sup>
- Elastin (a protein present in the ligaments of the bovine aorta and neck).
- Keratin (often made with the skin, bones, and connective tissues of animals like cows, chickens, pigs, and fish)
- Gelatine/gelatin (derived from cows or pigs and made by boiling skin, tendons, ligaments, and/or bones)
- Aspic (another commercially used gelatine substitute that is created from clarified animal, fish, or vegetable stocks and gelatin)
- Lard/tallow (animal fat often derived from the abdomen of animals like pigs)
- Shellac (obtained from the bodies of the female scale insect *tachardia lacca*)
- Honey and Propolis (used by bees in the construction of their hives)
- Royal Jelly (secretion of the throat gland of the honeybee)
- Vitamin D3 (from fish-liver oil or sheep's wool)
- Albumen/albumin (comes from egg)
- Isinglass (a substance obtained from the dried swim bladders of fish and is used mainly for the clarification fining of wine and beer)
- Cod liver oil (used in lubricating creams and lotions, vitamins and supplements)

- Pepsin (from the stomachs of pigs, a clotting agent used in vitamins)

While that may seem like a long list, there are plenty of products that are made without any of the above ingredients. Awareness of these ingredients makes it easier for the consumer to spot non-vegan foods

## I. Support required from the government for plant-based food startups in India

The Indian government may make strategic investments and policy changes to ensure that it leads the world in plant-based food production. The main objective of such measures is to promote industry innovation and growth, allowing it to not only be a significant economic driver, employer, and provider of nutrition on a national level, but also to become a strong regional and international exporter as other countries increasingly look for foods that are both nutrient-dense and environmentally friendly.

### The need to take a lead in the global discussion on changing the food system

India has the chance to take the lead globally in the expansion of the market for plant-based foods and, consequently, the overall future of the food system. Although China, North America, and Europe were early pioneers in the plant-based food industry, India's government is actively working to change national legislation, which could spur this industry's growth. The future must be based on a food system that provides healthy diets and effective, low-waste food production, according to a fervent demand from intergovernmental, academic, and civil society leaders around the world. The change is referred to as the "Great Food Transformation" in the much-publicized EAT-Lancet Commission report, which also emphasizes the value of diversity of plant-based foods as opposed to low levels of animal source foods.

Supporting the agri-food processing business, utilizing public procurement and subsidies, believing that consumers understand labels, and prioritizing effective examination and approval of innovative ingredients are the areas that should be focused in the Indian market for plant-based food startups.

### Encouraging the agri-food processing sector

India is in a good position to be a global leader in the processing of plant-based foods because it has the third-largest food processing industry in the world. The agri-food processing business and the market for plant-based foods are mutually beneficial. The sector's performance depends heavily on the industry, and the expansion of plant-based foods will create a large number of excellent new job possibilities.<sup>32</sup>

The Government of India can make supportive investments to ensure that India's processing industry can benefit as the demand for protein isolates, concentrates, flours, and finished products increases on a national and international level. The government can also assist in identifying the infrastructural, processing capacity, transportation, and research gaps that need to be filled for India's agricultural production to change. The best way to increase infrastructure capacity is to give priority to processing techniques that are less expensive, allow for the use of a wider range of components, and have the least negative effects on the economy, the environment, and society.

As new facilities are constructed, expenditures in the repurposing of existing infrastructure may be part of capacity expansion. Transit is a key element of the sector, and increasing funding for rail cargo transport would guarantee that plant-based foods are accessible outside of major cities and across the nation. In order to ensure that people from the formal and informal sectors may engage in the plant-based foods sector, the government of India should also invest in skill development programmes. If there is a labor disruption, this will be especially crucial in the long run.

## Aim to promote the development of novel plant-based goods and services

Innovative services assist attract joint venture investment and boost competitiveness while the majority of competitors are frequently focused primarily on innovative manufacturing. Such projects can keep offering startup mentoring through its many programmes, such as an incubator for fresh startups and an accelerator mentorship that aids startup growth by enhancing an already-existing business.

### A boost for entrepreneurs in the plant-based food industry

The next generation of entrepreneurs and those considering entering the industry must close gaps in product formats, packaging, nutrition, pricing, and accessibility if they are to reach the actual mass market. End-to-end value chains that are localized, capital investment, expanded manufacturing and processing facilities, and last but not least, ongoing government assistance, can make all of this possible.

The Indian government is aware of the potential of smart proteins and has previously provided public funding support to a number of businesspeople and research organizations. On the strength of a collaborative study proposal co-written by GFI India, the Department of Biotechnology (DBT) awarded the Centre for Cellular and Molecular Biology (CCMB) and the National Research Centre on Meat (NRC Meat) a Rs 4.6 crore grant in 2019.<sup>33</sup> Similar to this, the Department of Science & Technology (DST) awarded the Sanjay Gandhi Post-Graduate Institute of Medical Sciences (SGPGI), Lucknow, a grant of Rs 50 lakh to study cultivated meat in 2019. Additionally, in 2021, a Rs 66 lakh grant was given to researchers at the Central Institute of Fisheries Education (CIFE), Mumbai, to support their study of cultivated seafood.

Taking up the role of a torchbearer for plant-based foods will be hailed by a global chorus of agriculture professionals and could spark more prospects for foreign technical and financial support for India's developing plant-based startups.

## III. Policy recommendations to boost production of vegan products

Here are a few policy recommendations that could boost the production of vegan products:

1. **Financial incentives:** Governments could provide financial incentives to companies that produce and market vegan products, such as tax breaks, grants, and loans.
2. **Research and Development:** Governments could fund research and development programs aimed at improving the taste, texture, and nutritional profile of vegan products.
3. **Education and Awareness:** Governments could launch educational campaigns to increase awareness of the benefits of a vegan diet and the availability of vegan products. This could include public service announcements, school programs, and partnerships with food companies.
4. **Regulatory Support:** Governments could implement policies that make it easier for vegan products to be marketed and sold. For example, they could ensure that vegan products are accurately labeled and that there are no barriers to their sale.
5. **Infrastructure Investment:** Governments could invest in the infrastructure needed to support the production and distribution of vegan products, such as cold storage facilities, transportation networks, and processing plants.

These are a few examples of how government policies could support the growth of the vegan food industry.



## **India's strengths that work in the favor of our plant-based sector**

### **1. India's agrarian culture and crop biodiversity**

India is a top producer of protein-rich crops and is well-positioned to supply to the domestic and global plant-based food industries. It is home to 45,000 plant species. For each of the following essential plant proteins: chickpeas, lentils, millet, peas, rice, soybeans, and wheat, the nation is among the top five producers in the world. India, which accounts for 24% of worldwide production when looking at pulses as a whole, is by far the greatest producer.

India also produces 41% of the world's millet.<sup>34</sup> Millets are tough plants that require much less water to grow than rice. They can be rain-fed even in arid regions with nutrient-poor soils. They are high in fiber, extremely nutritive, and simple to digest. Sorghum, pearl millet, maize, barley, finger millet, and small millets including barnyard millet, foxtail millet, kodo millet, and proso millet are just a few of the diverse millets grown in India. India can take advantage of the distinctive features of its local crops.

### **2. India's capabilities of biopharmaceutical production and biotech industry**

The biopharmaceutical and biotech industries in India have a strong research and development base that can be leveraged to develop new plant-based ingredients and products. The industries have the experience and expertise to develop and scale up processing and manufacturing technologies for plant-based products. They also have a strong focus on quality control, which is critical for ensuring the safety and efficacy of plant-based products.

The alternatives industry may benefit from India's current strengths in biopharmaceutical production and fermentation. Because of its affordability, size, and adaptability to a variety of feedstocks, including waste and side streams, fermentation may be especially appealing for low and middle-income situations. By enhancing both supply chain resilience and environmental sustainability, innovation in side stream valorization will play a significant part in de-risking the alternative protein industry at scale. One such example is using microbial fermentation to transform agricultural waste into nutrient-rich protein at the farm level.

### **3. Young population a valuable resource for the plant-based industry**

India's young population is more health-conscious and environmentally aware, and they are increasingly interested in plant-based food options. This growing consumer demand is driving the growth of the plant-based industry.

They are also entrepreneurial and tech savvy, which is driving them to create new businesses and startups focused on plant-based food production and distribution. This entrepreneurial energy is helping to drive innovation and growth in the industry. The young labor force is also critical for scaling up production and meeting the growing demand for plant-based foods.

### **4. Favorable climatic conditions key to success of India's plant-based food industry**

India's favorable climatic conditions, including abundant sunshine and rainfall, provide an ideal environment for growing a wide range of crops, including those used for plant-based food production, year-round. It reduces the need for artificial heating and cooling systems, minimizing the cost of production and increasing the efficiency of the plant-based food industry.

The favorable climatic conditions allow for high-quality crops with optimal nutritional content, contributing to the safety and quality of the final plant-based food products. It also reduces the need for pesticides, improving the sustainability of the plant-based food industry and reducing its impact on the environment.

## 5. India's economic advantage over other markets

India has a large and growing workforce, low wages, and abundant raw materials, which together help to keep the cost of plant-based food production low compared to other countries. The Indian government's financial and policy support for the development of the plant-based food industry, including tax incentives and subsidies for new businesses, research, and development, also helps the industry.

## 6. Research capabilities driving innovation in this sector

India has a large pool of highly skilled scientists, researchers, and engineers, who are being used to develop new and innovative plant-based food products that meet the evolving needs of consumers. Research is also being conducted to improve the quality, safety, and nutritional content of plant-based food products, contributing to their competitiveness in the global market.

The research community in India is working closely with SMEs in the plant-based food industry to provide them with the technical and scientific support they need to grow and succeed. India's research community is also collaborating with international partners to share knowledge, expertise, and technology, further contributing to the development of the plant-based food industry.

## I. Current limitations of the plant-based industry

India is one of South Asia's most developed commercial economies. The demand for plant-based meat alone in this region is expected to increase 200% during the following five years.<sup>36</sup> Although there are many opportunities for the plant-based business in India, there are several common issues that need to be resolved if this industry is to grow.

"Historically, most APAC funding has been going to countries like Singapore, China, Australia and Korea. But dozens of talented founders are building promising startups in India, Indonesia and other large Southeast Asian markets. These startups, along with bodies like GFI, are helping the mass population in these markets understand the benefits of plant-based products for animals, health, and the planet. As consumer education and interest levels grow, startups creating local flavors and affordable options will succeed in attracting investment and scaling," opines Siddhart Kothari, VC, Ahimsa.

### The lack of cold chain logistics

The lack of cold chain logistics in the nation is one of the most significant obstacles impeding the expansion of this sector. Indian retailers in general are still warming up to varied products, which need temperature-controlled environments. Alternative dairy products, especially plant-based ice creams, do not have access to low-cost temperature-controlled transportation. This often hinders companies from expanding across states and in smaller retail stores.

"Most of the products are temperature-controlled in this segment. Infrastructure in terms of logistics really needs to be built in the country right now. And this is what hampers the growth rate of these companies as well because scalability becomes an issue," says Shivnayan Aggarwal, Lead at The Plant Factor, where they aim to bring together businesses, investors, and industry experts, to better understand what these barriers are and how entrepreneurs are overcoming them.<sup>37</sup>

### Lack of access to capital

Another issue is a lack of access to capital. The plant-based industry is currently an underfunded sector in India, and insufficient capital is a major obstacle in reaching price parity by most brands. Since Indian consumers are price-sensitive, this is a major obstacle for growth.

## Being data dark

Data darkness is limiting the ability of companies and organizations in the industry to make informed decisions and optimize their operations. Having access to more research and statistics can help the industry better understand consumer preferences, market trends, and opportunities for growth. It can also help companies identify areas for improvement and make more informed decisions about product development, marketing, and distribution.

However, the use of data and analytics is growing in the plant-based industry in India, and many companies are investing in the development of their data and technology capabilities. This is expected to improve the competitiveness of the industry and support its growth and development in the future.

## Higher regulatory hassles

Apart from that, the industry faces higher regulatory hassles than other food tech industries. The plant-based market has more entry barriers, and brands often struggle on how to position themselves in a market which is still warming up to plant-based products. For instance, dairy milk is an easily understood concept for the customer due to its prevalence in the market. Plant-based milks, on the other hand, have restrictions on how they are marketed, labeled, and categorized, which tends to affect sales.

In India, the plant-based food industry has seen the emergence of more than 200 companies in recent years. According to a survey by PBFIA and The Insight Partner, the market is currently worth

\$0.27 billion but will reach \$5 billion in the following

ten years. Indian customers are prepared to spend more on diets, natural foods, health supplements, and exercise after the pandemic.

## Challenges in terms of accessibility

The key concern that hampers accessibility of plant-based products is that many issues that the plant-based industry faces are common to other sectors as well. For example, the issue of temperature-controlled transportation is present in the ice-cream industry at large, as well as the pharmaceutical sector. The higher price point of plant-based alternatives is another hindrance that negatively impacts accessibility of these products for consumers. For instance, plant-based meals are subject to a higher rate (on average 18%) than their animal-based counterparts, which have an average GST rate of 5%.<sup>38</sup>

The sector will attain parity with the support of more accessible production, local ingredient procurement, and democratized technologies. Moreover, the reality is that dairy is a highly subsidized sector in India. In Feb 2020, an allocation of Rs 4460 crores was made towards dairy farming, which was further boosted with another Rs 15,000 crores in June 2020 towards animal husbandry. These issues can also be solved through collaboration between incumbents of different industries.

While some companies focus on manufacturing, some take up logistics and solving market issues, connecting companies with investors, technologies and experts. The corporate sector and the distribution and logistics sector can come together to tackle different obstacles. The plant-based industry will be one of the beneficiaries from this collaboration.

## Fighting the Price Imparity

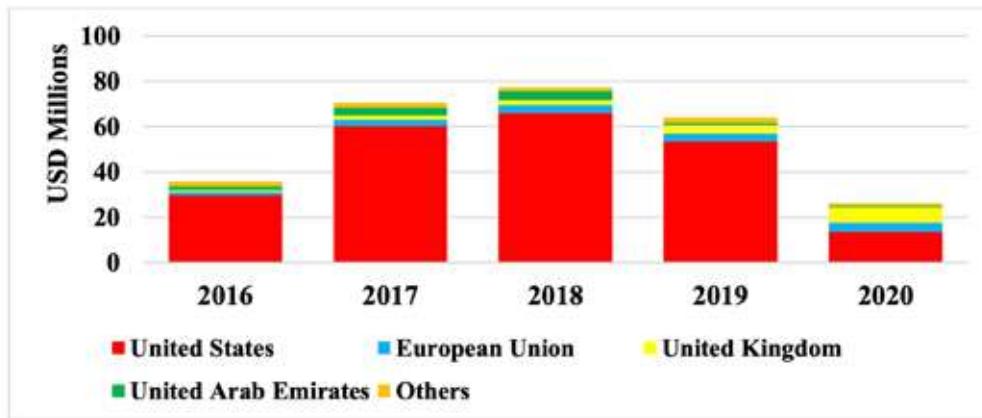


## I. Emerging opportunities for plant-based foods in India

In the Indian market, there are presently more than 56 brands, 300 SKUs, and 30+ formats operating across all 3 technology categories (plant-based, fermentation-derived, and grown).<sup>39</sup> More than 56 companies have launched and tested their plant-based foods in India during the past five years, marking an expansion that was unheard of. Entrepreneurs are increasingly experimenting with innovative protein sources, such as indigenous crops like millets and pulses, as well as microalgae and seaweed, by utilizing India's agricultural diversification and its extensive coastline. Additionally, at least ten businesses are currently operating in India and developing deep-tech innovations, including cultured meat and precision fermentation.

Not only is India expected to be a significant market for smart protein, but it also has the potential to be a significant exporter of goods and ingredients made from plants. The export potential for plant-based meat in 2030 ranges from Rs 2,194 crore to Rs 6,824 crore, according to a report by GFI India and Deloitte India. The number range for plant-based dairy is similar, falling between Rs 459 crore and Rs 1,889 crore. The export potential for plant-based eggs in 2030 is between Rs 266 crore to Rs 631 crore.<sup>40</sup>

**Graph 1. Indian Imports of Protein Concentrates and Textured Protein Substances**



India has a growing market for plant-based food products, and there are several flourishing opportunities in this industry:

1. **Increasing health awareness:** The rise of plant-based diets in India is driven by growing health concerns, as consumers look for more sustainable and nutritious food options.
2. **Growing vegetarian population:** India has a large and growing vegetarian population, which presents a significant opportunity for the plant-based food industry.
3. **Government support:** The Indian government has shown increasing support for the development of the plant-based food industry, recognizing the potential for growth and job creation.
4. **Export potential:** India has a large and growing export market for plant-based products, particularly in countries with large vegetarian populations.
5. **Growing demand from food service sector:** The growth of the plant-based food industry is also driven by the increasing demand for vegetarian and vegan options in restaurants and other food service outlets.
6. **Investment opportunities:** With the increasing demand for plant-based products, there are growing investment opportunities in this industry, from production and processing to distribution and retail.

Overall, the plant-based food industry in India presents a range of opportunities for entrepreneurs, investors, and consumers alike, as the demand for healthier and more sustainable food options continues to rise.

Plant-based food production at the national level can benefit from and encourage an expanding global market for plant protein crops, processed protein ingredients, and manufactured goods. The demand for plant-based meals is surging in North America, Europe, and Asia, which will create chances to bridge supply gaps and benefit from technology that is rapidly updating in the near future. India will benefit greatly if it can establish a global market for its domestic agricultural products.

## **II. Key growth drivers for plant-based alternatives in India**

Alternative proteins industry needs significant funding from a variety of participants, ranging from venture capitalists to development finance institutions. They also need favorable industrial policy to promote the expansion of the industry, in order to scale smart protein solutions. The main barriers for the industry in India include a lack of well-established production processes, long-lasting value chains,

and a distinct path to market.

When it comes to manufacturing capacity, hundreds of startups and established businesses already have off-take capabilities; but there are still no facilities for small-scale experimentation, pilot-scale production, or industrial-scale production. Therefore, entrepreneurs and businesses are now unable to satisfy the market's desire for highly inventive and more sustainably manufactured smart protein goods.

To support the application of specialized technologies that help construct an end-to-end vertical value chain proof of concept and a promise of self-sustainability and scaling, we also need patient and wise capital, particularly on the deep-tech side. Finally, a supportive regulatory framework is and will remain essential for fostering investor trust in the industry and facilitating capital inflow.

India, a major agrarian economy and one of the largest farm producers in the world, provides tremendous opportunities for investors and entrepreneurs in the country and abroad for the following reasons:

1. We are the 5th largest producer of soya in the world.
2. Cost of production in India is relatively economical, compared to other countries.
3. We have the geographical advantage as we are in close proximity to the Middle East, South East Asia and other demand-heavy regions.
4. India has the government's support through its 'Make in India, for the world' initiative.
5. We have world class agriculture and food technology research institutes

## **II. Current funding scenario for plant-based startups in India**

Recently, India got its first venture focused fund Ahimsa VC focused on reducing the harm to the planet, animals and human health.<sup>41</sup> While the worldwide alternative protein market attracted \$5 billion in investment capital in 2021, with only \$10.35 million going to India, 2022 saw a challenging economic and market climate overall. A minor decline from the rapid rate of investment growth seen in 2021, alternative protein companies collected a total of \$2.2 billion in investment capital. However, the industry entered a crucial period of market activity, with numerous businesses announcing the launching of new products and brand alliances.<sup>42</sup>

Infrastructure investments, advantageous financial and credit schemes, foreign direct investment policy, and centralized procurement schemes have propelled the sector's growth. Federal examples of such support are reflected in Pradhan Mantri Kisan Sampada Yojana (PMKSY), the National Bank for Agriculture and Rural Development (NABARD), the Production Linked Incentive Scheme for Food Processing Industry (PLISFPI), and specific support for smaller enterprises such as 'Make in India'. With an outlay of \$1.5 billion (Rs. 10,900 crore), PLISFPI supports the creation of global food manufacturing champions commensurate with India's natural resource endowment and will help Indian brands achieve success in international markets.

At NABARD, the government has set up a special Food Processing Fund of approximately \$265 million to extend affordable credit to designated food parks and the individual food processing units in the designated food parks. In 2020, Finance Minister Smt. Nirmala Sitharaman announced a scheme worth \$1.3 billion (Rs. 10,000 crore) to help micro food enterprises.

It seems like a level playing field among the several alternative protein sub-segments, but only time will determine which ones will win over the general public. India's alternative protein industry needs

crucial backing from regulators and policymakers if it is to compete globally with economies like China, Canada, or Israel.<sup>43</sup>

An interest in cell-based foods is also being encouraged. The Chief Minister's Office of the Government of Maharashtra approved a partnership between GFI India and the Institute of Chemical Technology (ICT), Mumbai, to establish a Center of Excellence in Cellular Agriculture, which will also serve as an incubator for entrepreneurs. Through their current Biotechnology Ignition Grant (BIG) programme, where grantees are granted Rs 50 lakh apiece, organizations like the Biotechnology Industry Research Assistance Council (BIRAC) and the DBT have been sponsoring a number of smart protein firms.<sup>44</sup>

India's sector for plant-based foods is expanding rapidly as a result of improved access and availability of products. The country's vegan milk and plant-based meat markets are worth \$20 million and \$30–40 million respectively.<sup>45</sup> Beyond big cities, accessibility to plant-based foods is expanding regionally. Plant-based foods are becoming more popular and readily available in Andhra Pradesh, Punjab, Tamil Nadu, Uttar Pradesh, and West Bengal. They are already comparatively well-established in Delhi, Telangana, Maharashtra, Haryana, and Karnataka.

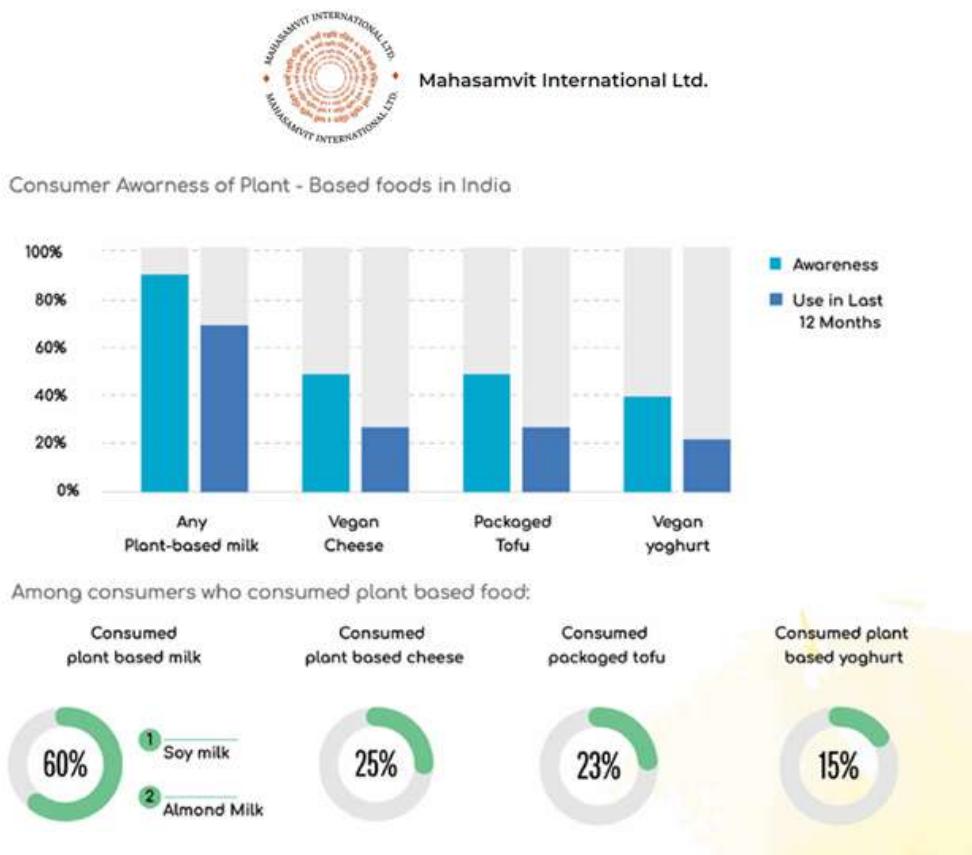
Plant-based foods can be of diverse nature. Below are few examples:

1. **Meat alternatives:** Plant-based burgers, sausages, hot dogs, and other meat alternatives made from soy, peas, mushrooms, and other ingredients.
2. **Dairy alternatives:** Plant-based milk, cheese, yogurt, and ice cream made from almonds, oats, soy, and other ingredients.
3. **Whole food plant-based diets:** Diets based on whole foods like fruits, vegetables, legumes, grains, and nuts, without any animal products.
4. **Snack foods:** Plant-based snack foods such as chips, crackers, and cookies made from ingredients like potatoes, corn, and legumes.
5. **Plant-based drinks:** Plant-based drinks such as smoothies, juices, cold coffee, flavoured drinks, and nut milks made from ingredients like fruits, vegetables, and nuts.
6. **Plant-based desserts:** Plant-based desserts such as ice cream, cakes, and cookies made from ingredients like soy, almond, and coconut.
7. **Plant-based condiments:** Plant-based condiments such as dressings, sauces, and spreads made from ingredients like nuts, seeds, and avocado.

These different types of plant-based foods offer a wide range of options for people following a vegetarian or vegan diet, or for those who are looking for more sustainable, ethical, or health-conscious food options.

For the foreseeable future, the market will continue to change swiftly. There are both international and Indian businesses operating and both business-to-business and business-to-consumer sales of plant-based goods have recently increased. Examples of firms that produce plant-based milk include Borges (Spain), Life Health Food (New Zealand), Hershey's (United States), Raw Pressery, Drums Food International, NatureVit, and Urban Platter in India.

Eateries and coffee shops are increasingly stocking plant-based goods. Restaurant brands like McDonald's, Subway, and KFC already offer a greater selection of plant-based items than what they do in the United States. While Starbucks, the biggest coffee chain in the world with over 250 stores in India, provides its patrons with soy, almond, and oat milks, Café Coffee Day, India's largest coffee chain with over 900 outlets, offers a variety of plant-based beverages.<sup>46</sup>



## I. Plant-Based Meat

India has seen a growing interest in plant-based meat products in recent years. Some of the latest innovations in India's plant-based meat industry include introduction of new plant-based meat products, such as sausages, burgers, and kebabs, made from ingredients like soy, pea protein, and mushrooms. Traditional Indian spices are also being used to create unique plant-based meat products that cater to local tastes and preferences, such as the Mutton Biryani by Imagine Meats. Meat enthusiasts are avoiding meat because plant-based meat provides a meat-like feel. Both in restaurants and in retail, plant-based meat is growing in popularity.<sup>47</sup>

India's plant-based meat industry is introducing a variety of new types of plant-based meats, including:

1. Soy-based meat alternatives: This includes products like tofu, tempeh, kebabs, chaaps and textured vegetable protein, made from soybeans.
2. Pea protein-based products: This includes burgers, sausages, and other meat alternatives made from

pea protein.

3. Mushroom-based products: This includes burgers and sausages made from mushrooms, which are a popular alternative for their meat-like texture and taste.
4. Legume-based products: This includes meat alternatives made from legumes like lentils, chickpeas, and black beans.
5. Jackfruit-based products: Jackfruit is a popular alternative meat source in India and is being used in products like burgers, biryanis and tacos.

## II. Plant-Based Seafood

Although alternatives to beef and chicken are expected to have the largest sales, there is still a sizable market for plant-based seafood, with a projected CAGR of 31.3% from 2022 to 2032.<sup>48</sup> In December 2021, CULT Food Science Corp. completed a strategic investment in Singapore-based startup Umami Meats, which produces cultured seafood.<sup>49</sup> The collaboration intends to lower production costs for farmed seafood, making it easier for businesses to sell it. Japanese Eel, Yellowfin Tuna, and Red Snapper cultivation will be Umami's first areas of attention. The business also plans to work on projects involving halibut, grouper, and mahi-mahi in the future.

In India, SeaSpire creates and manufactures the first whole-cut fish fillet made from plants. Shantanu Dhangar and Varun Gadodia founded Seaspire, which creates plant-based seafood substitutes using cutting-edge technology, digital tools, and nutrient-rich plant-based ingredients. The company is developing an operational base in India to serve the APAC region and claims to be the first of its type to make bioprinted whole-cut whitefish goods in that area.<sup>50</sup> According to SeaSpire, it focuses on technology that can replace inefficiencies in the production of seafood and is looking at the possibility of repurposing horticultural side streams to create feedstock for alternative seafood wholecuts.

The company is confident that in the future years, the Indian subcontinent will see a similar increase in demand for the alternative seafood sector as plant-based meat consumption there continues to develop. In New Zealand, they have their R&D headquarters. Beginning with plant-based whole-cut snapper filets, the company will pilot-launch its first batch of plant-based seafood products in India and New Zealand over the coming months. It will also concentrate on developing an alternative seafood brand in the developing APAC markets, such as Singapore and Australia.

According to the State of the Industry Report by the Good Foods Institute (GFI), global investments in alternative seafood increased by over two times in 2021 compared to 2020. The APAC area, where the majority of the world's fish consumption occurs, saw by far the biggest concentration of investment and research effort. Nearly 30% of all investments in plant-based products were made in the alternative seafood sector in 2021.

## III. Plant-based Poultry

It is widely known that chickens can carry *Salmonella* bacteria, which can be transmitted to eggs even before the shells have formed. *Salmonella* causes an estimated 1 million cases of foodborne illness in the U.S. annually. Moreover, antibiotic treatment of egg-laying hens has been linked with the development of antibiotic-resistant strains of *Salmonella*.<sup>51</sup> Liquid egg products are typically pasteurized to kill pathogens before they are sold, but they pose a risk nonetheless due to their high potential for bacterial contamination and because they exhibit a moisture level and nutrient profile that support bacterial growth. Moreover, for each ton of chicken eggs, layer hens produce multiple tons of manure. Ammonia emissions from this waste is a health and safety concern on farms, and water pollution from waste used as fertilizer is a major contributor to biodiversity loss in streams and ocean dead zones across the United States.

Consumers may seek egg-free options in particular to avoid cholesterol and egg allergies and also to support a sustainable and animal-friendly product, brand, or company. However, while plant-based poultry products exhibit an excellent solution in terms of food safety, they do lag behind in terms of

versatility. For instance, consumers will often use animal proteins such as chicken in dozens of different ways, while plant-based products are often formulated for highly-specific applications, such as nuggets.<sup>52</sup> Plant-based products that are convenient to purchase, transport, store, prepare, cook, and seamlessly integrate into common recipes and cuisines are needed.

## IV. Plant-based Dairy Products

The plant-based milk category is the most developed plant-based category, worth \$2.6 billion. Plant-based milk alone accounts for 36 percent of the total plant-based food market in the world.<sup>53</sup> Plant-based milk can often be produced using equipment and a process similar to fruit juice production, creating an opportunity for plant-based companies to repurpose old or underperforming juice plants.<sup>54</sup>

Plant-based milk users in India claim that they will continue using both animal-derived and plant-based milk in the future. In fact, 90% of them (plant-based milk users) have also consumed animal-derived dairy milk in the past 12 months.<sup>55</sup> This clearly shows the potential for plant-based dairy to grow alongside animal-derived dairy consumption and not instead of it.

Consumers rate plant-based milks high on unique propositions like sustainability and for lactose intolerance while they rate animal-derived milk better on taste, price and versatility - proving both categories to be distinctly desirable.

In recent years, the plant-based food business in the US has experienced unprecedented growth, and in 2021, it is expected to generate retail sales of over \$7.4 billion USD.

### Below are some plant-based food industry trends to lookout for

#### 1. Clean label products will be a priority

For a majority of plant-based food innovators, the next step would not just be to create an alternative with the new technology and ingredients but to match nutritional profiles or ensure the ingredients are healthier, whole and minimally processed. As the novelty of plant-based alternatives wears off and people consider whether they are healthier options

— especially in this inflationary period, given that these alternatives can sometimes cost more than conventional products. The young Gen Z consumer is a conscious and smart consumer that reads the ingredient deck and wants to understand what is going into their body. They want food products that are both delicious and healthy.

#### 2. Plant-based seafood will be making waves in the year ahead.

In 2021, plant-based seafood was just 1% of all plant-based meat dollar sales, but demand is growing, highlighting the whitespace opportunity for these products. The number of plant-based seafood products sold in U.S. retail increased 25% in 2021.<sup>56</sup>

By 2031, the plant-based seafood market is expected to be worth \$1.3 billion.<sup>57</sup>

This expansion can be attributed to the influx of new companies focusing on perfect seafood alternatives, such as Good Catch, which was recently acquired by Wicked Kitchen to expand its product distribution

#### 3. Advancements and perfection of plant based Meats

Specialty products and diverse offerings will be introduced as more companies perfect their offerings. This will benefit the still-growing plant-based meat industry, which will benefit from a clear, compelling message and products that are priced competitively while tasting just as good as traditional meat. More culinary diversity in alternatives will take place. Alternatives will be introduced for traditional recipes of butter milk, keemas, butter chicken, tikkas, and specialty foods such as whole cut meats. According to Datassential's 2023 Food Trends, 40% of consumers plan to purchase plant-based meat products in 2023.

"Any new industry is dynamic in the initial years. Innovations that solve real problems are often permanent and can't be considered as a passing trend. plant-based meat is an innovation which is here to stay as more and more people realize the need for it. Will all plant-based meat companies make the cut? Perhaps not. As the initial hype around the innovation dies down, it will be a play of survival of the fittest. Companies with great products, quality taste, better texture, transparent ingredients, clear go to market strategy, competitive pricing will thrive. Mediocre products might not," says Palak Mehta, founder of Vegan First.

#### 4. More partnerships for plant based foods

As the category expands in India, more plant-based meat and milk companies will introduce their products only through B2B channels. This will be especially true for plant-based meats. In the past, this approach has proven to be effective in creating a vegan-curious audience for this new category of foods. This allows companies to reach a wider audience and generate interest among consumers who may be curious about these products but may not have tried them yet. By targeting food service providers, companies can also benefit from the expertise and resources of these businesses, who can help promote and market the products to their customers. Additionally, the B2B format can provide a steady revenue stream and help build brand recognition, which can be crucial for the success of a new product or category.

#### 5. More legacy brands will introduce plant-based choices

Many food companies are introducing new plant-based products that cater to these needs, offering a range of flavors and textures, and working to create plant-based products that are indulgent and satisfying. Additionally, the prediction that 42% of consumers think most people will be eating plant-based foods instead of meat in the next decade highlights the growing demand for these products and the potential for growth in this industry. 58 Food companies that are able to innovate and offer a variety of high-quality, tasty, and satisfying plant-based options are likely to be well positioned for success in this growing market.

Plant and non-plant options launching in tandem. "In the past, if we were launching a dairy and non-dairy variant of an ice cream, the team would create a separate campaign for each. Now it feels natural to launch them together," says Fatma. "The launch of Ben & Jerry's campaign for its new sundaes in Europe and the products launched in partnership with Tony Chocolonely used this approach. Increasingly, consumers expect to be offered dairy and non-dairy options as a given, so their focus is on what they have always loved and looked for in our ice creams – flavours, product experience and indulgence."

#### 6. Projected Growth of Domestic and Export Market

India's market for plant-based foods is expected to grow dramatically over the next ten years as a result of rising consumer interest in and access to these foods, product innovation, and hundreds of millions of dollars in domestic and foreign private sector investment. Some domestic brands, like GoodDot and Greenest, are already well-

known abroad. The latter has won praise for its kebabs, samosas, and keema there. Others, like the creators of plant-based eggs Evo Foods, are well-known on a global scale as a result of their ingenuity. For the time being, India's primary concerns may be domestic production and food security, but the country's entry into new markets could bring in some much-needed funding for the industry.

An analysis conducted by Deloitte and the Good Food Institute India forecasts the domestic and export markets for plant-based foods in India through 2030. The research provides a variety of scenarios based on various customer uptake assumptions. The research for the domestic market takes into account the categories of plant-based dairy, plant-based meat, and plant-based eggs. The largest industry, with an estimated value of \$623 million to \$1.4 billion (Rs 4827 to 10625 crore), will be plant-based dairy.<sup>59</sup>

The market for plant-based meat is anticipated to be worth between \$233 million and \$759 million (1803 crore to 5884 crore in Indian rupees). The market for plant-based eggs will be the lowest, with estimates ranging from \$68 million to \$183 million (about 527 crore to 1416 crore in Indian rupees). Although the plant-based meat market is anticipated to be higher than that of milk, the export market for India's plant-based sector is also anticipated to be considerable by 2030.

## 7. A surge in cellular agriculture will grow more curiosity about alternatives

According to the co-founder of Aleph Farms, cellular agriculture will experience a spike in M&A activity in 2023, although partnerships will still be the most popular type of business arrangement.<sup>57</sup> By the end of the decade, the market will be worth \$25 billion and will be priced similarly to meat from farms. Early-stage and mature businesses will want to grow quickly, and mergers and acquisitions (M&A) are a quick way to do it when mega funding rounds (\$100M+) are less realistic.<sup>60, 61</sup>

## 8. Rise of the budget conscious flexitarian

Food shoppers are more concerned with their budgets than ever before. They are looking for value, which means brands must be creative with their pricing. With the increase in demand for plant-based products, there has been a rise in competition, leading to more affordable options. Brands will find new ways to reduce production costs to make their products more accessible to a wider range of consumers.

## 9. A surge in demand for low-impact and climate friendly foods and packing

There is no denying the effects of climate change. Consumer demand for brands and products that are produced responsibly or that considerably reduce their carbon footprints by doing away with or lowering the need for packaging is predicted to thrive in 2023. Brands will need to prioritize sustainability and reduce their carbon footprint to appeal to the conscious consumer of today.

Overall, we can predict that global growth of the plant-based industry is going to be both accelerated and sustained because of the great innovation, soaring consumer demand, and expanding multi-stakeholder support. Consumer interest in plant-based diets will continue to increase due to several reasons such as health, environmental, and ethical reasons. As a result, more and more food companies will continue to invest in the development of plant-based alternatives to meat, dairy, and other animal-based products.

Additionally, advancements in food technology are making it possible to create plant-based products that closely resemble the taste, texture, and nutritional profile of animal-based foods. This is likely to drive further growth in the industry, as it will make plant-based products more accessible and appealing to a wider range of consumers.



In India, plant-based food items have a promising future, and the market will grow quickly.

## VEGAN PRODUCTS

### Dairy free

Butter Alternates

Cheese Alternates

Cheddar

Mozzarella

Dips Specialty

Combo cheese alternatives

Nutritional Yeast & Parmesan

DIY Cheese Alternatives

Cheesy Nuggets

Curd & Cultures

Ghee Alternates

Ice cream alternates

Mayonnaise

Curd & Cultures

Ghee Alternates

Ice cream alternates

Mayonnaise

Milk Alternates

Almond & Cashew Drink

Oat Drink



**Millet Drink**

**Soya Drink**

**Oat & Legumes Drink**

**Rice Drink**

**Milk Powder Alternates**

**Tea-Coffee-Premixes**

**Tempeh (Soy-based)**

**Chickpea Tempeh & More**

**Tofu & Paneer Alternates**

**Whitener & Creamer**

**Combo Deal (DF)**

## **Alternative meat**

**Item wise**

**Biryani**

**Burger Patty/Grilled Meat**

**Egg Alternatives**

**Fish Finger**

**Jackfruit Meat**

**Kebabs**

**Keema/Minced**

**Momo**

**Meatball**

**Nuggets**

**Raw Meats**

**Ready to Cook/Ready to Eat**

**Sausage-Hotdog**

**Samosa**

**Soya chaap**

**Tempeh**



**Combo deal (MM)**

**Veg Delights**

## **PROTIEN AND SUPPLEMENT**

**Protein**

**Protein Powder - Pea and Seeds**

**Protein Powder - Pea and Brown Rice**

**Protein Powder - Soy**

**Hemp Protein Powder**

**Protein Bites & High Protein Soups**

**Protein Drinks**

**Kids' Nutrition**

**Hemp**

**Hemp Protein**

**Hemp Hearts, Seeds & Flour**

**Hemp Butter**

**Hemp Oil**

**Energy Bars**

**Supplement**

**B Vitamins**

**Biotin**

**Calcium**

**Multivitamin**

**Omega 3**

**Vitamin C**

**Vitamin D**

**Zinc**

**Other Supplements.**

# CHOCOLAETS AND SWEETS

Cacao Nibs, Powder & Butter

Dark Chocolate - 45- 65 % Cocoa

Dark Chocolate - 65- 75 % Cocoa

Dark Chocolate - 75- 85 % Cocoa

Dark Chocolate - above 86 % Cocoa

Chocolate Desserts & Cake Mixes

Drinking Chocolate

Mylk Chocolate

Sweets

Sweets

Fudge

Easy DIY Desserts

Silver & Gold Leaves

Candies, Gums & Marshmallow

# GROCERY

## Baked Goods & Baking Essentials

Cakes

Breads

Cake & Pancake Mixes

Baking Essentials

Beverages

Apple Cider Vinegar

Tea

Coffee

Fermented Drinks

Kombucha Brewing Starter Kit (DIY)

Frappe & Milkshake Premix

Sparkling Water (Naturally Flavoured)

Soups

Latte

Fun drinks

Sherbats & Concentrates

Fruits based

Vegetable and Herbs based

Thandai

Dry Fruit & Frozen Items

Almond

Cashews

Dates

Frozen Berries & Freeze Dried Fruits

Frozen Edamame (Young Soybeans)

Walnut & Pistachio

Nut Mixes & Others

Babycorn

Seed

Pumpkin Seed

Sunflower Seeds

Chia Seeds

Watermelon Seeds

Flax Seeds

Trail Mixes & Assorted Packs

DIY

Oils

Sesame Oil

Coconut Oil

Groundnut Oil

Mustard Oil

Sunflower Oil

Moringa Oil

Almond Oil

  
Flaxseed Oil

Others Oils

Staples

Healthy Flours

Breakfast Must Haves

Grains

Sprouts & Dals

Sweetener

Hemp Butter & Dips

Chutneys & Podi

Salt & Spices

Batter & Mixes

Pickle & Vegetables in Brine

Natural Powders

Pasta

Pasta and Pizza Sauces

Sauce, Dressings & Dips

Soy Chunks, Soya flour & More

Nut Butter & Spreads

Almond Butter

Cashew Butter

Peanut Butter (Creamy)

Peanut Butter (Crunchy)

Coconut Butter

Combos, Walnut, Hazelnut & More

Nut Sauces

Spreads

Sprouted Nut Butters

Snacks

Cookies, Wafers, Biscuits & Rusks

Crisps, Chips, & More

Gluten Free Cookies, Fudge & More

  
Snack Bars

Instant Foods

## **PERSONAL CARE AND FASHION**

Bodycare

Soaps

Bodywash and Bath Salts

Body Scrub & Shaving Bar

Moisturizer, Body Butter and Cream

Therapeutic Oils

Face

Face Wash and Face Scrub

Sunscreen, Cleansers and Gels

Face Mask

Face Oils, Gels, Toners, Mists and Serum

Face Cream & Moisturizer

Lip Care

Facial Roller

Tooth & Tongue

Kits and Combos

Haircare

Shampoo & Shampoo Butter

Conditioner

Hair Oils, Serums, Mask and Gel

Hair and Beard Colour

Hygiene

Intimate Hygiene

Hand Wash and Hand Sanitizer

Tampons, Menstrual Cups, Period Pants and Panty Liners

Make up Essentials

Lipstick

Eye

  
Skin

Make up Eraser

Perfume

Leather-free

Footwear

Wallet

Bags

**HOME AND PET CARE**

Home & Cleaning

Bio-Enzyme Cleaners

Laundry

Floor Cleaner & More

Toilet & Bathroom Cleaner

Dish & Veggie wash

Towel Roll

Gadget Cleaner & Tap Cleaner

Garbage bags & Grocery Storage Bags

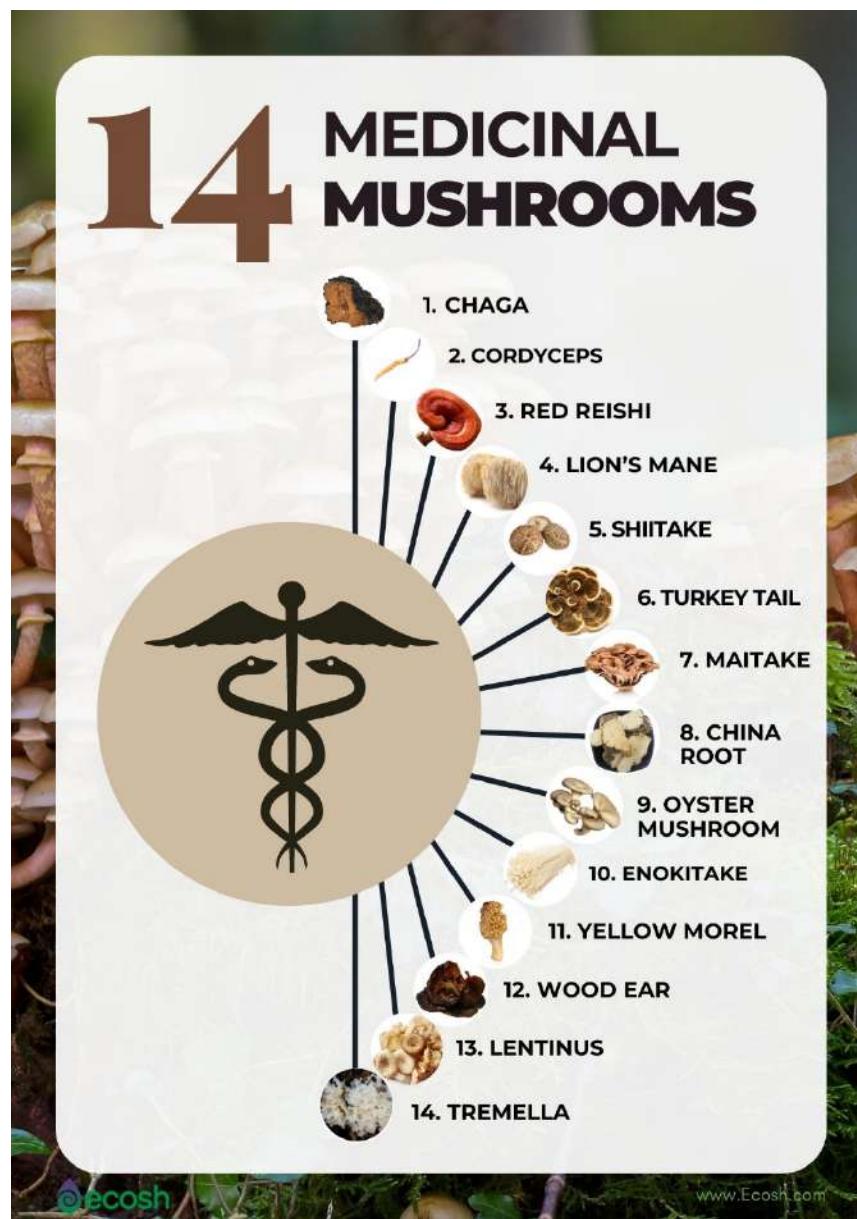
Good Random stuff

Stationery

Pet Care

**WE WILL PRODUCE MARKETING BOTH B2B AND B2C THESE PRODUCTS.**

MUSHROOMS



## The List of 14 Most Popular Medicinal Mushrooms

### 1. Chaga Mushroom May Help Fight Free Radicals, Cancer and Aging

The [Chaga mushroom](#) (*Inonotus Obliquus*), also called “Mushroom of Immortality” is the most nutritious wild mushroom that has been used in folk medicine to treat several disorders. Chaga is an exceptionally powerful [antioxidant](#) that delivers you an impressive dose of [antioxidants](#), SOD enzymes, essential amino acids, [minerals](#) and other vital substances. [Learn more.](#)

**Animal and test-tube studies have found that Chaga mushrooms may possess several health benefits. For instance, the mixture of these extraordinary substances may:**

1. Boost your immune system
2. Remove [free radicals](#) from your body and combat [oxidative stress](#) (oxidative stress is associated to aging)
3. Protect cells
4. Enhance resistance
5. Fight pathogens
6. Lessen inflammation
7. Lower [bad cholesterol](#) (LDL cholesterol)
8. Prevent long-term inflammation
9. Fight, prevent or slow the growth of cancer
10. Lower [blood sugar](#)
11. Have antitumor properties
12. Prolong cellular proliferation and extend lifespan, or in other words, Chaga may fight aging

### 2. Cordyceps To Stimulate Your Energy and Libido

[Cordyceps](#) (*Ophiocordyceps Sinensis* (formerly known as *Cordyceps Sinensis*)), also known as caterpillar fungus, is a powerful medicinal mushroom that has been acknowledged in Chinese medical books and Tibetan medicine for a long time. This plant is a rare combination of caterpillar and fungus.

**Some studies suggest, that different strains of Cordyceps, or some components inside this mushroom may have different beneficial effects on the human body, which include:**

- Boosting immune system
- Anti-tumor effect
- Boosting energy
- Stimulating libido
- Anti-metastatic property
- Antioxidant effect
- Anti-inflammatory
- Antimicrobial

- Hypolipidemic
- Hypoglycemic
- Anti-aging
- Neuroprotective
- Anti-stress
- Renoprotective effect
- Helps your body utilize oxygen more efficiently, stimulate blood flow, improve exercise and athletic performance, and speed up post-workout muscle recovery, which can be especially helpful for athletes or people who regularly work out ([7](#), [8](#), [9](#)).

Traditional healers and local people of Sikkim suggest [\*Cordyceps sinensis\*](#) for multiple health problems as a single drug or together with other herbs. For instance, these folk healers use it to cure as many as 21 different health conditions.

### 3. Red Reishi Calms Your Mind, Boosts Energy and Encourages Good Night Sleep

Red Reishi mushroom (*Ganoderma Lucidum*), also known as Lingzi, “10,000 Years Sponge”, “Queen of Plants”, “Immortal Sponge”, and “Life Elixir” has been known in China, Japan, and other Asian countries for its miraculous health-enhancing, stress relieving, and longevity promoting effects for thousands of years. It’s like nature’s Xanax.

In nature there are 6 types of Reishi, but Red Reishi mushroom (*Ganoderma lucidum*), is the most studied one and possesses the strongest medicinal effects. Due to its variety of potential health benefits and rich composition people use Reishi mushroom to:

- Boost the immune system
- Fight cancer cells
- Enhance many body functions
- The mood-boosting compounds in Reishi (triterpenes) have calming properties, so this mushroom may also lessen anxiety, relieve depression, calm the mind and reduce stress
- Triptanes in Reishi may also promote wound healing
- Sharpen focus
- Relieve cough and asthma
- Reduce insomnia and stimulate better sleep
- Lessen fatigue
- Improve the work of vital organs
- Strengthen and heal overall health
- Fight obesity
- In addition, to increase the so-called shen. In Chinese medicine shen is the connection of heart and mind – the channel of spirituality (1, 2, 3, 4, 5, 6).

Although Reishi mushrooms themselves can be consumed raw, it is also custom to use supplements, extracts or powdered forms of the mushroom that contain these particular healing molecules.



The fruiting bodies of the Reishi mushroom are a magnificent source of nutritionally important minerals, vitamins (mainly B-complex vitamins and vitamin D), antioxidants, amino acids, macronutrients, as well as protein (despite not being animal-based).

Despite the high mineral and vitamin content – the wide spectrum of prophylactic and therapeutic effects of Reishi mushroom is mainly due to the high content of polysaccharides, triterpenoids and germanium. It's because Reishi contains an enormous collection of bioactive polysaccharides, beta-glucans and more than 120 different triterpenoid compounds.

Some people use it also for Alzheimer disease, cancer, diabetes, and cold sores. In Japan, Reishi dry extract belongs in the official list of antitumor drugs. Although research is still ongoing and most evidence is based on animal studies, there is reason to believe that the beneficial effect of Reishi on humans is similar.

#### 4. Lion's Mane (*Hericium Erinaceus*)

Lion's mane is an edible mushroom native to Europe, North America, and Asia. Similarly to other medicinal mushrooms, Lion's mane contains antioxidants and boosts the immune system.

In addition, it promotes the production of the bioprotein nerve growth factor (NGF), and myelin (an insulation around nerve fibers), which are both absolutely vital to brain health.

#### 5. Shiitake

This edible mushroom is native to East Asia, and considered a medicinal mushroom in some traditional medicine. For instance, shiitake mushrooms:

May be good for your heart

Have been shown to lower LDL cholesterol

As well as maintain healthy blood pressure and circulation (13).

#### 6. Turkey Tail (*Trametes Versicolor*, also *Coriolus Versicolor* and *Polyporus Versicolor*)

Turkey tail is a common polypore mushroom that grows all over the world. In addition to high amounts of antioxidants that show anticancer properties (like most of the medicinal mushrooms on this list), turkey tail also contains polysaccharide-K (PSK).

Polysaccharide-K is an approved anticancer prescription drug in Japan. PSK also helps to stimulate your immune system. Therefore, turkey tails may:

Fight leukemia cells

Improve the survival rate of people with certain cancers

In addition, improve the immune system of those receiving chemotherapy

## 7. Oyster Mushroom (*Pleurotus Ostreatus*), also Oyster Fungus, or Hiratake

The oyster mushroom is a common edible mushroom that is related to the king oyster mushroom. People now grow this popular shroom commercially worldwide. Oyster mushrooms contain a high amount of antioxidants, fiber, vitamins, minerals, and other important nutrients. Some research suggests that oyster mushrooms may:

Reduce high blood pressure

Lower cholesterol levels

Lessen blood sugar

Improve cardiometabolic health

As well as possess immune-supportive benefits (18, 19, 20).

## 8. Hen-Of-The-Wood (*Grifola Frondosa*), also Maitake

Maitake is a soft-fleshed polypore mushroom that grows at the base of trees (particularly oaks), and is native to Europe, China, and North America. This mushroom may:

Improve artery functionality

Help lower LDL (bad) cholesterol levels

Better overall cardiovascular health, and therefore lower your risk for heart disease.

In addition, Maitake mushrooms may lower your blood sugar levels, support the immune system and help in targeting and destroying cancerous cells (21).

## 9. Enokitake (*Flammulina Velutipes*), also known as Enoki, and Velvet Shank

Enoki is an edible mushroom, and well known in Japanese cuisine. It grows wild in Western Europe, Eastern Asia, and much of North America. Enoki mushrooms are highly nutritious and rich in antioxidants. For instance, these mushrooms are said to:

Slow cancer cell growth

Support heart health

Improve brain function

As well as boost immunity (22).

## 10. China Root (*Wolfiporia Extensa*)

Ghina root is a wood-decay fungus with a large, long-lasting underground sclerotium that resembles a small coconut. This fungus is thought to possess various medicinal properties such as:

- Removing pus from wounds

- 
- Controlling swellings (anti-inflammatory)
  - Promoting urine (diuretic)
  - Removing gas (flatulence)
  - Clearing bowels
  - In addition, bringing down high body temperature (23).

## 11. Yellow Morel (*Morchella Esculenta*), also known as Morel, Guchi, Common Morel, True Morel, Morel Mushroom, Sponge Morel, etc.

Yellow morel is an edible mushroom that is much in demand. It may possess health benefits such as:

Antitumor activity

Antioxidant effects

Anti-inflammatory action

Immune stimulating activity

## 12. Auricularia Auricula-Judae, also known as Wood Ear or Black Wood Ear

*Auricularia auricula-judae* grows worldwide. It is an edible ear-like shape fungus that grows on wood (especially elder). This mushroom is claimed to be a significant source of both vitamin B5 and copper (contains also small amounts selenium and vitamin B2), and possess health benefits such as:

Anti-inflammatory effects

Antimicrobial effects

Anticoagulant action

Anti-cancer action

Anti-cholesterol properties

In addition, cardioprotective effects (25).

## 13. Lentinus

*Lentinus* is a genus of fungi in the family Polyporaceae. This widely distributed mushroom has many species that all grow in subtropical regions. *Lentinus edodes* is popular edible mushroom that is used for conditions such as:

- Cancer
- Fungal infection
- Depressed immune function (including AIDS)
- Environmental allergies

- 
- Frequent flu and colds
  - Bronchial inflammation
  - Heart disease
  - Hyperlipidemia (including high blood cholesterol)
  - Hypertension
  - Diabetes
  - In addition, infectious diseases (26).

#### 14. Tremella

Tremella is a genus of fungi that grows as a slimy, mucus-like film until it encounters its preferred hosts. Yes, all Tremella species are parasites of other fungi, and there are over 100 species of Tremella presently recognized worldwide. The most important tremella mushroom benefits are considered to be effects such as:

Anti-inflammatory

Anti-aging

Cholesterol lowering

Obesity combating

Cancer fighting

In addition, nerve protecting effects (27).

Due to the fact that medicinal mushrooms may help treat numerous health conditions and are usually safe, they can be great natural health boosters for those who believe in traditional treatment methods and herbal remedies. Though, before using, consult your healthcare provider for further information.

# PROJECT REPORT

Of



# **MUSHROOM CULTIVATION & PROCESSING**

## **PURPOSE OF THE DOCUMENT**

This particular pre-feasibility is regarding **Mushroom Cultivation & Processing**.

The objective of the pre-feasibility report is primarily to facilitate potential entrepreneurs in project identification for investment and in order to serve his objective; the document covers various aspects of the project concept development, start-up, marketing, finance and management.

[We can modify the project capacity and project cost as per your requirement. We can also prepare project report on any subject as per your requirement.]

### **PROJECT PROFILE ON 'MUSHROOM CULTIVATION & PROCESSING'**

#### **PRODUCT AND APPLICATIONS**

Mushroom is a nutritious vegetarian delicacy and has many varieties. It contains many vitamins and minerals but is low on sugar and fat. It can be grown in artificially created and controlled environment. It needs a temperature between 20 and 30 C and a relative humidity of 55 to 75%. It can be ideally grown in hilly areas or in artificially controlled sheds in plains. Fresh mushrooms can be readily sold in market or processed and dried. There are two main varieties of mushroom Button type or the oysters' variety. Oyster mushrooms are

easy to cultivate and process and do not require huge investment.

Mushroom is an exotic and nutritious source of vegetarian diet. It is a major horticulture product all over the world. It is also becoming popular in our country. Fresh mushroom has very limited shelf life, but processed and dried mushrooms properly packed can be stored over a long period. Under the present conditions and with know-how developed by CFTRI it is possible to cultivate in any part of the country. The technology is available with CFTRI. Compliance with PFA Act for such a unit is essential.

## **INDUSTRY PROFILE AND MARKET ASSESSMENT**

Mushroom is a vegetarian delicacy and a suitable substitute for meat and eggs. It is easily digestible. It is very popular in most of the developed countries and is being accepted in many developing countries. Market for mushroom is growing rapidly because of its rich nutritional value and special taste aroma, flavor etc. Many exotic preparations are made from them like soup, pickles, it can be cooked in traditional way as standard vegetable. It is also used as stuffing for various food preparations and for garnishing. Its consumption is basically confined to the urban region. It has a very short life after being harvested and are sold in fresh form. Their shelf life is enhanced by processing and properly packing in good quality polythene or proper canning. This can then be stored and transported for selling in far off markets. It is mainly consumed in hilly areas but as the nutritional awareness is increasing people from other regions are also taking it up. It is a very popular item in most of the star hotels and in urban households. Thus, there is a good market for the product in metropolitan cities and centre for tourists. The rural rich with changing lifestyle are also catching up with the urban tastes and eating habits. Processed and preserved mushrooms will ensure the availability throughout the year. It is a good substitute for standard vegetables and a good replacement for meat or eggs. The major limitation with the bulk of Green vegetables is that they are grown in a limited period only lasting for 3-4 months and thus their availability is restricted to this period. Properly preserved packed and canned mushrooms results in it being easier to handle. This also helps in exporting the product to other countries where ever Indian cuisine is popular. It has a good demand in urban areas and metropolitan cities. Once the product establishes its Brand, export opportunities can also be explored. Middle East countries and other western countries with Indian population are places where it has demand.

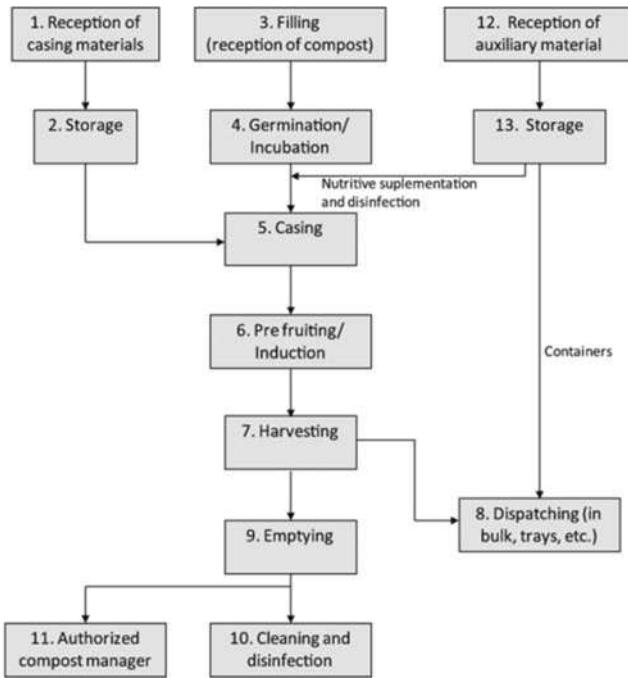
## **MANUFACTURING PROCESS & KNOW HOW PROCESS OF CULTIVATION**

Three aspects are to be taken care off for a successful cultivation of mushroom. These are good compost, reliable spawn and right temperature during growing period. Natural compost is prepared from horse dung and wheat or barley straw. Some quantity of chicken manure may be added. Compost preparation is very crucial. Mushrooms are grown in wooden trays or boxes. They are filled with compost and pressed firmly leaving a small space on top of the tray. The spawn is scattered on the surface which is covered with a thin layer of compost. The trays are then covered with old newspaper and water is sprayed to provide humidity. The trays are then stacked vertically. At a temperature 24 25 C white cottony mycelium spreads and permeate through the compost. It takes around 12 to 15 days for the complete spawn running. Ultimately the surface of the compost is covered with half to one inch level of casing soil. It is sterilized to kill insects. The casing soil is spread over plastic sheet and treated with formalin and stirred frequently for a week to remove formation of fumes. After casing the temperature has to be maintained at 24 25 C for three days after which it must be lowered to 18 C. Thus, batches of trays must be arranged in such a way that there is a regular daily production. The process chart is as follows:

## **MUSHROOM PROCESSING**

Fresh mushrooms have very limited life hence processing is recommended to enhance the shelf life. Initially mushrooms are washed in cold water then blanched in boiling water for 3 4 minutes. They are then dehydrated in drier and packed. It is advisable to pre treat mushroom in brine solution to prevent discoloration. Packing is very crucial as formation of moisture contaminates mushroom very quickly. The yield depends on many factors as moisture content in fresh mushroom, type of drier, process employed, moisture content requires in the finished product etc. Average yield is 25%. Plain cans and brine of 2% salt and 0.2% citric acid are used for packing. The cans are vacuumed before sealing at 19 C for 7 8 minutes, sealed and processed under pressure for 20 25 minutes. The process flow chart is as under:

**Fig. 1** Flow chart of the mushroom cultivation line



Know how is available with Central Government research Laboratories. The machinery is all indigenously available.

The production capacity envisaged is 90 tonnes per year. It is assumed that the proportion of fresh mushrooms will be twice that of canned mushrooms.

## LAND AND BUILDING

Land admeasuring to around 200 sq. mtrs. with built up area of 100 sq. mtrs. is adequate. (Land may cost Rs.10 lacs whereas cost of building could be Rs.12 lacs.) The cost of land and building is indicative For the sake of the project; it is presumed that the land and building is owned.

## PLANT & MACHINERY /CAPACITY

It is advisable to undertake thorough market survey before finalizing actual capacity.

Assuming capacity of 300 kgs. Per day, the annual capacity would be 90 tonnes considering 300 working days.

<b>Item</b>	<b>Qty.</b>	<b>Price (Rs.)</b>
Tray-type Dehydrator	1	1,50,000
Steam-jacketted Kettle	1	85,000
Can Steamer	1	40,000
Blanching Equipment's	1	55,000
Straight-line Exhaust Box with electric motor, gear box etc.	1	80,000
Canning Retort with attachment	1	65,000
Stacking Trays	200	1,20,000
Baby Boiler	1	80,000
Laboratory Equipments	--	75,000
<b>Total</b>		<b>7,50,000</b>

The total cost of machinery is estimated to be Rs.7.50 lac

### **RAW & PACKING MATERIALS REQUIRED AT 100%**

Materials like spawn, wheat or barley straw, formaline, insecticides etc. shall be required for cultivation whereas small quantity of salt and citric acid will be required for processing.

Packing materials like cans for processed mushrooms and plastic bags for fresh mushrooms and corrugated boxes, lables, box strappings etc. shall be required.

### **SELLING EXPENSES**

Selling prices are taken on lower side as it is envisaged that the promoters would directly cater to some bulk consumers like star hotels, restaurants, clubs, caterers etc. Retailing, to some extent, will be undertaken of canned mushrooms only. Hence, selling expenses are taken at 5% of total sales value.

## **TENTATIVE IMPLEMENTATION SCHEDULE**

<b>Activity</b>	<b>Period (in months)</b>
Application and sanction of loan	2
Site selection and commencement of civil work	1
Completion of civil work and placement of orders for machinery	2
Erection, installation and trial runs	1

## **QUALITY CONTROL AND STANDARDS**

The specifications of Fruit Products Order, 1955 and Prevention of Food Adulteration Act, 1954 certification are mandatory. The canned mushrooms should conform to the specifications laid down in F.P.O 1955.

The ISO 9000 2000, HACCP, ISO 14000 Series and European norms series standards promise a frame work which may guide the entrepreneurs towards fulfilment of a commitment of quality of products.

ISO series standards are available with the Bureau of Indian Standards from their headquarters office 9 Bahadurshah Zafar Marg, N. Delhi 2

## **LABELLING AND STORAGE**

The cooled cans are stored in a cool dry place and smeared with grease to remove any adhering moisture from the can body to avoid rusting. Cans are kept at ambient temperature for 8-10 days to check any swell, leakage, puffing and other disorders before labelling.

Before the cans are exposed for sale, proper labelling is done to meet statutory requirements of fruit products order, 1955 Prevention of Food Adulteration Act, 1954 and packed commodities (Regulation) Act 1975.



## BASIS AND PRESUMPTIONS

- 1 – This project is based on single shift and 300 working days in a year.
- 2 – To run the unit viably throughout the year, the other fruits and vegetables can be canned with the same machinery and equipment's whenever mushroom is not available.
- 3 – The yield of canned mushroom has been considered as 60% based on fresh mushroom. The drain weight of canned mushroom has been taken as 440 gms. In each A-2-1/2 can.
- 4 – The cost of machinery and equipment's/materials indicated refers to a particular make and the prices are approximate to those prevailing at the time of preparation of this profile.
- 5 – The cost of packaging forwarding, tax, etc. is taken @ 10% of the cost of machinery and equipment's.
- 6 – Depreciation has been taken on Plant and machinery @ 15%.
- 7 – Interest on total capital investment has been taken @ 11.5% per annum.
- 8 – Minimum 10% of the total investment is required as margin money.
- 9 – Payback period of the project will be 5 years with yearly instalments.
- 10 – Break-even point has been calculated on the Average capacity utilization.
- 11 – For smooth functioning of the unit, it is suggested that unit should have own arrangements for cultivation of mushroom for consistency and regular availability of quality raw materials.
- 12 – Mushroom cuttings/stems can be utilized for preparation of mushroom pickles and sold in local markets to get additional profit.

## PROJECT AT A GLANCE

- 1 Name of the Entrepreneur : XXXXXXXX
- 2 Constitution (legal Status) : XXXXXXXX
- 3 Father's/Spouse's Name : XXXXXXXX
- 4 Unit Address : XXXXXXXX  
Taluk/Block:District : XXXXX  
Pin: XXXXX State:  
E-Mail : XXXXX  
Mobile : XXXXX
- 5 Product and By Product : **Mushroom Cultivation and Processing**
- 6 Name of the project / business activity propose **Mushroom Cultivation and Processing**
- 7 Cost of Project : Rs25lac
- 8 Means of Finance  
 Term Loan : Rs.12.77 Lacs  
 KVIC Margin MoneyOwn : - As per Project Eligibility  
 Capital Working Capital : Rs.2 Lacs  
 Rs.5.22 Lacs
- 9 Debt Service Coverage Ratio : 3.95
- 10 Pay Back Period : 5 Years
- 11 Project Implementation Period : 6 Months
- 12 Break Even Point : 30%
- 13 Employment : 11 Persons
- 14 Power Requirement : 5.00 HP
- 15 Major Raw materials : **Spawn**
- 16 Estimated Annual Sales Turnover : 76.95 Lacs
- 16 Detailed Cost of Project & Means of Finance

### COST OF PROJECT

(Rs. In Lacs)	
Particulars	Amount
Land	Rented/Owned
Building & Civil Work (2000 Sq Ft)	5.00
Plant & Machinery	8.00
Furniture & Fixtures	0.69
Pre-operative Expenses	0.50
Working Capital Requirement	5.81
Total	<b>20.00</b>

### MEANS OF FINANCE

Particulars	Amount
Own Contribution @10%	2.00
Term Loan	12.77
Working Capital Finance	5.22
Total	<b>20.00</b>

Beneficiary's Margin Money (% of Project Cost)	<b>General</b>	<b>Special</b>
	10%	5%

**PLANT & MACHINERY**

PARTICULARS	QTY.	RATE	AMOUNT IN RS.
Tray-type Dehydrator	1	150,000	150,000
Steam-jacketted Kettle	1	85,000	85,000
Can Steamer	1	40,000	40,000
Blanching Equipments	1	55,000	55,000
Straight-line Exhaust Box with electric motor, gear box etc	1	80,000	80,000
Canning Retort with attachment	1	65,000	65,000
Stacking Trays	200	120,000	120,000
Baby Boiler	1	80,000	80,000
Laboratory Equipments	--	75,000	75,000
Misc. Toolsstorage racks, SS utensils, plastic tubs	1	50000	50000
<b>Total</b>			<b>800,000.00</b>

<u>PROJECTED BALANCE SHEET</u>					
PARTICULARS	1ST YEAR	2ND YEAR	3RD YEAR	4TH YEAR	5TH YEAR
<b>SOURCES OF FUND</b>					
Capital Account	2.00	2.00	2.00	2.00	2.00
Retained Profit	8.90	19.09	30.70	44.74	61.09
Term Loan	12.77	9.58	6.39	3.19	0.50
Cash Credit	5.22	5.22	5.22	5.22	5.22
Sundry Creditors	2.69	3.14	3.59	4.04	4.49
Provisions & Other Liab	0.36	0.40	0.44	0.48	0.53
<b>TOTAL :</b>	<b>31.95</b>	<b>39.43</b>	<b>48.34</b>	<b>59.68</b>	<b>73.83</b>
<b>APPLICATION OF FUND</b>					
<b>Fixed Assets (Gross)</b>	13.69	13.69	13.69	13.69	13.69
Gross Dep.	1.73	3.27	4.60	5.76	6.76
Net Fixed Assets	11.96	10.42	9.09	7.93	6.93
<b>Current Assets</b>					
Sundry Debtors	2.57	3.13	3.58	4.03	4.48
Stock in Hand	5.93	6.92	7.91	8.90	9.89
Cash and Bank	8.99	16.21	24.73	35.49	48.87
Deposits & Advances	2.50	2.75	3.03	3.33	3.66
<b>TOTAL :</b>	<b>31.95</b>	<b>39.43</b>	<b>48.34</b>	<b>59.68</b>	<b>73.83</b>

**PROJECTED PROFITABILITY STATEMENT**

PARTICULARS	1ST YEAR	2ND YEAR	3RD YEAR	4TH YEAR	5TH YEAR
<b>A) SALES</b>					
Gross Sale	76.95	93.83	107.33	120.83	134.33
<b>Total (A)</b>	<b>76.95</b>	<b>93.83</b>	<b>107.33</b>	<b>120.83</b>	<b>134.33</b>
<b>B) COST OF SALES</b>					
Raw Material Consumed	53.87	62.84	71.82	80.80	89.78
Electricity Expenses	0.43	0.50	0.57	0.64	0.72
Repair & Maintenance	-	0.94	1.07	1.21	1.34
Labour & Wages	5.28	5.81	6.39	7.03	7.73
Depreciation	1.73	1.54	1.33	1.15	1.00
Consumables and Other Expense	1.54	1.88	2.15	2.42	2.69
<b>Cost of Production</b>	<b>62.85</b>	<b>73.50</b>	<b>83.33</b>	<b>93.25</b>	<b>103.25</b>
<b>Add: Opening Stock /WIP</b>	-	3.24	3.78	4.32	4.86
<b>Less: Closing Stock /WIP</b>	3.24	3.78	4.32	4.86	5.40
Cost of Sales (B)	59.61	72.96	82.79	92.71	102.71
<b>C) GROSS PROFIT (A-B)</b>	<b>17.34</b>	<b>20.86</b>	<b>24.53</b>	<b>28.12</b>	<b>31.61</b>
	<b>23%</b>	<b>22%</b>	<b>23%</b>	<b>23%</b>	<b>24%</b>
D) Bank Interest (Term Loan )	1.10	1.33	0.96	0.60	0.24
Bank Interest ( C.C. Limit )	0.52	0.52	0.52	0.52	0.52
E) Salary to Staff	5.28	5.81	6.39	7.03	7.73
F) Selling & Adm Expenses Exp.	1.54	1.88	2.15	2.42	2.69
<b>TOTAL (D+E)</b>	<b>8.44</b>	<b>9.54</b>	<b>10.02</b>	<b>10.56</b>	<b>11.18</b>
<b>H) NET PROFIT</b>	8.90	11.32	14.51	17.55	20.44
I) Taxation	-	1.13	2.90	3.51	4.09
<b>J) PROFIT (After Tax)</b>	8.90	10.19	11.61	14.04	16.35

<u>PROJECTED CASH FLOW STATEMENT</u>						
<u>PARTICULARS</u>	<u>1ST YEAR</u>	<u>2ND YEAR</u>	<u>3RD YEAR</u>	<u>4TH YEAR</u>	<u>5TH YEAR</u>	<u>6TH YEAR</u>
<b><u>SOURCES OF FUND</u></b>						
Share Capital	2.00	-				
Reserve & Surplus	8.90	11.32	14.51	17.55	20.44	
Depreciation & Exp. W/off	1.73	1.54	1.33	1.15	1.00	
Increase in Cash Credit	5.22	-	-	-	-	
Increase In Term Loan	12.77	-	-	-	-	
Increase in Creditors	2.69	0.45	0.45	0.45	0.45	
Increase in Provisions	0.36	0.04	0.04	0.04	0.05	
<b>TOTAL :</b>	<b>33.68</b>	<b>13.35</b>	<b>16.33</b>	<b>19.20</b>	<b>21.93</b>	
<b><u>APPLICATION OF FUND</u></b>						
Increase in Fixed Assets	13.69	-	-	-	-	
Increase in Stock	5.93	0.99	0.99	0.99	0.99	
Increase in Debtors	2.57	0.56	0.45	0.45	0.45	
Increase in Deposits & Adv	2.50	0.25	0.28	0.30	0.33	
Repayment of Term Loan	-	3.19	3.19	3.19	2.70	
Taxation	-	1.13	2.90	3.51	4.09	
<b>TOTAL :</b>	<b>24.69</b>	<b>6.13</b>	<b>7.81</b>	<b>8.44</b>	<b>8.56</b>	
Opening Cash & Bank Balance	-	8.99	16.21	24.73	35.49	
Add : Surplus	8.99	7.22	8.52	10.76	13.38	
<b>Closing Cash &amp; Bank Balance</b>	<b>8.99</b>	<b>16.21</b>	<b>24.73</b>	<b>35.49</b>	<b>48.87</b>	

**COMPUTATION OF MANUFACTURING OF MUSHROOM**

**Items to be Manufactured**

**Mushroom**

Manufacturing Capacity per day	-	0.30	MT
	-		
No. of Working Hour		8	
No of Working Days per month		25	
No. of Working Day per annum		300	
Total Production per Annum		90.00	MT
Year	Capacity		MT
	Utilisation		
IST YEAR		60%	54
IIND YEAR		70%	63
IIIRD YEAR		80%	72
IVTH YEAR		90%	81
VTH YEAR		100%	90

**COMPUTATION OF RAW MATERIAL**

Item Name	Quantity of Raw Material	Recovery	Unit Rate of / MT	Total Cost Per Annum (100%)
	MT			
Raw Material Average rates	100%	90.00	95%	100,000.00
Spawn				
Wheat/Barley Straw				
Formaline				
Insecticides	Total (Rounded off in lacs)			89.78
Cans				
Plastic Bags, Cartons, Lables, Box-strapping, etc.	( In Lacs)			89.78

Raw Material Consumed	Capacity	Amount (Rs.)
	Utilisation	
IST YEAR	60%	53.87
IIND YEAR	70%	62.84
IIIRD YEAR	80%	71.82
IVTH YEAR	90%	80.80
VTH YEAR	100%	89.78

**COMPUTATION OF CLOSING STOCK & WORKING CAPITAL**

PARTICULARS	1ST YEAR	2ND YEAR	3RD YEAR	4TH YEAR	5TH YEAR
<b>Finished Goods</b>					
(15 Days requirement)	3.24	3.78	4.32	4.86	5.40
<b>Raw Material</b>					
(15 Days requirement)	2.69	3.14	3.59	4.04	4.49
<b>Closing Stock</b>	<b>5.93</b>	<b>6.92</b>	<b>7.91</b>	<b>8.90</b>	<b>9.89</b>

**COMPUTATION OF WORKING CAPITAL REQUIREMENT**

Particulars			Total
			Amount
Stock in Hand			5.93
Sundry Debtors			2.57
		Total	8.50
Sundry Creditors			2.69
Working Capital Requirement			<b>5.81</b>
Margin			0.58
Working Capital Finance			<b>5.22</b>

<b><u>BREAK UP OF LABOUR</u></b>				
Particulars	Wages Per Month	No of Employees	Total Salary	
Skilled Worker	8,000.00	2	16,000.00	
Unskilled Worker	6,000.00	2	12,000.00	
Helpers	4,000.00	3	12,000.00	
			40,000.00	
Add: 10% Fringe Benefit			4,000.00	
Total Labour Cost Per Month			44,000.00	
Total Labour Cost for the year ( In Rs. Lakhs)		7	5.28	
 <b><u>BREAK UP OF SALARY</u></b>				
Particulars	Salary Per Month	No of Employees	Total Salary	
Manager	12,000.00	1	12,000.00	
Accountant	8,000.00	1	8,000.00	
Sales Agent	10,000.00	2	20,000.00	
Total Salary Per Month			40,000.00	
Add: 10% Fringe Benefit			4,000.00	
Total Salary for the month			44,000.00	
Total Salary for the year ( In Rs. Lakhs)		4	5.28	

**COMPUTATION OF DEPRECIATION**

Description	Land	Building/shed	Plant & Machinery	Furniture	<b>TOTAL</b>
Rate of Depreciation		<b>10.00%</b>	<b>15.00%</b>	<b>10.00%</b>	
<b>Opening Balance</b>	Leased	-	-	-	-
Addition	-	5.00	8.00	0.69	13.69
	-	5.00	8.00	0.69	13.69
Less : Depreciation	-	0.50	1.20	0.03	1.73
WDV at end of Ist year	-	4.50	6.80	0.66	11.96
Additions During The Year	-	-	-	-	-
	-	4.50	6.80	0.66	11.96
Less : Depreciation	-	0.45	1.02	0.07	1.54
WDV at end of IInd Year	-	4.05	5.78	0.59	10.42
Additions During The Year	-	-	-	-	-
	-	4.05	5.78	0.59	10.42
Less : Depreciation	-	0.41	0.87	0.06	1.33
WDV at end of IIInd year	-	3.65	4.91	0.53	9.09
Additions During The Year	-	-	-	-	-
	-	3.65	4.91	0.53	9.09
Less : Depreciation	-	0.36	0.74	0.05	1.15
WDV at end of IV year	-	3.28	4.18	0.48	7.93
Additions During The Year	-	-	-	-	-
	-	3.28	4.18	0.48	7.93
Less : Depreciation	-	0.33	0.63	0.05	1.00
WDV at end of Vth year	-	2.95	3.55	0.43	6.93



<b>PARTICULARS</b>	<b>1ST YEAR</b>	<b>2ND YEAR</b>	<b>3RD YEAR</b>	<b>4TH YEAR</b>	<b>5TH YEAR</b>
<b>CASH ACCRUALS</b>	10.63	11.73	12.94	15.20	17.35
Interest on Term Loan	1.10	1.33	0.96	0.60	0.24
Total	11.73	13.06	13.90	15.79	17.59
<b>REPAYMENT</b>					
Instalment of Term Loan	3.19	3.19	3.19	2.70	2.70
Interest on Term Loan	1.10	1.33	0.96	0.60	0.24
Total	4.29	4.52	4.16	3.29	2.93
<b>DEBT SERVICE COVERAGE R</b>	<b>2.73</b>	<b>2.89</b>	<b>3.34</b>	<b>4.80</b>	<b>6.00</b>
<b>AVERAGE D.S.C.R.</b>			<b>3.95</b>		

COMPUTATION OF SALE					
Particulars	1ST YEAR	2ND YEAR	3RD YEAR	4TH YEAR	5TH YEAR
Op Stock	-	3	3	4	4
Production	54	63	72	81	90
	54	66	75	85	94
Less : Closing Stock	3	3	4	4	5
Net Sale	51	63	72	81	90
Sale Price per MT	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00
<b>Sale (in Lacs)</b>	<b>76.95</b>	<b>93.83</b>	<b>107.33</b>	<b>120.83</b>	<b>134.33</b>
(Avarage rates for canned and fresh mushroom)					

**COMPUTATION OF ELECTRICITY**

<b>(A) POWER CONNECTION</b>			
Total Working Hour per day	Hours	8	
Electric Load Required	HP	5	
Load Factor		0.7460	
Electricity Charges	per unit	8.00	
Total Working Days		300	
<b>Electricity Charges (8 Hrs Per day)</b>			71,616.00
Add : Minimim Charges (@ 10%)			
<b>(B) D.G. SET</b>			
No. of Working Days		300	days
No of Working Hours		1	Hour per day
Total no of Hour		300	
Diesel Consumption per Hour		-	
Total Consumption of Diesel		-	
Cost of Diesel		65.00	Rs. /Ltr
Total cost of Diesel		-	
Add : Lube Cost @15%		-	
Total		-	
Total cost of Power & Fuel at 100%			0.72
Year	Capacity	Amount (in Lacs)	
IST YEAR	60%		0.43
IIND YEAR	70%		0.50
IIIRD YEAR	80%		0.57
IVTH YEAR	90%		0.64
VTH YEAR	100%		0.72

## BREAK EVEN POINT ANALYSIS

Year	I	II	III	IV	V
<b>Net Sales &amp; Other Income</b>	76.95	93.83	107.33	120.83	134.33
Less : Op. WIP Goods	-	3.24	3.78	4.32	4.86
Add : Cl. WIP Goods	3.24	3.78	4.32	4.86	5.40
<b>Total Sales</b>	<b>80.19</b>	<b>94.37</b>	<b>107.87</b>	<b>121.37</b>	<b>134.87</b>
<b>Variable &amp; Semi Variable Exp.</b>					
Raw Material & Tax	53.87	62.84	71.82	80.80	89.78
Electricity Exp/Coal Consumption at 85%	0.37	0.43	0.49	0.55	0.61
Manufacturing Expenses 80%	1.23	2.25	2.58	2.90	3.22
Wages & Salary at 60%	6.34	6.97	7.67	8.43	9.28
Selling & administrative Expenses 80%	1.23	1.50	1.72	1.93	2.15
Intt. On Working Capital Loan	0.52	0.52	0.52	0.52	0.52
<b>Total Variable &amp; Semi Variable Exp</b>	<b>63.55</b>	<b>74.51</b>	<b>84.79</b>	<b>95.13</b>	<b>105.56</b>
<b>Contribution</b>	<b>16.64</b>	<b>19.85</b>	<b>23.08</b>	<b>26.23</b>	<b>29.31</b>
<b>Fixed &amp; Semi Fixed Expenses</b>					
Manufacturing Expenses 20%	0.31	0.56	0.64	0.72	0.81
Electricity Exp/Coal Consumption at 15%	0.06	0.08	0.09	0.10	0.11
Wages & Salary at 40%	4.22	4.65	5.11	5.62	6.18
Interest on Term Loan	1.10	1.33	0.96	0.60	0.24
Depreciation	1.73	1.54	1.33	1.15	1.00
Selling & administrative Expenses 20%	0.31	0.38	0.43	0.48	0.54
<b>Total Fixed Expenses</b>	<b>7.74</b>	<b>8.53</b>	<b>8.57</b>	<b>8.68</b>	<b>8.87</b>
<b>Capacity Utilization</b>	<b>60%</b>	<b>70%</b>	<b>80%</b>	<b>90%</b>	<b>100%</b>
<b>OPERATING PROFIT</b>	<b>8.90</b>	<b>11.32</b>	<b>14.51</b>	<b>17.55</b>	<b>20.44</b>
<b>BREAK EVEN POINT</b>	<b>28%</b>	<b>30%</b>	<b>30%</b>	<b>30%</b>	<b>30%</b>
<b>BREAK EVEN SALES</b>	<b>37.30</b>	<b>40.53</b>	<b>40.04</b>	<b>40.15</b>	<b>40.83</b>

## **Model Project for Naturally Ventilated Polyhouse (NVPH)**

**- Unit size = 1000 sq.mt.**

The details of estimated cost, means of finance, economics and financial viability is worked out for Naturally Ventilated Polyhouse as follows. Cucumber, Cowpea and Tomato have been taken as examples while preparing the model costs.

A. Estimated Unit Cost and Means of Finance

(Amount in `.)

Sr. No.	Items	Rate (`.)	Unit	Estimated Cost	Subsidy (%)	Subsidy Amount	<b>Beneficiaries'</b> Contribution	Bank Loan
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)=15% of (e)	(i)=(e)-(g+h)
1	Polyhouse and miscellaneous	1045	per sq.m	1045000	Max Amount	325000	156750	563250
2	Micro irrigation system (Drip)	150	per sq.m	150000	60%	90000	22500	37500
3	Planting Material cost	Actuals		20000		0	3000	17000
4	Land Preparation	as per table A		49500	0	0	7425	42075
5	Recurring Expenses - excluding cost of planting material (for the 1st	As per Table B		86855	0	0	13028	73826



	year)									
	Total			1351355		415000	202703		733651	

B. Economics (Year wise Income & Expenditure)

(Amount in `.)

Sr No.	<b>Item/ Year →</b>	1	2	3	4	5	6	7	8	9	10
1	Income from sale of produce (as per Table C)	40253 5									
2	Recurring cost (Table B)	10685 5	10446 5	10231 4	10037 8	98635	97067	95656	94386	93243	92214
3	Gross profit (1-2)	29568 0	29807 0	30022 1	30215 7	30390 0	30546 8	30687 9	30814 9	30929 2	31032 1
	Loan Repayment										
4	Principal	0	81517	81517	81517	81517	81517	81517	81517	81517	81517
5	Interest @ 14% p.a.	10271 1	10271 1	91299	79886	68474	57062	45649	34237	22825	11412
6	Total Loan Repayments (4+5)	10271	18422	17281	16140	14999	13857	12716	11575	10434	92929



		1	8	6	3	1	9	6	4	2	
7	Income after repayment of Principal & Interest (3-6)	19296 9	11384 2	12740 5	14075 4	15390 9	16688 9	17971 3	19239 5	20495 0	21739 2
8	Less Depreciation @10% on depreciated value of fixed assets	11950 0	10755 0	96795	87116	78404	70564	63507	57156	51441	46297
9	Profit after Depreciation (7-8)	73469	6292	30610	53638	75505	96325	11620 6	13523 9	15350 9	17109 5

### C. NPW, BC Ratio, IRR and DSCR – As per Table D

(Amount in `.)

i	NPW @ 15 %	228980.20
ii	BC ratio	1.13
iii	IRR	22%
iv	DSCR	1.8

### D. Assumptions

a	Rates for the items viz. Polyhouse, Micro irrigation system (drip) and land preparation are taken from Field level surveys and kept at conservative levels.	
b	Recurring Cost	Assumptions are given in Table B
c	Production	Taken from field surveys and kept at conservative levels
d	Sale Price per Kg	Taken from field surveys and kept at conservative levels
e	Term Loan repayment Period	10 Years (including grace period of 1 year)
f	Interest on Term Loan	14% p.a.
g	Depreciation on fixed assets	@ 10% p.a. on reducing balance
h	Insurance premium for structure	@ 2% of depreciated value of structure (may vary from insurance company to company)

Capital  
Investment

(Amount in `.)

SrNo	Details/Investments		Unit Rate (`)
1	Poly House with Irrigation facility		
1.1	Land Development	Nos	60000
1.2	Preliminary Civil works - Foundation	Nos	50000
1.3	Poly House Construction Cost of Pipes, Plastic sheets and nets)	Nos	750000
	1 Sheet(Ginger Yellow/White diffused 200 Micron)		160000
	2 Shade net 50%		11000
	3 3/4 Self Screw		2000
	4 Aluminium profile		10000
	5 Coated Spring(Zig Zag)		10000
	6 Insect Net 40 mesh		10000
	7 Pipes		380000
	8 Grouting		
	Gutter Sheet		9000
	Nut and Bolts		8000
	Labour(` 150/Sqm)		150000
	Total		750000
1.4	Water Supply Arrangements	Nos	65000
1.5	Irrigation and Fertigation System		85000



1.6	Digital Weighing Balance	Nos	20000
1.7	Fencing	Nos	40000
1.8	Store Room	Nos	35000
1.9	Creeper net and Trailing rope	Nos	30000
1.10	Miscellaneous / Contingency @ 5%	Nos	60000
	Sub Total 1		1195000

## Variable and Recurring Costs

*Table A - Land Preparation Cost*

(Amount in `.)

Sr. No	Particular	Cucumber	Cowpea	Tomato	Amount
1	Compost / Neem cake / Rice Husk	4000	5000	6000	15000
2	Chemical Fertilizer / Micro Nutrients	8000	7000	7000	22000
3	Fumigation /Bed preparation cost	10000	2500	0	12500
	Total	22000	14500	13000	49500

*Table B - Break Up of Recurring Cost*

(Amount in `.)

Sr. No.	<b>Item/ Year →</b>	Cucumber	Cowpea	Tomato	From Year 1 to 10
1	Planting Material cost	13500	2000	4500	20000
2	Fertigation cost (Table B-I)	8364	5768	10815	24947
3	Spraying cost (Table B-II)	1339	824	1545	3708
4	Packaging cost (Table B-III)	0	0	1000	1000
5	Transportation cost (Table B-IV)	2500	1000	1000	4500
6	Electricity cost	2100	2100	2100	6300

7	Labour cost (Table B-V)	7500	7500	7500	22500
8	Insurance @ 2 % on depreciated value of Polyhouse & Micro Irrigation System *				23900
	Total recurring cost	35303	19192	28460	106855

**Table B I –**

Fertiliser Costs

(Amount in `.)

Sr. No	Particular	Cucumber	Cowpea	Tomato	Amount/Quantity
1	Fertiliser dose (Kg)	58	40	75	
2	Avg. rate of fert. `/kg	140	140	140	
3	Fertigation cost	8120	5600	10500	24220
4	Contingency @ 3% of Fertigation cost	244	168	315	727
	Total Fertigation cost	8364	5768	10815	24947

**Table B II a –**

Micronutrient Costs

(Amount in `.)

Sr. No	Particular	Cucumber	Cowpea	Tomato	Amount/Quantity



1	Micronutrient Dose	3	2	3	
2	Avg. Rate of micronutrient	300	300	300	
3	Spraying cost	900	600	900	2400
4	Contingency @ 3% of spraying cost	27	18	27	72
	Total Spraying cost	927	618	927	2472

**Table B II b –**

Fungicide Costs

(Amount in `.)

Sr. No	Particular	Cucumber	Cowpea	Tomato	Amount/Quantity
1	Fungicide Dose	4	2	6	
2	Avg. Rate of Fungicide	100	100	100	
3	Spraying cost	400	200	600	1200
4	Contingency @ 3% of spraying cost	12	6	18	36
	Total Spraying cost ( `.)	412	206	618	1236

**Table B III –**

Packaging Costs

(Amount in `.)

Sr. No	Particular	Cucumber	Cowpea	Tomato	Amount/Quantity
1	No. of crates			5	5
2	Price per crate			200	200
	Total Cost for crates			1000	1000

**Table B IV –**

Transportation Costs

(Amount in `.)

Sr. No	Particular	Cucumb er	Cowpea	Tomato	Amount/Qua ntity
1	Transport charges	2500	1000	1000	4500

Table B V - Labour

Costs \*

(Amount in `.)

Sr. No	Particular	Cucumb er	Cowpea	Tomato	Amount/Qua ntity
1	Total man-days	25	25	25	75
2	Avg. salary/day/head	300	300	300	300
3	Total wages	7500	7500	7500	22500

\* Insurance premium may vary from insurance company to company

---

\*\* Labour cost calculated only for spraying and Fertigation. Family labour assumed for day to day activities

**Table C – Production and**

*Income*

(Amount in `.)

Sr. No	Particular	Cucumbe r	Cowpe a	Tomat o	Amount/Quant ity
1	Plant Population	2300	2200	2500	
2	Total Production in Kg	5500	850	4500	
3	Less: Loss of produce	110	17	90	



	(2%)					
4	Produce available for sale (kg)	5390	833	4410		
5	Rate Per Kg	35	45	40		
6	Income from sale of produce	188650	37485	176400	402535	

Table D - NPW, Benefit Cost Ratio, Internal Rate of  
Return and DSCR

(Amount in `.)

Sr No.	Item/ Year →	1	2	3	4	5	6	7	8	9	10
1	Capital Cost	119500 0									
2	Recurring Cost including land preparation cost	156355 5	15396 4	15181 8	14987 5	14813 7	14656 6	14515 6	14388 3	14274 4	14171
3	Total cost (1+2)	135135 5	15396 5	15181 4	14987 8	14813 5	14656 7	14515 6	14388 6	14274 3	14171 4
4	Total Income from Sale of produce	402535 5	40253 5								
5	Net benefit (4-3)	- 9488200	24857 1	25072 7	25265 0	25440 8	25596 9	25737 9	25864 9	25979 2	26082 1
	FRR	22.37%									
	NPW at 15% DF (` lakhs)	228980									
	NPW Cost at 15% DF (` lakhs)	179125 0									



NPW Benefit at 15% DF (' Lakhs)	202023
BCR	1.13

6 DSCR Calculation											
I	Profit Before Interest and Tax	176180	19052	20342	21504	22549	23490	24337	25099	25785	26402
II	Total repayments towards Principal and Interest on Term Loan	102711	18422	17281	16140	14999	13857	12716	11575	10434	92929
III	DSCR (I/II)	1.72	1.03	1.18	1.33	1.50	1.70	1.91	2.17	2.47	2.84
	Average DSCR	1.80									

Table E - Repayment Schedule

Repayment period = 10 years

Annual repayment instalment of Principal @ ` 81,517/-

Years	Bank Loan o/s at the beginning of the year (a)	Repayment of Principal (b)	Bank Loan o/s at the end of the year (c) = (a-b)	Payment of Interest @ 14% (d)	Total Outgo (e) = (b+d)	Surplus Available for repayment (f)	Surplus available after repayment (g) = (e-f)
1	733651	0	733651	102711	102711	295680	192969
2	733651	81517	652134	102711	184228	298070	113842
3	652134	81517	570617	91299	172816	300221	127405
4	570617	81517	489100	79886	161403	302157	140754
5	489100	81517	407583	68474	149991	303900	153909
6	407583	81517	326066	57062	138579	303900	165321
7	326066	81517	244549	45649	127166	305468	178302
8	244549	81517	163032	34237	115754	305468	189714



9	163032	81517	81515	22825	104342	305468	201126
10	81515	81515	0	11412	92927	305468	212541

# **PROJECT REPORT ON PLANT TISSUE CULTURE**

## **PART A: PRIMER ON PLANT TISSUE CULTURE**

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## **PART A: PRIMER ON PLANT TISSUE CULTURE**

## **1. Introduction**

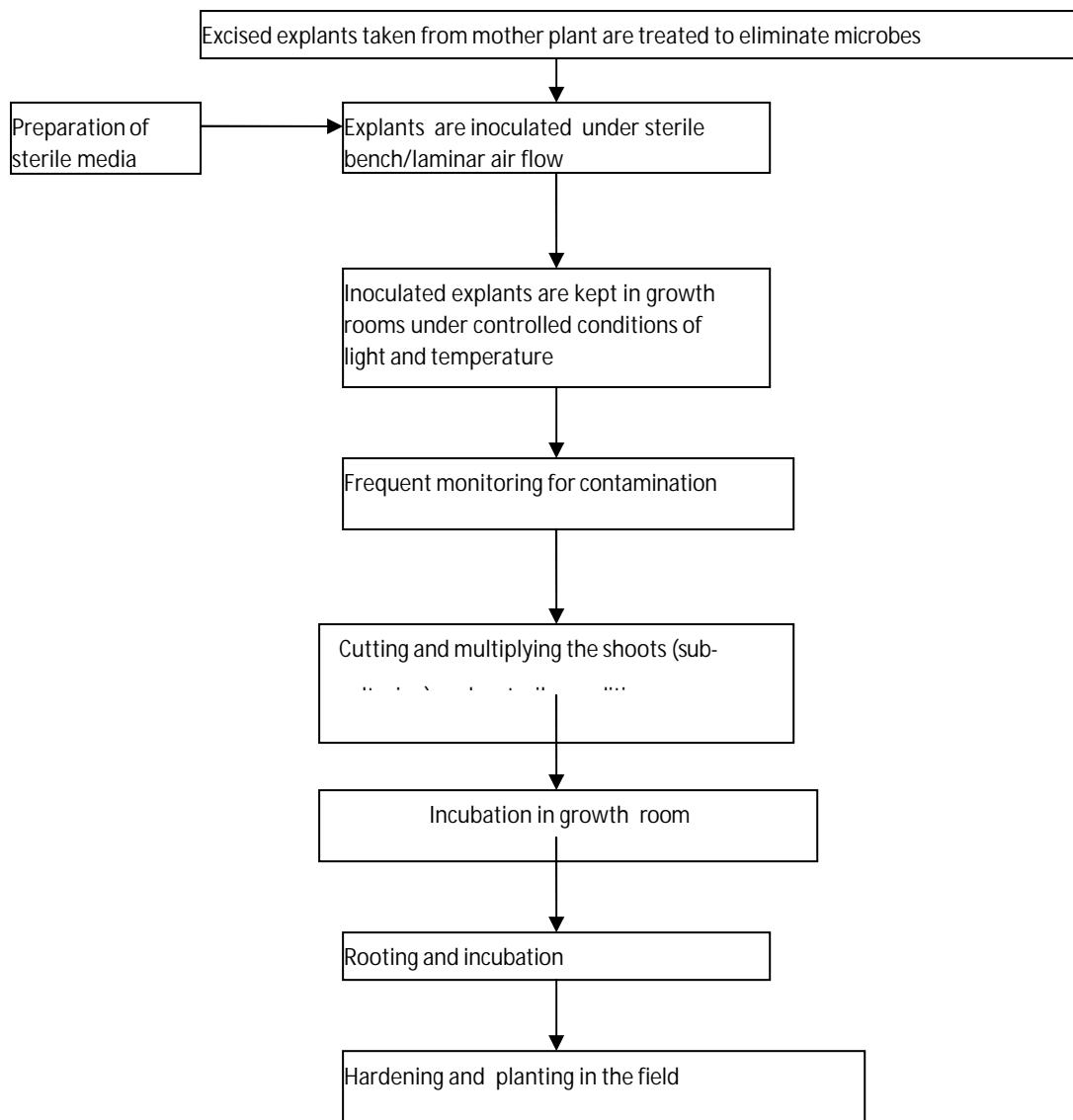
A whole plant can be regenerated from a small tissue or plant cells in a suitable culture medium under controlled environment. The plantlets so produced are called tissue-culture raised plants. These plantlets are a true copy of the mother plant and show characteristics identical to the mother plant. For example, if the mother plant is a high yielding plant the plantlets will also be high yielding. Many plant species are presently being propagated through tissue culture successfully.

This capacity of a single cell to grow into a complete plant is termed as Totipotency, which was first put forward by a German Botanist Haberlandt in 1902. Tissue culture is the propagation of plants wherein a part/tissue of the plant is placed in nutrient media that favors the production of shoots, roots following which they are hardened and transferred to soil. Quality planting material of economically important species can be produced in a large scale/desired quantity through tissue culture.

Plant tissue culture can be initiated from almost any part of a plant however, for micropropagation or direct shoot regeneration, meristematic tissue such as shoot tip is ideal. The physiological state of the plant does have an influence on its response to tissue culture. The mother plant must be healthy and free from obvious signs of disease or pest. The shoot tip explants being juvenile contain a higher proportion of actively dividing cells. It is important to use quality mother plant stock to initiate cultures.

The cultural conditions required to initiate and sustain plant cells in culture, or to regenerate intact plants from cultured cells, are different for each plant species. Each variety or clone of a species often have a particular set of cultural requirements.

## 2. Process of Plant Tissue Culture





**Figure I: Production process of Tissue Culture Plants (TCPs)**

### 3. Stages of Tissue Culture Process

#### 3.1 Preparation of nutrient medium

A semi-solid medium is prepared in double distilled water containing macro elements, micro elements, amino acids, vitamins, iron source, carbon source like sucrose and phyto-hormones. The medium is heated for dissolving the agar and 25 to 50 ml is dispensed into each wide mouth bottles. The vessels containing culture media are then sealed and sterilized by autoclaving.

### 3.2 Establishment of aseptic culture

The starting material for the process is normally an actively growing shoot tip of axillary or terminal bud or shoot tip of a plant. The process of tissue culture starts from the selection of mother plants having the desired characteristics. Ex-plant preferably the meristematic tissue of the selected mother plant is isolated. The excised tissue/explant is washed with water and then rinsed with a disinfectant such as savlon or detol solution followed by a sterile-water wash. The tissue is then dipped in 10% bleach solution for ten minutes for disinfecting the plant tissue material, killing most of the fungal and bacterial organisms. Sterilization process of explants depends on the plant species and types of explants

### 3.3 Inoculation

Inoculation is carried out under aseptic conditions. In this process explants or micro shoots are transferred on to the sterilized nutrient medium.



**Fig II: Inoculation of excised micro shoots**

### 3.4 Development of plants in growth room

After the inoculation of the plant tissue, the bottles are sealed and transferred into growth room to trigger developmental process under diffused light (fluorescent light of 1000-2000 lux) at  $25 \pm 2^\circ\text{C}$  and 50 to 60% relative humidity. Light and temperature requirements vary from species to species and sometimes during the various stages of developments.

The cultures are observed daily for growth and any signs of infection/ contamination. Cultures, that do not show good growth or infected, are discarded. The healthy cultures grow into small shoot buds. These are sub- cultured on the fresh medium after 4 weeks. The number of subcultures required is specific to the plant species, which are standardized. The shoots generally develop after 4 weeks. After enough number of shoots is developed in each container (10 to 15), to a minimum height of 2 cm they are transferred to another medium for initiating the process of rooting. The constituent of rooting medium for each plant species are specific. Roots are generally formed within 2 to 4 weeks. Plants at this stage are delicate and require careful handling.



**Fig III: In vitro rooting of micro shoots**

### 3.5 Hardening of micro plants

Due to very high humidity inside the culture vessel and artificial conditions of development, the plantlets are tender and are therefore not ready for coping up with the field conditions. The plants removed from the sterile medium are washed and are maintained under intermittent mist or are covered with clean transparent plastic. After 10 to 15 days under high humidity, the plants are transferred to green house and maintained for another 4 to 6 weeks. They are then ready to be transferred to net house or the field. Normally, the tissue culture plants are sold either as ex-agar plants or hardened plants from the green house.

### **3.5.1 : Ex-agar plants**

Depending on the parameters such as location/the site of planting, soil quality and the climatic conditions defined by the customer, the ex-agar plant for sale could be in vitro rooted plants or only the shoots. When the tissue culture plants are sold at this stage, the plants are washed in sterilized water to remove the agar medium.

The washed plants are sorted into 2 to 3 grades and packed in corrugated plastic boxes lined with sterilized tissue paper as per specifications of the Plant Quarantine Authority, Government of India for exports. The number of plants per box depends on the customer's requirement. Depending on the final destination and the preference of the customer, the plants are treated with specific fungicides and antibiotics to avoid infection. The ex-agar plants are preferred for export or for destinations where hardening facility are available. The plants after being removed from nutrient media should preferably be transplanted within 72 hours.



**Fig IV: Ex agar plants ready for packaging and dispatch**

### 3.5.2 : Hardened plants

The plants are transferred to net pots/ pro tray for acclimatization after they fully develop shoots and roots in the bottles. The rooted plantlets are transferred to pots filled with suitable substrate and are watered. This operation is carried out on an open bench. These pots are then transferred to the green house for 4 to 6 weeks. During this process, they are given fertilizers and treated like plantlets obtained by any other means of propagation. After the plants are acclimatized fully, they are transferred to poly-bags. At this stage the plants are completely hardened and are ready to be planted in the field for cultivation. Hardening units can be set up in sites away from the micropropagation unit.



**Fig. V: Hardening of plants in green house**

## **4. Advantages of Micro-propagation Technology**

Micro-propagation has several advantages over conventional methods of propagation such as:

## **1. Rapid multiplication :**

Micro-propagation offers rapid multiplication of desired plant species.

## **2. Requirement of only limited number of explants :**

Small pieces of plant (explants)/tissue can be used to produce a large number of plants in a relatively small space.

## **3. Uniform or true to type plants:**

Micro-propagation provides a high degree of phenotypic/physical uniformity. Since the production cycle takes place under controlled conditions, proper planning and scheduling based on the market demand is possible. The resulting product has very high degree of uniformity compared with traditionally propagated plants.

## **4. Germplasm storage:**

Plants can be stored in vitro in a small space and less labour is required for maintenance of stock plants.

## **5. Disease free planting material:**

Plantlets produced by tissue culture are usually disease free. With proper diagnosis and treatments, elimination of fungus, bacteria and virus prior to large scale propagation is possible. With the help of serological and molecular technique it is possible to index virus of mother plant/explant which is to be used for mass multiplication.

## **6. Growth manipulation:**

Nutrient levels, light, temperature and other factors can be more effectively controlled to manipulate the growth, multiplication and regeneration.

## **7. Round the year production:**

Micro-propagation is independent of season. As micro - propagation could be carried out throughout the year; production cycle can be scheduled to meet peak demands.

## **8. For species that have long generation time, low levels of seed production, or seeds that do not readily germinate, rapid propagation is possible through tissue culture.**

## **9. The time required is much shortened, no need to wait for the whole life cycle of seed development.**

## **5. Commercially propagated plants through micro-propagation in India**

The plants in each category which are commercially propagated are as follows

<b>Plant category</b>	<b>Plants</b>
<b>Fruits</b>	Banana, Pineapple, Strawberry,
<b>Cash crops</b>	Sugarcane, Potato
<b>Spices</b>	Turmeric, Ginger, Vanilla, Large cardamom, Small Cardamom

<b>Medicinal plants</b>	Aloe vera, Geranium, Stevia, Patchouli, Neem
<b>Ornamentals</b>	Gerbera, Carnation, Anthurium, Lily, Syngonium, Cymbidium
<b>Woody plants</b>	Teak, Bamboo, Eucalyptus, Populus
<b>Bio fuel</b>	Jatropha, Pongamia

## 6. Mitigating Risks of commercial plant tissue culture

The utilization of plant tissue culture for commercial production is limited by two major risks viz., spread of diseases especially those caused by viruses, and variations. The movement of plants also involves accidental risk of introducing plant disease. Pathogens that are often symptom less, such as viruses, pose a risk. The risk of distribution of inferior micropropagated plants has posed a major threat to the ever-increasing agribusiness industry. In order to prevent these risks, effective testing (indexing) procedures are required prior to bulking up culture for commercial propagation. Standard procedure should be adopted such as:

- Carefully selection of mother plants
- Ensuring establishment of virus free culture through indexing of 100 % explants
- Proper package and practices to be adopted such as limited number of cycles of multiplication, grading of cultures as well as plants, insect, pest monitoring in hardening area etc.

## 7. Need for Certification of tissue culture raised plants

Micropropagation is effectively used for producing quality planting material free from disease. Yet there is threat of inadvertent propagation of virus infected plants which will not only result in loss or poor performance of the crop but also spread of virus. Further failure to used standard crop specific guidelines can lead to variations in the plants produced. The most deleterious variants in tissue culture raised plants are those that affect yield through somaclonal variations and carry viruses and other pathogens which are difficult to diagnose. This is an area of great concern and requires a well structured

system to support the tissue culture industry to ensure virus free quality planting material for commercial production.

## **PART B: TECHNO-COMMERCIAL FEASIBILITY**

### **1. MARKET SCENARIO**

Demand for tissue cultured plantlets is growing rapidly. India, with its low cost skilled labour as well as scientific manpower (both of which are essential for tissue culture) has a natural advantage. Additional favourable factors are the wide range of plant biodiversity in the country and favorable tropical climate (which enables greenhouses with low energy consumption).

The potential for the domestic market is enormous and by conservative estimates it is around Rs. 200 crores with an annual growth rate of 20%. There are more than 70 established commercial tissue culture units. Their production capacity ranges between 0.5 million to 10 million plants per annum with an aggregate production capacity of about 200 million plantlets per year. The protocols have either been developed in-house or transferred through the various research institutions and universities engaged in development of the protocols through support of the Department of Biotechnology (DBT). Currently, the focus of the companies is mainly banana, floriculture, sugarcane and potato.

With increasing awareness about the advantages of tissue culture raised plants in improving yield and quality, their domestic consumption is also increasing optimistically. The major consumers of tissue culture raised plants are the State Agriculture Department, Agri Export Zones (AEZs), State agencies such as Spice Board, sugar industry and private farmers. The paper industry, medicinal plant industry and State Forest Departments are using tissue culture raised plants in a limited scale. Also a number of progressive farmers and nurseries in the states are the major consumers of Tissue culture plants particularly for flowers, banana, sugarcane and medicinal plants.

### **2. Establishment of Commercial Plant Tissue Culture Unit**

Commercial plant tissue culture unit consists of the following components

### Storage room for chemicals:

It is advisable to have a separate area for storage of chemicals, apparatus and equipments. Chemicals required in small amounts should not be purchased in large quantities as they may lose their activity, pick up moisture or get contaminated. Such problems can be overcome by purchasing small lots on a regular basis.

### Washing and Media Preparation Room:

The glassware washing area should be located near the sterilization room. This area should have at least one large sink but two sinks are preferable with running tap water. Adequate workspace is required on each sides of the sink; this space is used for glassware soaking and drainage. Plastic netting can be placed on surfaces near the sink to reduce glassware breakage and enhance water drainage. The outlet pipe from the sink should be of PVC to resist damage from acids and alkalis. Both hot and cold water should be available and the water still and de-ionisation unit should be located nearby. The washing room should be swapped periodically. Mobile drying racks can be used and lined with cheesecloth to prevent water dripping and loss of small objects. Ovens or hot air-cabinets should be located close to the glassware washing and storage area. Dust-proof cabinets and storage containers should be installed to allow for easy access to glassware. When culture vessels are removed from the growth area, they are often autoclaved to kill contaminants and to soften semi-solid media. It should be possible to move the vessels easily to the washing area. The glassware storage area should be close to the wash area to expedite storage and access for media preparation.

The media preparation room should have smooth walls and floors, which enable easy cleaning to maintain a high degree of cleanliness. Minimum number of doors and windows should be provided in this room

but within the local fire safety regulations. Media preparation area should be equipped with both tap and purified water. An appropriate system for water purification must be selected and fitted after careful consideration of the cost and quality. A number of electrical appliances are required for media preparation; hence, it is essential to have safety devices like fire extinguisher, fire blanket and a first aid kit in the media preparation room. A variety of glassware, plastic ware and stainless steel apparatus is required for measuring, mixing, and media storage. These should be stored in the cabinets built under the worktables and taken out for use as and when required. The water source and glassware storage area should be in or near the media preparation area. The workbench tops should be made with plastic laminate surfaces that can tolerate frequent cleaning. Media storage room should have capacity to storage the media for at least 7 days. Sterility Class 1,00,000 is desirable for media storage room.

### Inoculation Room

The most important work area is the Inoculation room where the core activity takes place. The transfer area needs to be as clean as possible with minimal air disturbance. Walls and floors of the Inoculation room must be smooth to ensure frequent cleaning. The doors and windows should be minimal to prevent contamination, but within local safety code. There is no special lighting requirement in the transfer room. The illumination of the laminar airflow chamber is sufficient for work. Sterilization of the instruments can be done with glass-bead sterilizers or flaming after dipping in alcohol, usually ethanol. The culture containers should be stacked on mobile carts (trolleys) to facilitate easy movement from the medium storage room to the transfer room, and finally to the culture room. Fire extinguishers and first aid kits should be provided in the transfer room as a safety measure. Special laboratory

shoes and coats should be worn in this area. Ultraviolet (UV) lights are sometimes installed in transfer areas to disinfect the room; these lights should be used only when people and plant material are not in the room. Sterility Class 1,00,000 is desirable for inoculation room which can be achieved through installation of pressurized air module or air handling unit.

### Growth Room

Culture room is an equally important area where plant cultures are maintained under controlled environmental conditions to achieve optimal growth. It is advisable to have more than one growth room to provide varied culture conditions since different plant species may have different requirements of light and temperature during *in vitro* culture. Also, in the event of the failure of cooling or lighting in one room, the plant cultures can be moved to another room to prevent loss of cultures. In the growth room, the number of doors should be minimal to prevent contamination. The culture containers can be placed on either fixed or mobile shelves. Mobile shelves have the advantage of providing access to cultures from both sides of the shelves. The height of the shelves should not exceed 2m.

The primary source of illumination in the growth room is normally from the lights mounted on the shelves. Overhead light sources can be minimized, as they would be in use only while working during the dark cycle. Plant cultures may not receive uniform light from the conventional downward illumination. Lights directly fitted to the racks create uneven heat distribution. Sideways illumination is an alternative, which requires less number of lights, and provides more uniform lighting. But care has to be taken not to break the lights while moving the cultures across the shelves. Sterility Class 1,00,000 is desirable for growth room.

### 3. PROJECT DETAILS

#### A: PROFILE OF A SELF CONTAINED UNIT:

The project profile of a micropropagation unit with an annual production capacity of 3 million plantlets is discussed below. A product mix of 5 different plants has been assumed:

1. Banana *Musa acuminata*
2. Sugarcane *Saccaharum officinarum*
3. Ginger *Zingiber officinale*
4. Medicinal plants *Chlorophytum borovillianum* (Safed musli),  
*Aloe barbadensis*
5. Ornamental plants Carnation-*Dianthus caryophyllus*, Orchids-*Vanilla*

#### Location

The tissue culture laboratory should be preferably located in a moderated climate condition having uninterrupted supply of water and power. The tissue culture operations have to be carried out under controlled conditions of temperature. Extreme climatic condition adds to the cost of maintenance.



#### Project Cost

A.	Fixed asset	
S. No.	Head	Cost ( Rs. In lakhs)
1.	Land	5.00
2.	Land development	5.60
3.	Building	35.20
4.	Utilities	16.00
5.	Equipment	69.40

6.	Green and shade house	30.00
7.	Miscellaneous fixed asset	2.75
	<b>Total</b>	<b>163.95</b>

**Land:** Approximate 5 acres land should be adequate for setting up a TC unit with the above capacity. Cost of land is assumed at Rs. 5.00 Lakhs

### **Building and civil works**

The building of about 8800 sq.ft includes class 1000 clean rooms and areas with comfort AC for laboratory, growth rooms and office space.

The following facilities would be required in the building.

- a) Storage room for chemicals
- b) Washing and Media preparation room
- c) Sterilization room
- d) Inoculation room
- e) Culture room

The total cost is estimated at Rs. 35.20 lakhs @ Rs. 400/sft.

### **Green house**

A green house of 7500 sq.ft. and a shade house of 80,000 sq.ft. have been assumed at a cost of Rs. 22.00 lakhs and 8.00 lakhs (total Rs. 30 lakhs) respectively. The greenhouse should be provided with heating equipment, fans and cooling systems.

### **Equipment**

Major equipment and instruments required for the plant are as follows.

Autoclave

Laminar air flow cabinet Equipment for sterilization Electronic weighing balance

Water distillation apparatus

Air handling units Refrigerator  
Air conditioners Stereomicroscope  
Digital pH meter Shelves / racks  
Green house material

## **WORKING CAPITAL REQUIREMENT**

### **(I) Raw material**

The basic inputs for the production of micropropagated plantlets include meristems of elite and disease free plants, ready to use culture medium, sucrose and agar.

### **(II) Manpower**

The unit with the proposed capacity may need 40-50 people at various positions including managerial, supervisory, skilled and unskilled

### **(III) Recurring expenses (per month)**

**(Rs. lakhs)**

Raw Material	2.50
Manpower	2.41
Utilities (power, water)	0.45
Contingencies (marketing, office expense, repair etc)	0.40
<b>Total</b>	<b>5.76</b>
<b>Recurring expenses (per annum)</b>	<b>Rs. 69.12 lakhs</b>

## **CAPITAL INVESTMENT**

**(Rs. lakhs)**

Fixed assets	163.95
Technology knowhow	15.00
Working Capital (3 months)	17.28
<b>Total</b>	<b>196.23</b>

## MEANS OF FINANCE

Particulars	(Rs. in Lakhs)
1. Debt	117.73
2. Equity	78.50
<b>Total</b>	<b>196.23</b>
Debt: Equity	- 3:2
Interest	- 16%

## FINANCIAL ANALYSIS

### (I) Cost of Production

	(Rs. lakhs)
Recurring cost (per annum)	69.12
Depreciation (@10%)	17.87
Interest (@16% Pa)	18.83
<b>Total</b>	<b>105.82</b>

### (II) Turnover

Average selling price	-	Rs. 7 per plant
Total no. of plants	-	30 lakhs
<b>Total turnover</b>	<b>-</b>	<b>Rs. 210 lakhs</b>

### (III) Profitability

Net profit	-	Rs. 104.18 lakhs
% Profit on sales	-	49%
IRR	-	26%
Return on investment	-	53%

## **(B) ECONOMICS OF STARTING PLANT TISSUE CULTURE BUSINESS WITH THE MINIMAL INVESTMENT**

Micro propagation business can be started by entrepreneurs interested in venturing into this area, with smaller investment by setting up a hardening unit to start with. Such entrepreneurs can procure primary hardened tissue culture plantlets from established micro propagation units and undertake secondary hardening in the facility and sell it to the farmers. Once the market is established, a full-fledged micro propagation unit could be set up. The following profile provides an overview of profitability for a hardening facility for handling 3 lakh plantlets per annum.

### **HARDENING FACILITY**

#### **Project Details Capacity**

3 lakh plantlets / annum

#### **Land**

1 acre

#### **Project Cost**

##### **A. FIXED ASSETS**

<b>S. No</b>	<b>Heads</b>	<b>Rs in lakhs</b>
1.	Land and site development	1.00
2.	Green House	8.00
3.	Electrical fittings	0.60
4.	Furniture and fixtures	0.60
<b>Total</b>		<b>10.20</b>

**B. Recurring expenses (per month)**

(Rs. lakhs)

Raw Material (Rs 4.00/explant)	1.00
Manpower	0.15
Utilities {power (500 units), water}	0.15
Contingencies	0.05
<b>Total</b>	<b>1.35</b>

**Annual Recurring Expenses (per annum) Rs. 16.20 lakhs****C. CAPITAL INVESTMENT**

(Rs. lakhs)

Fixed Assets	10.10
Working capital (3 months)	3.63
<b>Total</b>	<b>13.73</b>

**D. MEANS OF FINANCE**

1.	Debt	10.25
2.	Equity	3.63
	<b>Total</b>	<b>13.73</b>

Debt : Equity - 3:2

Rate of interest on loans - 16%

**E. FINANCIAL ANALYSIS**

Sl. No.	Particulars	(Rs. Lakhs)
1.	Debt	10.25
2.	Equity	3.63
	<b>Total</b>	<b>13.73</b>



<b>(I) Cost of Production (per annum)</b>		
<b>(Rs. lakhs)</b>		
Recurring cost		14.52
Depreciation (@10%)		0.80
Interest (@16%)		1.31
<b>Total</b>		<b>16.63</b>
Debt : Equity	-	3:2
<b>(II) Turnover</b>		
Total plantlets		3 lakhs
Selling price		Rs. 8 per plant
<b>Total turnover</b>		<b>Rs. 24 lakhs</b>
<b>(III) Profitability</b>		
<b>Net profit</b>	-	<b>Rs. 7.37 lakhs</b>
% Profit on sales	-	30%
IRR	-	19%
Return on investment	-	56%

## SOYA MILK

### Global scenario – Soy beverages and products market

Soy beverages are consumed because of the increased availability of soy, and the scientific facts that prove the many health benefits of the beans; including lowering blood cholesterol and reducing the risk of certain cancers. Additionally, soy beverages are consumed as a replacement for lesser-healthy drinks because of higher nutrition content.

Soybean-based foods, apart from being a complete source of protein, also contain other important nutrients, such as fiber, vitamin B and omega3 fatty acids. All these nutrients play an important role in the growth of infants, fetal growth in pregnant women, and provide various other benefits for children and adults alike. The rising health consciousness in the developing and developed regions is driving the soy beverages market. It is a healthy alternative to meat and other animal products and hence, is a good source of protein for vegetarians.

Despite the challenge from other plant-based dairy alternatives, the outlook for the global soy milk and cream market is positive due to the increasing consumption from countries in APAC. The market is growing at a CAGR of around 15%, due to new product launches in India, Malaysia, and Indonesia. The players in the market are also targeting key consumer segments and are launching products especially for them. As per Mordor Intelligence, another leading global technology research and advisory company, Asia-Pacific has highest demand for soy beverages due to the rising disposable incomes and higher demand for processed foods. It is followed by fast-growing markets like North America and Europe. The demand for soy beverages is also increasing in the developing regions of South America and Africa because of rising health concerns. The growing demand for soy-based products in the developing regions of South America and Africa provide a huge incentive for existing players to increase their presence in these regions and thus, increase their market share.



### National scenario— Soy beverages and products market

The soya milk industry in India is estimated at Rs 50 crore and has a CAGR at 50 per cent. Currently, the soya milk category is dominated by international brands such as Silk and Soyfresh as well as indigenous brands such as Sofit (Hershey Foods) and Staeta Soy Milk (ProSoya Foods). Even Hindustan Unilever had made a splash into the category under Kissan Soya Milk in 2011.

Being a non-dairy product, soya milk targets lactose intolerant consumers but the taste has been the biggest hindrance for the acceptability of the product. Even big players such as HUL are struggling to get volumes for its Kissan soya milk despite extensive research and development on the product. Masking the taste is the biggest challenge for soya milk brands. However, Indians are getting more aware about the benefits of soya and this should lead in making these soya milk brands more acceptable going forward. Mumbai-based ProSoya Foods which has been selling one of the first indigenous brands Staeta for the past eight years has

recently roped in Australian fast bowler Brett Lee to endorse its brand and help in growing the category in India.

FMCG player Ruchi Soya Industries also plans to re-enter the soya milk category with a modified offering and possibly a new brand. The maker of Nutrela brand of soya nuggets and edible oil had entered the soya milk category under the N'rich brand in 2008 and subsequently pulled out. Later, it had also introduced another brand Soya fresh in glass bottles. But due to issues like packaging, Ruchi Soya had to keep a low profile with the brand and also exit the category. It is now planning to reformulate its soya drink offering to re-enter the still nascent category.

#### State scenario— Soy beverages and products market

The major share of soybean production in India comes from Madhya Pradesh, Maharashtra and Rajasthan and hence majority of soya processing units are situated in these states. It has been estimated that nearly 85 per cent of soybean produced in the country is processed and nearly 20 per cent is processed in Rajasthan alone. Therefore, soybean processing is an important sector in Rajasthan. There are an estimated more than 60 soybean processing units in Rajasthan, but most of them are engaged in processing soybean for oil, deoiled cake (DOC) and lecithin.<sup>9</sup> Only a few are engaged in making value added products indicating apprehensions on viability of investments in soybean value added products. With the increasing level of awareness of the people with regard to the soybean value added products, the demand for the products is also on the rise. In this regard, there is need to understand the financial implications of processing of various value added products of soybean, especially Soy milk and connected products. Therefore, in the present study, attempt is made to find out the profitability of processing such soybean value added products.

Notably, Rajasthan is also the second largest producer of milk in India, with the fifth-largest cattle population and some of the finest breeds of milch and draught cattle. The milk production in the state was around 17,000 mn tonnes (12% of India's total milk produce) in 2015. This milk produce is facilitated by a pool of about 13,000 cooperative societies headed by a state level apex organization, RCDF (Rajasthan Co-Operative Dairy Federation or "Saras"). Notably, in terms of organic milk production, Rajasthan's seven types of indigenous cattle are rich in A2 type of beta-casein protein in comparison to A1 protein commonly found in regular milk. The commercial venture of this milk popularly known as A2 milk is proving to be a great success. This segment in itself is an entry concern for new entrepreneurs, primarily since the general public traditionally has been consuming animal milk as against vegetable source milk like soymilk. With popularity of organic dairy options on a rise, aggressive marketing strategy and product positioning by soymilk manufacturers will be the key to success.

None the less, in some food retail outlets in shopping malls, more prominent brands of soymilk like Sofit (Hershey's), SoyMilky (Stateta), Silk and Soyfresh are more visible on shelves, along with some other alternative health drinks like Almond Milk, etc. In this context, both original (i.e. without sugar or any flavor) and flavored products are available. Products (mostly flavored) of some regional players are also being promoted by small outlets like kirana shops or dairy products outlets. As a beverage, flavored soymilk also faces stiff competition from packaged flavored milk brands like Amul Kool. In this context, persuasive labeling and media promotion has helped even in 'impulse purchase'.

Tofu (also known as Soy-paneer) and soy yogurt consumption has dramatically risen in the last ten years or so. Several consumers are now turning to tofu to make recipes like palak paneer, matar paneer, etc and this trend has been aggressively tapped by restaurants especially those serving Indian, Chinese or Thai cuisine. This Tofu and Soy yogurt (or curd) demand is generally met directly by regional processors (sometimes through small local dairy outlets). Without a doubt, even with several competing dairy and substitute products, soy products (also including

soy nuggets, soy flour, etc) have gained a good market share.

## Soy milk and Derivatives Products and Applications-A brief note

### Soy Milk:



Soy milk is made by soaking soybeans, grinding them with water. The fluid which results after straining is called soy milk. One can make soy milk at home with basic kitchen tools or with a soy milk machine. Soy milk is most commonly found in aseptic cartons. Most of the soy milk available in the market is flavored and fortified with extra calcium or vitamins. The most popular flavors are vanilla and chocolate. Some producers also add thickeners to their soy milk to give it a mouth feel of cow's milk.

Traditionally, soy milk has a beany taste which is well accepted by the Chinese, but less by the Western palate. Recently, with the recognition of its health benefits and with its improved flavor and texture, soy milk has now a high and rising acceptance.

Plain soy milk is very nutritive. It's an excellent source of high quality proteins, isoflavones and vitamin

B. Soy milk is free of the milk sugar (lactose) and is a good choice for people who are lactose intolerant. It is also a good alternative to those who are allergic to the proteins in cow's milk. Soy milk also contains isoflavones which may help to reduce osteoporosis risk. Several studies have suggested that soy isoflavones may be a factor that helps to prevent bone loss. The isoflavone genistein seems to enable bone breakdown and may have similar effects as estrogens in maintaining bone tissue. Diets which are high in animal protein cause more calcium to be excreted in the urine. Replacing animal protein with soy protein may help to prevent calcium loss from the bones. Epidemiological data show that Asian women suffer less from hot flashes and night sweats compared to Western women. These symptoms of menopause are caused by low estrogen levels. Estrogens play a role in the body temperature control. Soy isoflavones can through their estrogen-like effect control these menopausal symptoms. Notably, in countries where soy products are ingested regularly, the rates of cardiovascular diseases are low.

Research suggests that soy may help to prevent heart disease by reducing total cholesterol, low density lipoprotein cholesterol and preventing plaque buildup in the arteries, which could lead to stroke or heart attack. These health benefits are also mainly attributes of the soy isoflavones. The soy isoflavone genistein may also increase the flexibility of blood vessels. Several studies have also indicated that a regular intake of soy foods may help to prevent hormone related cancers such as breast cancer, prostate cancer and colon cancer.

Soy milk is very rich in protein. This protein is of very high quality because it contains all essential amino acids. The amino acids of soy combine very well with the amino acids of cereals. The soy protein is therefore very important for vegans. Soy is a good source of lecithin and vitamin E. These natural antioxidants prevent oxidation of LDL cholesterol. It is also rich in

magnesium, which plays an important function for the bones, heart and arteries.

Tofu:



A staple in Asia for 2,000 years, Tofu is known for its extraordinary nutritional benefits as well as for its versatility. Tofu is a soft cheese-like food made by curdling soya milk with a coagulant. Tofu is a rather bland tasting product that easily absorbs the flavors of the other ingredients. Tofu is sold in water-filled packs or in aseptic cartons. Fresh tofu is usually packaged in water and should be refrigerated and kept in water until used. If the water is drained and changed daily, the tofu should last for one week.

Tofu can be frozen for up to three months. However freezing will change its texture; it will make the tofu slightly chewier.

An additional benefit of tofu is that it is extremely easy to digest. This is because the soybean's fiber is removed during the manufacturing process. As most other soy foods, tofu reduces heart disease by lowering the level of the "bad" LDL cholesterol and by maintaining the level of "good" HDL cholesterol.

Tofu too is rich in isoflavones. When making tofu, the soy isoflavones, genistein and daidzein, remain bound to the soy protein. Isoflavones reduce the risk of osteoporosis; a disease associated with reduced bone density and increased bone fractures. Isoflavones also lower rates of breast cancer and prostate cancer, and reduce menopausal symptoms including mood swings and hot flushes.

- . Soy Yogurt



Soy yogurts or soyogurt are becoming more and more popular because of their low levels of cholesterol and saturated fat, and the fact that they are lactose-free. Fermentation has the additional advantage of reducing the bean flavour of soy foods. In general, soy yogurts aim at providing a vegetarian/vegan alternative to regular (probiotic) yogurt and are not developed specifically as carriers for probiotics. Nevertheless, the stability of probiotics in a fermented soy matrix is usually good and is very similar to that in yogurt.

Okara



Okara is a food by-product from tofu and soy milk production. Most okara worldwide is used as feed for livestock — especially dairy cows. The rest of it is used as a natural fertilizer or compost, which is fairly rich in nitrogen. A small amount is used in cookery. Due to its high fiber content and low production costs, okara is a good raw material and a rich source for preparing fiber and could also be used as a dietary supplement to prevent diabetes, obesity, and hyperlipidemia.

## Evolution of Soy Milk and Dairy-like Soy Milk Derivatives Processing

Soymilk is an aqueous extraction of the soybean resembling milk. The nutritional composition, appearance, and flavor of good quality soymilk are remarkably similar to that of cow's milk. All traditional soymilks were filtered and the 'okara' (insoluble soybean pulp) was removed. Some modern soymilks are suspended, containing the entire original soybean except its hull, while others are made from soy protein isolates.

The spread in popularity of soymilk from its home in China to the rest of the world is a recent phenomenon, which can be divided into four major periods:

1. Ancient times to 1900: Soymilk was made in small soymilk or tofu shops and consumed only in China;
2. 1900-1949: Scientific interest developed in soymilk, its nutritional value, and its use for feeding infants in China or those allergic to cow's milk in the West. A few small soy dairies were started, both in China and the West;
3. 1950-1969: The success of Hong Kong's Vitasoy that was introduced as the first soymilk soft drink, inspired many companies in East Asia to introduce similar products, which became very popular;
4. 1970-1981: In the early 1970s new methods were developed, mostly in the United States (such as the soy protein isolate, hot grind, cotyledon pre-blanch, and defatted soy meal methods) that led to major improvements in soymilk flavor by largely eliminating the so-called beany flavors, which had been a major obstacle in the introduction of soymilk outside of China. It was also realized that soymilk, even at relatively low volume production, could be retailed for 15-25% less than cow's milk, which had always been relatively expensive in densely populated East Asia. The introduction of the Tetra Pak and Tetra Brik containers in the early 1970s made it possible to market soymilk in a colorful, disposable container that gave a shelf life of at least 6 months without refrigeration.

All of these factors led a number of East Asia's and the world's largest food companies to make a strong commitment to manufacturing and marketing soymilk. Excellent products, reasonable pricing and extensive advertisement fueled the soymilk boom in East Asia. Soymilk began to be popular outside

### History of Soymilk and Dairy-like Soymilk Products- Soya Info Center

Chinese-speaking Asia too. Regional marketing in East Asia started rising by Nestle's efforts around 1979. Soymilk popularity, at the same time, also began to catch up in Latin America, starting with Brazil.

Most people in East Asia have not traditionally consumed animal milks or dairy products, despite an abundance of milk-producing animals such as cows, buffaloes, and goats. The non-milking zone embraces all of Southeast Asia from Burma eastwards to China, Korea, and Japan. Nearby dairying people were the Mongols to the north and the Tibetans and Indians to the west. There are various sound reasons that animal milks have not been used in East Asia;

1. Physiological: Around 85% of the people in the non-milking zone above the age of three years have low levels of the intestinal enzyme lactase that breaks down the lactose in animal milks into glucose and galactose, which can then be readily absorbed by the body. Like the majority of people in the world, East Asians are lactose intolerant, and when they consume animal milk they often feel bloated and gaseous, and experience diarrhea, indigestion, stomach pains or cramps, general discomfort, and even vomiting. Other Asian peoples have circumvented this problem by simply fermenting the dairy milk (as with Lactobacillus to make yogurt), which breaks down the lactose;

2. Ecological: The densely populated portions of East Asia have never had much pasture land for grazing cattle or other milk animals, nor have they been able or willing to afford the luxury of feeding a milk cow 4 pounds of grains and soy protein to get 1 pound of milk protein in return. In contrast, the soybean produces more protein (as in the form of soymilk) per unit area of land than any other conventional farm crop. Thus soymilk provides more nutrition from less land at lower cost than dairy milk;

3. Cultural and Economic: The Chinese first encountered dairy products in the culture of the nomadic Mongolians, whom they considered barbarians and who later partially conquered China under Genghis Khan. The Chinese chose, by not adopting the dairy habit, to differentiate their culture from that of the barbarians.

4. Culinary: Many, if not most, Chinese dislike the taste of milk from cows or other animals. They describe it as having a dominant "animal-like" flavor just as many Westerners describe soymilk as having a "beany" flavor.

In the basic Chinese method for making soymilk, the soybeans were washed, soaked overnight, and ground to a thick puree using a vertical-axis hand turned stone mill. The puree was mixed with (usually cold) water, and then placed in a cloth-lined bamboo colander to allow the uncooked soymilk to filter through. The okara (insoluble residue) remaining in the cloth was washed several times with cold water, then the ends of the cloth were folded over the okara and it was pressed with a large rock to extract more soymilk. Finally, the soymilk was boiled for 10-20 minutes before serving. The Japanese later modified this method in two basic ways:

1. the slurry was boiled before extraction of the soymilk, a few drops of shell ash mixed with vegetable oil were added to prevent boiling over; and

2. the okara was pressed using a lever press or other mechanic press to extract the soymilk.

During the Japanese invasion of China, soymilk was used extensively in refugee camps, especially for feeding infants and children. It saved many lives, and offered a unique opportunity for further observing its nutritional value. Several studies showed that children receiving soymilk gained more weight than those not receiving it. After the War, the Chinese government took more interest in soymilk and commissioned Willis Miller to build them a soymilk plant in Shanghai, patterned after Dr. Miller's plant in the US (Smith 1949).

Interest in modern soymilks, packaged and sold like soft drinks or in other new forms, began to increase rapidly during the early 1980s and by 1983 was one of the "hottest" food subjects in China. Reasons for this growth of interest include the success of Vitasoy in Hong Kong and Yeo Hiap Send in Singapore, the spectacular rise of soymilk consumption in Japan, the great need for a low cost and nutritious beverage in China, promotional efforts by foreign companies selling soymilk equipment and technology and the growing recognition by decision makers in China that the soybean will be one of the key protein sources of the future. Indeed during this period, the image of soymilk in China, at least among government officials, was dramatically upgraded from that of a traditional, often poor quality product, to that of a modern, healthful, economical, and nutritious beverage that could play a key role in China's modernization program by improving the diet and health of people of all ages.

Soymilk was introduced to India in about 1933-36, when Mr. F.S. Kale and the Maharajah of Baroda introduced it at various exhibitions and restaurants in West India. A plan to open soymilk centers for children of the poor was proposed, but failed to materialize. In 1936 when Kale's magnum opus Soya Bean was published in Baroda, it contained a long chapter on soymilk, and urged its use for feeding infants and children who could not obtain enough mother's or cow's

milk.

Starting in 1935, Mahatma Gandhi, a vegetarian, began to take a strong interest in soyfoods. Although he was apparently unaware of soymilk, he was looking for such a product. He wrote: "I believe that in the limitless vegetable kingdom there is an effective substitute for milk, which, every medical man admits, has its drawbacks and which is designed by Nature not for man, but for babies and young ones of lower animals. I should count no cost too dear for making a search."

Soymilk was largely unknown in India prior to 1943, the year of the great Bengal famine. That year Sasanka S. De (one of India's soyfoods pioneers) and Dr. B.C. Guha of Calcutta University worked together, making soymilk on a small scale and feeding it to several hundred starting infants. In 1944, systematic research on soymilk began at the Indian Institute of Science in Bangalore, where De went to work. A bland soymilk was developed using a new technique: the soybeans were first sprouted for 2 days, dehulled, heated for 10 minutes at 70°C in a dilute solution (0.08%) baking soda, drained, ground, mixed with water, simmered for 15 minutes, and served flavored with a little invert sugar and salt.

Systematic research on soybean utilization started in 1971 at G.B. Pant University of Agriculture and Technology in Pantnagar, Uttar Pradesh, with the joint collaboration of the University of Illinois and the Nave Technical Institute, Shahjahanpur. A small soymilk plant, Pantnagar Soya Milk Products Ltd., was set up inside the university and by 1978 had produced nearly 1,000,000 bottles of soymilk (made by the University of Illinois' whole-bean method) which had been sold to the students and test marketed. A New Delhi plant was established in 1979; it produced Sipso soymilk in 200-ml bottles and had a capacity of 50,000 bottles a day. Soy ice cream, yogurt, and cheese were also produced on a small scale.

Soymilk based products have a short shelf life. However, today's consumers, and the modern lifestyle, request products with a longer shelf-life and which remain safe and stable during the complete storage period. For production of such soy milks and beverages, utilization of the UHT technology is necessary. Hereby shelf-life from several months and up to a year can be obtained, depending on the composition of the product. Further, the right choice of emulsifiers and stabilizers is necessary for ensuring a homogeneous product without creaming and sedimentation during the entire shelf-life.

## 2.2. Key Advances in each step and process of Soy Milk and derivatives processing

The process of converting soybean into milk and further into other value added products has three fundamental steps – Soybean cleaning, grinding and filtering to obtain soymilk base, and Packaging of milk to ensure shelf life or further processing to value added products like tofu and yogurt.

Advances in Soybean cleaning and optical sorting<sup>11</sup>: The production of quality soymilk begins with effective cleaning of soybean. Critical quality characteristics of soymilk like sensory properties, odour, nuttiness/consistency, color, etc are impacted by the cleanliness of the soybean grains. Consistency and texture of the soymilk base depends on effectively removing dust, foreign grains and other impurities from the raw material.

The soybean processing industry continues to develop and incorporate new technology to improve soy products' quality and consistency and to maximize equipment utilization by reducing downtime and improved energy utilization. Recent advances in the process to remove the unwanted impurities from the raw soybeans reflect the industry's desire to become more efficient at producing consistent, quality products.

Screening or sieving to separate good quality soybean from foreign grains, sand, stones and

many other types of coarse and fine impurities has been the principal method of cleaning soybean from the beginning of soymilk and derivatives processing history. Over time, various machines have been introduced and improved upon to increase sieving efficiencies. Sifters and sifting reels to remove impurities and classify soybean by size were commonly used as primary cleaning equipment when the importance of cleaning and grading grain developed.

As the operating capacities of mills increased, the use of oscillating or vibratory screeners expanded to keep up with the increased capacity requirements. Aspiration was incorporated into these designs to remove the dust and light impurities before the screening to improve effectiveness of the sieving as well. As grain cleaning technology continued to advance, machines that combined multiple cleaning principles were introduced that incorporated sieving, density separation and aspiration into one machine. Combination machines allowed higher cleaning capacity to be installed in a smaller space, helping to reduce the capital cost of new mills and mill expansions. New innovations in grain cleaning reintroduced the advantages of sifting and grading soybean by size while removing impurities. These more recent advancements in soybean cleaning integrate modern technology and materials to meet the

This report largely focuses on soymilk processing technology which is a milling procedure undertaken post soybean is primary processed to obtain cleaned grains. Hence, only some limited and relevant information with reference to cleaning and grading is considered in this report. Detailed description of various technologies in cleaning and grading of food grains and advances in the sector are presented in similar report on cleaning and grading technology, prepared under the aegis of Rajasthan Agricultural Competitiveness Project.

growing demand for higher operating capacity, improved cleaning efficiency and lowering the cost of operation and maintenance.

Soybean hulls contain unwanted substances and the same are also an obstruction to processing, especially in the decanter. Soil bacteria are present in the soybean hulls and therefore hulls should be removed to reduce bacteria count in the soymilk, resulting in better flavor and shelf-life. Soybean hulls contain polysaccharides that should be removed to avoid off-flavors and processing problems caused by foaming. Notably, the holding time for heat treatment of the soybeans to inactivate undesired enzymes can be shortened when using de-hulled soybeans. This will decrease protein denaturation and browning of the soymilk. Further, dehulled soybeans produce a white, attractive and appetizing soymilk.

For dehulling, traditional stone chakki design was used as a template for the attrition-type mills as commercial-scale dehulling of soybean emerged. The two-stone principle was retained and the much larger stones were rotated using the energy of harnessed animals (such as bullocks) or running water (such as in the flour mills of Europe). The mills were adapted as electricity became an available power source, and automation increased. Now, the stones are artificial and coated with carborundum (derived from silicon carbide) of various abrasive grades (grit size).

These new improved attrition-type mills are often called under runner disk shellers (URD Shellers). The orientation of the stones can be either horizontal (as in the original chakkis) or vertical, and the gap between the stones can be adjusted to the seed size to optimize dehulled seed yields. The other modern mill type is a carborundum roller mill. It has a cylindrical carborundum stone that is tapered and rotates inside a perforated metal casing so that the gap between the roller and casing decreases from the inlet to the outlet. The stone or casing can sometimes be moved to adjust the gap depending on the seed size. These mills are often mounted horizontally or on a slight downward angle to facilitate passage of the seed. A lot of work is being done on de-husking of seed coat. New Generation de-hullers in market are able to scratch seed coat more effectively with a proper control on emery Speed, Pressure, and

Appropriate selection of emery grit size vis-à-vis typical soybean variety. New hullers are capable of handling all types of seeds with equal ease. Efficient De-husking means removal of seed-coat with minimum damage which in turn helps to increase yield.

Drying technology was another technological gap where milling industry was struggling to get food safe solution and efficient de-hulling. Dryers introduced in the food grain industry efficiently remove surface moisture and core moisture of seed. This makes seed coat scratching easy.

Drying technology helps in getting higher yield and higher productivity. New drying technologies are helping processors to avoid sun drying process which was not food safe. Dryers with better temperature and process controls help soybean seed to retain its original properties.

With ever increasing focus on color properties of products, naturally the demand for the color consistent product has increased even in the soymilk market. Hence, color sorting (i.e. surface and color grading) of soybean before processing for milk base has become a standard practice. The technology in color sorters has advanced from basic monochromatic versions to bi-chromatic and now to the advanced Tri-chromatic/RGBS models.

#### Advances in Grinding and other processes:

The soymilk processing, after raw material is cleaned, includes: dehulling, boiling, draining, grinding, homogenization, enzymatic treatment, and heat treatment. The sensory attributes, beany flavor,

chalkiness, and flavor, etc are evaluated before final packaging. The composition of soymilk depends on different factors, such as the bean composition and parameters that depend on the type of process being used, such as dilution level during the process.

There are several different methods for soymilk processing. The traditional method involves soaking the beans, followed by wet grinding (cold water grinding), filtering and cooking. The traditional process results in a typical oriental soymilk with an intense characteristic of the "beany" flavor, which is not generally accepted by the western consumers. Such off-flavor characteristic results from the reaction catalyzed by soybean enzyme lypoxigenase that acts almost immediately upon wet grinding. The use of hot water (80-100°C) to inactivate the lypoxigenase either previously or during the grinding is the basis of other methods of the soymilk processing. The referred methods avoid the reaction of the enzyme and the formation of the attribute 'beany' flavor. Some of those methods involve, like the traditional one, the grinding of the beans and the discharge of the solid residue retained in the filtration. In other methods the bean is ground with hot water and the remaining slurry is neither filtered nor centrifuged. These methods have the advantage of avoiding generating solid residue. In one of these methods the slurry is homogenized in two stages. One negative aspect of the methods that use the whole grain to produce soymilk, without generating solid residue by filtration or centrifugation, is the presence of another flavor attribute in the product named "chalkiness". The resulting products are also, sometimes, physically unstable, i.e., phase separation occurs during the product storage, depending on the pressure of homogenization.

In Asian countries, fresh soymilk is often sold in plastic bags with a straw, other manufacturers sterilize soymilk in cans, while UHT processing coupled with aseptic packaging into Tetra Pak or combiblock aseptic containers is very popular.

**Modern Systems:** Modern airless grinding processes have been developed which prevent denaturation of protein and eliminate oxygen which permits grinding of beans in cold/warm water. Low oxidation attained in these machines allow easy to formulate low pH juice soy blends, carbonated and cultured products. Resultant products can have upto 15% higher protein yield with lower calories. The new modern systems are developed to provide flexibility for producing both beany and non beany flavors. Most modern plants ensure low power and utility consumption leading to lower production cost.

**Quality Assurance:** Quality assurance and food safety is another area where food sector is looking beyond just legal standards and providing the whole food industry with a scientific basis

which ultimately leads to new approaches in technology. Food assurance and food safety standards such as ISO 9000, ISO22000, HACCP, GMP, GHP are now becoming integral part of food industry thus keeping food industry technologically abreast to global practices.

The quality of soy products can be measured using both sensory and instrumental techniques. Sensory measures are useful for identifying the product attributes that consumers like, while instrumental measures provide more objective measures. Soy based breakfasts and snacks are expected to have a crisp texture and grain taste, soy based meat analogues are expected to have a chewy texture and savory taste, while soymilk is expected to be similar in texture and taste to bovine milk. Sensory testing can be applied to all soyfoods, however some of the instrumental measures can be very specialized. For example to measure the mechanical properties of soymilks, a rotational viscometer is used. Some of the

quality measures that are important for developing product specifications and for statistical process control are described below:

- Sensory techniques usually involve the use of a trained panel to measure the color texture and flavor of the soy products. Panelists may describe the off-flavors of soymilk as: 'beany', 'green', 'bitter', 'grassy', 'painty' and 'astringent'. They may describe poor texture as: 'gritty', 'floury', 'chalky'.
- Nutritional profile requires measurement of protein, fat, minerals, vitamins photochemical and anti-nutrients (trypsin inhibitor). This information is needed for nutrition labeling.
- Color can be measured using a Chroma meter, with measurement based on the CIE system.
- Viscosity of soymilk is similar to milk, and is measured with a rotational viscometer.
- Particle Size: Soymilk contains colloidal fat and protein and in some cases cellular particles. The size and distribution of these particles, which affects mouth-feel, can be measured with a particle size analyzer.
- Particle stability: Creaming and sedimentation of soymilk is undesirable, and potential particle instability in soymilk can be identified using turbidity measurements, based on changes over time of the back-scattering of light.
- Volatiles or aroma chemicals effect taste, and are identified and measured using gas chromatography (GC).
- Microbiological safety: It is essential that soy products be safe to consume, so microbial testing must be carried out in relation with storage conditions and the expected shelf life.

Larger Capacities of Machines: The principle emphasis in this area has been on improving the effectiveness of existing machines rather than on new types of machine. The so-called 'short surface mill' is now the norm. Typically grinders are operated at double the speed and three times the feed rate that would have been the norm in the 1950s. The advent of new 'high speed' grinders has taken this evolution one step further with speeds and loadings double than those of today's norms. The efficiency of sifting has also been increased significantly. Similarly, capacities of all other functions vis-à-vis cooking, homogenization, packaging, etc have considerably increased even in terms of speed of operations.

Safe, Scientific and Food Grade Machine Construction: In recent years, significant changes have been made in the way machines are built. In general, all surface contact parts are suitably built of food grade materials like stainless steel. Also, minor supports and fixtures like screws and bolts have been largely eliminated inside the process sections to avoid any contamination. Modern machines are now designed to have compact structure and small footprint. Advanced mills are now designed to deliver high capacity, increase productivity and plant efficiency while providing the flexibility of producing a range of products from the same mill. In a nutshell,

modern plants are designed to replace multiple smaller machines used in conventional milling, leading to a reduction in power consumption per ton. Moreover, the simplified operation results in lower maintenance and manpower costs. This has become increasingly important where processing plants are expected to run for extended periods between maintenance shutdowns. In addition, hygiene considerations are now being taken into account in all new machine generations. Features are being incorporated that minimize stock hold up and ease cleaning, thereby reducing contamination and infestation problems.

**Advanced Engineering and design, Efficient Aspiration and Material Movement:** Material handling systems like elevators, conveyors, etc and the engineering design behind the same is now executed to ensure reduced material travel between machines enabling leaner manufacturing which also

aids in reduction of power costs and unnecessary instances of human intervention at various stages. Modern designs of soybean cleaning plants with controls at multi-level or even at central plant location (with PLC) have now become the standard norm. The aspiration system (in the grain cleaning sections) that includes cyclones, fans, airlocks, etc. and the engineering behind the same is done to ensure compact design eliminating leakages/wastages and resultant dust discharge in shop floor air. This has increased overall safety and efficiency of the mills.

**Process Optimization:** All processes in soybean cleaning and soymilk processing can be optimized and controlled through control panel i.e. automation. Process optimization refers to operating the plant optimally with economic performance in terms of productivity and yields. It also avoids human errors. Scada systems are now integral part of cleaning industry. Electro-Pneumatics and PLC have significantly changed the way plants are operated. Automation ultimately leads to higher productivity and ease of operation. Automation, as such monitors system, diagnoses problems and provides actionable information which in turn helps prevent problems both on Grain and Equipment side. It allows operator to identify problems before they happen and take diagnostic action. Milling and food processing industry is now changing from plant control to process control and even beyond that.

#### Recent Global Technology Advances

The global soymilk processing industry and service suppliers that support it are continually searching to improve technology and methods to process soybean into milk base and further value added products. Some of the most recent technological advances in the industry offer breakthroughs in areas such as sanitation, safety and quality control; some are presented below:

a. **Testing and Research Findings:** Recent research has identified the three soybean lipoxygenase isozymes, the activity of which contributes to hexanal formation and soy flavor. The chemicals that contribute to soy odors have been identified. It was found that removal of the lipoxygenase enzymes did reduce the hexanal level; however, improvement in the sensory properties was disappointingly minimal. On the other hand, more traditional approaches where soy flour was extracted with ethanol, was more effective in reducing the off-flavors.

Further, several novel techniques are now being applied to purifying soy proteins; these include the use of physical separation techniques to remove fat, electro dialysis, supercritical carbon dioxide extraction, ultra-filtration and membrane separation for the extraction, precipitation and isolation of the soy proteins. Soy Protein fractions that include Glycinin and conglycinin have different gelling, emulsification and foam properties. It is expected that over the next decade, more highly specified soy protein ingredients will provide the basis for innovative food products

and growth of the soy food market.

b. Latest Color sorter technology:<sup>13</sup> With eight individual models ranging from a 0.5 chute to a high-capacity 7-chute unit, the Cymbria SEA Chrome offers the latest in sorting technology. The system perfectly suits the needs of modern food processing systems that demand the optical sorters'

Advances in soybean processing and utilisation- Dr Bob Hosken University of Newcastle Efficient color sorting has become an essential step in integrated soymilk processing plants. Processing to obtain quality soymilk requires soybeans that are effectively clean from foreign impurities including color and surface impurities.

ability to detect and reject products of similar colors but with different shades. Machine adjustment can be carried out easily due to the real image setting, and as with all SEA sorters, the SEA Chrome allows for Internet connection for remote control. Each unit features standard TRU color cameras with 0.1 mm resolution and the ability to add NIR and InGaAs cameras, making it a very versatile color sorter for milling applications. Key features of the new technology include:

- High capacity feeding chutes with robust in-house vibratory feeder design;
- Proprietary software for defect size analysis as well as for shape based on geometric characteristics;
- Program for storing of up to 16 families of defects; LED lighting for long life and low heat dissipation;
- Versatile flow configuration with re-sort and reverse re-sort;
- Specially designed ejectors to prevent delays and pressure drops;
- Vortex pressurized optical boxes to purge dust;
- 15-inch color touch screen; and
- Rotating optical boxes to provide easy access for maintenance and service.

c. Loading spout: Vortex has made several design changes to its loading spout. Vortex's outer sleeve is now rivet free and utilizes cable guides rather than less durable plastic. Vortex also redesigned the cone harness cable to eliminate the possibility of misaligned cones, drill shavings and broken hardware, thus reducing the potential for contamination. These loading spouts are designed to capture fugitive dust, prevent material waste, and ensure plant and environmental safety, with low maintenance and service expenses. From the retractable loading spout attached to the bottom of a silo/hopper or located at the end of an air conveying system, to the dust collecting filter system, to the loading spout positioner, the company offers a complete line of versatile loading spout systems for loading process.

Vortex loading spouts are unique for loading bulk materials into open and/or enclosed vessels because of their four-cable lifting design that provides maximum stability, compared to the standard 2- or 3-cable systems. The in-line drive system also incorporates special 3-piece CNC-machined pulleys that feature chamfered edges and precision cable grooves to significantly reduce cable wear and back lashing as the loading spout extends and retracts, especially during the misalignment of the hatch opening. Because the cables do not fray, cable failure is nearly eliminated and so is costly downtime for repairs.

d. Wireless hazard monitoring: HazardPRO Wireless Hazard Monitoring System from Electro- Sensors is a comprehensive solution to combining sensors, advanced technology, and intuitive software at a lower installed cost than traditional wired systems. The goal is to protect

facilities and people by providing the fastest alerts when they happen and transmit the alerts via the most convenient method. Consistent operation is ensured with self-diagnostics, transmission logging and redundant receivers. It allows millers to invest this savings in more accurate sensors, better displays and more intelligent controls that provide increased system reliability, ease of use and fewer false alarms. On the HazardPRO status screen, an operator can quickly view the complete operation, including what machines are running and the status of each. The operator can instantly spot a problem and then touch the display screen to bring up specific information for that equipment.

Because the HazardPRO intelligent transmitter nodes send information when a change is detected, there are no polling delays. When an event occurs, it is automatically logged. An operator can view a graph of the event and, after investigating, can document the cause and resolution. With HazardPRO, determining the condition of a rub block alignment sensor does not require shutting down the belt and performing a visual inspection. A warning will be displayed at the control panel if a block is wearing down to a point where it should be replaced.

e. Recent Innovations in Tofu: Recent research has focused on better utilization of the co-products of tofu processing. These co-products contain healthy proteins and fats that taste good and can be beneficial to human health. Methods to stabilize wet okara in an efficient manner are being studied, as are value-added final product uses for okara in foods. Better utilization of soy permeate in foods is also being explored. Finally, sprouted tofu is gaining popularity. This is tofu made from soybeans that have germinated. Sprouted tofu has a less beany/grassy flavor and better aroma.

f. Aseptic Packaging: Aseptic is a major advance in packaging technology that has been embraced in Europe, Asia and South America for decades. Because of difficulties in shipping cold products, and limited cold storage in these markets, aseptic packages offer a convenience that has made them instantly popular in these regions.

The aspect of technology advancement in processing sector discussed above gives us fairly good idea on development of soy grain cleaning and soy milk processing industry globally and in India on background of growing demands. Development in Machine capacities, Automation and End products are constantly changing towards betterment to cope with consumer demands. External influence from market is driving technological changes in machines and process and still trying to keep commercial viability. Obviously, there is still lot of scope in the sector for technological development / improvement of processes as well as for new innovative products.

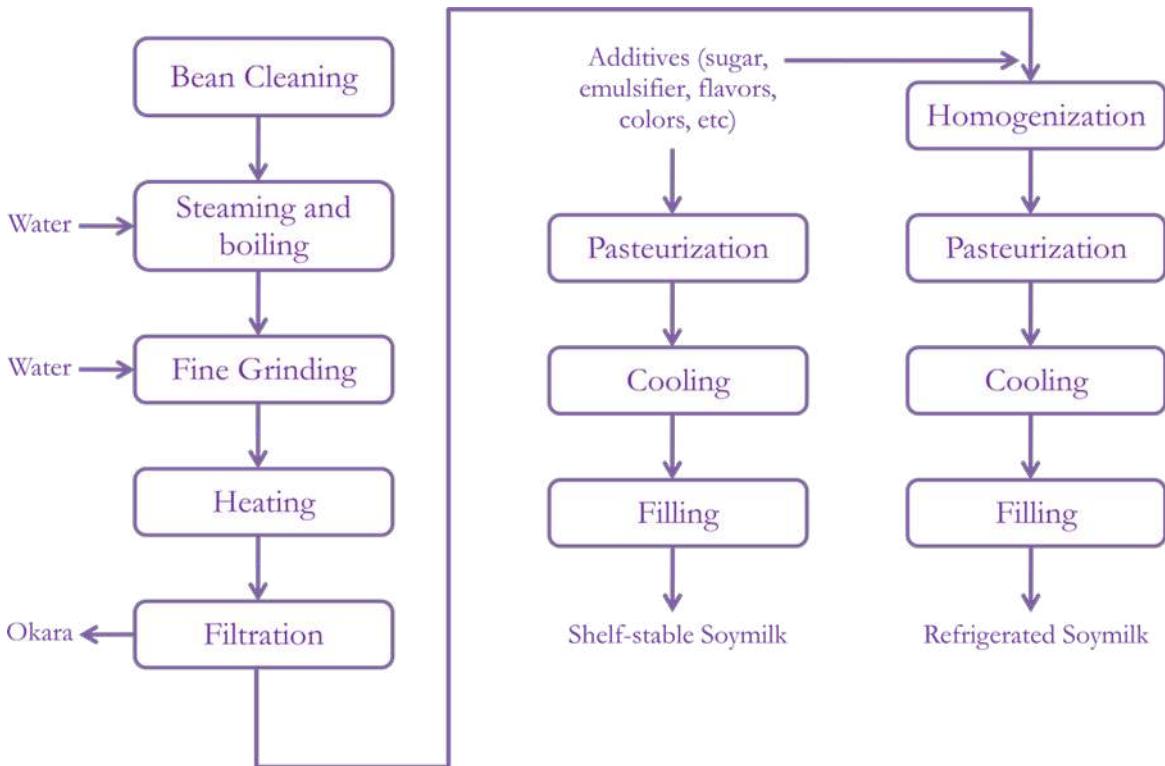
#### 4.1. Manufacturing Process

Soymilk production has three stages of processing. The first stage involves proper pre-cleaning and main cleaning of the raw material produce. The second stage involves production of soymilk base and third stage involves conversion of soymilk base to tofu or yogurt or other value added foods.

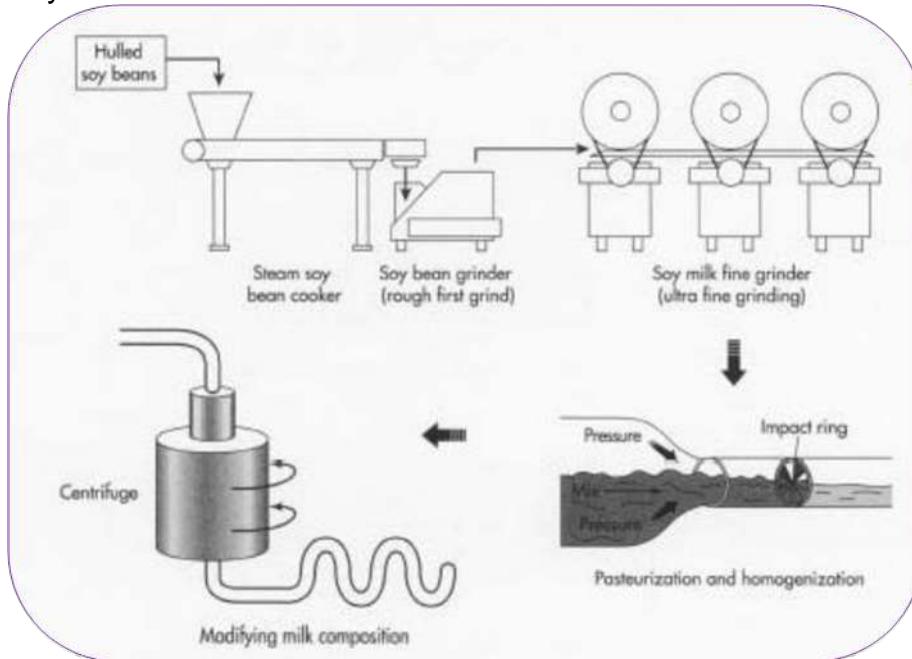
In the first stage, raw material soybean from farm is transported to unit for processing. The material passes through several cleaning machines like reel machines, gravity separators, destoners, etc. Cleaned and graded material is later processed in a dehusker machine which is used for cracking the husk layer and for scratching of clean soybean passing through it. This is done for loosening the husk from sticking to the grains. During this operation soybean grains are

de husked and often split which are separated by sieving and the husk is aspirated off. For complete de-husking the whole process may also be repeated. The grains are further moved to color sorting section to remove any color and surface level defects.<sup>15</sup>

In the second stage, the cleaned grains are moved to soymilk processing section. The process details are as under:



## Soymilk



Cleaned and graded soybean is required for processing and preparation of soya milk, and subsequently to prepare flavored soya milk, soya yogurt and tofu. The soybeans are steamed and split in half. This loosens the

hull on the bean. A vacuum sucks off the hulls. Next, soybeans must be cooked in order to invalidate, or counteract, a specific enzyme which makes them indigestible to humans.

This cooking occurs in the Enzyme Invalidator, in which the de-hulled

soybeans are cooked using high pressure, Water, and high temperature (creating very hot live steam) to invalidate that enzyme. The cooked soybeans then are transferred to the first rough grinder or mill. Water is added to the machine and the bean pieces are roughly ground in this first milling. Although they have been ground once, the cooked soybeans are still rather coarse. Thus, the fine grinder further pulverizes the bean pellets into small particles. The hot slurry is white in color with minuscule particles of insoluble soybean particles.

A large centrifuge (or muslin cloth in micro units) is then used to extract the tiny bits of soybean that are insoluble and cannot be included in the finished product. These particles are separated from the soy milk slurry. A rubber roller presses the soy milk slurry against the surface of a drum within the centrifuge, forcing the liquid inside the drum while the fibers remain on the outside of the drum. The drum is then scraped off these fibers.<sup>16</sup>

These soybean fibers are physically removed from the production process at this time. This soy fiber is called okara and almost resembles mashed potatoes. A separate process dries the okara for use other than human consumption. The fiber-less soy liquid is raw soy milk at this point and is referred to in the industry as jun.

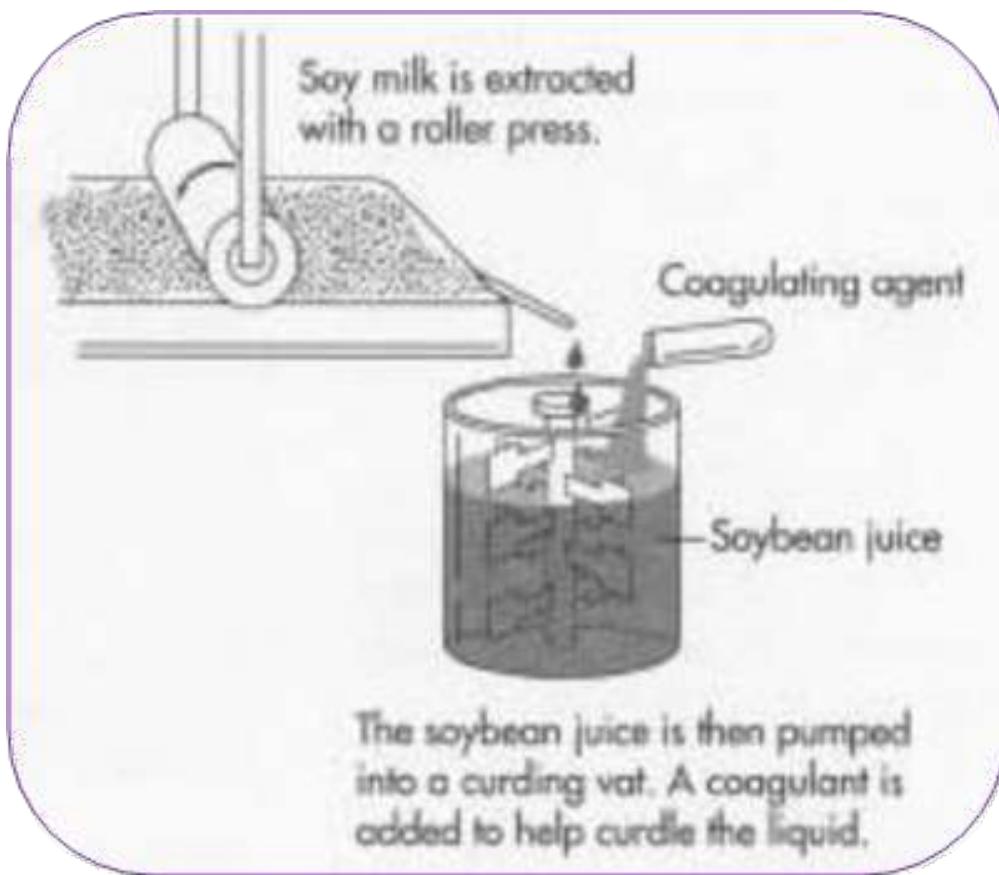
The jun is injected into large tanks and flavorings, sugar, and vitamins are mixed separately in smaller tanks. Ingredients of the smaller tank are infused into the larger tanks, thus blending the flavors with the raw milk. At this point, it is essential that the jun be sealed within the equipment until the end of the manufacturing process (including packaging) in order to keep out air and ambient bacteria and germs that can grow in low-acid soy milk. Sterilization occurs with pressure and very hot temperatures within a vacuum for a short period of time. From the sterilizer, the hot milk is sent to the homogenizer. This breaks down the fat particles and prevents them from separating from the rest of the mixture. In the homogenizer, which is essentially a high-pressure piston pump, the milk is blended as it is drawn into the pump cylinder and then forced back out in a repetitive motion. Next, the hot milk is piped to the cooling tank. Here, the hot milk passes next to cold plates that lower the temperature of the soy milk to room temperature. The cooled milk is sent to the aseptic (sealed) tanks and held here in preparation for packaging. Here, the soy milk is refrigerated, pressurized, and sealed to ensure no bacteria thrive in the milk.

A very important part of the production is the aseptic packaging of the product. Packaging machines have been developed for soymilk and similar liquid products that are able to mechanically package the product without exposing it to air. The cooled milk is sent to this packaging machine which has a ribbon of flat packaging (cardboard) threaded into it. As the milk runs through the machine, the packaging surrounds the milk and a cutter cuts through the cardboard packaging and the milk, simultaneously folding the package and sealing the milk within it. A machine glues a plastic spout onto the sealed package. From here, the product is sent to an automatic sorter that packs a case and places it on a pallet. Alternatively, soymilk is also filled in bottles (generally of 200 ml capacity) and crown caps are fixed on bottles. Bottles are then fed in Autoclave unit and treated (retorted- controlled method to reduce microbial load) for 15 minutes at 121 Degree Celsius. Packaged soymilk is also often kept in cold storage for enhanced shelf life.

<sup>16</sup> Various types of flavors like Vanilla, Chocolate, Coffee, Fruits & Nuts, Pista, Mango, Orange, Pineapple, Strawberry, etc may be used to flavor the soymilk now. According to flavor, colors too are added to give look as per flavor. In addition, sugar is added for taste.

## Tofu (Soy Paneer)

Once the soymilk base is extracted, it is pumped into curding vats. A coagulating agent is mixed in, such as calcium sulfate, magnesium chloride, etc. The coagulant alters the pH and curds the soymilk much like the process for making cottage cheese. This step takes about 20 minutes. Traditionally the obtained curd like output is pressed with hand-turned screw presses or simple lever presses. The tofu may be pressed in cheesecloth-lined boxes. Modern systems use centrifuges or hydraulic presses. The (residual) water in pressing is drained off, leaving soft blocks of pressed curds. Tofu can be produced in a variety of textures, from a dense cheese-like texture to a softer or liquid form.



Automated cutters slice the cake tofu into desired weight blocks. The tofu blocks are washed in vats of water where they firm up and are stored until they are ready to be processed further. Tofu may be packaged into shrink-wrapped blocks or continuous thermo-form packages. Water may be added to the packages, or tubs, and then they are sealed, weighed, and dated.

The packaged tofu is pasteurized at about 180°F (82°C). Pasteurization extends the shelf life of tofu to about 30 days. The tofu is then chilled in water until it is ready to be placed into boxes and shipped to distributors. Tofu must be refrigerated at below 45°F (7°C) to keep it fresh.

Formulation is also possible with tofu. The addition of herbs and spices and other ingredients can make the product more ready to eat and easier to prepare at home. The addition of other ingredients, before coagulation, requires careful testing since some ingredients will negatively affect the coagulation or pressing. Silken tofu, which is very soft and pudding-like, is made without removing the whey water or pressing.

## Soy Yogurt

After obtaining the soymilk base, the same is allowed to cool down to a lower temperature (though keeping it warm). Later, curd/yogurt culture (curd/yogurt bacteria) is added and the same is incubated for few hours to make yogurt. Once the yogurt is ready, it is kept in cool temperature and packed in transparent food grade pouch at the time of sale. Cup filling systems are also used in some modern soy yogurt plants. Alternatively, some further value added products like yogurt desserts, flavored curds, etc are prepared for sale.

Yogurt and its derivative foods and drinks are some of the easiest products to understand and produce for people with dairy food experience. The processing of soy yogurt is almost identical to that made of cow milk, but with some very important differences. Formulation is required, primarily to add a simple carbohydrate such as sugar, to compensate for the missing lactose found in cow milk. The bacterial culture, which can be of the same type as for cow milk, as well as others, needs the additional carbohydrate to feed and develop. Another ingredient may be required to reduce the surface separation of water, which occurs somewhat more than that with cow milk. Flavored yogurt and drinks are easily formulated and processed for packing the same way that traditional yogurt products are packed. The flavored products, when properly produced, are almost identical in taste to cow milk versions. Incubation time and temperature are also adjusted compared to traditional yogurt. Soy yogurt can require 6-10 hours or more of incubation at temperatures near 40° C. This is also partly determined by the type of finished yogurt and the desired or neutral taste.

It is important to note that the soymilk base for making soy yogurt products, does not have to be absolutely bland tasting and that vacuum deodorization may not be necessary. This allows a less complex system and also one with a medium or lower production volume. Nevertheless, a good quality soymilk base is a must.

Testing: Quality control begins with acquiring high quality soybean for the production of soymilk. The beans considered most desirable for the process are called clear hylem, with a white (or colorless) hylem on the body of the bean. While the soybean is generally bland, the clear hylem variety is considered more flavorful. A number of global soymilk producers market their product as organic and beans purchased from farmers for soymilk must be certified organic in order to be utilized.

The production of soy milk must be meticulously monitored to ensure that no bacteria grow in the low acid medium. Thus, many global factories include several quality control checkpoints in this production. Temperatures of water, steam, and the monitoring of pressure is essential in this process. In addition, the product is constantly analyzed as a sample of the product is taken off the line every 10 minutes and checked for pH, temperature, and bacterial growth (many samples are cultured). Because the product is sealed off from the workers for most of the production, visual checks occur primarily as the product comes off the line. Here, workers check to ensure packages are properly sealed.

### 4.2. Technology constraints and Benchmarking

The global food industry is becoming ever more aware of the potential offered by soybean to deliver innovative food products, with strong consumer attributes. A significant advantage of this is that new techniques often reduce the amount of waste, enable hygiene and standardize process, so can add significantly to the overall efficiency of value added products (especially soymilk and derivatives) manufacturing.

Soy milk is a water extract from whole soy beans. It is an emulsion containing water soluble proteins, carbohydrate and oil droplets. Soy milk was traditionally produced in small shops where the soy beans were soaked, grinded, filtered and cooked. These products have a short shelf life. However, today's consumers, and the modern lifestyle, request products with a longer shelf-life

and which remain safe and stable during the complete storage period.

Historically, traditional processing of soymilk was started by the Chinese, as long as 2,000 years ago. Today the same methods, or modern variations of the same basic process, are still used in Asia and by many tofu producers in the rest of the world. This traditional method, which is also the simplest and least expensive, can be done both manually, in a simple kitchen, or by commercial equipment in a modern plant. This process has four steps:

- 1) Soak soybeans (4-12 hours depending on water temperature)
- 2) Grind soaked soybeans into a mash or pulp (Stone/manual grinding, electric blending etc.) with the addition of water.
- 3) Cook the resulting slurry (Stove top or commercial steam injected vessels).
- 4) Separate the cooked soymilk from the remaining "Okara" fiber. (Filter press or centrifuge.)

Modern Processing methods have evolved for a number of reasons; the main one being to eliminate or reduce the "beany" off-flavor, present with traditional processing. This taste has proven to be unacceptable to most consumers, particularly since their use of soymilk is as a replacement for cow milk and hence a neutral and non-beany taste is preferred. The taste issue is largely due to the activity of the lipoxygenase enzyme, and the inactivation of this is one of the major objectives of modern processing systems.

Additionally, production capacity, sanitation and functional versatility (variety of flavors and other value- added products) are other factors which have determined the configuration and capability of modern systems.

Competing Methods are available for modern processing. Most modern technology is designed to:

- a) eliminate or reduce the problem of "beany" off-flavor and,
- b) optimize yield and functionality.

These competing technologies employ various methods and principles including: hot grinding of soaked soybeans, cold grinding of soaked soybeans, hot blanching, dry bean grinding and others. With some methods, the problem of flavor is controlled, but the product yield goes down. With others the result is good flavor but poor "mouthfeel", or unsuitable functionality for other derivative foods. Finally, many major processors design either hybrids or variations of these methods, with or without their own innovations. For some consumer products, the final soymilk is "deodorized" with vacuum systems, prior to formulation and packaging.

The complexity of performance claims and the processing options are the greatest challenge to the new soymilk processor or for the upgradation of existing facilities.

Traditional vs. Modern methods is a fundamental issue that processors are facing, particularly those who begin production with a medium capacity in the range of approximately 200 to 300 Liters per hour. For some products, such as tofu and yogurt, it is not necessary to eliminate the beany off-flavor and so the processing line can be simpler and more cost-effective (essentially using the traditional method, with modern equipment). Another factor is the kind of packaging that will be used for the finished product.

Ultimately there are a number of overlapping considerations that determine how complex a system needs to be for any given processor. However, it is safe to conclude that a processor planning to produce a "non-beany" soymilk drink, in a long-life consumer package, will have to acquire the more complex (and more expensive) production technology. Yet, even for this category, there are cost- effective solutions available.

Packaging of many types is used internationally. The most common is the higher-volume, long-life aseptic/UHT packages such as TetraPak. This is generally only cost-effective at higher production volumes in the 1,000 to 2,000 liter / hour minimum or even higher. However, contract packing at an existing milk packaging facility may allow lower volumes to be handled. Newer

milk carton packing is also allowing extended shelf life (refrigerated) for about two months. Bottles can also be used for extended, even non-refrigerated shelf-life, but not for as long as the aseptic UHT. Plastic bottles and pouches / bags are used also for various products. Ultimately, local tastes and market considerations will determine not only the kind and variety of soymilk and soya-dairy products that should be produced but also the type and complexity of equipment and know-how required. For these reasons, a careful analysis is required that reflects the local market and financial conditions.

Invariably, in the near future, automation will be increasingly used to ensure consistent quantity and quality of throughput. There will also be technological solutions for reducing processing time, improving hygiene, increasing productivity and enhancing nutrition. These developments can be classified as improving existing techniques and systems but there is also considerable effort going into creating true innovation, which will drive revolutionary new solutions into the industry and open up new markets.

## Appropriate technology options

### 5.1.1. Silo storage of soybean grains



**Storage silos**

Poor storage facility leads to infestation by pests depending on various factors like moisture content of soybean, relative humidity, temperature, storage, structures, fumigation frequency etc. Silos play a critical role in this context and may be considered as an essential part of a pre-cleaning line.

The silo system for soybean (raw material for soymilk) should ideally be built or configured according to DIN 1055 standards made in galvanized steel of 450 GSM (grammas per cm

square ft size coating). Galvanized steel of 450 GSM will ensure longer life span of even 15-20 years of silos. Quality of raw material stored in silos is stored in bulk directly in silos without use of gunny bags. This ensures reduced loss due to rodents, wastage etc.

Typically, a 50 MT capacity silo comes with diameter of about 3.82 meters with height of over 11.03 meters and capacity of about 82.13 cu. meters. This volume can hold soybean of 50 MT based on bulk density @ 600 kg/ m<sup>3</sup> and 3% compaction. The silo comprises body of shallow corrugated panels, galvanized outside stiffeners made from high tensile steel, hopper supporting and leg structure hot dipped galvanized protection, vertical and roof ladder.

Silo accessories include sensors that are vibratory fork type high and low level indicators provided for indicating the high and low levels of grain in a silo; and discharge gates in terms of manually operated screw type discharge gates provided in the bottom of the silo for controlling the flow of grain. In addition, accessories include catwalks, goal post and silo cap support (for supporting the overhead chain conveyor), receiving hopper, bucket elevator, supporting structure for elevator and holding bin for cleaner; cyclone, rotary air lock, chain conveyors made of GI steel; transfer chutes, ducting, spouts and waste product chutes. Equipment suppliers such as Fowler Westrup India Pvt. Ltd., Rostfrie Steels, Westeel Silos, Buhler Group, Milltec Machinery, Bansal Group etc. have an established reputation in the field of galvanized silos.

#### 5.1.2. Dry Soybean Tank



In smaller set-ups, where large GI steel silo is not a recommended option, dry soybean tanks are essential. Dry soybean tank with elevator or other transferring equipment ensures not only labor cost savings, but also increased production efficiency with fixed transfer quantity to fit the production capacity for de-hulling, washing and grinding. The height of these tanks is around waist of operators, and hence Soybean can be easily poured into the tank by the operator or

other material handling equipment. This, in a nutshell, reduces the risk associated with transportation problems and occupational injuries.

#### 5.1.3. Soybean De-huller (complete with aspiration and sifting system)



Soybean hulls are an obstruction to continued processing, especially in decanter. Since soil bacteria are present in hulls, it is imperative to remove hulls to ensure better shelf life and flavor. Further, soybean hulls contain polysaccharides that not only cause off-flavors but are also responsible for processing problems caused by foaming. Additionally, the holding time of heat treatment of the soybeans to inactivate undesired enzymes can be shortened when using dehulled beans. This will decrease protein denaturation and browning of the soymilk, also leading to a white, attractive and appetizing soymilk product. De-hulling (or decortication) is the process of removing the hull of the soybean seed. Typically, soymilk units need to decrease the final fiber content in the end product to ensure removal of any off colors and bitter taste, so de-hulling is the answer.

In the process, beans are passed through the roller mill, post which the beans are transferred to the primary aspirator. The aspirator has a series of steps that the beans bounce on. The fan/cyclone system is set to only vacuum off the hulls while the hulled beans fall through via gravity into the conveyor. The cyclone picks up a combination of hulls as well as beans and deposits them into the sifter/screener. The sifter/screener contains a series of screens that separates and classifies the remaining hulls and hulled beans. The shaking action loosens everything and places them into various streams, usually categorized as overs, unders, and discard. The overs/unders are conveyed to their own aspiration systems complete with fans. They go through the same steps as primary aspiration but with less aggressive settings to retrieve even more acceptable quality beans.

#### 5.1.4. Soybean Soaking and Washing Machine



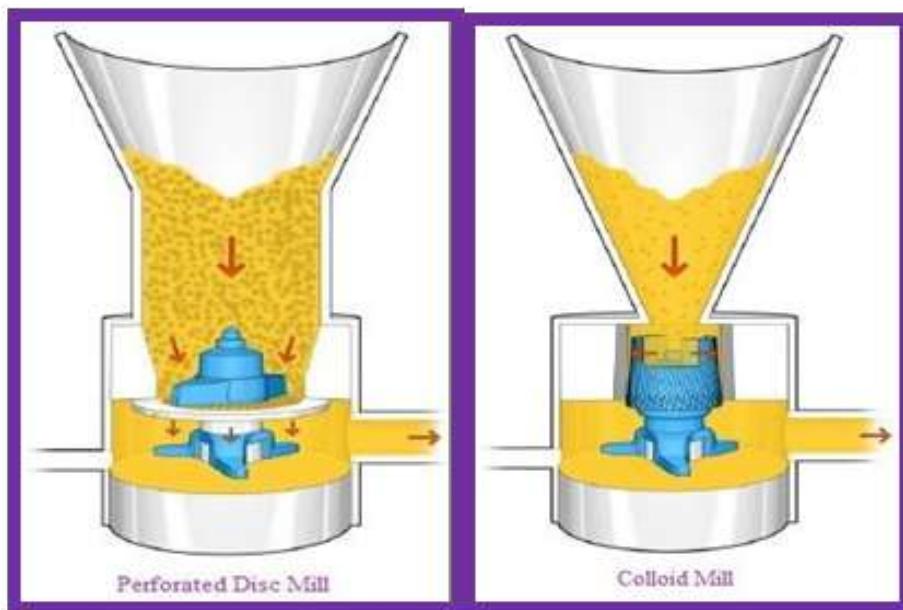
5.1.4. Soybean Soaking and Washing Machine Soybeans are required to be thoroughly washed and soaked in three times their volume of water for a period to swell them sufficiently. The soaking process softens the beans for grinding and leaches out flatulence-causing oligosaccharides. An advanced soybean cleaning and soaking system comprises of a frame, a soybean soaking chamber, a drum-

type cleaning machine and a screw feeder. The soybean cleaning and soaking system also includes a material level sensor which detects the material level of soybeans in the soybean soaking chamber and controllers which respectively controls the drum-type cleaning machine, the screw feeder and an electrical control value. The beans are cleaned by the drum-type cleaning machine, and the cleaned beans are transferred into the soaking chamber by the screw feeder. This system ensures that cleaning efficiency is high, work intensity is low, and the cleaned soybeans contain little impurities so that the quality of soymilk is greatly improved; in addition, the material level sensor arranged on the soybean soaking chamber can accurately detect the added amount of soybeans in the soybean soaking chamber, and hence the soaking quality is higher. Notably, if the beans are not cleaned well, bacteria and dust from soybeans' skin will also enter the grinding section, and thus influence the taste and quality of soymilk. The wet soybeans are then transferred to cooking and grinding section through an automatic flow and suction system.

#### 5.1.5. Soybean Cooking, Grinding and Milk Separating system



## Soybean Cooking and Grinding Machine



Soybeans must be cooked in order to invalidate or counteract a specific enzyme that makes them indigestible to humans. This cooking occurs in the Enzyme Invalidator in which the de-hulled soybeans are cooked using high pressure, water, and high temperature (creating very hot

live steam) to invalidate that enzyme.

The cooked soybeans then fall into the first rough grinder or mill.

Water is added to the machine and the bean pieces are roughly ground in this first milling. Although they have been ground once, the cooked soybeans are still rather coarse. Thus, the fine grinder further pulverizes the bean pellets into small particles. The two stage grinding system generally uses two type of grinding mills. The first one is a perforated disc mill and the second one involves colloid mill system. The hot slurry is white in color with minuscule particles of insoluble soybean particles.



Decanter



Soymilk Cooking System

A large centrifuge/decanter is then used to extract the tiny bits of soybean that are insoluble and cannot be included in the finished product. In a nutshell, in order to avoid chalkiness and obtain a good mouth-feel of the soymilk, the insoluble fibres need be filtered. A rubber roller presses the soy milk slurry against the surface of a drum within the centrifuge, forcing the liquid inside the drum while the fibers remain on the outside of the drum. Some modern decanters can achieve the highest possible separation degrees, meaning that the residual sediment in the soya milk is less than 0.5%. These soybean fibers are physically removed from the production process at this time. Alternatively, an okara

transportation machine is used to discharge okara. Okara, being adequately cooked, is also a good source of high quality protein with dietary fiber. Unless dried to a moisture level of 10% or lower, its shelf life without refrigeration is rather limited. A separate process dries the okara for use other than human consumption. It can further be dehydrated using a belt press.

Some modern processes involve airless cold grinding of soybeans in water that keeps enzyme dormant during the grinding phase to extract most soya solids in water. The enzyme is eventually inactivated along with the trypsin inhibitors while cooking the soya-water slurry. The process thus prevents the denaturing of soya protein and other solids and their adhesion to fibers in soybeans prior to or during their extraction into water; the problem common to all processes employing hot grinding of raw beans or cooked beans.

In several modern units, extracted soymilk is passed through steam heated pipes to further cook the milk to kill any bacteria after which it is transferred to vacuum chamber to enable 'cool down' of the sterilized milk. Most manufacturing equipment is sealed to prevent any contamination from the air. On the other hand, some modern units also deploy separate cooking system, i.e. where cooking is not done in same system of grinding and separation. Most modern soymilk cooking systems are designed with highly precise and automatic temperature and pressure monitor.

#### 5.1.6. Soymilk Blending/Mixing system (Flavoring and Formulation) and buffer tanks



Soymilk Blender



**Buffer Tank with Agitator system**

One of the keys to increasing acceptance of soymilk is formulation, using sweetening and flavoring agents suited for local tastes as well as nutrients. The extracted soymilk is injected into large tanks and flavorings, sugar, and vitamins are mixed separately in smaller tanks. Ingredients of the smaller tank are infused into the larger tanks, thus blending the flavors with the raw milk.

The well mixed beverage is transferred in refrigeration cum storage tank where an agitator maintains the

suspension of various ingredients to keep them well mixed and preserved. These 'buffer barrels' are placed between head devices and soluble sugar devices/blenders to avoid a great amount of cooked soy milk to be poured into the next operation stage and thus influence the quality of soymilk products. Therefore, they serve as machines for temporary storage and transport the right amount of soy milk to the next device in operation on the basis of device capacity. Hence, the buffer barrels are the important mechanism for soy milk production lines - a measure for quality management to keep the lines in normal operation - and reduce the cost of maintenance and labor resources

#### 5.1.7. Soymilk Homogenizer, 'Cool down' and Deodorizing system



## Homogenizer



## Heat Exchanger Machine

The soymilk is again passed through steam heated pipes to kill any microbes present in same. After this the soymilk is quickly cooled down with the help of modern Heat Exchanger machine. A vacuum deodorizer is further used for eliminating the beany smell and off flavor which comes in soy milk. Thereafter, the same is passed through a Modern Homogenizer which pushes the beverage through very small holes to break

down the fat, reducing the size of the particles. Otherwise the fats will tend to lump together, rise to the surface, and separate as distinct layer. Homogenization gives soymilk a creamier appearance and taste and brings consistency to its composition. At the same time, soybean milk is less prone to sedimentation and smoother to the taste. The obtained soymilk beverage is then

stored in a sterile tank and is ready to be packaged.

#### 5.1.8.Tofu Press and Cutter



Automatic Stacking Tofu Mould Machine



Tofu Cutting Machine

Once the soymilk is extracted (separated from okara), the milk is pumped into coagulation tank. A coagulating agent is mixed in, such as citric acid. The coagulant alters the pH and curds the milk much like the process for making cottage cheese. This step takes about 20 minutes. Modern systems use centrifuges or hydraulic presses to drain off excess water, leaving soft blocks of pressed curds. Tofu pressing machine not only increases the production's efficiency, but also improves the production's sanitation. Automated cutters slice the cake tofu into required weight blocks. The tofu blocks are washed in vats of water where they firm up and are

stored until they are ready to be packed.

### Yogurt Incubator



Soy Yogurt Incubator follows a simple process to make yogurt wherein the boiled soymilk is cooled to bring it to room temperature. This cooled soymilk is then mixed with bacterial culture which is used for the milk fermentation. After the thorough mixing of the milk it is then filled in the plastic cups and incubated to 30-35°C for about 2 to 4 hrs. Basically, the equipment helps in speeding up the fermentation process.

### 5.1.10. Soymilk, Tofu and Yogurt Packaging



**Aseptic Packaging:** A very important part of the production is the aseptic packaging of the product. Packaging machines have been developed for this product that are able to mechanically package the product without exposing it to air. The cooled milk is sent to this packaging machine which has a ribbon of flat packaging (cardboard) threaded into it. As the milk runs through the machine, the packaging surrounds the milk and a cutter cuts through the cardboard packaging and the milk, simultaneously folding the package and sealing the milk within it. A machine glues a plastic spout onto the sealed package. From here, the product is sent to an automatic sorter that packs a case and places it on a pallet.

Aseptic soymilk processing takes place before packaging with very short heating and cooling times. The soymilk is heated to 275-300°F for 2-15 seconds. The product is then cooled to filling temperature.

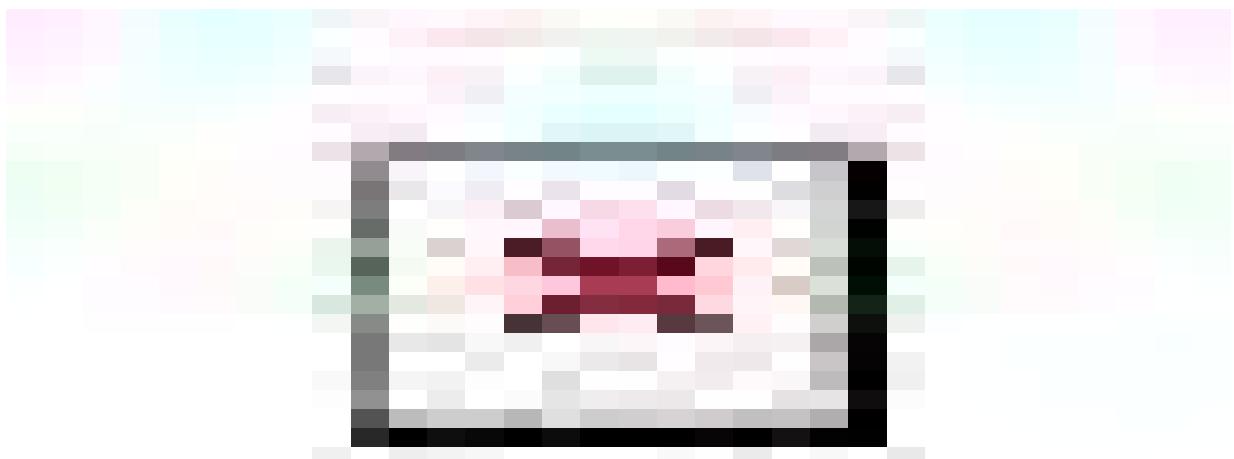
Soymilk is now referred

to as UHT soymilk (Ultra High Temperature). Packaging materials are sterilized through a heated hydrogen peroxide bath. Hydrogen peroxide is then removed from the packaging material using pressure rollers and hot, sterile air.

The filling and sealing machinery are also brought to and maintained at a condition of commercial sterility before packaging occurs. This is achieved using hot air, steam or hydrogen peroxide chemical sterilization. Post cooling, the UHT soymilk is packaged in a special Tetra Pak aseptic container, sealing in the natural goodness of soymilk for many months. Aseptic technologies ensure that the soymilk and packaging materials are free from harmful bacteria. This means soymilk can be safely kept for months without the need for preservatives or refrigeration while retaining color, taste and nutrition.



Modern Multi-Head Automatic Liquid Filling Machines, Crown capping system and Automatic bottle Labeling and Printing system:



Autoclave provides a physical method for disinfection and sterilization. It works with a combination of steam, pressure and time. Autoclaves operate at high temperature and pressure in order to kill microorganisms and spores. Autoclaved sterilized soymilk products have an expected shelf life of few months or more with no refrigeration required. Packaging can also be done in plastic bottles specially designed for autoclaving

Tofu Vacuum Sealing and Tofu Tub Sealing Machines and Yogurt Cup Fillers and sealers: Tofu



Vaccum Sealing Machine



Tofu Tub Sealing Machine



Cup Filling and Sealing Machine

## Tofu

may be packaged into shrink-wrapped blocks or continuous thermo-form packages. Water may be added to the packages, or tubs, and then they are sealed, weighed, and dated. A Yogurt Cup Filling and Sealing Machine is the technologically advanced line with smooth index or driven movement of multi-positions rotary platform. These features make the machines the best available solution for yogurt packaging. All the mentioned packaging machines can be fitted with a CIP cleaning system and operated by a computerized control system PLC.

**Quality Control and Testing Equipments:** Testing equipment comprising Spectro Colorimeter, pH meter, moisture meter, Digital Viscometer, Refractometer, Universal Testing Machine, Kjeldahl Apparatus, hot air oven, ashing oven/muffle furnace, vortex stirrer, sedimentation shaker, NIR grain analyzer, precision weighing scales, milk samplers, glassware and chemicals, etc could be required by unit owner as per requirements.



Spectrocolorimeter



pH Meter



Digital Viscometer



## Refractometer

Functionality and importance of some of these equipments: A Spectro Colorimeter is testing equipment used to provide color measurements, comparisons, and reporting of soymilk and tofu which makes testing and managing color consistency from product lot to lot easy and reliable. A pH meter is a scientific instrument that measures the hydrogen-ion activity in soymilk, indicating its acidity or alkalinity expressed as pH. Digital Viscometers are used to determine the viscosity of a soymilk under specific flow and atmospheric conditions. A Refractometer is used to measure the percentage of soluble solids of soymilk. A Universal Testing Machine is used for hardness determination of Tofu.



Some key tests like Moisture test (air oven method and IR), protein content, Carbohydrate and Ash content test, pH Content test, Fat content test, Viscosity test, Water absorption test, Color test, etc may be conducted at shop floor for effective quality control. Dealers of some reputed manufacturers like Agilent and Presto Testing could be considered for testing equipments.

#### 5.1.11. Support Equipments, Engineering and Automation

CIP system and control: Modern units use CIP systems, i.e. "Cleaning in Place", in most parts of the

unit where soymilk is pumped and undergoes continuous processes. Some equipment still needs to be dismantled and manually cleaned, but wherever possible, CIP is the preferred choice. In CIP the equipment is not dismantled, but is cleaned in the same set-up as it was used during production. Cleaning liquid is then circulated through the equipment in a cleaning circuit. CIP is an important component in guaranteeing food safety in food processing plants.

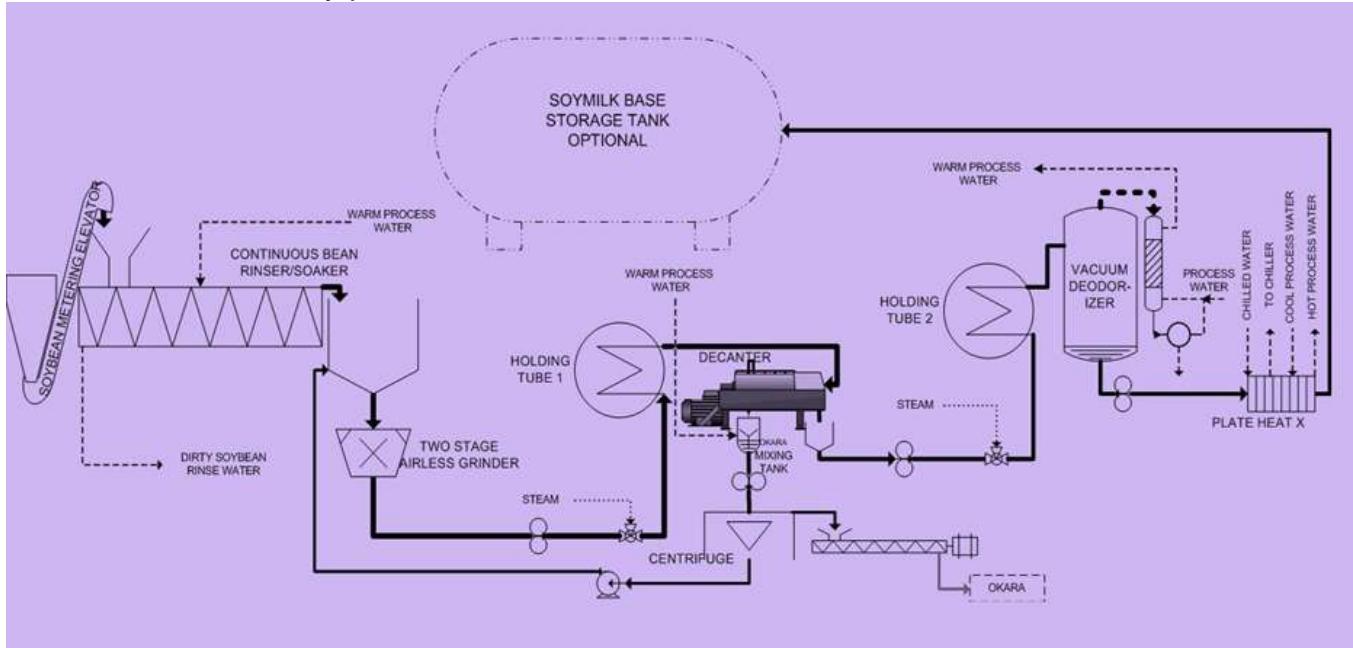
Successful cleaning between production runs avoids potential contamination and products that don't

meet quality standards. In a nutshell, by eliminating the repeated and unnecessary opening of equipment, one can drastically reduce both spare parts consumption and the number of man-hours required for cleaning.

Supporting Equipments and accessories: The support structure and equipments play a highly important role in the performance of the unit. Based on size and capacity, appropriate engineering with appropriate support structure and equipments need to be installed. Supporting equipments include material flow and handling systems, Water softeners, Weighing Scales, Compressors, Deep Freezers, motors and fittings. Key suppliers like Prosoya (Canada), Takai Tofu and Soymilk Company (Japan), Yung Soon Lih Food Machine (Taiwan), Haryana Agro Industry (India), Pristine Plants India (Pvt) Ltd. (India), Pushpanjali Agro Tech (India) etc. provide these systems on turnkey basis. Compressors of Atlas Copco, ELGI or similar repute make are highly preferred by modern units to support packaging operations other pneumatic

functions.

Engineering: Engineering of a soymilk plant depends on several factors such as size/capacity, technology, type of raw material and level of automation. The design decisions have a tremendous impact on operational sanitation and maintenance. The plant layout should present a smooth, orderly flow of raw materials or ingredients through each manufacturing phase on to the storage of the finished product. Moreover, the key principles that govern benchmarking in material handling and support equipment's are: high efficiency, low power consumption, easy and minimum maintenance, durability and long lifetime, smooth operation, movement direction control switch for safety precaution.

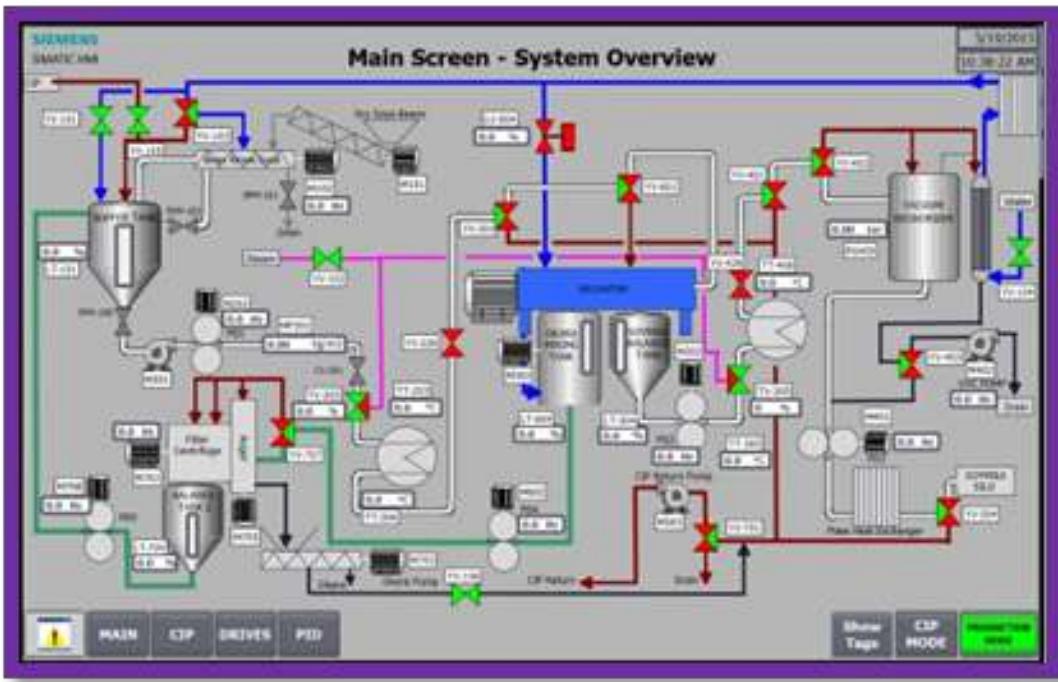


Modern Soymilk Plant Engineering and Layout

Automation: All processes in soymilk plant can be optimized and controlled through control panel i.e.

automation. Process optimization refers to operating plant optimally with economic performance in terms of productivity and yields. It

also avoids human errors. Scada and PLC systems are now integral part of soymilk industry. Automation ultimately leads to productivity and ease of operation. New concept of Internet of things (IoT) has a great potential to make manufacturing process smarter and predictive. The Internet of Things is also becoming a part of food industry and it cannot be ignored that skilled/ technical workforce will be a challenge for future. IoT as such monitors system, diagnoses problems and provides actionable information which in turn helps prevent problems both on Material and Equipment side. It allows operator to identify problem before it happens and take diagnostic action.



Automation: All processes in soymilk plant can be optimized and controlled through control panel i.e.

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Key turnkey plant suppliers like Prosoya (Canada), Takai Tofu and Soymilk Company (Japan), Yung Soon Lih Food Machine (Taiwan), Haryana Agro Industry (India), Pristine Plants India (Pvt) Ltd. (India), Pushpanjali Agro Tech (India) etc. provide solutions on this front as well.

## Strength

1. Modern technology facilitates higher efficiency and productivity.
2. Use of modern storage systems will ensure proper hygiene and highly reduced incidences of leakages, improper handling of material, and various other factors that lead to losses in storage.
3. Use of modern CIP system eliminates impurities that pose a significant health and safety risk.
4. The use of modern technology may help reduce the yield losses.
5. Use of modern decanters/centrifuge eliminates impurities which impact downstream machine efficiency.
6. Modern separation methods facilitate relatively higher separation of liquid soymilk, thus ensuring higher recovery.
7. Relatively low competition in micro and small scale segment.
8. The use of modern technology will enable production of premium quality soymilk, which will help link with premium consumer segment and may fetch better margins.
9. New age machines, having small footprint, facilitate optimum space utilization for plant installation.
10. Use of two stage grinding with larger throughput capacities ensure higher production and reduced breakdowns, as well most precise grinding for maximum milk recovery.
11. Soymilk machines are built of complete non-corrosive material, i.e. stainless steel, which further supports the food safety approach.
12. Soymilk base lends itself to making several value added products like tofu, yogurt, soy-cream, soy ice-cream and soymilk base chocolates, energy bars and sweets.
  
13. Modern packaging methods significantly reduce man hours spent on the activity, while considerably increasing the accuracy.
14. Scientific design and engineering of modern soymilk plant facilitates optimum space utilization, reduced leakages, reduced power consumption (by power saving in processes), better product output and manpower safety.
15. Automation in the plant can decrease the dependency on the labour contractors. It also ensures minimum human handling of products.
16. Automation can also help real-time identification of problems and immediate trouble shooting

## Opportunity

1. Scope for technology upgradation.
2. Large scope of tapping the “Protein rich- lactose free-healthy” products market.
3. Key schemes of Central Govt. (like Kisan Sampada, etc) and State Govt. could be utilized to set up most modern plants.
4. Changes in lifestyle, such as longer work hours, higher disposal incomes, growth in online purchase, impulse purchase, working women, convenience lifestyle, etc have increased the demand for packaged beverages.
5. Branding offers huge potential for product promotion.
6. Increased interest in health and nutrition is creating demand for some properly processed and packaged soymilk products.
7. FPOs can invest in mini versions of recommended technologies, which are developed by some Institutes like CFTRI/KVKs and even other reputed private players.

8.FPOs who upgrade with mini mills will be able to produce quality products and directly penetrate in premium markets.

9.FPOs can also tap opportunity of soymilk for malnourished children programs or distribution in school programs.

10.Opportunity to penetrate the growing market of packaged soymilk value added products.

11.Niche yet increasing market demand for soymilk products with better quality standards- with least contamination.

12.Higher value realization to units by way of higher yields and production of premium quality soymilk products.

13.Scope of large scale backward integration with Farmers Groups/FPOs to integrate procurement and production and marketing operations.

14.Opportunity to custom process for larger players in market: Custom milling/processing offers three specific advantages to the soymilk products marketer (1) Ability to customize products to the specific requirement of a particular market (2) Flexibility to upscale or downscale production volumes in line with seasonal variations in demand in the shortest possible time and (3) a cost advantage due to differential labour costs structure.

15.By using print and electronic media, attempt could be undertaken to increase public awareness of the health and nutritional benefits of Soy, emphasizing in particular that soy food is inexpensive and can help to eliminate both malnutrition and chronic diseases associated with over nutrition. Part of this effort should be to assure the public and medical communities that soy is safe and concerns expressed by some segments of society that soy adversely affects growth and the reproductive life of men or women are without scientific merit.

16.It could be (rather should be) publicized that soy based beverages are most effective in alleviating malnutrition among children, lactating and expecting mothers and would be of significant value in minimizing low birth weight of children in the country.

17.Industries could club up and jointly advertise and promote the soymilk and products in international market.

18.Soymilk and products could be promoted as generic products and their promotion could emphasize on the health benefit of Soy rather than the advertisement of a particular company's product.

19.Soymilk products could be made even more available on the supermarkets shelves so as to create awareness among the customers regarding its uses.

## PREPARED BY BISWAJIT BHATTACHARYA

### Acknowledgement

•Comparative Study of Soy Paneer Prepared from Soymilk, Blends of Soymilk and Skimmed Milk- By Jeelani Raja\*, Hillal A Punoo and Farooq A Masoodi, Department of Food Science and Technology, University of Kashmir, Srinagar-190006, India

•G. C. Mustakas-Process Engineering, V. E. Sohns-Cost Engineering, Engineering and Development Laboratory, Northern Regional Research Laboratory

•Technology of Soymilk and some Derivatives- By Tan Boe Han

•History of Soymilk and Other Non-Dairy Milks (1226 TO 2013) - Compiled by William Shurtleff & Akiko Aoyagi, Soyinfo Center

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DIRECTORATE OF HABITABILITY AND ENVIRONMENTAL FACTORS DIVISION

Cleaning in place: A guide to cleaning technology in the food processing industry- by Tetra Pak

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Bühler sets new standards in soybean seed cleaning- <http://www.buhlergroup.com/>

How Tofu Is Processed- Tara McHugh

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Soya Drinks and Beverages - Soy Yogurt - Soymilk Powder - Soya Dairy Foods-  
[www.soyadairy.com](http://www.soyadairy.com)

Soybean Dehulling – How Does It Work?- By Jason Buseman

Soy Food Processing- Overview of Soy Food Production- Tuchenhagen Dairy Systems

## STEVIA PROCESSING TECHNOLOGY

Stevia as the healthiest sweetener with many medicinal properties is a wonderful gift from nature. Its true potential was discovered by the ancient wisdom of a warrior race living in the rain forests of South America. Modern science brought the benefits of Stevia to the common people. Tireless works of countless scientists and technologists made the benefits of Stevia accessible to us. Now we have pretty standardized knowledge of the cultivation technique of Stevia, its extraction and purification process and application.

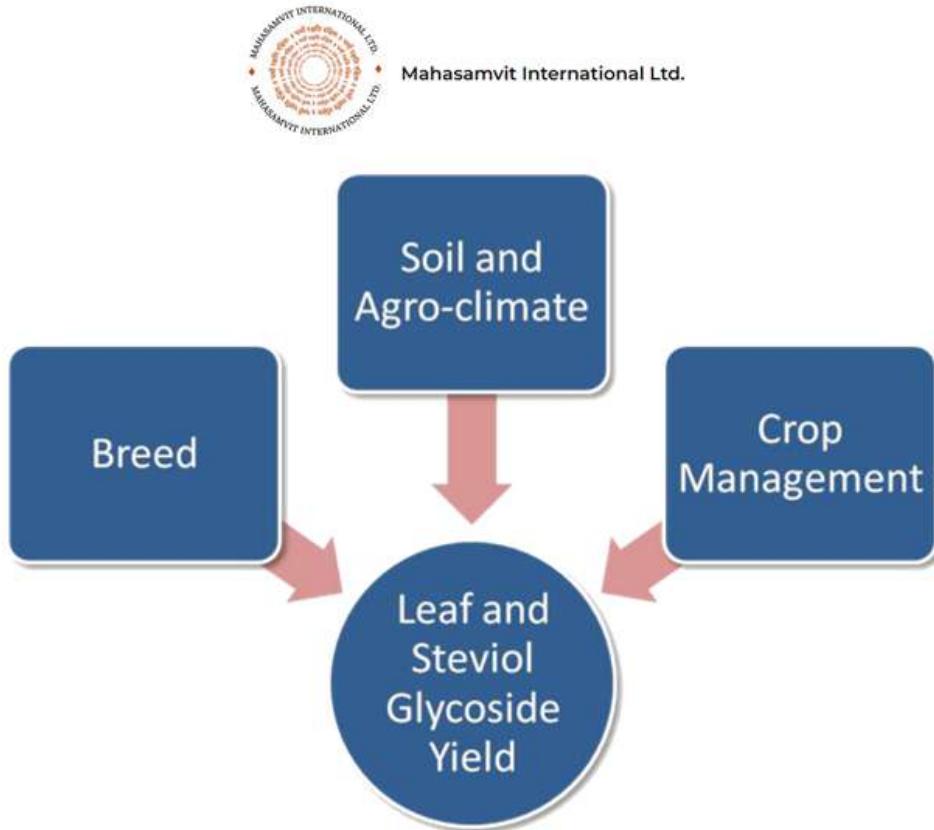
### Modern Stevia Farming

My experience in stevia farming taught me that growing stevia and making profit out of a stevia plantation is a different subject altogether. The stevia value addition chain starts from its farming and the success of the entire value addition chain is dependent on its economic farming. Steviol glycosides are not produced in factories – it is actually grown in the field. Unplanned and poor managed stevia plantation never leads to a profitable and sustainable of stevia business.

With the following articles, I tried to illustrate the ideal farming practice of Stevia.

#### Stevia Farming - Demystified

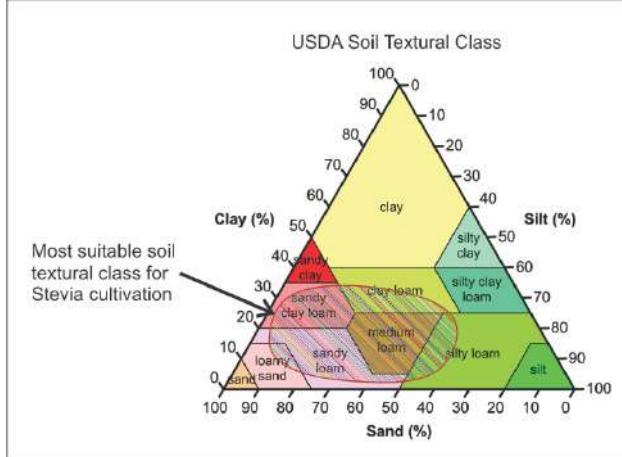
During identification of a land for stevia farming, generally, very little effort is invested on proper assessment of its fertility status, inherent soil problems, topography and water availability. Selection of wrong stevia cultivars, improper irrigation planning and sub-optimal nutrient management are the other factors which contributes to underperformance of stevia plantations.



#### The Three Pillars of Success

The leaf biomass yield and steviol glycoside yield from a farm is a function of three variables – the breed, the existing soil and agro-climate and the crop management. I shall discuss about the breeds in some later article. Now, let me present my brief notes about the farming operations

with specific reference to soil and agro-climate, as well as crop management.



### Soils suitable for Stevia cultivation

Gray Alluvial Soils – but soils with high clay content and low drainage should be avoided

Red Soils – but highly acidic soils with aluminium and iron in toxic level shuld be avoided

Black Soils – The chernozem black soil with high organic matter is suitable. The highly clayey volcanic black soils have drainage and hardness issue and not favoured.

### Soils not suitable for Stevia cultivation

Black peaty soils

Marshy peat bog soils

Chalky soils with high phosphate binding capacity

Infertile desert soils

Highly eroded soils, specifically when the surface horizon is lost

Saline and sodic soils

Gravelly and rocky soil

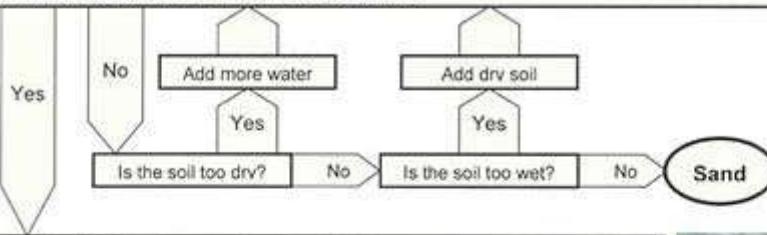
Soils with low water-holding capacity

Soils with very hard structure i.e. clod formation

## **Soil Texture by Feel**

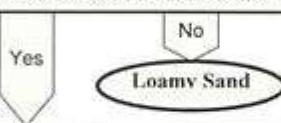
**Start:** Place soil in palm of hand. Add water drop-wise and knead the soil into a smooth and plastic consistency, like moist putty.

Does the soil remain in a ball when squeezed?

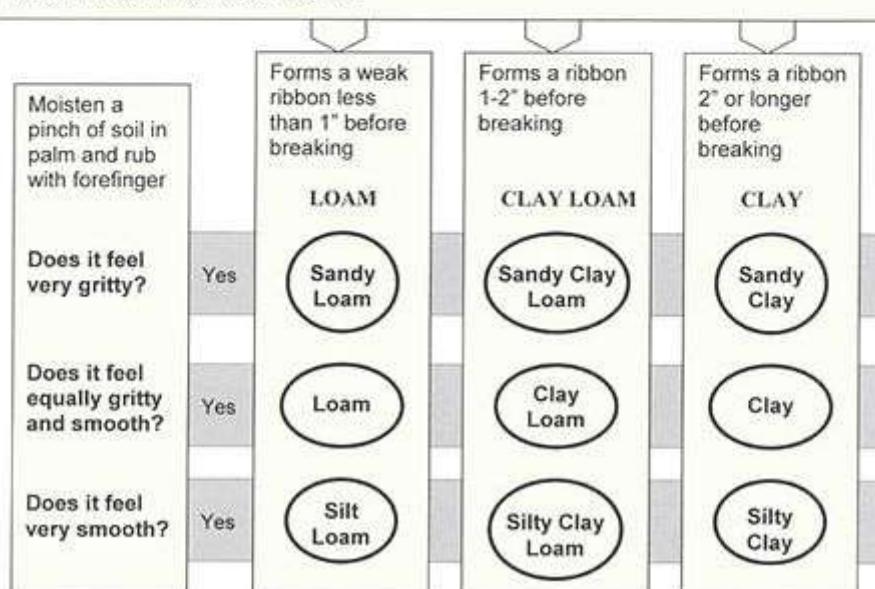


Place ball of soil between thumb and forefinger, gently pushing the soil between with the thumb, squeezing it upward into a ribbon. Form a ribbon of uniform thickness and width. Allow ribbon to emerge and extend over the forefinger, breaking from its own weight.

Does the soil form a ribbon?



What kind of ribbon does it form?



## **Soil Test**

For assessment of suitability of a soil for Stevia cultivation, soil fertility test is indispensable. The soils should be fertile enough to nutritionally sustain a high yielding Stevia crop. I am providing here a rough guideline about the required soil test values for soil capable of economically sustaining high yielding stevia crop.

<b>Parameters</b>	<b>Acceptable range</b>
pH	6. – 7.5
<b>Organic carbon as a measure of available nitrogen</b>	> 0.5%
<b>Available nitrogen by alkaline permanganate method</b>	> 400 Kg/ha
<b>Available P<sub>2</sub>O<sub>5</sub> by Olsen method</b>	> 90 Kg/ha
<b>Available potassium by neutral ammonium acetate method</b>	> 250 Kg/ha
<b>Calcium by neutral ammonium acetate method</b>	> 3.0 milliequivalent/100g
<b>Magnesium by neutral ammonium acetate method</b>	> 2.0 milliequivalent/100g
<b>Zinc by DTPA method</b>	> 0.6 ppm
<b>Manganese by DTPA method</b>	> 2.0 ppm
<b>Copper by DTPA method</b>	> 0.2 ppm
<b>Iron by DTPA method</b>	> 2.0 ppm
<b>Boron by hot water extraction method</b>	> 0.5 ppm
<b>Molybdenum by ammonium oxalate method</b>	> 0.2 ppm

### **How to Take a Soil Sample**

The reliability of a soil test is only as good as the sample you submit. The small amount of soil in the sample bag you send to the Agricultural Testing Lab must represent the entire area to be fertilized. Avoid unusual areas such as those where fertilizer or lime has spilled. Take samples before lime, fertilizer, or manure are added. Use only clean equipment for collecting soil samples.

### **Where to sample**

The area to be sampled should be as uniform as possible in terms of soil type and cropping and fertilizing history. For practical purposes it should be an area you expect to fertilize as a unit. If you have a problem on part of the production field, you may wish to determine if soil fertility is the cause by taking one sample to represent the “good” and the other to represent the “poor” area.

### **Take a good sample**

Collect a number of cores or slices by walking in a zig-zag pattern over the area. Mix cores thoroughly in a clean pail for a composite lab sample. The greater the number of collected cores mixed together, the better the sample will represent the average condition of the sampled area. Choose one of the following tools:

## **Soil Probe or Auger –**

A soil probe or auger is the best tool for sampling. An auger will be needed if the soil is very stony or gravelly. Simply push the probe (or push and turn the auger) into the soil to the desired depth, lift up to remove the core, and place it in the clean pail. Sampling depth should be 6 inches deep.

## **Garden Trowel or Shovel –**

If a soil probe or auger is not available, collect your sample by pushing the blade of a garden trowel, shovel, or spade into the soil to the desired depth. Cut out a triangular wedge of soil and set it aside (to be replaced after sampling). Now slide your blade into the soil again taking a thin (half inch) slice from one side of the hole. With a knife, trim the slice to about a 1-inch strip of soil down the center of the spade – top to bottom. Save this “core” as part of your composite lab sample.

## **Mix the sample and fill the sample bag**

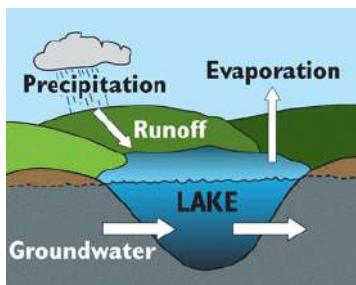
Make sure that all the cores are thoroughly mixed together. Your soil test mailer contains a plastic bag intended for one lab sample. Fill plastic bag about 1/2 full (approximately 1 cup) with the mixed sample.

## ***Good Agricultural and Environmental Conditions***

It is always a good idea to follow the Good Agricultural and Environmental Conditions (GAEC) especially if maintenance of environment is one of the objectives of the farming operations. The guidelines for maintenance of GAEC are as follows :

### **Main issue – Water**

1. Establishment of buffer strips along water courses
2. Where use of water for irrigation is subject to authorisation, compliance with authorisation procedures
3. Protection of ground water against pollution: prohibition of direct discharge into groundwater and measures to prevent indirect pollution of groundwater through discharge on the ground and percolation through the soil of dangerous substances.



### **Main issue - Soil and carbon stock**

1. Minimum soil cover
2. Minimum land management reflecting site specific conditions to limit erosion
3. Maintenance of soil organic matter level through appropriate practices including ban on burning arable stubbles, except for plant health reasons



## Main issue - Landscape, minimum level of maintenance

1. Retention of landscape features, including where appropriate, hedges, ponds, ditches, trees in line, in group or isolated, field margins and terraces, and including a ban on cutting hedges and trees during the bird breeding and rearing season and, as an option, measures for avoiding invasive plant species



## **Agroclimate**

Stevia grows as a wild plant in semi-humid, sub-tropical climates where temperatures typically range between -6°C to 43°C. It is a long day plant and requires 12-16 hours of sunlight per day and is sensitive to excessive heat and low temperature. Long spells of higher temperature may inflict heat stress to the plants and they may wilt. The plant can withstand mild frost but heavy frost may adversely affect the roots. The optimal temperature for growing Stevia is between 15°C to 30°C. Long cold spells are also undesirable as it can affect the growth rate and can make the plants dormant. The day temperatures should not exceed 48°C and the night temperatures should not fall below 4°C.

Annual average rainfall of 140 cm per year has been found optimum for its good growth. Higher annual rainfall promotes fungal leaf diseases. Higher cloud cover also promote flowering and decrease in steviol glycoside content in the leaves.

It is a photophilous plant and doesn't grow in shady locations. The growth rate of the plant is reduced at a photoperiod of less than 12h. The increase in the photoperiod to 16h and the high intensity of solar radiation increase the vegetative growth of the plant, and the levels of stevioside.

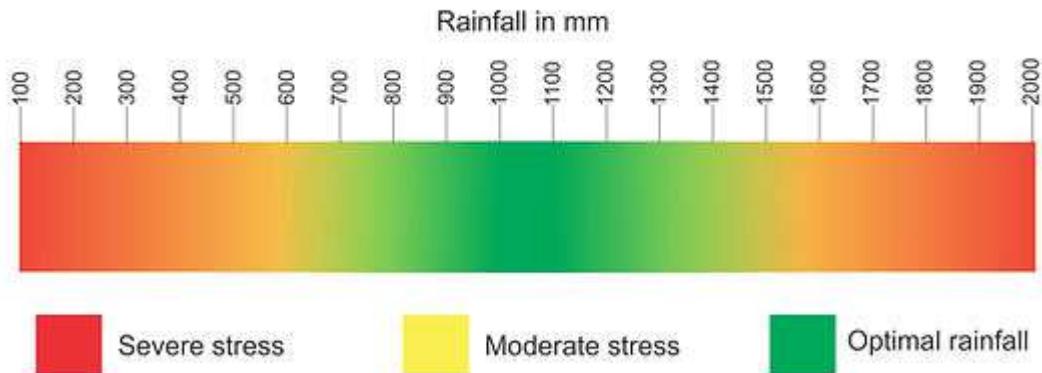
The flowering is directly linked to the duration of the photoperiod and accelerates during short days. Flowering always decreases steviol glycoside and biomass yield.

Meanwhile, the atmospheric moisture appears to play an important role in the plant development, as cases of wilt have been mentioned in crops sufficiently provided with water,

when dry and warm conditions prevailed.



### Rainfall Requirement



## Growth Variation with Temperature



### Physical Methods of Pest Control in Stevia Farming

Insect infestation in Stevia may cause significant damage to the crop both in greenhouse and field stage. Thus, pest control becomes one of the most important part for overall agronomic management of the crop. The chemical control methods for most common insect pests have already been described elsewhere in this website. The chemical control methods should be adopted only as the last resort and methods which are more environment friendly with minimal adverse effect on human health should be adopted preferentially as profilactic measure.

Physical insect control has been used successfully in Stevia and several other crops. Though the initial investment is higher in comparison to other pest management systems, its environment friendliness, minimal health risk and compatibility with organic farming often make them a viable option. Let us discuss some physical methods which have been used in Stevia.

#### Methods:

The widely accepted methods for physical insect pest control are as follows –

1. Barrier method
2. Insect traps
3. Electronic insect repellent

Let us now have a closer look at all the systems.

#### Barrier Methods

##### Kaolin Spray

In this method, a physical barrier is created between the plant surface and attacking insects. A natural mineral, kaolin is often used for this purpose. Kaolin-based sprays have been studied extensively since 1999 and research has established that these sprays deposit a "particle film" that has numerous beneficial effects on plants and in insect pest control.

Kaolin mixed with spreaders and stickers and applied to plants as a spray at 1–6% concentration in water form has been shown to be an effective approach to agricultural pest control and to protect plants from environmental stresses.

Kaolin acts as a physical barrier preventing insects from reaching vulnerable plant tissue. It acts as a repellent by creating an unsuitable surface for feeding or egg-laying. The uniform white film may also disrupt the insect's host finding capability by masking the color of the plant tissue. Furthermore, particles of kaolin act as an irritant to the insect. After landing on a treated surface, particles of kaolin break off and attach to the insect's body triggering an excessive grooming response that distracts the pest.

Kaolin-based sprays can also form a highly reflective white film over plant surfaces that is known to enhance plant photosynthesis and reduce heat stress in plants by reflecting the infrared light spectrum. Kaolin is generally regarded as safe to humans and has long history of use in the paint, plastics, pharmaceutical and paper industry. Kaolin sprays are used for pest control and sunburn protection in both conventional and organic food production in the United States and abroad.

Kaolin clay is available as a wettable powder to be mixed with water. Application can be done with most commercially available spray equipment but large amounts of water are required. To prevent caking, it is suggested that the material be added while mechanical agitation is running, or to first completely mix the required amount in a small amount of water before filling up the tank to the recommended volume. It may be tank mixed with soaps, and most pesticides, but not copper, sulfur, or Bordeaux mixtures. Precipitation, curdling, uneven film formation or changes in viscosity are signs of incompatibility. Periodic shaking is recommended for a backpack sprayer or use of an automatic agitation mechanism for larger equipment in order to keep the material suspended in water. Efficacy is only successfully achieved with thorough coverage. Care should be taken to cover the entire surface of the crop.



A brand of kaolin spray



Kaolin treated plants

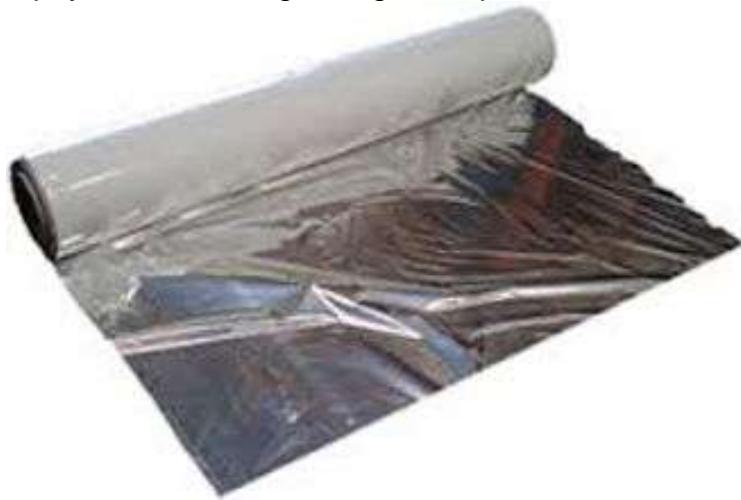
[TOP](#)

## Silver Reflective Mulch

Plastic mulch with metalized silver sunlight reflecting upper surfaces has shown considerable insect repellent activity.

Silver mulches reflect sunlight up into the undersides of the canopy thereby increasing photosynthesis. The reflective surface of the silver mulch produces an increased light intensity that tends to repel whiteflies, aphids and other bottom leaf dwelling insects. Generally, these insects harbor at the dark underside of the leaves. The reflection of sunlight from the mulch illuminates the underside of the leaves and affects the phototaxis of the insects. The insects are thus repelled from the lower leaf surfaces. High light intensity at the lower surface of the leaves also interferes with the metamorphosis of some insect pests and disturbs their life cycle.

Other benefits of silver mulch include weed control and decreased water usage. It also provides a physical barrier against ground pests.



Reflective Much Roll



Stevia with reflective mulch

## Insect Traps

Several types of insect traps can be used in Stevia plantations and greenhouses. Their mode of action and efficacy varies widely. Some of the trapping systems are described below.

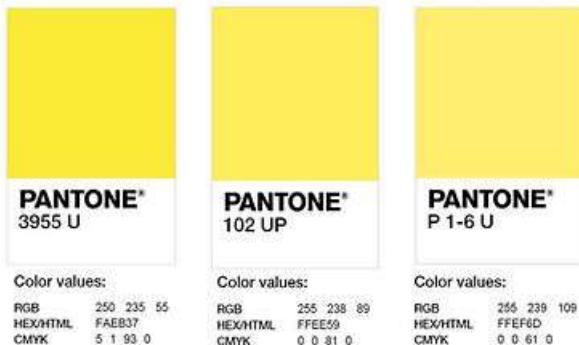
### Yellow Sticky Traps

A number of insects are found to be attracted to objects of specific colours. Aphids, whiteflies, scales, and many other insects initially locate plants on which they feed by using visual cues such as colour. However they do not see the colours reflected from the plants in the same way

we do. Insects are able to distinguish among the various colours-of light that are reflected from the surface of plants. Therefore, instead of seeing leaves as a green colour, they see varying hues of yellow and blue that are reflected from the leaf surface. The colour of reflected light that we perceive as yellow (wavelength 500-600 nm) is a major component of the light reflected from plant surfaces, and a greater amount is reflected from newer growth than older growth. Most aphids, whiteflies and scales prefer the newer growth and fly towards objects reflecting large amounts of light at the proper wavelength. They will be attracted to any object strongly reflecting light in the 500-600 nm range. This strong response to yellow coloured objects can be used to help control the numbers of aphids and whiteflies in the plantation and green house.

Yellow sticky traps are plastic or cardboard strips with bright yellow colour and coated with strong non-drying glues. They are hung in different locations in greenhouse and nurseries. Airborne insects are attracted to the colour and whenever the land on the strips, they get trapped by the glue. Originally the sticky traps were used as a sampling tool to study insect population in certain areas, but their application area has been broadened as a pest control/management tool. In green house, one standard sticky trap per 20 square feet (approximately 2 sq. m) can reduce the white fly population be 90%.

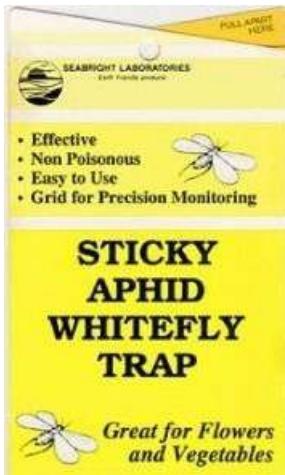
The sticky traps can also be made at home with yellow paper (post it notes may work) and some common kitchen supplies. An acceptable quality non-drying glue can be made by boiling corn starch in water along with corn syrup, water and white vinegar. Otherwise, any commercial pressure sensitive adhesives may work. A lot of resources for “do it yourself” yellow sticky traps are available over the internet.



Colour of yellow sticky traps



Application in green house



Yellow pan trap

The sticky traps can also be made at home with yellow paper (post it notes may work) and some common kitchen supplies. An acceptable quality non-drying glue can be made by boiling corn starch in water along with corn syrup, water and white vinegar. Otherwise, any commercial pressure sensitive adhesives may work. A lot of resources for “do it yourself” yellow sticky traps are available over the internet.

The affinity of white flies and aphids towards yellow colour is also utilized in yellow pan traps. In this system, a shallow plastic pan of proper yellow colour is filled with water up to a depth of 1-2 inch (25-50 mm). A little detergent is added in the water to break the surface tension. Insects attracted to this pan for its colour fall in the water and gets drowned.

Sometimes, insect pheromones are used in these sticky traps to make them more effective. For some insects like grass hoppers, blue is more favoured colour, and blue sticky traps are used to control them.

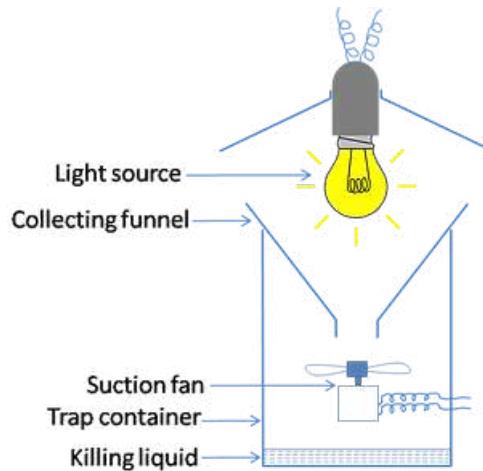
### **Light Traps**

Light trap is one of the very effective tools of insect pest management in organic agriculture as it mass-traps both the sexes of insect pests and also substantially reduces the carryover pest

population.

A light trap consists of three major components

1. Light source
2. A funnel and container for collecting the insects
3. A fan to create air blast for arresting the insects and guiding them to the trap container
4. A quantity of killing/drowning liquid – often dilute detergent solution



## Light source

Long ago, paraffin wick lamps were used as light source for these types of traps. Later, as the lighting technology progressed, incandescent electric lamps and then fluorescent lamps and mercury vapor lamps are used. At present, energy saving LED lamps are most prevalent in these systems. A lot of insects has affinity towards ultraviolet (UV) radiation, and thus, UV lamps are also used extensively in light traps.

While the light source attracts the insects, the traps need another device to kill or capture them. Often this is a container with water that is placed under the light source. The insects that circle around the light will drop in the water and get drowned. It is recommended to add a bit of soap to the water. Instead of water, it is also possible to use sticky plates.

Percentage of insects attracted at different colored light during night hours in the field

RED

2.20%

YELLOW

10.60%

GREEN

4.70%

WHITE  
18.00%  
UV  
42.10%  
BLUE  
22.40%

Light traps were originally used as monitoring tools and their insect population management potential was identified later. One of the major problems with light trap is that it cannot discriminate between harmful and beneficial insects. If the traps appear to kill large numbers of beneficial insects it is better to take out the traps.

### Solar powered models

Recently, many solar powered models of light trap have been launched. They generally employ UV and yellow LEDs as light source. The systems are provided with rechargeable batteries, which can provide power to the light source throughout the night.

These solar powered units can run without any human intervention as they are provided with ambient light sensor and thus turn themselves on automatically in the evening and turn off at dawn. They need little maintenance too. The efficacy of light traps remains unchanged in rainy seasons when most of other pest management procedure becomes less effective.

For optimum effectiveness, the light traps should not be placed near competing lights (lamp posts) and should not be installed in heavy traffic areas. Traps are also to be placed in such a way that they do not attract insects from adjoining farms across the Stevia plantation. In that case the harm will outweigh the benefit.



The traps should be placed at a height that is within the normal flight range of most flying insects. But it is just as important to position the units in a place that is easily accessible for inspection and routine service. Regular clearance of the trap pan is also necessary to ensure proper farm hygiene.

### Local Experiences

My friend Mr. Ranganath Krishnan of **Stevia World Agrotech Pvt Ltd**, Bangalore informed me

in a personal communication about successful adaptation of solar powered trap in Bangalore region. One trap in one acre of land was found to be sufficient for adequate insect control.



Pictures of Solar Powered Insect Traps used in Karnataka

A light trap in action

A short video of a "Do It Yourself" light trap

[TOP](#)

### Bug Zappers

A bug zapper, more formally called an electrical discharge insect control system, electric insect

killer or (insect) electrocutor trap, is a device that attracts and kills flying insects that are attracted by light. A light source attracts insects to an electrical grid, where they are electrocuted by touching two wires with a high voltage between them. The name stems from the characteristic onomatopoeic zap sound produced when an insect is electrocuted. They were originally designed for indoor applications, mainly in food processing facilities, but, later they are successfully used in agricultural pest control also.

Bug zappers are usually housed in a protective cage of plastic or grounded metal bars to prevent people or animals from touching the high voltage grid. A light source is fitted inside, often a fluorescent lamp designed to emit violet and ultraviolet light, which is visible to insects and attracts them. The light is surrounded by a pair of interleaved bare wire grids or spirals. The distance between adjacent wires is typically about 2 mm (0.079 in). A high-voltage power supply powered by mains electricity, which may be a simple transformer-less voltage multiplier circuit made with diodes and capacitors, generates a voltage of 2,000 volts or more, high enough to conduct through the body of an insect which bridges the two grids, but not high enough to spark across the air gap. Enough electric current flows through the small body of the insect to heat it to a high temperature. The impedance of the power supply and the arrangement of the grid is such that it cannot drive a dangerous current through the body of a human.

Many bug zappers are fitted with trays that collect the electrocuted insects; other models are designed to allow the debris to fall to the ground below. Some use a fan to help to trap the insect.

A standard bug zapper is generally claimed to effective for controlling an area of 0.5 ha. One of the typical problems with bug japer is that it cannot differentiate between beneficial and harmful insects and indiscriminate killing of insect may have serious impact on beneficial insects.



An omnidirectional outdoor type insect zapper  
Installation of solar powered insect zapper in field

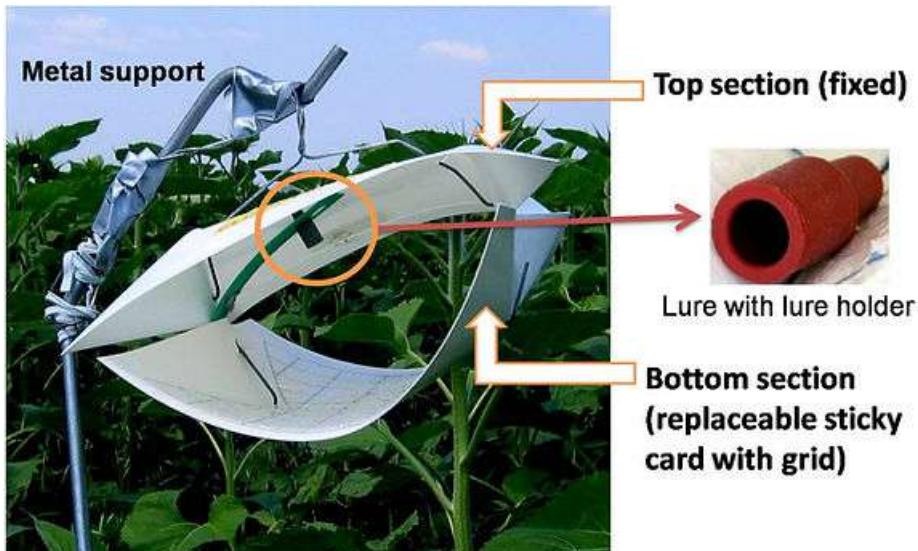


## Pheromone traps

Pheromones can be used as a bait to attract certain insects (especially moths) and catch them in a trap. Usually these traps use a sticky surface to catch the insects, but others use containers filled with water or other liquids to catch them.

Most pheromones are "sex pheromones". These are chemicals released by female moths to attract a male partner. As a consequence the traps will only catch male moths and usually of only one species. To catch other species, different pheromones will have to be used.

Pheromone traps are very useful for monitoring a specific pest species and will often detect low population densities. However, the traps are not very efficient for controlling pests.



A disadvantage of the pheromone traps is that the chemicals are often expensive and not easily available. On the other hand, they have the advantage that they only attract the pest and will not kill beneficial insects.

A type of trap, often used with pheromone baits, is the "delta-trap". It is a triangular trap, made of plastic or weatherproof card. Insects that fly into the trap are caught on a surface treated with a special type of non-drying glue.

## Electronic Pest Repellants

There are two types of electronic pest control devices widely available: electromagnetic and

ultrasonic.

## **Electromagnetic**

Electromagnetic ("EM") pest repelling devices claim to affect the nervous system of many pests. The major mechanism for the lethal action of EM towards the insect was proposed to be absorption of radiofrequency energy and rise of temperature within the insect body – just like the action of a microwave oven.

Though there are several equipments available in the markets, which are claimed to be effective in pest control through microwave EM radiation, it is very unlikely that any affordable instrument is able to generate and radiate enough microwave energy to affect insect population even at a short distance.

## **Ultrasonic**

Ultrasonic devices operate through emitting short wavelength, high frequency sound waves that are too high in pitch to be heard by the human ear (all frequencies greater than 20,000 Hz). Humans are unable to hear sounds higher than 20 kHz due to physiological limitations of the cochlea. Some animals, such as bats, dogs, and rodents, can hear well into the ultrasonic range. Some insects, such as grasshoppers and locusts, can detect frequencies from 50,000 Hz to 100,000 Hz, and lacewings and moths can detect ultrasound as high as 240,000 Hz produced by insect-hunting bats. The claims of effectiveness of these equipment and application of ultrasonic sound waves for control of insects in general has been questioned by scientific fraternity.

## **Farming**

### **Contract Farming**

#### **Initiation into Stevia Farming:**

#### **Stevia as a diversification crop for tea gardens**

A major success was achieved with intercropping of stevia with rubber. Rubber has a long gestation period and at least 10 years are required for the first yield. Rubber trees are generally planted 3.0 m apart and the space between the plant rows can be efficiently utilized for stevia cropping. For the first 5 years, the canopy of the rubber plants does not block too much sunshine and thus stevia can grow very well as an intercrop with rubber. This intercropping helps to reduce the time for getting economic return from rubber plantations.



## **Large scale farming**



## **Stevia Extraction Technologies and Recent Developments**

Scientific and honest information about industrial extraction technologies of stevia are very scarce in public domain. Whenever a person starts looking for basic information about the extraction technology options, he encounters the following things –

1. Patents documents written in mystic language – which hide more than they reveal
2. Webpages of technology developers – who often make unjustifiable tall claims and use a lot of marketing jargons
3. Research papers – Some are legit and others are fakes – but all of them are too

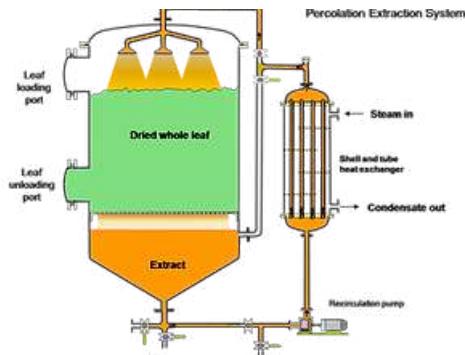
technical.

now looking for overseas technology partners for jointly working for technology dissemination. The objective for the collaboration will be –

1. Establishing local single window facilities for technical assistance to Stevia Start Ups
2. Jointly executing overseas turnkey project
3. Promotion of location specific appropriate technology
4. Assimilation of local home-grown technologies and their commercialization.



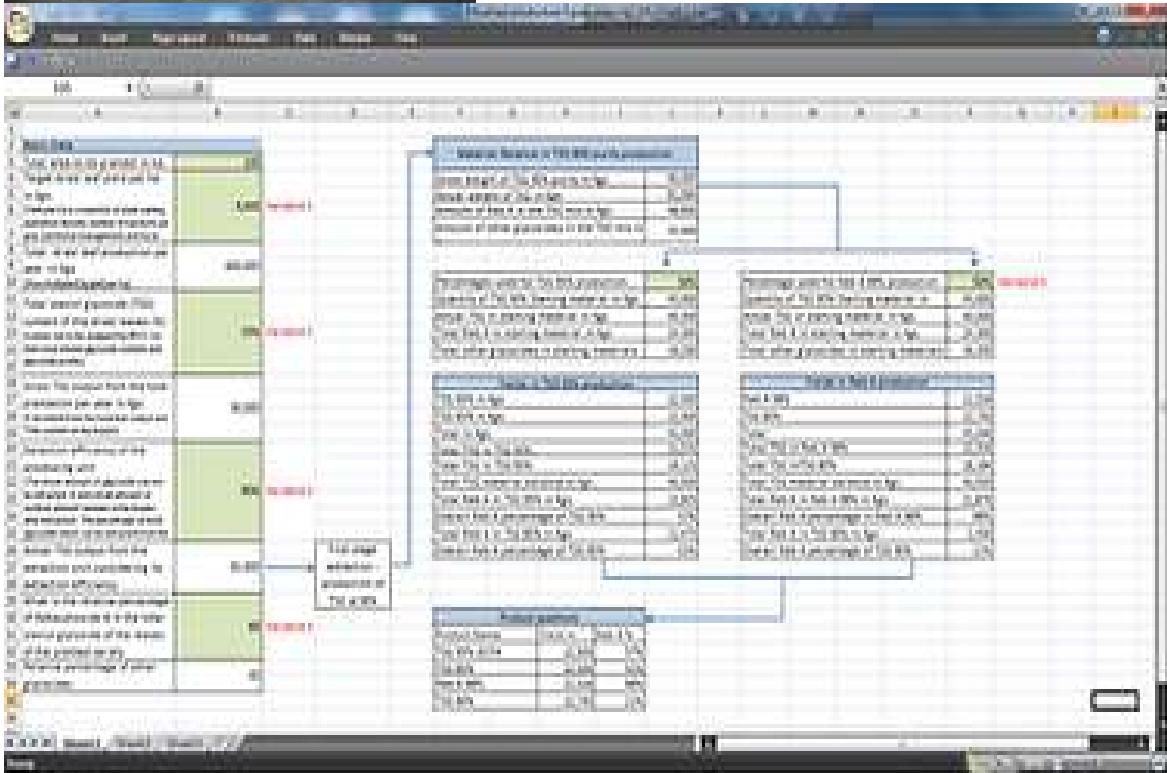
Overview of Extraction Process



New Extraction Methods

In almost all the industrial technologies for extraction and purification of steviol glycosides, leaves are extracted with water as the first step. Generally, the process involves seeping whole dried leaves with hot water, sometime with agitation, and then separation of the liquid extract from the spent leaves. Most of the time, the economics of the whole extraction and purification process depends on the efficiency of this water extraction process.

Resin Free Extraction



## Production Variables for an Extraction Unit

All the extraction process actually yields simultaneously a spectrum of products with different total glycoside content and glycoside profile (i.e. relative percentage of different glycosides). All these products fetch different prices. Thus, to maximize profit, all the production parameters are to be planned in such a way, which maximizes production of products which sale at higher price.

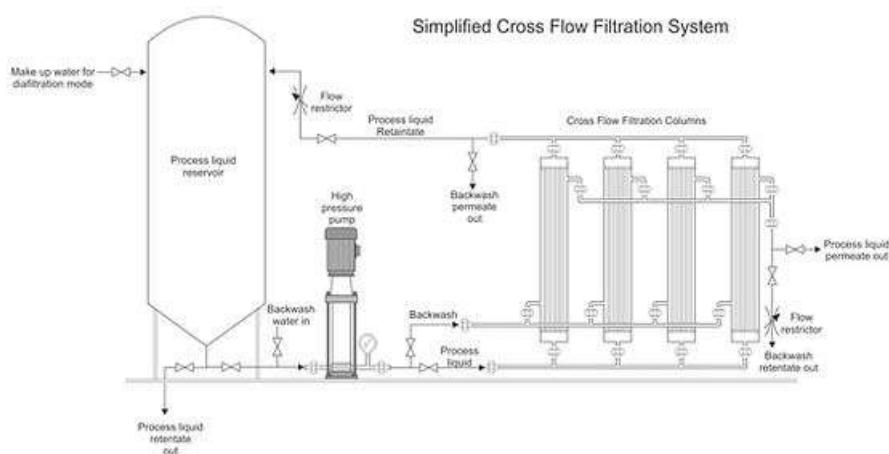
## New Methods for Activated Carbon Decolorization in Stevia Extraction

In the extraction and purification process of steviol glycosides has several steps which involve removal of coloured components from liquid extract by activated carbon. Activated carbon treatment is a very delicate unit process which needs proper equipment and precision process control. The conventional Chinese origine extraction process engineering is yet to assimilate the modern methods of activated carbon treatment. Thus, very often the extraction units end up with activated carbon treatment units with primitive design with very low efficiency and high process time.

Let us discuss about some modern activated carbon treatment systems and equipments which may be integrated into the extraction process for higher process efficiency and lower processing cost.



## [Membrane based steviol glycoside purification – Demystified](#)



Use of ion exchange resins, chemical flocculating and chelating agents and solvents in the conventional extraction and purification process of steviol glycosides seemed as incompatible to its “natural” and “organic” image to a group of workers. To address these issues, the membrane filtration based extraction technology has been proposed.

The essential features of this technology are as follows –

1. Apart from water, no other solvent is used in the process
2. Steviol glycosides are purified only on the basis of physical filtration

Recently, this technology is often being promoted as the “Holy grail” of extraction processes. But, like all other process technologies, it has also its pros and cons. Here, I am trying to “demystify” the process through a simple process description and discussions about its advantages and drawbacks.

## [Fermentation Based Steviol Glycoside Production – Demystified](#)



Produced by nutrition from earth, rain and sunshine from a plant.....found by ancient wisdom



Produced by a genetically modified organisms in an industrial setup utilizing inorganic/synthetic nutrients



started working on a micro-scale Stevia extraction set up. The objective of the work is to standardize a system, which can be accommodated on few tables....but capable of producing steviol glycoside economically. In short, I am trying to break the “scale of economy” barrier. The system is actually a miniaturization of the industrial process, to be used as process modification and standardization platform. For this process, I have worked out the engineering details and standardized the process parameters for an electro-coagulation system for clarification of the water extract. This process does not require use of hazardous chemical flocculants like Calcium Hydroxide, Ferric Chloride or Alums. We are now one more step closer to absolute organic extraction process.

## Recent Trends in Stevia Formulations

### Steviol Glycoside - Formulation Challenges

As a sweetener, steviol glycosides poses several technical challenges to the formulators. Some of the major technical challenges are -

1. Slow onset of the sweetness
2. Hollow sweetness.

- 3. Long lasting aftertaste.
- 4. Perceptible bitterness above 6% sucrose equivalency.
- 5. Short shelf life for the liquid product.
- 6. Keeping a clean and natural label while reducing calories
- 7. Side effects of the auxiliary components.
- 8. COST



### **Co-crystallization of Steviol Glycosides with sugar alcohols**

Development of process technology for co-crystallization of steviol glycoside and erythritol has been standardized in our laboratory.

In this process, both the components are integrated into single crystals. The resultant product looks just like crystalline sugar. The crystals are shiny and transparent. In this type of products, individual components never separate.

All the detailed engineering of the low cost process is also now complete. The same technology can be used to produce co-crystallized product of steviol glycoside with any sugar alcohol

### **Research and Developments on Stevia**

#### **Genetic Improvement of Stevia**

Now, the profitability of the Stevia sector is mostly governed by the economic efficiency of its farming. To remain competitive in the Stevia market, we need to derive the maximum yield from our farming against reasonable crop management expenses.

We now need more and more quantity of leaves from unit area of our Stevia farms and we need maximum number of sweet glycosides in the leaves. Moreover, to reduce our input costs in farming, we need robust plants with resistance to diseases and environmental stresses.

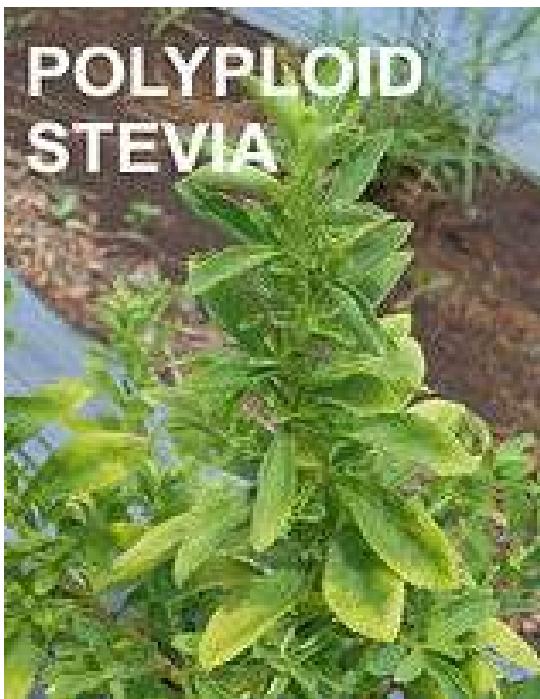
It's a real ropewalk now !

We need better Stevia plants now, which will produce more leaves per plant, more glycosides in the leaves and should be tough enough to fight all the diseases and environmental stresses. So, genetic improvement of the Stevia plants and development of high yielding varieties is the topmost priority.



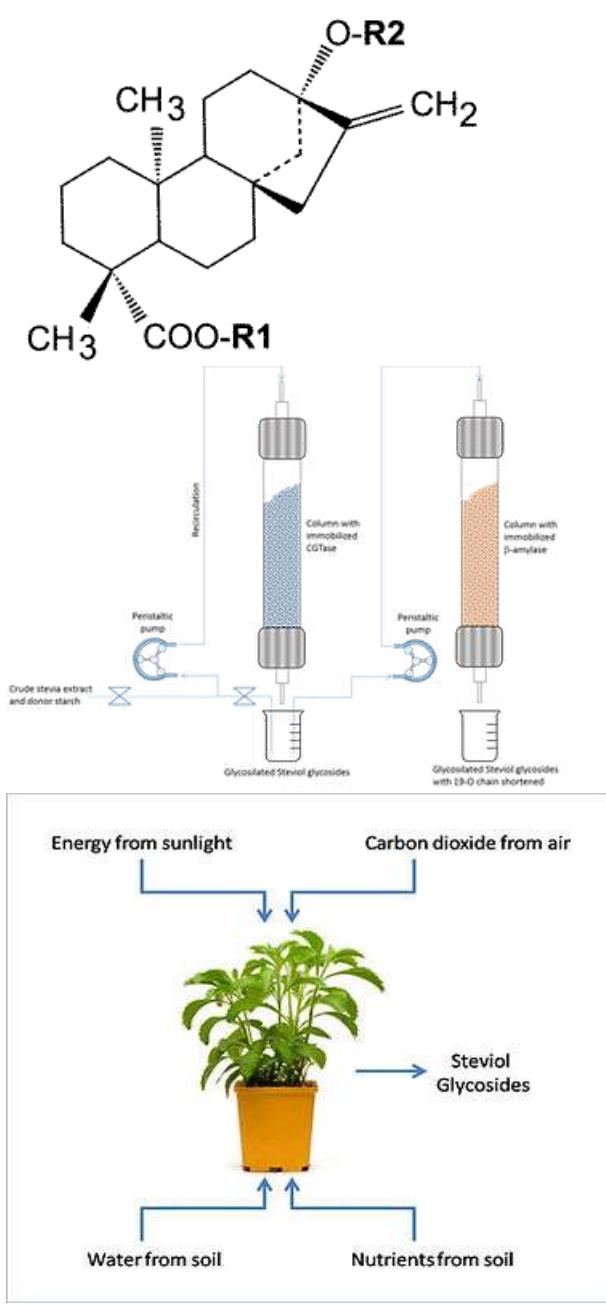
### ***Polypliody Induction in Stevia***

Polypliody, the condition of possessing more than two complete genomes in a cell, has intrigued biologists for almost a century. Polypliody is found in many plants and some animal species and today we know that polypliody has had a role in the evolution of all angiosperms. In stevia, induction of polypliody is often an important tool in its genetic improvement. In some cases, the polypliod plants have higher growth vigour, larger and thicker leaves and greater biomass production potential.



### ***Enzymatic Transglycosylation of Steviol Glycosides***

Steviol glycosides taste somewhat bitter, and show aftertaste. In order to improve of sweetness, modifications of sugar moieties were conducted by enzymatic transglycosylation. Steviol glycosides, when treated with Cyclomaltodextrin-glucanotransferase (CGTase), yield a complex mixture of products which are mono-, di-, tri and more glycosylated. Significant improvement in quality of taste was observed for most of the glycosylated products.



### Steviol Glycoside Biosynthesis

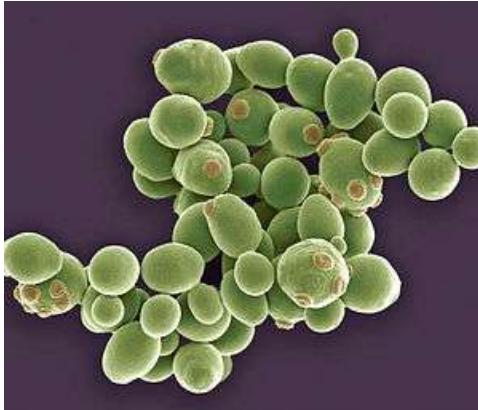
Stevia plants synthesize steviol glycosides as a bio-chemical defense against some species of insects. Steviol glycosides are synthesized from products of photosynthesis and glucose breakdown in a complex biosynthetic pathway. Steviol – the backbone of steviol glycoside molecules belongs to diterpene group of compounds – which plays a multitude of biological functions in plants.

Production of all diterpene group of compounds shares a common initial biosynthetic pathway. The diterpene compounds have a basic backbone of “poly-isoprene”. Isoprene is a simple organic compound with the following chemical structure -

### Genetic Modification of Yeasts for Steviol Glycoside Production

From basic building blocks, generated from photosynthesis and glucose breakdown, the

synthesis of Steviol Glycosides requires 15 specialized enzymes. The organisms, which have all these 15 enzymes in functioning condition within their cells can only synthesize Steviol Glycosides. All these enzymes are proteins and the necessary software code for producing these proteins should reside in the DNA of the organism capable of producing Steviol Glycosides.



### How Yeasts are Genetically Engineered for Steviol Glycoside Production

The foreign protein or enzyme, which we want to express in our production organism, is first extracted from the original organism, purified and its amino acid sequence is determined. Amino acid sequence of all the enzymes for steviol glycoside biosynthesis pathway is available in database like UniProt.

Next we can back calculate the possible nucleotide sequence in the DNA of the region which codes for the enzyme. There are several bio-informatics tools available for this job. In plant cells finding a gene in this process is not very useful, since the coding region may contain non-sense fragments into it (introns). So it is better to look for the messenger RNA for the particular protein. Once we can figure out the mRNA sequence, and its length, which in turn can give an idea about its molecular weight, we may proceed to the next stage.

## Yeast Expression Vector (example)

2 μ seq features:

**yeast ori**

ori<sup>E</sup> = bacterial ori

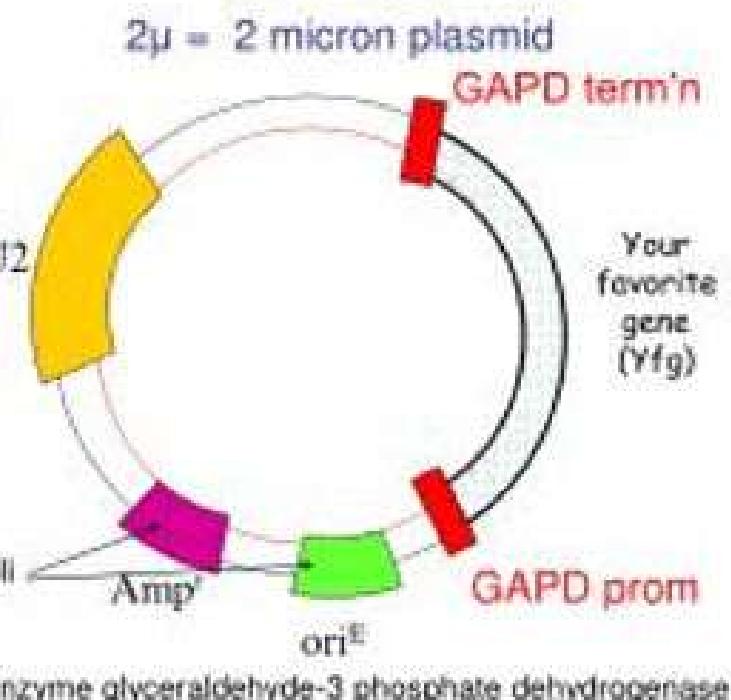
Amp' = bacterial selection

LEU2, e.g. = Leu biosynthesis  
for yeast selection

Complementation of  
an auxotrophy can  
be used instead of  
drug-resistance

Auxotrophy = state of a mutant  
in a biosynthetic pathway  
resulting in a requirement for a  
nutrient

For growth in E. coli



GAPD = the enzyme glyceraldehyde-3 phosphate dehydrogenase



### The "Eversweet" Story

In December 2015, Swiss headquartered biotech company Evolva announces that it has achieved a technical milestone in its partnership with Cargill, Inc. to commercialise EverSweet™, the next-generation fermentation based, zero-calorie stevia sweetener. Reaching this milestone triggers the payment of USD 0.5 million by Cargill to Evolva. EverSweet™ is made with the best-tasting sweetness components found in the stevia leaf, Reb M and Reb D, which deliver a great taste with better sweetness intensity, faster sweetness onset and improved sweetness quality.

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**EverSweet™**, the next-generation fermentation based, zero-calorie stevia sweetener. Reaching this milestone triggers the payment of USD 0.5 million by Cargill to Evolva. EverSweet™ is made with the best-tasting sweetness components found in the stevia leaf, Reb M and Reb D, which deliver a great taste with better sweetness intensity, faster sweetness onset and improved sweetness quality.

**Table II.B.1-1 Summary of Enzymes and Respective Functions Introduced into the Production Strain**

Enzyme	Function
Cytochrome P450 reductases ( <i>A. thaliana</i> , <i>S. rebaudiana-1</i> , <i>S. rebaudiana-8</i> )	Works with P450 enzyme(s) in pathway
UDP-Glucosyl Transferase 74G1	Adds a glucose to C19 of steviol or steviol glycosides
UDP-Glucosyl Transferase 76G1	Adds a glucose in beta 1,3 positions of primary glucose in steviol glycosides
UDP-Glucosyl Transferase 91D2	Adds a glucose in beta 1,2 positions of primary glucose molecules in steviol glycosides
Copalyl diphosphate synthase	Converts GGPP to CDP
Kaurene Synthase	Converts CDP to kaurene
Kaurene Oxidase	Converts kaurene to kaurenoic acid
UDP-Glucosyl Transferase	Adds a glucose in beta 1,2 positions of primary glucose molecules in steviol glycosides
Geranylgeranyl pyrophosphate synthase	Converts prenyl phosphates to GGPP
Kaurenoic acid hydroxylase	Converts kaurenoic acid to steviol
UDP-Glucosyl Transferase 85C2	Adds a glucose to C13- of steviol or steviol glycosides
Beta-isopropylmalate dehydrogenase	Complements LEU2 auxotrophy in <i>S. cerevisiae</i>
Histidinol phosphate transaminase	Complements HIS3 auxotrophy in <i>S. cerevisiae</i>
Orotidine-5'-phosphate decarboxylase	Complements URA3 auxotrophy in <i>S. cerevisiae</i>

It seems that they have not made any change in the MVA pathway and did not try any MVA pathway deregulation. They did not try to introduce the MEP pathway also in their production strain also. The biosynthesis of steviol glycoside is evidently dependant on original built-in IPP and DMAPP biosynthesis system.

### **Deletion of mating type switching gene**

Along with vegetative reproduction by budding, yeast can also reproduce sexually. Any yeast population has two types of cells....either a type or  $\alpha$  type. When both the types are present, mating between them may occur. Yeast cells can also switch their mating types. In this genetic modification work, the production strain has been rendered HO-(haploid) by deletion of a specific gene to prevent switching of mating types during the production of steviol glycosides so that they can not undergo mating events and bring about unwanted genetic rearrangement.

### **Growth Parameters**

The GRAS notice mentioned – “The growth rate of the strain is slightly altered due to expression of a large number of heterologous genes”. The obvious effect of expression of large number of heterologous genes should be diversion of significant portion of metabolic resources for assembling of the products of the heterologous genes, which in turn should adversely affect the growth vigour.

### **Yield and Production Cost**





