Model Bankable Projects – 2026

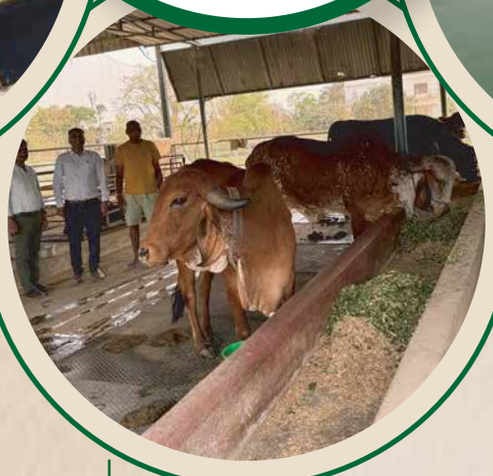
Part – I

Makhana

Mushroom

Solar Dryer

Cage Culture



Dairy Farming

नाबार्ड

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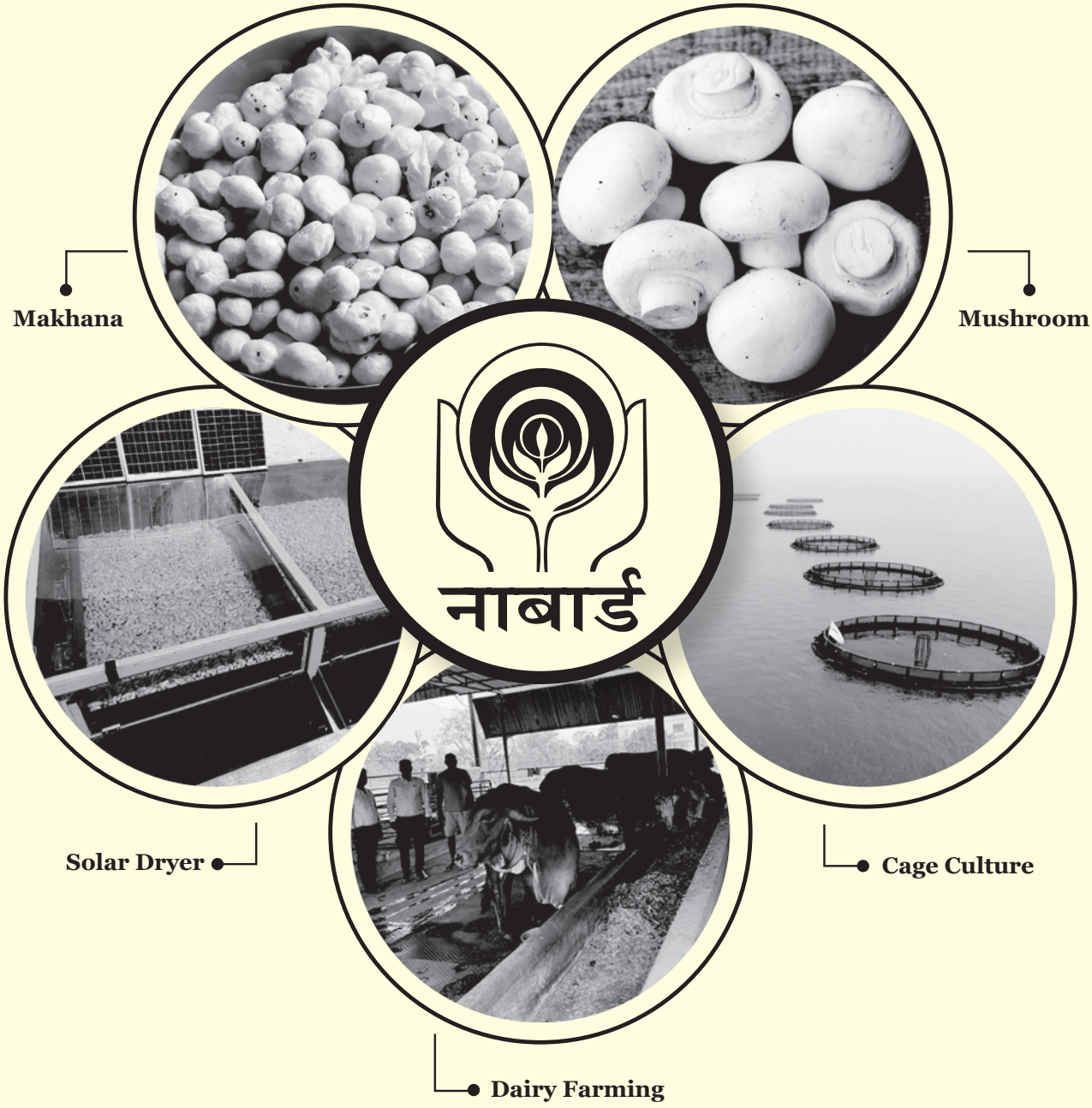
Model Bankable Projects – 2026

Part – I



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गाँव बढ़े >> तो देश बढ़े

Taking Rural India >> Forward

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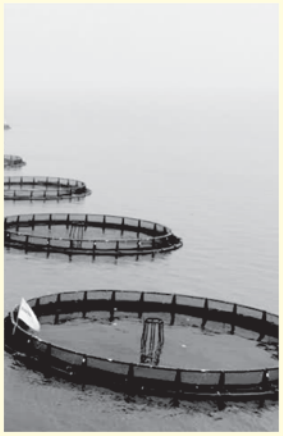
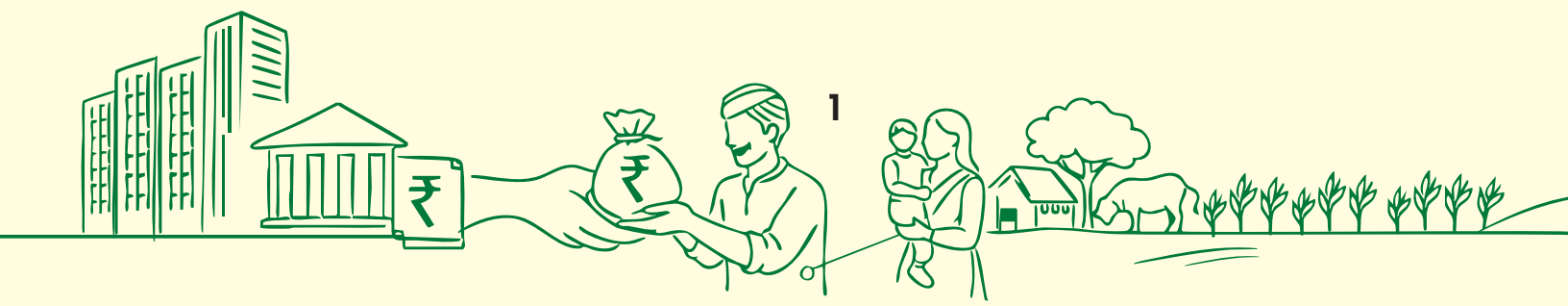



BANKABLE PROJECT ON

MAKHANA CULTIVATION AND PROCESSING



Makhana Cultivation and Processing (micro units) in North Bihar

Makhana Cultivations and Primary Processing - A Model for Rural Empowerment in Bihar

Makhana (Euryale ferox), a traditional aquatic crop, holds immense economic, cultural and nutritional significance in Bihar, particularly in the North Bihar region. The state contributes more than 90% of India's total makhana production, owing to its favourable agro-climatic conditions, extensive network of Ponds and Chaur lands, and the presence of skilled traditional communities engaged in its cultivation and processing. Despite this natural comparative advantage, the makhana value chain remains largely informal, labour-intensive and under-capitalised, limiting income realisation for farmers and processors.

Agro-Climatic Suitability and District-wise Potential in the Seven Makhana-Growing Districts

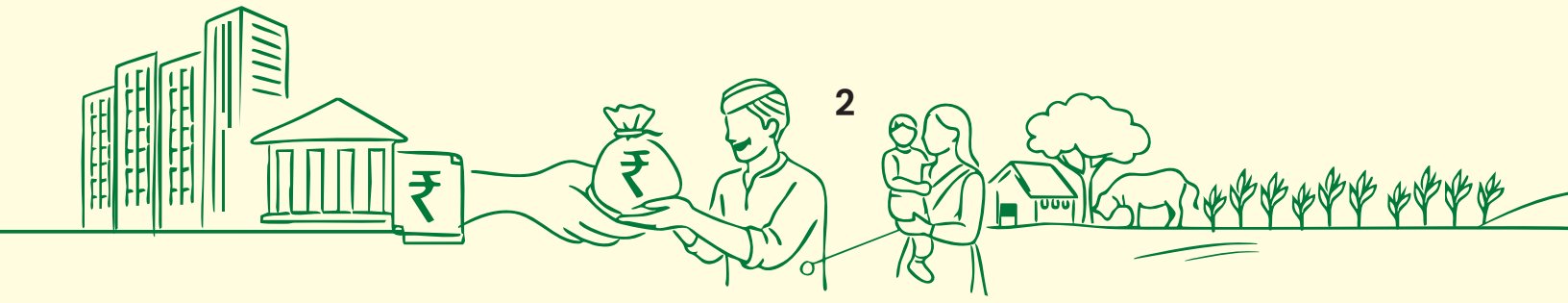
The agro-climatic conditions of North Bihar—characterised by shallow water bodies, humid subtropical climate, fertile alluvial soils, and abundant rainfall—are ideally suited for makhana cultivation. Districts such as Darbhanga, Madhubani, Sitamarhi, Saharsa, Supaul, Katihar, and Purnea have a long tradition of makhana farming. These districts offer significant untapped potential for area expansion, productivity improvement, and scientific pond-based cultivation, which can be leveraged through targeted investments and planned credit flow.

Current Status of Makhana Cultivation, Processing and Marketing:

At present, makhana cultivation in North Bihar remains largely traditional, labourintensive, and dependent on inherited skills. Productivity levels vary widely across districts, and post-harvest losses remain high due to rudimentary processing techniques. Processing and popping units are mostly unorganised, operating with outdated technology and limited access to working capital. Marketing is dominated by intermediaries, resulting in low price realisation for farmers and primary processors. This underscores the need for an integrated and formalised value-chain approach.

Key Challenges in Traditional Cultivation

Major challenges include low productivity, high drudgery, occupational health risks for cultivators, limited access to quality seed and modern inputs, inadequate mechanisation, and climate-related vulnerabilities such as floods and waterlogging. On the processing side, lack of modern popping machines, quality grading facilities, storage infrastructure, and standardisation restrict value addition and competitiveness. Limited institutional credit and absence of risk mitigation instruments further constrain sectoral growth. A bankable model focusing on scientific cultivation and decentralised primary processing at farmer/cluster level can transform makhana into a powerful instrument for rural livelihood enhancement, women empowerment, employment generation and financial inclusion.



By integrating improved agronomic practices, mechanisation of primary processing, institutional credit and market linkages, makhana can emerge as a sustainable, high-value rural enterprise in Bihar.

Rationale for a Cluster-Based Model Scheme with Banking Support

A cluster-based approach enables economies of scale, targeted infrastructure development, and efficient delivery of extension, credit, and market linkages. By focusing on geographically contiguous makhana-producing pockets, the model scheme aims to integrate cultivation, processing, and marketing within defined clusters. Banking support is critical to finance long-term investments, meet working capital needs, and facilitate technology adoption across the value chain.

Objectives of the Banking Plan for Makhana Cultivation and Processing

The primary objectives of the scheme are to enhance productivity and income of makhana farmers, promote scientific cultivation practices, modernise processing and value addition, strengthen farmer institutions, and ensure sustainable and inclusive growth of the makhana sector. The scheme also aims to improve access to institutional credit, reduce dependence on informal finance, and create resilient rural livelihoods.

Proposed Cluster Development Approach for Makhana Value Chain Strengthening

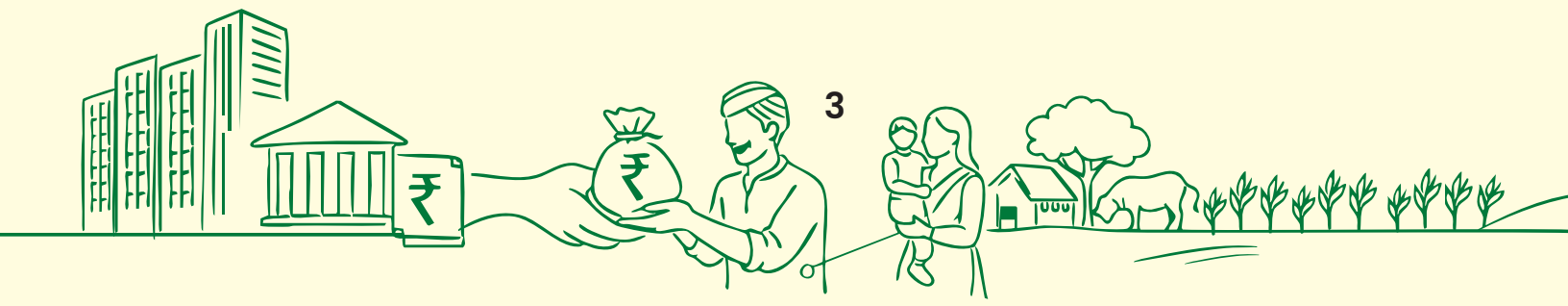
Each identified cluster will comprise farmer groups, FPOs, PACS, SHGs, and local processing units. Cluster-level interventions will include pond development, input supply, extension services, establishment of common processing facilities, and market aggregation platforms. Dedicated implementing agencies will coordinate with banks and line departments to ensure seamless execution.

Improved Cultivation Practices, Productivity Enhancement And Climate Resilience

The scheme promotes scientific pond preparation, improved seed varieties, line sowing, balanced nutrient management, and use of appropriate tools to reduce drudgery. Climate-resilient practices such as water management, flood-tolerant cultivation methods, and diversification with fish or other aquatic crops will be encouraged to enhance sustainability and risk mitigation.

Primary Processing, Value Addition and Quality Upgradation Interventions

Investments will focus on modern popping machines, grading and sorting equipment, hygienic drying yards, packaging units, and storage facilities. Value-added products such as flavoured makhana and branded consumer packs will be promoted to improve margins. Quality upgradation will align with food safety and export standards.



Institutional Framework: Role of Farmers, FPOs, PACS, SHGs and Processing Units

Farmers will be organised into groups and FPOs to facilitate collective input procurement, credit access, and marketing. PACS and SHGs will play a key role in lastmile credit delivery, savings mobilisation, and women's participation in processing activities. Private and cooperative processing units will act as anchors for value-chain integration.

Credit Architecture and Financing Needs - Makhana Value Chain

The scheme envisages a comprehensive credit architecture covering crop loans, term loans for pond development and machinery, working capital for processing units, and infrastructure finance for common facilities. Credit will be aligned with activityspecific cash flows and repayment capacities, supported by interest subvention and refinance wherever applicable.

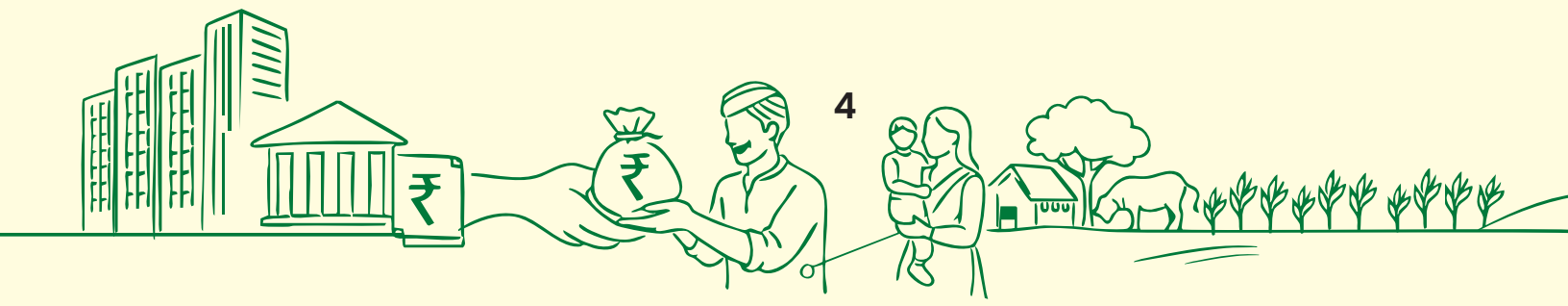
Indicative Unit Cost of cultivation per ha in Rs. lakh

Makhana Cultivation (Pond)	Makhana Cultivation (Field)	Primary Processing (Micro) Unit	Primary Processing (Small) Unit
1.80	1.32	10.00	39.00

- The per ha Unit Cost for cultivation of Makhana in Pond and Field based system has been adopted from Bihar Agricultural University, Sabour, Bhagalpur. (Detailed cost break-up indicated at Annexure-I and Annexure-II, respectively).
- Cost norms for post-harvest processing and value addition of Makhana for Micro and Small Units have been adopted from CIPHET, Ludhiana. (Detailed cost break-up indicated at Annexure-III and Annexure-IV, respectively).

As per NABARD's Indicative Unit Cost of Investment in Agriculture and Allied Activities Booklet for 2025-26, per ha unit costs for cultivation of Makhana are as under:

Sl. No	Particulars	Unit Cost (Rs. Lakh)
i.	Makhana Cultivation in Chaur land without lease	1.80
ii.	Makhana Cultivation in Chaur land with lease	2.10
iii.	Makhana Cultivation in Renovated Pond without lease	1.26
iv.	Makhana Cultivation in Renovated Pond with lease	1.50



Makhana Cultivation in Ponds

Three-Year Banking Plan: District-wise Credit Projections

The three-year banking plan provides phased credit projections for each of the seven districts, covering cultivation, processing, and marketing components. Year-wise targets will focus initially on capacity building and infrastructure creation, followed by scaling up of production and value addition. Monitoring at SLBC/ DLCC will ensure alignment with district credit plans.

Sl. No	Districts/Year	2026 - 27	2027 - 28	2028 - 29	Total
1	Araria	8.63	10.43	12.51	**31.57**
2	Darbhanga	28.45	34.37	41.22	**104.04**
3	Katihar	37.33	44.94	54.14	**136.41**
4	Kishanganj	6.75	8.18	9.59	**24.52**
5	Madhepura	15.20	18.14	21.94	**55.28**
6	Madhubani	27.32	32.65	39.23	**99.20**
7	Purnea	34.43	41.18	49.36	**124.98**
8	Saharsa	27.47	33.16	40.05	**100.68**
9	Sitamarhi	0.75	0.84	1.05	**2.64**
10	Supaul	34.18	40.80	49.04	**124.02**
	Total	**220.51**	**264.68**	**318.13**	**803.32**

Assumptions:

For deriving area of cultivation under Makhana - Pond system: Field System – 30:70 (Araria, Katihar, Kishanganj, Purnea, Saharsa, Sitamarhi and Supaul); 80:20 (Darbhanga and Madhubani); 50:50 (Madhepura) ii. Yield of Makhana seeds (quintals/ ha) – Pond based (18 quintals), Field based (21 quintals)

Banking plan considering % of area under cultivation over three years with 20% increase in coverage every year – 2026-27 (25%), 2027-28 (30%) and 2028-29 (36%)

Financial Outlay & Three-Year Banking Plan – Indicative Framework

The financial outlay under the model scheme is designed to support the entire makhana value chain through a combination of short-term crop credit, medium- and long-term investment credit, and working capital finance. The indicative banking plan covers cultivation, pond development, mechanisation, primary processing units, common infrastructure, and marketing support across the seven identified districts of North Bihar.

- Over the three-year period, the banking plan proposes a phased credit deployment strategy.
- Year 1 focuses on foundational investments such as pond renovation, improved inputs, basic processing equipment, formation of farmer institutions, and pilot clusters.
- Year 2 emphasises expansion of cultivated area, adoption of improved practices, establishment of additional processing and grading units, and enhanced working capital support.
- Year 3 consolidates gains through scaling up of value-added processing, branding, market integration, and export-oriented initiatives.

The overall financial outlay is envisaged to be shared across the following broad components: (i) cultivation and productivity enhancement, (ii) primary processing and value addition, (iii) common infrastructure and logistics, and (iv) institutional development and market linkages. Credit flow will be channelled through commercial banks, RRBs, cooperative banks, supported by refinance, interest subvention, and credit guarantee mechanisms wherever applicable.

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District-wise credit targets will be aligned with the District Credit Plans and monitored through the SLBC/DLCC/BLBC mechanism to ensure timely achievement. The proposed banking plan is expected to catalyse private investment, crowd in government support, and create a sustainable financing ecosystem for the makhana sector in North Bihar.

Convergence with Government Schemes and Institutional Support Mechanisms

The model scheme will converge with central and state government programmes related to agriculture, fisheries, food processing, MSMEs, and rural livelihoods. Technical support from research institutions and extension agencies will complement financial interventions to maximise impact.

Makhana Vikas Yojana

This scheme is 100% state supported to increase production, enhance quality, support processing/value addition of Makhana and boost farmer's income in select districts of Bihar. 10 districts of Bihar viz. Katihar, Purnia, Darbhanga, Madhubani, Kishanganj, Supaul, Araria, Madhepura, Saharsa and Khagaria covered under the scheme. The major components covered under this scheme are :

- **Seed Production of HYV** (Sabour Makhana-1 and Swarn Vaidehi): Assistance (Rs. 97000/ ha.) for high quality seed production is provided to BPS Agricultural College, Purnea and RCM Darbhanga – 100% subsidy
- **Demonstration of improved seed** of (Sabour Makhana-1 and Swarn Vaidehi) in the field: Assistance (Rs.72,750/ ha.) for demonstration is provided to farmer – 75% subsidy
- **Capacity building:** It is done with help of the scientist of above-mentioned organization @Rs. 1000 / person. New district like West Champaran is included in this scheme

Bihar Agri Investment Promotion Policy (BAIPP):

This scheme extended credit linked capital subsidy for establishment of new unit or modernization / expansion / diversification of existing units in the sectors of Makhana, Fruits & vegetables, Maize, Honey, Seed, Medicinal & aromatic plant and Seed processing. The incentive extended are as follows:

Subsidy/Support	Quantum	Purpose of support
Capital subsidy for project cost (land value, land development, plant and machinery, factory building, civil construction, MFA) – credit linked cost of land shall not exceed a limit of 10% of the total project cost and land development cost to be capped at 2.5% of the total project cost	(i) for individual investors – 15% of the project cost (project cost – min. Rs. 0.25 cr. and maximum of Rs. 5 cr.) 1st installment – 50% (purchase and installation of plant and machinery) 2nd installment – 50% (commencement of commercial production of the unit / project) (ii) for Farmer Producer Companies (FPCs) – 25% of the project cost (project cost – min. Rs. 0.25 cr. and maximum of Rs. 5 cr.) 1st installment – 50% (purchase and installation of plant and machinery) 2nd installment – 50% (commencement of commercial production of the unit / project)	Setting up / expansion & diversification / modernization for agro and food processing units (definition of expansion and modernization same as BIPP 2016)
Scheduled Castes (SC), Scheduled Tribes (ST) and Extremely Backward Castes (EBC) investors, the maximum limit of capital subsidy shall be increased by additional 5%		

Makhana identified as ODOP under Pradhan Mantri Formalization of Micro Food Processing Enterprises Scheme (PMFME scheme)

This centrally sponsored scheme is being implemented by Directorate of Food Processing, Department of Industries, Bihar across the State. Under the said scheme makhana has been identified as ODOP for districts of Araria, Darbhanga, Katihar, Madhubani, Saharsa and Supaul. The supports extended under the scheme include: incentive extended are as follows:

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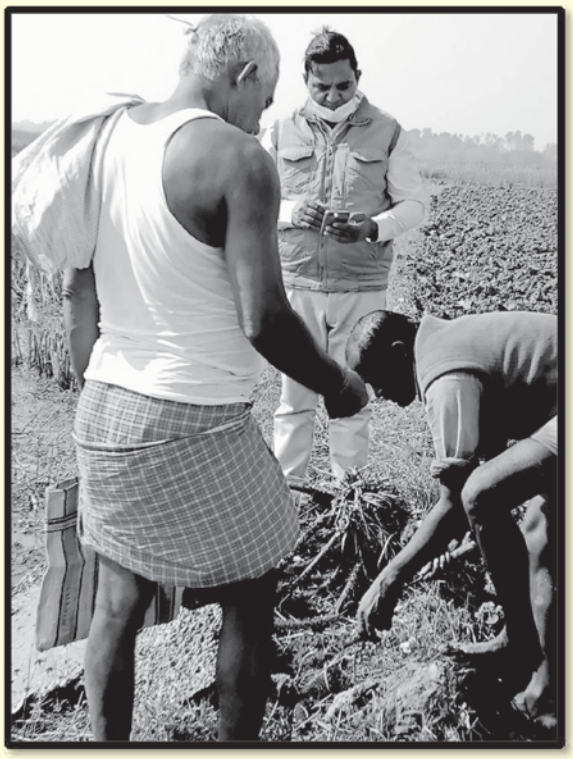
- Credit-linked capital subsidy@35% of project cost (Maximum ceiling of subsidy- Rs. 10 Lakh per unit for individual micro enterprises and for groups
- Maximum limit of grant in such case would be as prescribed) Seed capital to SHG members @Rs. 40,000/- per member for working capital and purchase of small tools.
- Support for common infrastructure would be provided to FPOs, SHGs, Cooperatives, any Government agency or private enterprises - Credit-linked capital subsidy@35% of project cost
- Support for Incubation Centre: Cost norms- 2.75 Cr (for 3 to 5 processing lines); Govt. Institute/ Organization- 100% of project cost; Private Agency- 50% of project cost; SC/ST category- 60% of project cost



Makhana Cultivation in Fields

Central Sector Scheme (CSS) for Development of Makhana

The Central Sector Scheme is aimed for developing strategies to enhance production and productivity, quality, increase value addition and diversification, expand export markets and strengthen domestic scales. Components include –

- **Research and Development –** Development of improved cultivars for pond cultivation, tissue culture standardisation, mechanisation of value chain process especially in harvesting and popping, seed production and storage, harvesting, value addition of Makhana.

- **Production –** Scientific seed production, Nursery management and storage of seeds, expansion of cultivation area in traditional ponds and field, area-based cluster approach for optimum use of infrastructure, creating backward linkages for farmer groups/ FPOs/ FPCs, improving efficiency of Makhana harvesting, etc.]

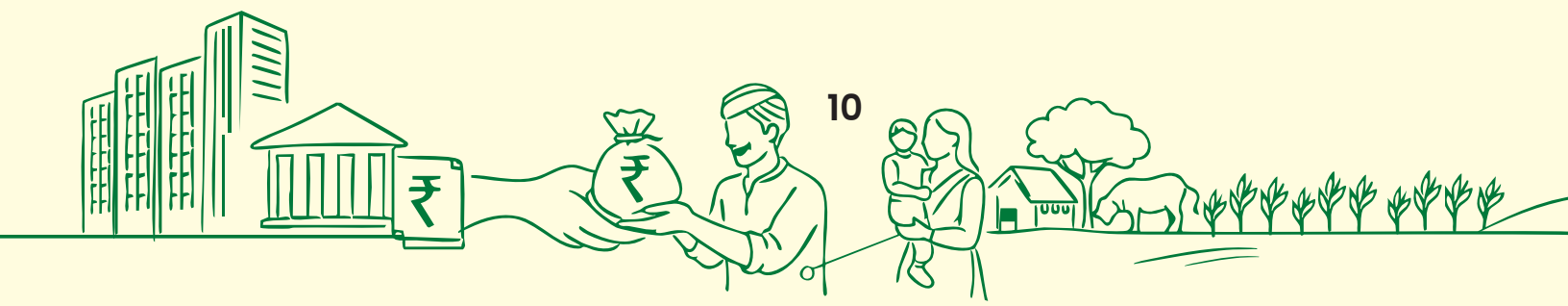
- **Post Harvest Management –** Creation of machinery and infrastructure for minimising post-harvest losses, technology for storage of nuts, machinery for heating, popping and value addition.

- **Capacity Building and Knowledge Dissemination –** Organisation of International/ National/ State/ District Level seminars, workshops, conferences with help of SAUs, ICAR Institutes, KVKs, Other Institutes having technical expertise in Makhana, etc. Intra and Inter State Training and Exposure Visit as per MIDH norms, Field Demonstrations, etc.

- **Pattern of Assistance and Eligibility –** 100% funding from GoI. 35-60% of cost norms for individuals and FPOs. 100% to public sector on project basis.] **Seminars/ Workshops/ Conferences**

Level	Duration in days	Min. no. of participation	Financial Assistance in Rs. Lakh/ event
International	03	300	7.5
National	02	300/ day	5.0 (100% support)
State	02	250/ day	3.0 (100% support)
District	02	200	2.0

- **Eligibility Criteria –** Makhana farmers, fishermen, SHGs, FPOs, Women SHGs, FPCs, Cooperatives, Public Institutions, Registered Companies, State/ Central Govt., Firms, ICATS/ SAUs, CAUs, etc.



- **Convergence –** PMMSY, NRLM, PMKSY, PDMC, PMKUSUM, AIF, MIDH, PMFME, KCC, MGNERGA, APEDA, ATME, KVKs, etc.

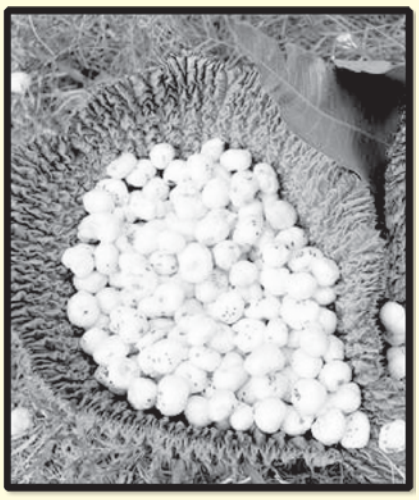
- **Credit linkage and insurance –** Facilitate KCC, Term Loan for Infrastructure creation, FPO formation, preparation of model projects and DPR's to facilitate credit linkage for infrastructure projects, credit guarantee under AIF, coverage under PMFBY-RWBCIS for Makhana farmers.

Makhana Cluster Development under Chief Minister Micro and Small Udyog (Enterprise) Cluster Vikas Yojana:

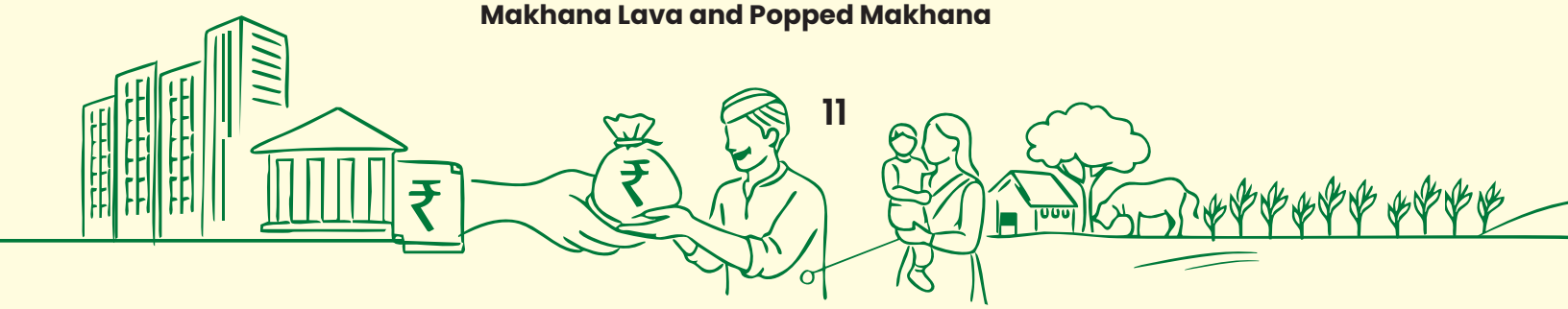
Development of a processing cluster of Makhana in Darbhanga through Jeevika supported SPV – Darbhanga Women Jeevika Producer Company Limited with an objective of enhancing income of Makhana growers through different value chain interventions like aggregation/ sorting/ processing/ packaging, etc. Estimated investment – Rs. 198.66 lakhs. Components – Capacity Building, Infrastructure Development, Value Addition and Market Development, etc.

Post Harvest and Processing

Makhana processing is a critical value-addition activity that transforms raw foxnut seeds into a high-value, nutritious, and market-ready product, significantly enhancing income and employment opportunities in Makhana-growing regions, particularly North Bihar. The processing chain begins after harvesting, where raw seeds are washed, sun-dried, and graded to remove impurities and damaged seeds. Proper drying is essential to reduce moisture content and ensure storability. The dried seeds are then roasted in iron pans or mechanized roasters at controlled temperature, followed by tempering to loosen the hard outer shell. This is succeeded by manual or semi-mechanized cracking; wherein skilled workers carefully break the shell to extract the inner kernel without damage. Post-popping, the product undergoes grading based on size, whiteness, and texture, which determines market price and end use. Secondary processing includes polishing, flavouring (salted, spiced, or sweet variants), and hygienic packaging in consumer-friendly packs.



Makhana Lava and Popped Makhana



Issues in Makhana Popping

The Popping of Makhana is a laborious, time intensive and cumbersome process, popping is done in a 3-stage manual process, the seeds are roasted in a traditional earthen pot or in cast iron pan at very high temperatures ranging from 2500C to 320oC, tempered for 2 to 3 days, roasted again, and popped manually using a mallet.

The malleting after roasting requires highly skilled workers as few seconds delay in the malleting would lead to poor quality popped makhana. Popping causes burns and injuries to the processors hands as it involves handling of hot roasted nuts manually.

Manual popping keeps processors on health risk as during popping season, a day for processors starts at 3 AM and ends at 11 AM usually. Continuous sitting in squatting posture leads to backaches, spine problems and inhaling smoke from the dingy kitchen leads to breathing related health problem. 15.2. Interventions at Post-Harvest Stage (Farm / Pond Level)

Interventions at Post - Harvest Stage (Farm/ Pond Level)

a. Scientific Harvesting & Drying

- Standardization of **harvest maturity indicators** to reduce immature/broken seeds.
- Introduction of **improved sun-drying platforms / solar dryers** to achieve uniform moisture (<12%).
- Promotion of **batch-wise drying protocols** instead of open-ground drying.

b. Primary Cleaning & Grading at Farm Gate

- Provision of manual/low-cost mechanical cleaners to remove mud, stones and damaged seeds.
- Initial grading into size categories to improve processing efficiency and pricing.
- Training farmers on quality-based segregation.

c. On-farm Storage Solutions

- Moisture-proof storage using HDPE bags, lined bins or hermetic storage.
- Village-level storage godowns with pallets and ventilation.
- Periodic fumigation and pest management protocols.

Strengthening Primary Processing (Cluster / Village Level)

a. Modernizing Popping Technology

Introduction of improved popping units (semi-mechanized, fuel-efficient) developed by:

- ICAR institutes
- RuTAG (IIT Patna)
- Local MSME innovators/ Blacknut (Ambala)
- Reduction in fuel use, drudgery and occupational hazards.

b. Decentralized Processing Clusters: Establishment of Primary Processing Centres (PPCs) at FPO/SHG level:

- Roasting / popping
- Polishing
- Grading/Packaging
- Shared infrastructure model to reduce unit cost. (CFC- pay and Use Model)

c. Skill Upgradation: Certification-based training for women and youth in:

- Scientific popping techniques
- Quality control/Equipment handling and maintenance
- Transition of traditional processors into formal micro-entrepreneurs.

Marketing, Branding, Export Potential and Price Realisation Strategies

Marketing interventions will include branding of Bihar makhana, GI-based promotion, participation in trade fairs, and development of export linkages.

Market promotion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Geographical Indication Registry

a. **Branding and marketing support limited to 50% of total expenditure:** SPV; Groups- FPOs/SHGs/ Cooperatives; Up to Rs. 5 lakh support per proposals for preparation of DPRs from professional agencies.

b. **Geographical Indication (GI) tag to Mithila Makhana :** The government has awarded Geographical Indication (GI) tag to Mithila Makhana, in a bid to help farmers get the maximum price of their produce. "Mithila Makhana" which, as indicated by its name, is cultivated in the Mithila region of Bihar and some parts of Nepal — is the fifth product from Bihar which has received the GI tag.

It is important to form Farmer Producer Organization (FPO) before applying for Geographical Indication (GI). For this, Mithilanchal Farmer Producer Organization was formed o n 20/04/2018 under society registration act, 1860 with the technical support of Bhola Paswan Shashtri College, Purnea (BAU, Sabour, Bhagalpur) with the objective for overall development of Makhana growers and its branding. According to the registration certificate, Bihar state's Darbhanga, Muzaffarpur, Champaran, Begusarai, Madhubani and Katihar among other districts have been defined as the geographic location for the production of Mithila Makhana.

Export Potential and Global Reach

The global demand for healthy snacks like Makhana is rising. Bihar's Makhana has found markets in countries like the USA, UK, and Japan. Export growth brings:

- Foreign exchange earnings
- International recognition for Bihar's agricultural produce
- Scope for contract farming, benefiting local farmers

Companies like Patanjali and Big Basket have started sourcing Makhana from Bihar, expanding its reach beyond domestic boundaries.

Risk Mitigation: Credit Guarantee, Insurance and Market Risks

a. Credit & Financial Risk Mitigation

- Coverage under Credit Guarantee schemes (CGTMSE / proposed Cooperative Credit Guarantee / State-level Guarantee Fund) for SHGs, FPOs, JLGs and small entrepreneurs to reduce collateral constraints.
- Phased financing linked to crop cycle and processing milestones to reduce default risk.
- Interest subvention / prompt repayment incentives to encourage credit discipline.

b. Market & Price Risk Mitigation

- Forward linkages with bulk buyers, processors, exporters and institutional buyers through MoUs and buy-back arrangements with Retail Chains like ITC
- Promotion of FPO-led aggregation and collective marketing to enhance bargaining power.
- Development of local primary processing and storage facilities to avoid distress sale.
- Market intelligence support and digital platforms for real-time price discovery.

Expected Outcomes: Income Enhancement, Employment Generation and Financial Inclusion

a. Income Enhancement

- Increase in net farm income of makhana growers by 30–50% through productivity gains, value addition and reduced post-harvest losses.
- Additional income streams from primary processing, grading, packing and local branding.

b. Employment Generation

- Creation of on-farm & off-farm employment, especially for women and youth for
- Seed collection and pond operations
- Primary processing (popping, grading, polishing)
- Packaging, storage and logistics
- Promotion of micro-enterprises and household-based units in rural clusters.

c. Financial Inclusion

- Formalization of growers and processors through KCCs, SHG/JLG, term loans and digital payments.
- Strengthening of SHGs, JLGs and FPOs with improved credit access and market linkage and brand promotion.
- Enhanced penetration of insurance, pension and social security schemes.

Monitoring and Implementation Mechanism

a. Institutional Framework

- **Nodal Agency**: NABARD / State Agriculture Department / Makhana Development Board.
- **Implementing Agencies:** Banks, FPOs, Cooperatives, NGOs, KVKs and technical institutions.
- **District-level Committees** for coordination, review and grievance redressal.

b. Implementation Approach

- Cluster-based implementation covering identified makhana-growing districts.
- Time-bound action plan with clear roles for each stakeholder.
- Capacity building and handholding at farmer and FPO level.

c. Monitoring Tools

- Defined Key Performance Indicators (KPIs): area covered, productivity, credit flow, processing capacity, income levels.
- Periodic field inspections, MIS-based reporting and third-party reviews. • Geo-tagging of ponds and digital tracking of assets and credit utilization.

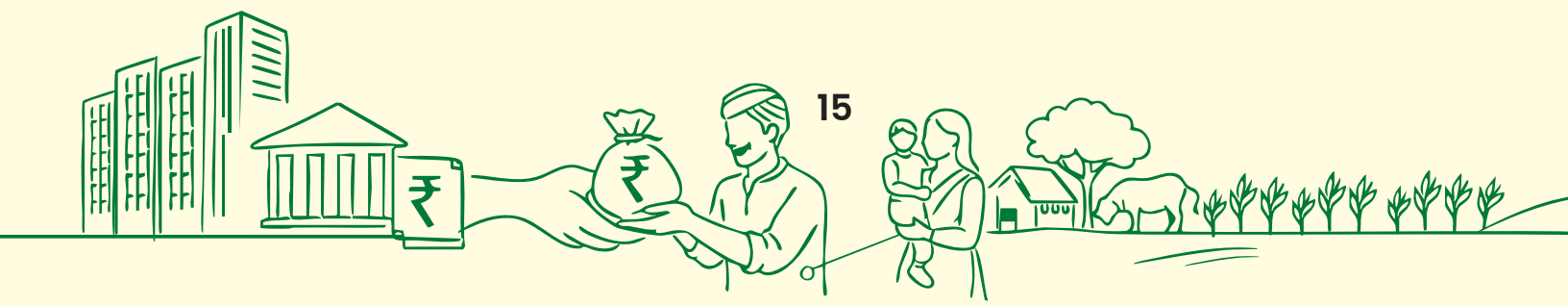


Table 1.1 Nutritional Content of Makhana Seed and Popped Makhana

Parameters	Makhana Seed	Popped Makhana
Carbohydrate (% by wt.)	57.0	79.8
Protein (% by wt.)	7.2	8.7
Fat (% by wt.)	0.3	0.5
Moisture (% by wt.)	34.7	10.4
Total Ash (% by wt.)	0.3	0.4
Crude Fiber (% by wt.)	0.5	0.2
Amylose (%)	19.0	18.2
Calorific Value (K.cals/100g)	259	358
Phosphorus (mg/100 g)	66.1	53.2
Potassium (mg/100 g)	35.6	42.0
Iron (mg/100 g)	0.8	1.4
Calcium (mg/100 g)	9.5	18.5
Magnesium (mg/100 g)	11.3	13.9
Sodium (mg/100 g)	48.2	71.0

Systems of Makhana Cultivation

There are two systems of cultivating makhana, the **Pond System** and the **Field System.**

a. Pond System:

This is the traditional system of Makhana cultivation. Makhana plants germinate from the left-over seeds of the previous season and serve as planting material of subsequent crop. However, Makhana cultivation may not be started either through direct seed sowing or transplanting the plantlets in new water bodies. In the traditional system, apart from Makhana, air breathing fishes enter the ponds as wild fishes along with flood water and harvested by the farmers as an additional crop.

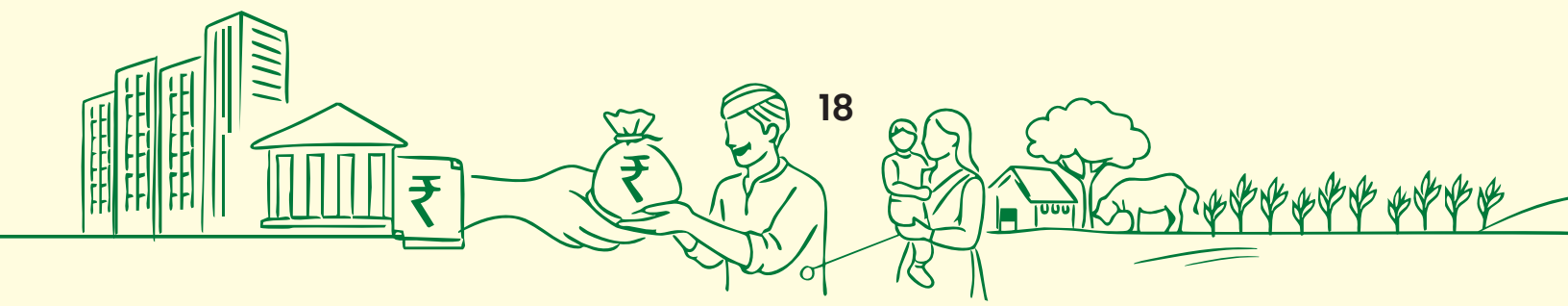
Sprouting takes place by December-January, and the early leaves appear on the pond surface during January- February. During April-May, the entire water surface gets covered with huge, sprawling and thorny leaves, which float on the surface of water. Flowering begins in the month of April when the temperature is around 300 C and maximum flowering occurs in the month of May. Makhana flowers stay afloat for two days and then submerge inside water. Fruiting begins by mid of May and each plant bears around 10-20 fruits. Each fruit contains 40-70 seeds, and 100 seeds weigh around 80-100 gm. On an average, a plant of Makhana yields around 450-700 gm. of seeds. Makhana fruits burst inside water during May-July and the seeds float in water for a day or two and then settle at the bottom of the pond. In local parlance, Makhana seeds are called gudi. After fruiting, the gigantic leaves are cut and thrown out or left to decay, which enriches the soil health through addition of organic nutrient

b. Field system:

This is a new system of Makhana cultivation, which has been standardized by the research institute. In the system, Makhana cultivation is carried out in agriculture fields at a water depth of 1-2 ft. This system is very easy to operate and provides opportunities of cultivating the same fields in a year for cereals and other field crops. The Makhana seedlings are first raised as a nursery and then transplanted in the main filed at the optimum time. Depending upon the availability of field and nursery, the transplanting can be done in between first week of February to the third week of April.
Through this system, the duration of Makhana crop is reduced up to four months.

Table 1.2. Comparison of Pond and Field System

Parameter	Pond Eco - System	Field System
Water Requirements	Around 4 -6 feet	Around 1 -2 feet
Seed Requirements	80 -90 kg/ha (new Pond)	20 kg/ha
Water Source	Natural water as perennial water bodies	Irrigation water or any other perennial source of water
Fertilizers and Manures	Not possible due to high depth of standing water	Can be applied very easily before and after the transplantation
Weed Management	Very tedious	Very easy
Crop Duration	Long to very long (8 -10 months)	Short (4 - 5 months)
Seed yield	1.8 -2.0 t/ha	2.6 -3.0 t/ha
Scope for grain and fodder production	Not possible	Water Chestnut, Rice, Wheat, Berseem and other field crops can be grown in rotation.
Possibility of maximum no. of crops in a year	Two	Three
Intensification of cropping system	Makhana with Water Chestnut	Makhana - Water Chestnut Makhana - Berseem, and Makhana - Rice
Crop protection measures	Very tedious	Quite feasible
Cropping Intensity (%)	100 % in traditional system	200%
Net Income	Low to medium in traditional system	High to very high
Feasibility of harvesting	Very tedious. It can be done only be trained labourers	Very simple. It can be done even by unskilled

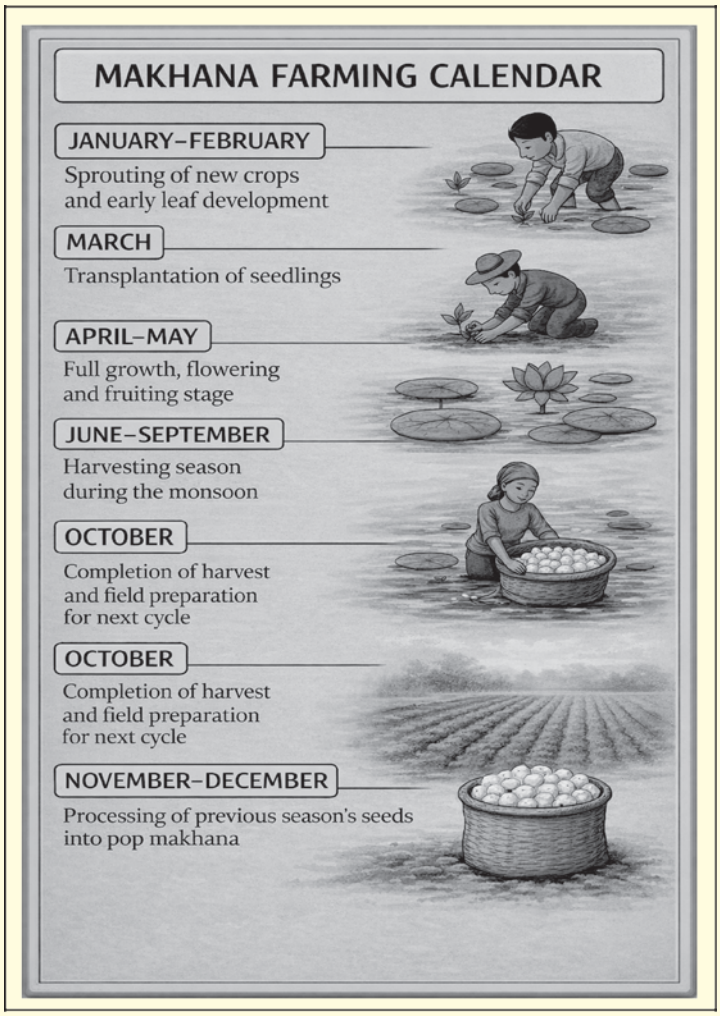


Soil & Climate

Makhana crops grow well in **warm and humid** conditions with a temperature ranging from **20°C to 35°C** and prefer **clayey soil** rich in organic matter with a **pH of around 5.5 to 7.5** that can retain water.

Calander of Operation- Makhana Cultivation

- **Field Preparation -**



To cultivate makhana by following the field system, farmers need to prepare their fields from the first week of February to the second week of March. Prepare the land with two to three deep ploughings, followed by planking with tractor-drawn implements or desi ploughs. Before transplanting makhana seedlings, prepare earthen bunds of 2 feet in height to retain water up to 1-foot level. The field should be puddled by 2 to 3 runs of tractor-based paddlers to check the downward percolation of water to the lower layer of the field. Fill water up to 1 foot height of the bund before transplanting makhana seedlings.

- **Direct Sowing of Makhana**

To cultivate makhana by following the pond system (new pond), then makhana seeds can be sown directly from December to January. Farmers can broadcast 80 to 100 Kilograms of makhana seeds per hectare in shallow water before gradually increasing the water depth. One can soak seeds in water for 24–48 hours before sowing to enhance germination. Later, weak seedlings are removed and an optimum distance of 1 × 1 meter.

- **Nursery Preparation**

To prepare seedlings for transplanting in the field system, farmers need to prepare a nursery to raise makhana seedlings. For transplanting in one hectare area farmers need to prepare a nursery of 500 m2. Start by applying organic manure, deep ploughing 2 to 3 times followed by levelling of the field.
Then prepare earthen bunds of 2 feet height around the field and fill water up to 1.5 feet height. Broadcast 20 Kilograms of seed from December to January. To prevent new seedlings from Aphids, spray 0.2% solution of Endosulphan on newly emerged seedlings. They will get ready for transplantation by the mid of March.

- **Transplantation**

From last week of March- 1st week of April uproot healthy seedlings from the nursery and immediately plant in the prepared field by following a spacing of 1.2 meters plant to plant for optimum yield.

- **Manure & Fertilizer**

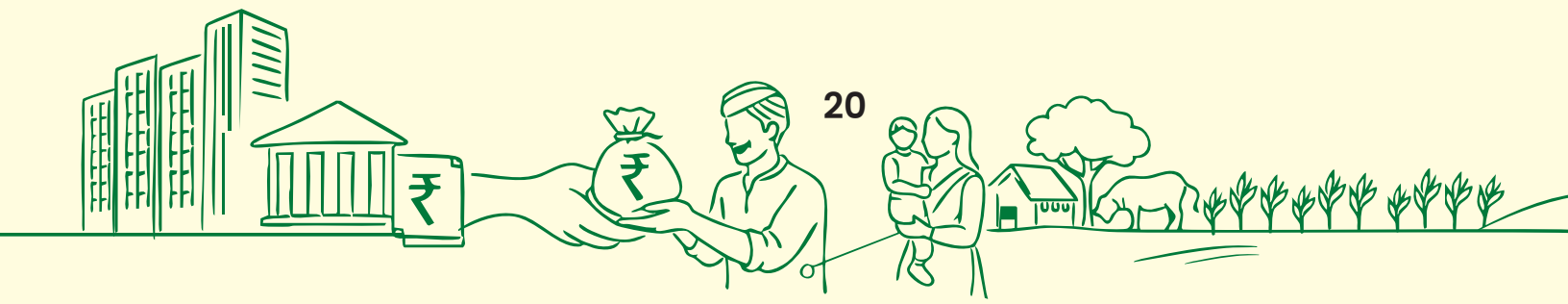
Makhana is a fertilizer-intensive crop, that's why in the pond system due to lack of proper nutrients, the yield is low. To get optimum yield farmers can apply 100:60:40 Kilograms of NPK along with 15 tons of organic manure per hectare before transplantation. Fertilizers can be incorporated during field preparation.

- **Water Management**

Makhana is an aquatic crop, hence maintaining water level is necessary for good production. In India, due to Monsoon most of the water needs can be fulfilled. However, after transplantation, 4 to 5 irrigations according to the field conditions are appropriate. Maintain water at 1 to 1.5 feet in the field system while 4 to 6 feet in the pond system.

- **Flowering & Fruiting**

Flowering and fruiting in the makhana plant starts in May and continue till November. Within 30 to 40 days of flowering, fruits become fully developed and matured. They start rupturing and appear to be floating on the upper water surface for 2 to 3 days after which they get settled in the bottom surface.



- **Harvesting**

Harvesting starts from August to October in which farmers collect scattered makhana seeds manually. Generally harvesting of makhana seeds in practiced in the morning hours. Seeds are collected in a basket and are further sent for cleaning, storage and processing.

- **Yield of Makhana**

On average, the yield in the pond system is around 1.4 to 2.0 tons per hectare, while in the field system, it is 2.0 to 2.5 tons per hectare. After harvesting farmers need to clean the harvested seeds followed by sun drying, size grading, pre-heating, tempering, roasting, popping, polishing, grading, packaging and storage to finally sell in the market.

Category	Details
Major Pests	– Aphids (Aphis spp.) – Suck plant sap, cause leaf curling and reduces yield. Leaf-Eating Caterpillars – Feed on leaves, reduce photosynthesis. – Borers – Damage stems and roots, affect plant health.
Pest Management	– Biological Control: Introduce natural predators like ladybugs for aphid control. – Organic Sprays: Neem oil, garlic extract, and fermented plant extracts. – Chemical Control: Use recommended insecticides only when necessary.
Common Diseases	– Leaf Blight (Alternaria spp.) – Brown spots on leaves, leads to wilting. – Root Rot (Fusarium spp.) – Causes plant decay, especially in stagnant water. – Powdery Mildew – White fungal growth on leaves, reduces photosynthesis.
Disease Management	– Crop Rotation to reduce pathogen buildup. – Fungicide Sprays (Bordeaux mixture, copper-based fungicides). – Improve Drainage in field-based cultivation to prevent root rot.
Preventive Measures	– Maintain proper plant spacing to improve air circulation. – Use disease-resistant seed varieties. – Regularly monitor fields and apply organic treatments early.

Appendix -I

Model bankable Project Cost for setting up of Micro processing Units at cluster level:

I. Basic Assumptions

a. Production Capacity of Foxnut (Makhana) is 10 kg per hr. First year, Capacity has been taken @ 65%.
b. Working shift of 8 hours per day has been considered.
c. Raw Material stock is for 7 days, and Finished goods Closing Stock has been taken for 7 days.
d. Credit period to Sundry Debtors has been given for 20 days.
e. Credit period by the Sundry Creditors has been provided for 7 days.
f. Depreciation and Income tax has been taken as per the Income tax Act, 1961.
g. Interest on working Capital Loan and Term loan has been taken at 11%.
h. Salary and wages rates are taken as per the Current Market Scenario.
i. Power Consumption has been taken at 14 KW.
j. Increase in sales and raw material costing has been taken @ 5% on a yearly basis.

II. Capacity Installed and Capacity Utilisation:

Specifications	Details	Unit
Machine capacity Per hour	10	Kg
Total working Hours	8	
Machine capacity Per Day	80	Kg
Working days in a month	25	Days
Working days per annum	300	
Wastage Considered	10%	
Raw material requirement	24000	Kg
Final Output per annum after wastage	21600	Kg

Production	Capacity	KG
1st year	65%	14,040
2nd year	70%	15,120
3rd year	75%	16,200
4th year	80%	17,280
5th year	85%	18,360

Raw Material Cost

Year	Capacity Utilisation	Rate (per Kg)	Amount (Rs. in lacs)
1st year	65%	320.00	49.92
2nd year	70%	336.00	56.45
3rd year	75%	353.00	63.54
4th year	80%	371.00	71.23
5th year	85%	390.00	79.56

COMPUTATION OF SALE					
Particulars	**1st year**	**2nd year**	**3rd year**	**4th year**	**5th year**
Op Stock	-	328	353	378	403
Production	14,040	15,120	16,200	17,280	18,360
Less: Closing Stock	328	353	378	403	428
Net Sale	13,712	15,095	16,175	17,255	18,335
Sale price per kg	600.00	630.00	662.00	695.00	730.00
Sales (in Lacs)	82.27	95.10	107.08	119.92	133.84

III. Premises and Infrastructure

The approximate total area required for complete factory setup is 2000-2500 Sq. ft. for smooth production including storage area. It is expected that the premises will be on rental.

IV. Plant & machinery & Equipment's

Machine Name	Description
• Seed washing machine with paddle beater	• The machines are used for washing fruit and remove mud and other scraps with clear water.
• Size Grader • machine	• This machine is used for Grading and Separating the Makhana seed according to their size.
• Hot air dryer	• A hot air dryer is a machine designed to separate water vapor or moisture from a given product.
• Rotary Roaster	• The dried nuts are heated by placing them in this machine and rotate them continuously.

• Sieve Separator	• This is the machine use for grading the processed Makhana into different grades depending on their sizes.
• Filling and packaging machine	• This Makhana packing machine is mainly used for the packaging of Makhana into appropriate packages according to market demand
• Seasoning • Machine	• This machine is used to season the given product with appropriate flavouring • i.e. spice & salt blends.
• Conveyer machine	• A conveyor is a common material handling device, which moves material between locations.
• Material handling other Equipment's	• These Equipment are used for material handling. Other equipment like water pumps, weighing machine, bucket elevator etc are also used.

Annexure-I

Cost of Cultivation of Makhana (per ha) in Pond System

Sl. No.	Particulars	Quantity (kg/No.)	Rate per Unit	Total Amount
A	Input cost per ha - Management of Makhana seedlings in initial stage (December to February)			
i	Makhana Seed (any improved variety) - 50 kg/ha @ Rs. 255/ kg	50	255	12750
ii	Foliar spray of NSKE - 1500 ppm (Neem based insecticides) @ 1 litre / spray - 3 sprays @ Rs. 500/ per litre	3	500	1500
iii	Manpower wages for foliar spray of NSKE @Rs. 412/ day for 02 man - days	2	412	824
	Subtotal (A)			15074
B	Pond system: Gap filling and uprooting of dense Makhana saplings (Area = 1ha)			
i	Pond preparations (cleaning of aquatic weeds, etc)			2500
ii	Drone Sprayer - Nano Urea, Nano DAP, water soluble, micronutrients, NSKE, etc - 3 sprays/ha @ Rs. 350/ flight, 3 flights/ ha	9	350	3150

a	Nano Urea - 500ml/ 10 lts. of water OR per flight of Drone Spray - 3 times/ ha @ Rs. 225/ spray	3	225	675
b	Nano DAP - 500ml/ 10 lts. of water OR per flight of Drone Spray - 3 times/ ha @ Rs. 600/ spray	3	600	1800
c	Neem Oil - 500 ml/ 10 lts. of water OR per flight of Drone Spray - 3 times/ ha @ Rs. 300/ spray	3	300	900
d	PGRs/ Micronutrients - 250ml/ 10 lts of water OR per flight of Drone Spray - 3 times/ ha @ Rs. 185/ spray	3	185	555
e	WSF -0-52-34 - 100 g/ 10 lts of water OR per flight of Drone Spray - 3 times/ ha @ Rs. 30/ spray	3	30	90
iii	Manpower wages @Rs. 412/ day - 02 mandays	2	412	824
iv	Gap filling and uprooting of dense Makhana saplings @Rs. 6250/ ha	1	6250	6250
v.	Integration of Fish Yearlings - 7500 yearlings/ ha @Rs. 10 / yearlings	10	7500	75000
vi	Foliar spray of NSKE - 1500 ppm (Neem based insecticides) @ 1 litre / spray - 3 sprays @ Rs. 500/ per litre	3	500	1500
vii	Manpower wages for foliar spray of NSKE @Rs. 412/ day for 03 man - days	3	412	1236
	Subtotal (b)			94480

Amount in Rs.

Sl. No.	Particulars	Quantity (kg/No.)	Rate per Unit	Total Amount
C	Manual Harvesting Cost of Makhana seed			
a	First harvesting - approx. 15 quintals @ Rs. 3000/ quintals	15	3500	52500
b	Second harvesting - approx. 02 quintals @ Rs. 5000/ quintals	2	5000	10000
c	First harvesting - approx. 02 quintal @ Rs. 7500/ quintal	1	7500	7500
	Subtotal (C)			70000
	Grand total (A+B+C)			179554

Adopted from Bihar Agricultural University (BAU), Sabour, Bhagalpur, Bihar

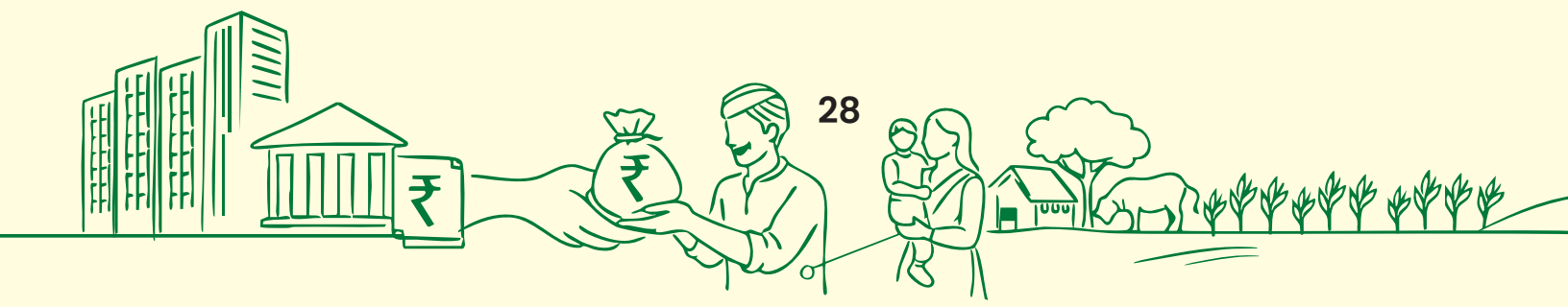
Annexure-II

Cost of Cultivation of Makhana (per ha) in Field System

Sl. No.	Particulars	Quantity (kg/No.)	Rate per Unit	Total Amount
A	Input cost per ha. Nursery raising of Makhana (500 - 600 sqm. nursery for 1 ha)			
i.	Field preparations	1	1000	1000
ii.	Makhana Seed (any improved variety)-30 kg/ha @ Rs. 255/ kg	30	255	7650
iii	Seed treatment with Imidacloprid 70 WS o Thiomethoxam 25 WG @ 5g/kg seed			500
iv	Irrigation (water standing upto 1ft height) for 6hrs @ Rs. 100/hr	6	100	600
v	Manpower wages for irrigation, cleaning of water and sowing of Makhana seed @ Rs. 412/ person/ day for 01 man-day	1	412	412
	Subtotal (A)			10162
B	Makhana sapling transplanting in main field (Area = 1 ha)			
i	Field preparations (ploughing, levelling an puddling)			2500
ii	Irrigation (water standing upto 1ft height ir Makhana field) for 20hrs @ Rs. 100/hr	20	100	2000
iii	Chemical fertilizers (N-75: P2O5-45: O-30 kg/ha)			0
a	Urea -2 bags/ ha @ Rs. 266.5/bag-45 kg)	2	266.5	533
b	DAP -1 bag/ ha @ Rs. 1350/bag-50 kg)	1	1350	1350
c	MOP -1 bag/ ha @ Rs. 1740/bag-50 kg)	1	1740	1740
d	Lime Powder (Agricultural Grade)50 kg/ha @ Rs. 10/kg	50	10	500
iv	Manpower wages for broadcasting of chemical fertilizers and lime in Makhana field @ Rs. 412/ person/ day-2 man-days	2	412	824
v.	Transplanting cost-Root dip treatment (solution of imidacloprid 70WS or Thiomethoxam 25WG @5g/ litre if Water fo half at the time of transplanting cost of Makhana saplings in main field) @ Rs. 18,750/ ha	1	18750	18750
vi	Drone Sprayer-Nano Urea, Nano DAP, water soluble, micronutrients, NSKE, etc-3 sprays/ha @ Rs. 350/ flight, 3 flights/ ha	9	350	3150
a	Nano Urea-500ml/ 10 lts. of water OR per flight of Drone Spray-3 times/ ha @ Rs. 225/ spray	3	225	675
b	Nano DAP-500ml/ 10 lts of water OR per flight of Drone Spray-3 times/ ha @ Rs. 600/ spray	3	600	1800

Amount in Rs.

Sl. No.	Particulars	Quantity (kg/No.)	Rate per Unit	Total Amount
c	Neem Oil - 500 ml/ 10 lts of water OR per flight of Drone Spray - 3 times/ ha @ Rs. 300/ spray	3	300	900
d	PGRs/ Micronutrients - 250ml/ 10 lts of water OR per flight of Drone Spray - 3 times/ ha @ Rs. 185/ spray	3	185	555
e	WSF - 0-52-34 - 100 g/ 10 lts of water OR per flight of Drone Spray - 3 times/ ha @ Rs. 30/ spray	3	30	90
vii	Manpower wages for weeding and irrigation in Makhana field @Rs. 412/ day - 10 mandays	10	412	4120
viii	Irrigation (water standing upto 1ft height in Makhana field) for 35 hrs @ Rs. 100/hr	35	100	3500
ix	Foliar spray of NSKE - 1500 ppm (Neem based insecticides) @ 1 litre / spray - 3 sprays @ Rs. 500/ per litre	3	500	1500
x	Manpower wages for foliar spray of NSKE @Rs. 412/ day for 03 man - days	3	412	1236
	Subtotal (B)			45723
C	Manual Harvesting Cost of Makhana seed			
a	First harvesting - approx. 17 quintals @ Rs. 3000/ quintals	17	3000	51000
b	Second harvesting - approx. 02 quintals @ Rs. 5000/ quintals	2	5000	10000
c	First harvesting - approx. 02 quintal @ Rs. 7500/ quintal	2	7500	15000
	Subtotal (C)			76000



Annexure-III

Post-harvest processing and value addition of Makhana (Cost Norms) MICRO Level Enterprise (upto 100 kgs of raw Makhana seed per day)

Sl. No.	Name of the Equipment	Unit	Capacity	Cost (Rs.)
1	Barch type raw Makhana seed washer	kg/ hr	100	Technical Civil Work should not exceed more than 25% of total project cost
2	Seed grading machine	kg/ hr	200	
3	Batch type Primary Roasting Machine	kg/ hr	100	
4	Final Roasting and Popping Machine	kg/ hr	20 -25	
5	Popped Makhana Grader	kg/ hr	100	
6	Miscellaneous (Moisture meter, Thermal sensors, Scaler, Bag stitching machine, etc.)			
7	Makhana flavouring and instant Kheer manufacturing Unit	kg/ hr	20	
8	Makhana puffs production Unit	kg/ hr	20	
9	Civil Works	sq. ft.	2000	
	Total Cost			**39,00,000**

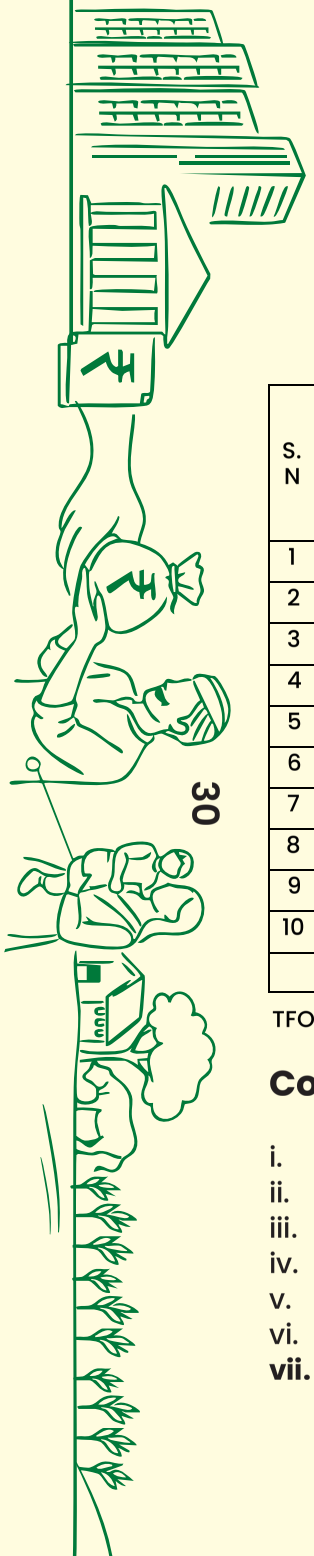
Adopted from CIPHET, Ludhiana

Rate of Interest

As per bank lending policy, RBI guidelines and/or schemes guidelines for availing capital subsidy/ interest subvention.

Security

As per bank lending policy, RBI guidelines and/or schemes guidelines for availing credit guarantee.



Annexure - V

Banking Plan for FY 2026-27

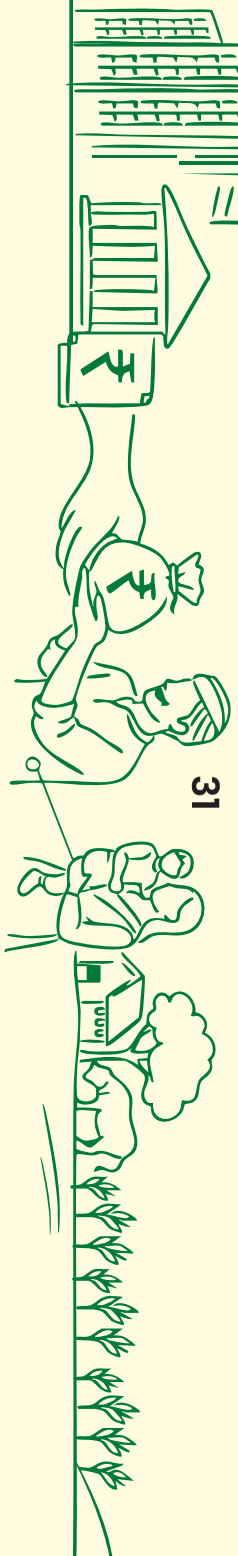
Area in ha
Units in Nos
Cost/ Amount in Rs. Cr
Bank Loan = 90% of TFO

S. N	Districts	Pond System of Cultivation				Field System of Cultivation				Micro Processing				Small Processing				Total Bank Loan
		Area	Unit Cost/ SoF	TFO	Bank Loan	Area - Field system	Unit Cost/ SoF	TFO	Bank Loan	Units	Unit Cost/ SoF	TFO	Bank Loan	Units	Unit Cost/ SoF	TFO	Bank Loan	
1	Araria	105.00	0.018	1.89	1.70	245.00	0.013	3.23	2.91	29.00	0.10	2.90	2.61	4.00	0.39	1.56	1.40	8.63
2	Darbhanga	870.00	0.018	15.66	14.09	217.50	0.013	2.87	2.58	84.00	0.10	8.40	7.56	12.00	0.39	4.68	4.21	28.45
3	Katihar	450.00	0.018	8.10	7.29	1050.00	0.013	13.86	12.47	125.00	0.10	12.50	11.25	18.00	0.39	7.02	6.32	37.33
4	Kishanganj	82.50	0.018	1.49	1.34	192.50	0.013	2.54	2.29	23.00	0.10	2.30	2.07	3.00	0.39	1.17	1.05	6.75
5	Madhepura	300.00	0.018	5.40	4.86	300.00	0.013	3.96	3.56	48.00	0.10	4.80	4.32	7.00	0.39	2.73	2.46	15.20
6	Madhubani	830.00	0.018	14.94	13.45	207.50	0.013	2.74	2.47	80.00	0.10	8.00	7.20	12.00	0.39	4.68	4.21	27.32
7	Purnea	412.50	0.018	7.43	6.68	962.50	0.013	12.71	11.43	115.00	0.10	11.50	10.35	17.00	0.39	6.63	5.97	34.43
8	Saharsa	333.00	0.018	5.99	5.39	777.00	0.013	10.26	9.23	92.00	0.10	9.20	8.28	13.00	0.39	5.07	4.56	27.47
9	Sitamarhi	10.88	0.018	0.20	0.18	25.38	0.013	0.33	0.30	3.00	0.10	0.30	0.27	0.00	0.39	0.00	0.00	0.75
10	Supaul	408.75	0.018	7.36	6.62	953.75	0.013	12.59	11.33	114.00	0.10	11.40	10.26	17.00	0.39	6.63	5.97	34.18
	TOTAL	3802.63		68.45	61.60	4931.13	0.16	65.09	58.58	713.00		71.30	64.17	103.00		40.17	36.15	220.51

TFO = Total Financial Outlay

Considerations –

i. Pond system: Field System – 30:70 (Araria, Katihar, Kishanganj, Purnea, Saharsa, Sitamarhi and Supaul);
ii. 80:20 (Darbhanga and Madhubani); 50:50 (Madhepura)
iii. Yield of Makhana seeds (quintals/ ha) – Pond based (18 quintals), Field based (21 quintals)
iv. 50% of total yield towards micro processing and 30% of total yield towards small processing
v. Micro level Enterprise (upto 1 quintal raw makhana seed/ day) and 120 quintals/ enterprise in season (120 days)
vi. Small level Enterprise (upto 4 quintals raw makhana seed/ day) and 480 quintals/ enterprise in season (120 days)
vii. Banking plan considering 25% of area under cultivation for FY 2026-27



Annexure - VI

Banking Plan for FY 2027-28

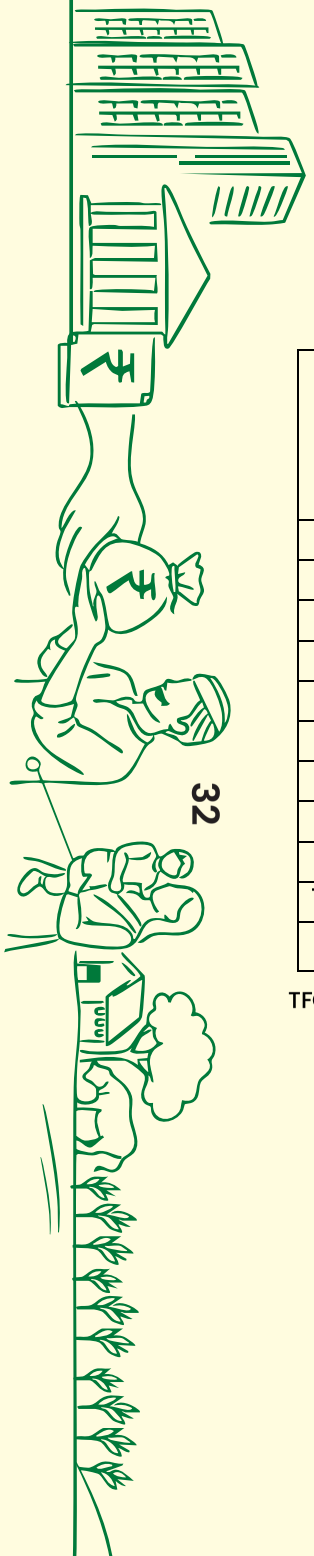
Area in ha
Units in Nos
Cost/ Amount in Rs. Cr
Bank Loan = 90% of TFO

S. N	Districts	Pond System of Cultivation				Field System of Cultivation				Micro Processing				Small Processing				Total Bank Loan
		Area - Pond System	Unit Cost/ SoF	TFO	Bank Loan	Area - Field system	Unit Cost/ SoF	TFO	Bank Loan	Units	Unit Cost/ SoF	TFO	Bank Loan	Units	Unit Cost/ SoF	TFO	Bank Loan	
1	Araria	126.00	0.018	2.26	2.03	294.00	0.013	3.88	3.49	35.00	0.10	3.50	3.15	5.00	0.39	1.95	1.76	10.43
2	Darbhanga	1044.00	0.018	18.79	16.91	261.00	0.013	3.45	3.10	101.00	0.10	10.10	9.09	15.00	0.39	5.85	5.27	34.37
3	Katihar	540.00	0.018	9.72	8.75	1260.00	0.013	16.63	14.97	150.00	0.10	15.00	13.50	22.00	0.39	8.58	7.72	44.94
4	Kishanganj	99.00	0.018	1.78	1.60	231.00	0.013	3.05	2.74	27.00	0.10	2.70	2.43	4.00	0.39	1.56	1.40	8.18
5	Madhepura	360.00	0.018	6.48	5.83	360.00	0.013	4.75	4.28	58.00	0.10	5.80	5.22	8.00	0.39	3.12	2.81	18.14
6	Madhubani	996.00	0.018	17.93	16.14	249.00	0.013	3.29	2.96	96.00	0.10	9.60	8.64	14.00	0.39	5.46	4.91	32.65
7	Purnea	495.00	0.018	8.91	8.02	1155.00	0.013	15.25	13.72	138.00	0.10	13.80	12.42	20.00	0.39	7.80	7.02	41.18
8	Saharsa	399.60	0.018	7.19	6.47	932.40	0.013	12.31	11.08	111.00	0.10	11.10	9.99	16.00	0.39	6.24	5.62	33.16
9	Sitamarhi	13.05	0.018	0.23	0.21	30.45	0.013	0.40	0.36	3.00	0.10	0.30	0.27	0.00	0.39	0.00	0.00	0.84
10	Supaul	490.50	0.018	8.83	7.95	1144.50	0.013	15.11	13.60	136.00	0.10	13.60	12.24	20.00	0.39	7.80	7.02	40.80
	TOTAL	4563.15		82.12	73.91	5917.35		78.11	70.30	855.00		85.50	76.95	124.00		48.36	43.52	264.68

TFO = Total Financial Outlay

Considerations –

i. Pond system: Field System – 30:70 (Araria, Katihar, Kishanganj, Purnea, Saharsa, Sitamarhi and Supaul);
ii. 80:20 (Darbhanga and Madhubani); 50:50 (Madhepura)
iii. Yield of Makhana seeds (quintals/ ha) – Pond based (18 quintals), Field based (21 quintals)
iv. 50% of total yield towards micro processing and 30% of total yield towards small processing
v. Micro level Enterprise (upto 1 quintal raw makhana seed/ day) and 120 quintals/ enterprise in season (120 days)
vi. Small level Enterprise (upto 4 quintals raw makhana seed/ day) and 480 quintals/ enterprise in season (120 days)
vii. Banking plan considering 30% of area under cultivation for FY 2027-28



Annexure - VII

Banking Plan for FY 2028-29

Area in ha
Units in Nos
Cost/ Amount in Rs. Cr
Bank Loan = 90% of TFO

S. N	Districts	Pond System of Cultivation				Field System of Cultivation				Micro Processing				Small Processing				Total Bank Loan
		Area- Pond System	Unit Cost/ SoF	TFO	Bank Loan	Area- Field system	Unit Cost/ SoF	TFO	Bank Loan	Units	Unit Cost/ SoF	TFO	Bank Loan	Units	Unit Cost/ SoF	TFO	Bank Loan	
1	Araria	151.20	0.018	2.71	2.44	352.80	0.013	4.66	4.19	42.00	0.10	4.20	3.78	6.00	0.39	2.34	2.11	12.51
2	Darbhanga	1252.80	0.018	22.55	20.30	313.20	0.013	4.13	3.72	121.00	0.10	12.10	10.89	18.00	0.39	7.02	6.32	41.22
3	Katihar	648.00	0.018	11.66	10.50	1512.00	0.013	19.96	17.96	180.00	0.10	18.00	16.20	27.00	0.39	10.53	9.48	54.14
4	Kishanganj	118.80	0.018	2.14	1.92	277.20	0.013	3.66	3.29	33.00	0.10	3.30	2.97	4.00	0.39	1.56	1.40	9.59
5	Madhepura	432.00	0.018	7.78	7.00	432.00	0.013	5.70	5.13	70.00	0.10	7.00	6.30	10.00	0.39	3.90	3.51	21.94
6	Madhubani	1195.20	0.018	21.51	19.36	298.80	0.013	3.94	3.55	115.00	0.10	11.50	10.35	17.00	0.39	6.63	5.97	39.23
7	Purnea	594.00	0.018	10.69	9.62	1386.00	0.013	18.30	16.47	165.00	0.10	16.50	14.85	24.00	0.39	9.36	8.42	49.36
8	Saharsa	479.52	0.018	8.63	7.77	1118.88	0.013	14.77	13.29	133.00	0.10	13.30	11.97	20.00	0.39	7.80	7.02	40.05
9	Sitamarhi	15.66	0.018	0.28	0.25	36.54	0.013	0.48	0.43	4.00	0.10	0.40	0.36	0.00	0.39	0.00	0.00	1.05
10	Supaul	588.60	0.018	10.59	9.54	1373.40	0.013	18.13	16.32	164.00	0.10	16.40	14.76	24.00	0.39	9.36	8.42	49.04
	TOTAL	5475.78		98.55	88.69	7100.82		93.73	84.36	1027.00		102.70	92.43	150.00		58.50	52.65	318.13

TFO = Total Financial Outlay

Considerations –

i. Pond system: Field System – 30:70 (Araria, Katihar, Kishanganj, Purnea, Saharsa, Sitamarhi and Supaul);
ii. 80:20 (Darbhanga and Madhubani); 50:50 (Madhepura)
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vi. Small level Enterprise (upto 4 quintals raw makhana seed/ day) and 480 quintals/ enterprise in season (120 days)
vii. Banking plan considering 36% of area under cultivation for FY 2028-29

BANKABLE PROJECT ON

DAIRY FARMING

DAIRY FARMING

Introduction

Dairy farming in India has transitioned from a traditional backyard activity to a sophisticated, high-growth industrial sector. As of 2026, India maintains its position as the world's largest milk producer, contributing approximately 25% of global output.

Scope for Dairy Farming and its National Importance

The dairy sector is often called the "growth engine" of Indian agriculture, outperforming crop sectors in terms of consistent annual growth.

- **Economic Contribution:** The dairy sector contributes approximately **5% to India's National GDP.** Unlike seasonal crops, milk provides a steady, daily cash flow to over **80 million rural households.**
- **Livelihood & Employment:** It is the largest single agricultural commodity in the country. It serves as a primary safety net for small and marginal farmers, particularly during crop failures.
- **Women's Empowerment:** Women make up about **70% of the dairy workforce.** The sector is a major driver of gender-inclusive growth, with over 48,000 women-led dairy cooperative societies across the country.

- **Nutritional Security:** With a per capita milk availability of **485 grams per day** (2025-26 data), India significantly exceeds the global average of 328 grams, playing a vital role in combating malnutrition.
- **Waste-to-Wealth (Circular Economy):** Initiatives like the **Gobardhan Scheme** convert cattle dung into biogas and organic manure, reducing chemical fertilizer dependence and providing additional income.

Scope and Future Trends (2026 & Beyond)

The market is shifting from "bulk milk" to specialized, high-value products.

Category	Description & Market Potential
Value-Added Products	Massive growth in the consumption of curd, paneer, cheese, and ghee. Consumers are shifting from loose milk to branded, packaged products.
A2 & Organic Milk	High demand in urban centers for A2 milk and certified organic dairy due to rising health consciousness, growing at ~20% annually.
Digital Integration	Use of "Pashu Aadhar" (digital ID for cattle) and IoT-based health monitoring to track productivity and disease.
Direct-to-Consumer (D2C)	Quick-commerce and subscription-based apps are disrupting traditional supply chains, ensuring farm-to-table freshness in under 15 minutes.

Government Support & Infrastructure

To achieve the goal of "**White Revolution 2.0,**" the government has significantly increased funding:

- **Record Budget Allocation:** In the 2026-27 Union Budget, the Department of Animal Husbandry & Dairying received its highest-ever allocation of **₹6,153 crore**.
- **Rashtriya Gokul Mission:** Focuses on enhancing the productivity of indigenous breeds using advanced technologies like IVF and sex-sorted semen.
- **Infrastructure Funds (AHIDF & DIDF):** Multi-billion dollar funds provide interest subvention (3%) for private and cooperative players to set up processing plants and cold chains.
- **Kisan Credit Card (KCC):** The credit limit for animal husbandry has been doubled to **₹5 lakh**, easing working capital for small farmers.

Financial Assistance Available from Banks for Dairy Farming

For dairy schemes with large outlays, detailed project reports will have to be prepared. The items of finance would include capitalasset items such as purchase of milch animals, construction of sheds, purchase of equipment etc. The feeding cost during the initial period of one/two months is capitalised and given as a term loan. Cost towards land development, fencing, digging of well, commissioning of diesel engine/pump set, electricity connections, essential servants' quarters, godown, transport vehicle, milk processing facilities etc. can be onsidered for loan. For high value projects, the borrowers can utilise the services of NABARD Consultancy Services (NABCONS) who are having wide experience in preparation of Detailed Project Reports.

Project Formulation for Bank loan

Project can be prepared by a beneficiary after consulting local technical persons of State Animal Husbandry Department, DRDA, Dairy Co-operative Society / Union / Federation / commercial dairy farmers. If possible, the beneficiaries should also visit progressive dairy farms and government / military / agricultural university dairy farms in the vicinity and discuss the profitability of dairy farming. A good practical training and experience in dairy farming will be highly desirable. The dairy co-operative societies, if existing in the villages would provide all supporting facilities particularly for marketing of fluid milk. Nearness of dairy farm to such a society, veterinary aid centre, artificial insemination centre should be ensured.

The project should include the following information on technical, financial and managerial aspects in detail based on type of unit and capacity.

Technical:

- Land and land development (Location, area, suitability, proximity to road, site map etc.)
- Proposed capacity / No. of milch animals
- Civil structures (Sheds, store room, milk room, office quarters, staff room etc.)
- Equipment and Plant and Machinery (Chaff cutter, Silo pit, Milking machine, Feed grinder and mixer, Milking pails/milk cans, Biogas plant, Bulk coolers, Equipment for manufacture of products, Truck/van)
- Housing Type of housing (Area requirement – Adults, Heifers (1-3 years), Calves (less than 1 year)
- Animals (Proposed species, Proposed breed, Source of purchase, Place of purchase, Distance, Cost of animal)
- Production parameters (Order of lactation, Milk yield (ltrs. per day), Lactation days, Dry days, Conception rate, Mortality(%) – Adults, Young stock)
- Feeding (Source of fodder and feed - Green fodder, Dry fodder, Concentrates. Fodder crop- rotations- Kharif, Rabi, Summer. Fodder cultivation expenses, Requirement and costs)

- Breeding Facilities (Source, Location-Distance (km.), Availability of semen, Availability of staff, Expenditure per animal/year)
- Veterinary Aid Source (Location-Distance (km.), Availability of labour and other staff, Types of facilities available, If own arrangements are made-Employed a veterinary doctor/stockman/consultant, Periodicity of visit, Amount paid/visit (Rs.), Expenditure per animal per year)
- Electricity (Source, Approval from SEB, Connected load, Problems of power failure, Arrangements for generator)
- Water (Source, Quality of water, Availability of sufficient quantity for drinking, cleaning and fodder production, If investment has to be made, type of structure, design and cost)
- Marketing of milk (Source of sales, Place of disposal, Distance (km.), Price realised - (Rs. per liter of milk), Basis of payment, Periodicity of payment
- Marketing of other products (Animal – age, place of sale, price expected, Manure Qty./animal, Price/unit (Rs.), Empty gunny bags- Number, Cost/bag (Rs.)

Financial:

- Financial viability (Internal Rate of Return, Benefit Cost Ratio, Net Present Worth)
- Financial position of the borrowers (Profitability Ratios, Debt Equity Ratio, Whether Income Tax & other tax obligations are paid upto date, Whether audit is up to date)
- Lending Terms (Rate of Interest, Grace Period, Repayment Period, Nature of Security)

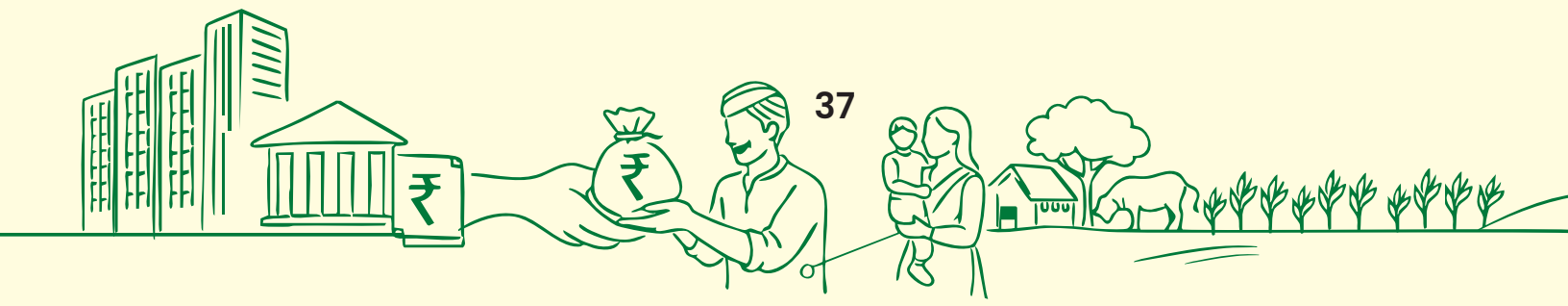
Managerial:

Borrower's profile

- Individual/Partnership /Company/ FPO / Corporation/ Co-operative Society /Others
- Capability in managing the proposed business
- Experience in proposed activity or others
- Financial soundness
- Technical and other special qualifications
- Technical/ Managerial staff and adequacy there of

Others:

- Name of the financing bank
- Training facilities
- Assistance available from State/ Central Government
- Regulatory clearances, if any etc.



Appraisal of the Project

The scheme so formulated should be submitted to the nearest branch of the bank. The bank's officer can assist in preparation of the scheme or filling in the prescribed application form.

The bank will then examine the scheme for its technical feasibility and economic viability.

Sanction of Bank Loan and its Disbursement

After ensuring technical feasibility and economic viability, the scheme is sanctioned by the bank. The loan is disbursed in kind in 2 to 3 stages against creation of specific assets such as construction of sheds, purchase of equipment and machinery, purchase of animals and recurring cost on purchase of feeds/fodders for the initial period of one/two months. The end use of the funds is verified and constant follow-up is done by the bank.

Lending terms - General

Outlay

Outlay of the project depends on the local conditions, unit size and the components included in the project. Prevailing market prices may be considered to arrive at the outlay.

Margin Money

Margin depends on the category of the borrowers and range from 10 to 25%.

Interest Rate for ultimate borrower

Banks are free to decide the rates of interest within the overall guidelines. However, for working out the financial viability and bankability of the model projects we have assumed the rate of interest as around 12% p.a.

Security

Security will be as per NABARD/RBI guidelines issued from time to time.

Repayment period of loan

Repayment period depends upon the gross surplus in the scheme. The loan will be repaid in suitable monthly/quarterly instalments usually within a period of five to seven years.

Insurance

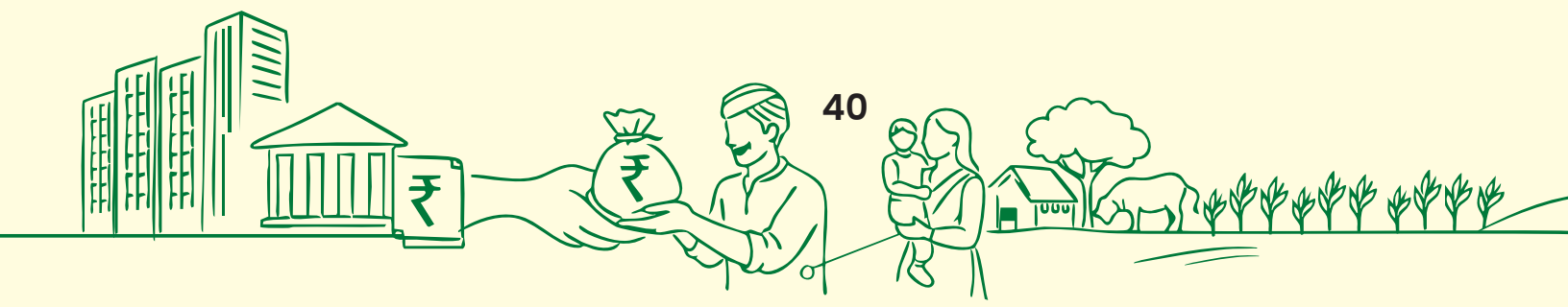
The animals and capital assets may be insured annually or on long term master policy, where ever it is applicable.

Economics of Dairy Farming

A model project with 10 buffaloes is given below. This is indicative and the applicable input and output costs as also the parameters observed at the field level may be incorporated.

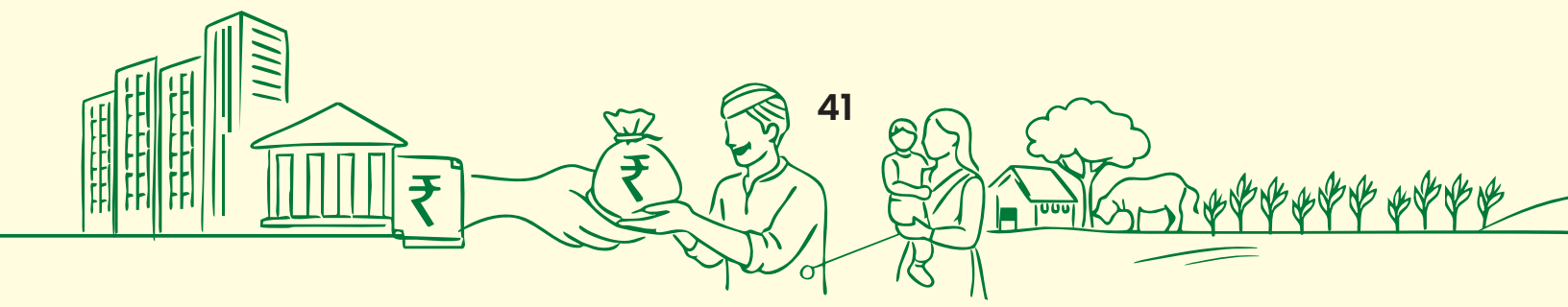
Capital Cost	**(Rs in Lakh)**
Cost of animals	9,00,000
Transportation cost	50,000
Construction of animal shed	3,20,000
Construction of calf shed	1,60,000
Cost of Chaff cutter and equipment	2,35,000
Sub Total	**16,65,000**
Capitalised Recurring Cost	
Fodder Cultivation	16,000
Insurance	5,000
Concentrate Feed	5,000
Veterinary Breeding andother Expenses	20,000
Miscellaneous Over Heads	12,500
Sub Total	**76,000**
Total Financial Outlay	**17,41,000**

Techno economic parameters	
Type of Animal	Cross Bred Cows
No. of Animals	10
No. of animals/batch	5
Cost of Animal (Rs./animal)	90,000
Cost of culled animal	36,000
Transportation Cost/Animal	5,000
Average Milk Yield (litre/day)	10
Floor space (sqft) per adult animal	40
Floor space (sqft) per calf	20
Cost of construction per sqft (Rs.)	800
Cost of chaff cutter (power operated) (Rs.)	50,000
Cost of equipment per animal (Rs.)	1000
Insurance premium (% per annum)	5
Veterinary aid/animal/ year (Rs.)	8000
Quantity of Concentrate feed in one bag(kgs.)	50
Cost of concentrate feed (Rs./kg)	25
Cost of dry fodder (Rs./kg)	5
Cost of green fodder (Rs./kg)	4
No. of labourers	1
Salary of labourer per month (Rs.)	15,000
Cost of electricity and water/animal/year (Rs.)	2,000
Margin (%)	25
Rate of interest (%)	11.90%
Repayment period (years)	5
Selling price of milk/litre (Rs./litre)	40
Sale price of Manure/gunny bags (Rs.per bag)	10
Lactation days	300
Dry days	65



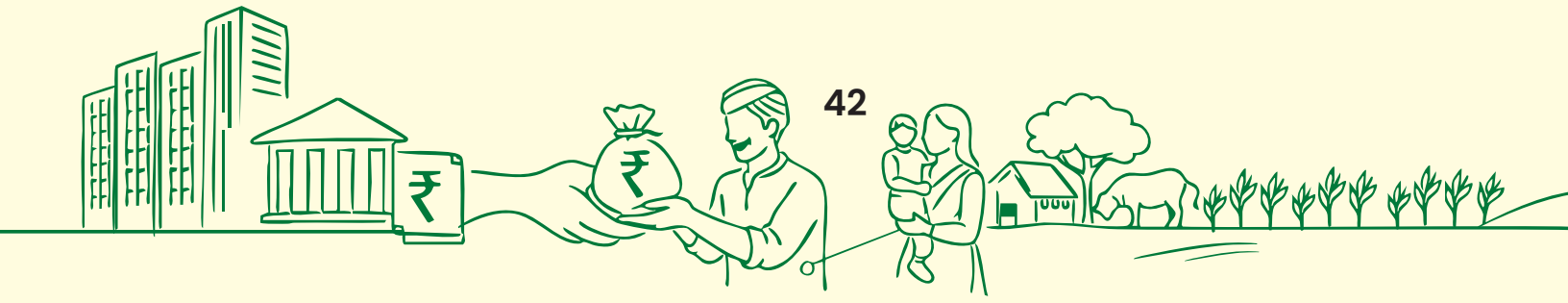
Feeding Schedule					
	Lactation			Dry	
Type of feed	Price (Rs.)	Qty. (kg)	Cost Per Day (Rs.)	Qty. (kg)	Cost Per Day (Rs.)
Concentrate Feed	25	6	150	1	25
Green Fodder	4	25	100	20	80
Dry Fodder	5	4	20	5	25
Total			**270**		**130**

Lactation Chart Per animal				
Year	I Batch		II Batch	
	Lactation days	Dry days	Lactation days	Dry days
I	270	95	180	0
II	300	65	265	100
III	300	65	265	100
IV	295	75	265	100
V	265	100	265	100
VI	45	0	230	0



Economics						
Particulars	**Years**					
	1	**2**	**3**	**4**	**5**	**6**
Sale of Milk	13,50,000	16,95,000	16,95,000	16,65,000	15,90,000	8,25,000
Sale of Manue/Gunny bags	45,000	60,000	60,000	60,000	60,000	60,000
Residual Value						3,60,000
Total	13,95,000	**17,55,000**	**17,55,000**	**17,25,000**	**16,50,000**	**12,45,000**
Cost of feeding during lactation	6,07,500	7,62,750	7,62,750	7,49,250	7,15,500	3,71,250
Cost of feeding during dry period	61,750	1,07,250	1,07,250	1,13,750	1,30,000	0
Veterinary aid and breeding charges	15,000	20,000	20,000	20,000	20,000	940
Labour charges	1,35,000	1,80,000	1,80,000	1,80,000	1,80,000	1,80,000
Electricity and misc. charges	2,000	2,000	2,000	2,000	2,000	2,000
Insurance charges	48,600	48,600	48,600	48,600	48,600	48,600
Total	**8,69,850**	**11,18,600**	**11,18,600**	**11,11,600**	**10,94,100**	**6,00,790**
Surplus	**5,25,150**	**6,36,400**	**6,36,400**	**6,13,400**	**5,55,900**	**2,84,210**

BCR & IRR						
	1	**2**	**3**	**4**	**5**	**6**
Capital Costs	17,41,000					
Recurring Cost	8,69,850	11,18,600	11,18,600	11,11,600	10,94,100	6,00,790
Total Costs	26,10,850	11,18,600	11,18,600	11,11,600	10,94,100	6,00,790
Benefit	13,95,000	17,55,000	17,55,000	17,25,000	16,50,000	12,45,000
Net Benefit	-1,215,850	6,36,400	6,36,400	6,13,400	5,55,900	6,44,210



PW (Present Worth) Costs @ 15%	52,90,884
PW (Present Worth) Benefits @ 15%	60,38,880
NPW (Net Present Worth)	7,47,996
B.C. Ratio	1.14
I.R.R. (%)	42.53%

Loan Repayment Schedule							
Year	**Loan Outstanding**	**Gross Surplus**	**Interest**	**Principal**	**Total Repayment**	**Surplus**	**DSCR**
1	13,92,800	5,25,150	1,54,173	2,16,768	3,70,941	1,54,209	1
2	11,76,032	6,36,400	1,26,923	2,44,018	3,70,941	2,65,459	2
3	9,32,015	6,36,400	96,248	2,74,693	3,70,941	2,65,459	2
4	6,57,322	6,13,400	61,716	3,09,225	3,70,941	2,42,459	2
5	3,48,097	5,55,900	22,844	3,48,097	3,70,941	1,84,959	1
6	0	5,55,900	0	0	0	5,55,900	
						Average	1.60

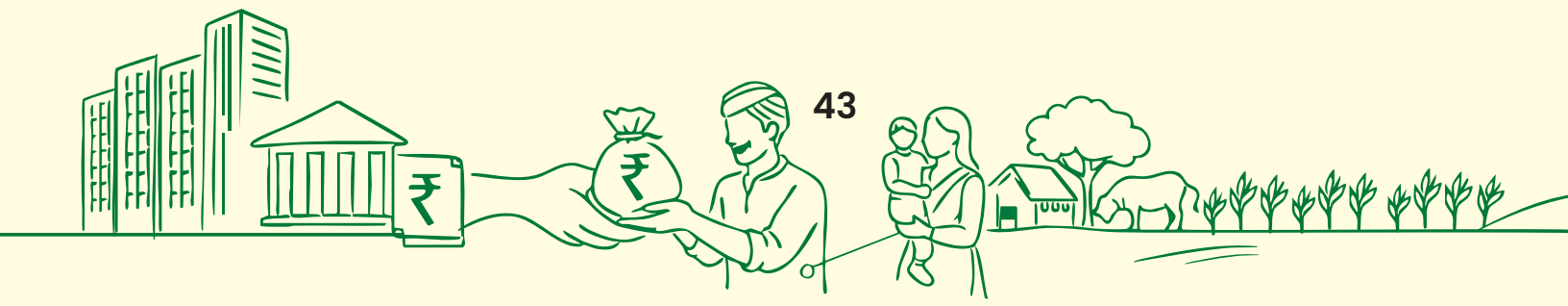
This model is indicative.

Rate of Interest

As per bank lending policy, RBI guidelines and/or schemes guidelines for availing capital subsidy/ interest subvention.

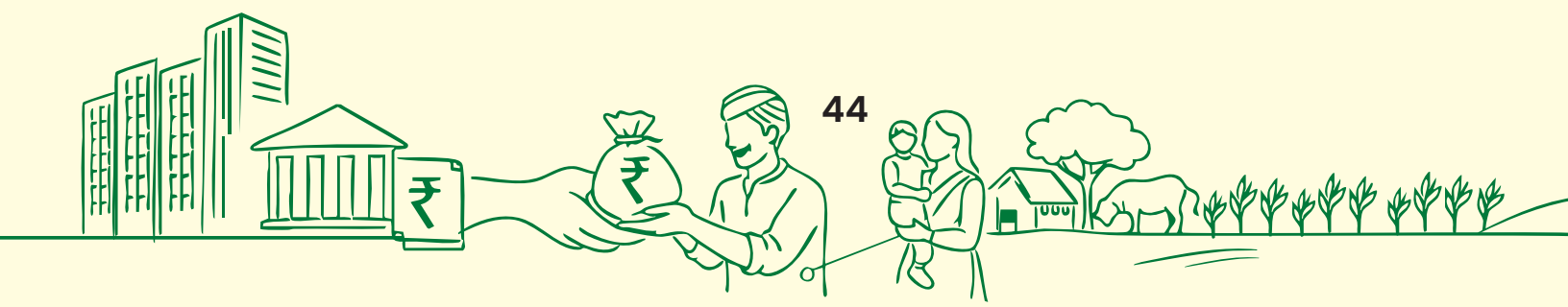
Security

As per bank lending policy, RBI guidelines and/or schemes guidelines for availing credit guarantee.



BANKABLE PROJECT ON

SOLAR DRYER UNIT



SOLAR DRYER UNIT (100 KG/DAY CAPACITY)

Introduction

Solar drying is a proven post-harvest technology used for reducing moisture content of agricultural produce using solar energy. The low-cost solar dryer model is suitable for small farmers, SHGs, JLGs, FPOs and rural entrepreneurs. It will impact the optimum utilisation of produce, generate employment and boost rural economy.

Solar Dryer Unit

Establishment of Solar Dryer Unit for fruits, vegetables, medicinal plants etc. targeting hygienic dehydration and value addition for better price realisation.

Background and Rational

Post-harvest losses in fruits, vegetables, medicinal plants etc. range from 20–30%. The traditional open sun drying, depends on weather, causes contamination and provide low quality dried produce. The modern solar dryer, controlled drying, will provide better quality dried product with extended shelf life of produce resulting in reduction of post-harvest losses and enhanced income to farmers. The indirect drying mechanism ensures better product quality, uniform drying, and reduced contamination compared to open sun drying.

Objectives

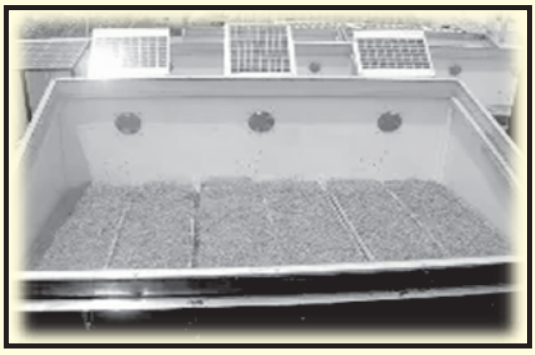
- To establish a renewable energy-based drying unit
- To reduce post-harvest losses
- To produce hygienic, high-quality dried products with increase shelf life
- To enable value addition at farm level

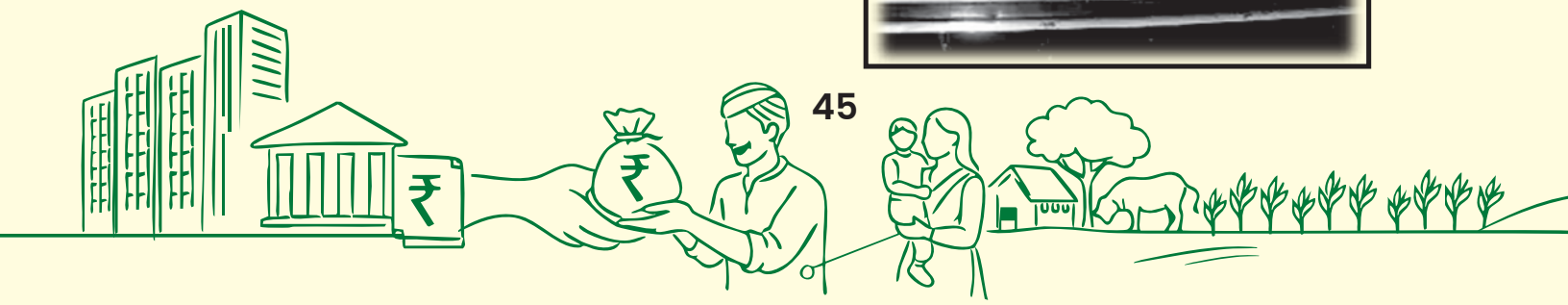
Products to be Dried

- Fruits : Banana, Mango, Papaya etc.
- Vegetables : Onion, Tomato, Carrot, Leafy vegetables etc.
- Spices : Chilli, Turmeric, Coriander etc.
- Medicinal plants & herbs

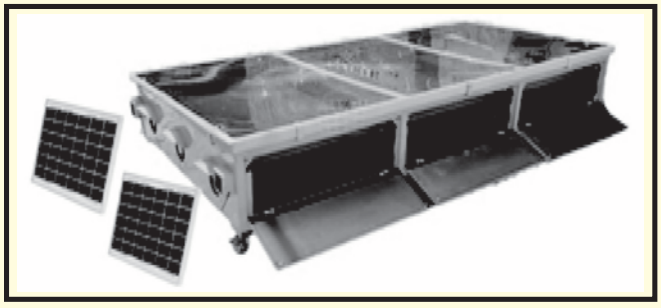
Technology

The produce is dried using hot air generated in a solar collector without direct exposure to sunlight. Hot air generated in the solar collector moves naturally into the drying chamber, removing moisture from agricultural produce placed on trays.



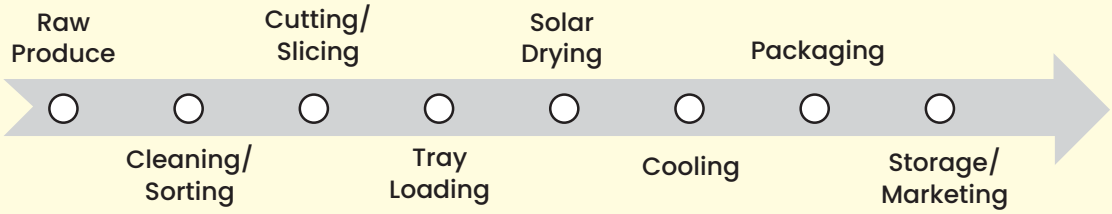


The solar dryer consists of two main units:



- Solar Collector: A flat plate collector made of black-painted GI/Al sheet covered with transparent glass or UV-stabilized poly sheet. It absorbs solar radiation and heats the air.
- Drying Chamber: An insulated cabinet with multiple perforated trays where the agricultural produce is placed for drying.
- Tunnel/cabinet 8ft×4ft; 6-12 perforated trays; 3 small fans + PV panels (10–30W); UV treated polycarbonate cover; temperature 40–85°C; optional electric backup.

Process Flow



Infrastructure Requirement

- Land 200-300 sq. m
- Dryer shed 100 sq. m
- Storage space 50 sq. m
- Utilities water and basic electricity

Techno - Economical Parameters and Assumptions

- Working days : 300 days/year
- Dried yield : 20%
- Fresh produce input : 100 kg/day
- Dried produce output : 20 kg/day
- Average raw material price : 20/kg fresh (seasonal average)
- Average dried product selling price : 200/kg (conservative price, chilly/ turmeric can be higher; leafy green lower price)
- Capacity Utilization :

S.N.	Year	Capacity Utilization
i	1st	70%
ii	2nd & 3rd	75%
iii	4th & 5th	80%

- Project period : 5 years
- Moratorium period : 3 months
- Repayment frequency : Quarterly
- Margin : 10%
- Rate of Interest : 10%

Project Cost (CAPEX and OPEX)

- **Fixed Capital Investment (CAPEX)**

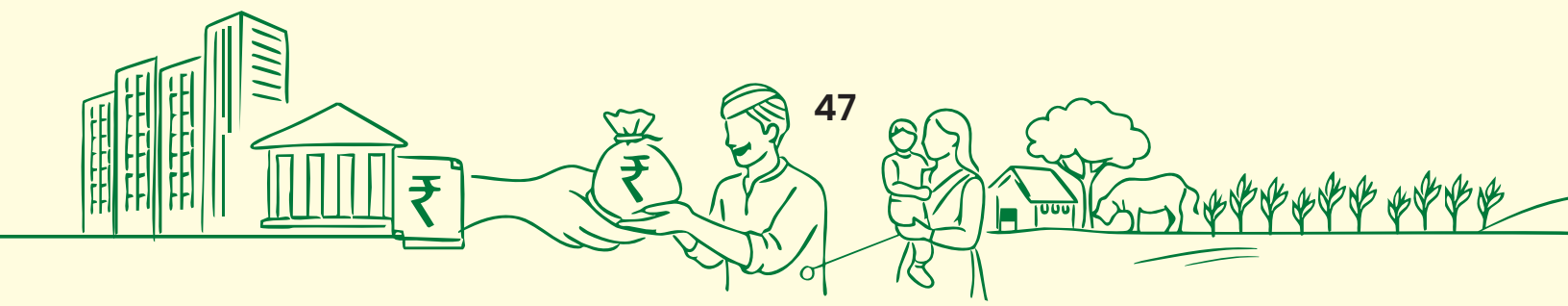
S.N.	Particulars	Amount (Rs.)	Total Amount
i	Solar polyhouse dryer	3,57,000	(3,40,000 plus GST @5%)
ii	Installation charge	21,000	(20,000 plus GST @5%)
iii	Slicer machine	23,600	(20,000 plus GST @18%)
iv	Weighing scale	7,670	(6,500 plus GST @18%)
v	Sealing machine	4,720	(4,000 plus GST @18%)
vi	Moisture machine	88,500	(75,000 plus GST @18%)
vii	civil work (Platform etc.)	25,000	
viii	Misc expenditure	25,000	
	Total CAPEX	5,52,490	

- **Operating Expenditure (OPEX) to be Capitalised for 03 months**

S.N.	Particulars	Amount (Rs.)
i	Raw material	1,26,000
ii	Labour	22,500
iii	Packaging material	12,600
iv	Electricity & water	7,500
v	Misc. expenditure	15,000
	Total OPEX	1,83,600

- **Total Project Cost**

S.N.	Particulars	Amount (Rs.)
i	Capital Expenditure (CAPEX)	5,52,490
ii	Operating Expenditure (OPEX) to be Capitalised	1,83,600
	Total CAPEX + OPEX	7,36,090



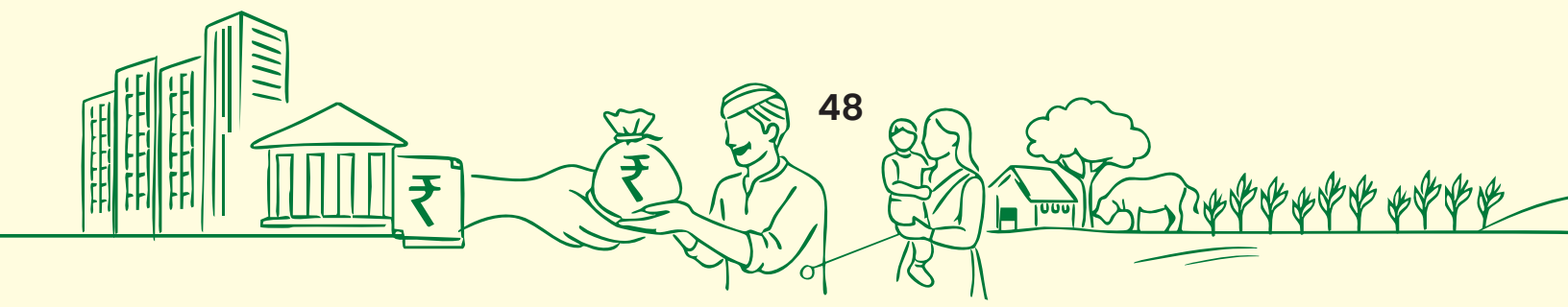
Means of Finance

S.N.	Particulars	Amount (Rs.)
i	Promoter Contribution	73,609
ii	Bank Loan	6,62,481
	Total	7,36, 090

Note: Eligible for Capital Subsidy under PMEGP/ PMFME & Interest Subvention and Credit Guarantee under AIF.

Expenditure and Income Statement

S.N.	Particulars	1st Year	2nd Year	3rd Year	4th Year	5th Year
1	**Capital Expenditure (CAPEX)**					
1.1	Solar polyhouse dryer	3,57,000				
1.2	Installation charge	21,000				
1.3	Slicer machine	23,600				
1.4	Weighing scale	7,670				
1.5	Sealing machine	4,720				
1.6	Moisture machine	88,500				
1.7	civil work (Platform etc.)	25,000				
1.8	Misc expenditure	25,000				
	Total CAPEX	5,52,490				
2	**Operating Expenditure (OPEX)**					
2.1	Raw material	4,20,000	4,50,000	4,50,000	4,80,000	4,80,000
2.2	Labour	75,000	75,000	75,000	75,000	75,000
2.3	Packaging material	42,000	45,000	45,000	48,000	48,000
2.4	Electricity & water	30,000	30,000	30,000	30,000	30,000
2.5	Misc. expenditure	60,000	60,000	60,000	60,000	60,000
	Total OPEX	6,27,000	6,60,000	6,60,000	6,93,000	6,93,000
	Total CAPEX + OPEX	11,79,490	6,60,000	6,60,000	6,93,000	6,93,000
3	**Income**					
3.1	Dried product sale	8,40,000	9,00,000	9,00,000	9,60,000	9,60,000
	Total	8,40,000	9,00,000	9,00,000	9,60,000	9,60,000

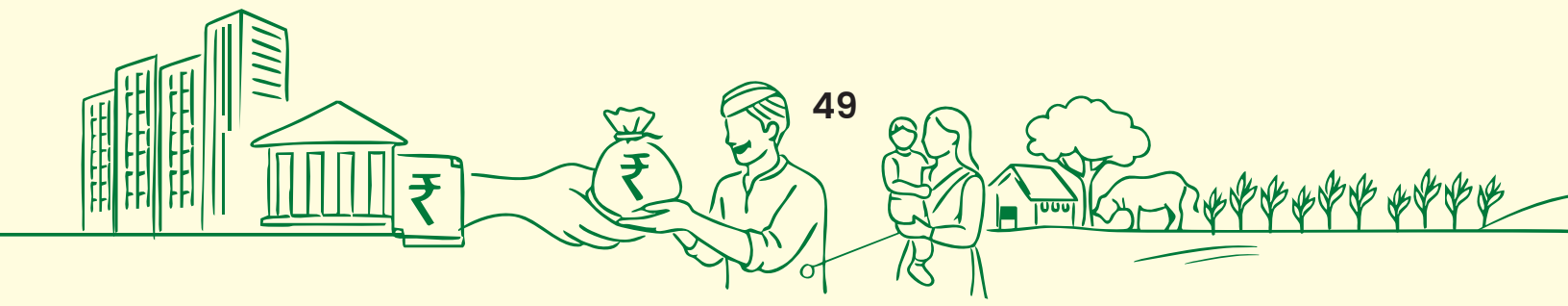


Financial Analysis

1	Net income before interest	-3,39,490	2,40,000	2,40,000	2,67,000	2,67,000
2	Net surplus	2,13,000	2,40,000	2,40,000	2,67,000	2,67,000
3	Interest on term loan	63,633	50,558	36,611	22,665	8,718
4	Principal repayment of term loan	1,04,601	1,39,468	1,39,468	1,39,468	1,39,476
5	Net income after repayment	44,766	49,974	63,921	1,04,867	1,18,806
6	DF at 15%	0.87	0.76	0.66	0.57	0.50
7	DF at cost/expenditure @ 15%	1026156	498960	434280	396396	344421
8	DF at income @ 15%	730800	680400	592200	549120	477120
9	NPW @ 15% DF	329427				
10	BCR	1.12				
11	IRR	62%				
12	DSCR	1.5				

Repayment Schedule

Capital Expenditure (CAPEX)	5,52,490
Operating Expenditure (OPEX) to be Capitalised	1,83,600
Total CAPEX + OPEX	7,36,090
Margin /Promoter Contribution @10%	73,609
Term loan @90%	6,62,481
Rate of interest (%)	10.00
Project period	05 years
Moratorium period	03 months
Repayment frequency	Quarterly



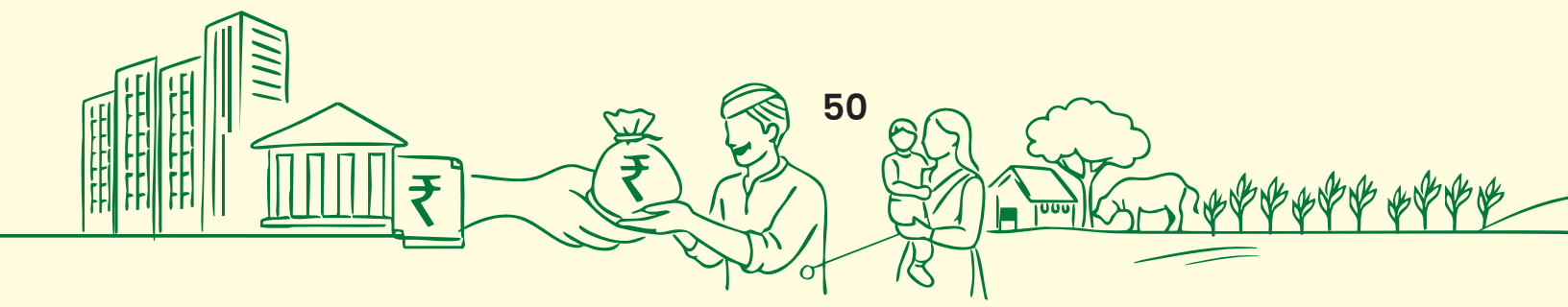
Year	Quarter	Repayment Amount	Principal Repayment	Interest Repayment	O/s Balance
1st	1st				6,62,481
	2nd	67991	34867	33124	6,27,614
	3rd	50557	34867	15690	5,92,747
	4th	49686	34867	14819	5,57,880
2nd	5th	48814	34867	13947	5,23,013
	6th	47942	34867	13075	4,88,146
	7th	47071	34867	12204	4,53,279
	8th	46199	34867	11332	4,18,412
3rd	9th	45327	34867	10460	3,83,545
	10 th	44456	34867	9589	3,48,678
	11 th	43584	34867	8717	3,13,811
	12 th	42712	34867	7845	2,78,944
4th	13 th	41841	34867	6974	2,44,077
	14 th	40969	34867	6102	2,09,210
	15 th	40097	34867	5230	1,74,343
	16 th	39226	34867	4359	1,39,476
5th	17 th	38354	34867	3487	1,04,609
	18 th	37482	34867	2615	69,742
	19 th	36611	34867	1744	34,875
	20 th	35747	34875	872	0

Rate of Interest

As per bank lending policy, RBI guidelines and/or schemes guidelines for availing capital subsidy/ interest subvention.

Security

As per bank lending policy, RBI guidelines and/or schemes guidelines for availing credit guarantee.

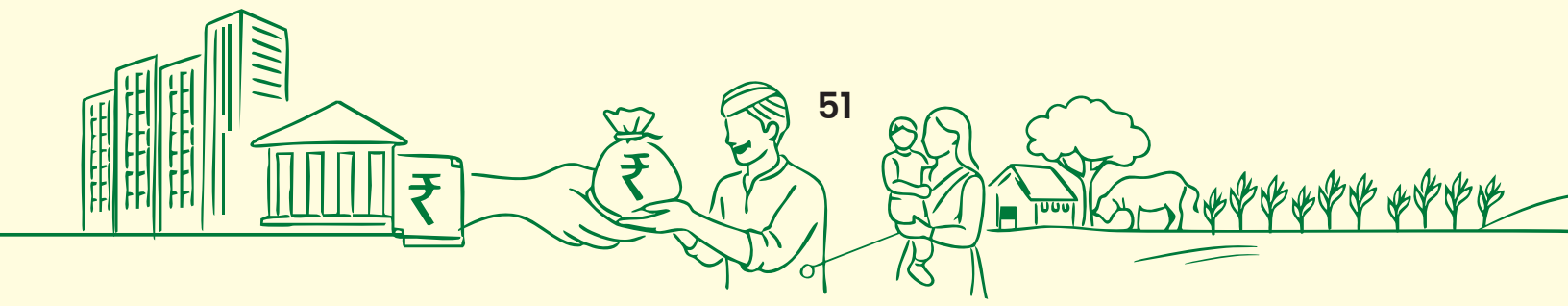


Risk Analysis & Mitigation

S.N.	Risk	Mitigation
i	Seasonal raw material	Multi-crop drying
ii	Weather variation	Hybrid solar dryer
iii	Market price fluctuation	Product diversification
iv	Quality issues	FSSAI compliance

Conclusion

From a technical and financial perspective, the proposed 100 kg/day capacity solar dryer project is environmentally friendly, technically sound, economically viable and sustainable intervention for post-harvest management. The project requires minimal operational cost with quick payback make profitable enterprise for small farmers, SHG, JLG, FPO, PACS etc. Therefore, the **100 kg/day capacity solar dryer project is eligible for bank finance under Priority Sector Lending.**



BANKABLE PROJECT ON

MUSHROOM & SPAWN PRODUCTION

MUSHROOM & SPAWN PRODUCTION UNIT (With an Investment of Rs. 20,00,000/-)

Introduction

Milky mushroom (calocybe indica) is one of the most suitable fungal organisms for producing protein rich food from various agro wastes without composting. Mushroom, which is pure vegetarian food, is good for diabetic patients. It also has other medicinal properties. It is good for stomach-related ailments like gastric ulcer and has high fiber content and no sugar. It is also rich in protein. Mushroom cultivation has become a profitable business with the produce fetching good returns in the market Milky mushroom is second tropical mushroom suitable for cultivation in tropical and subtropical regions of the country. It can grow in temperature 25 - 35 °c and relative humidity 85-90% Time period (sowing to harvesting) is 45-50 days.

Health Benefits of Milky Mushroom:

Milky mushrooms are an excellent source of vitamins B2, E, and A, phosphorus, potassium, and selenium, and also contain calcium, vitamin C, iron, and zinc. It strengthens and regulates the immune system, which makes it a powerful defense against infections. It is also said to have antibiotic, anti-tumour, and anti- cancer properties, and to help in regulating diabetes, lowering bad cholesterol levels, and to have strong antioxidant properties.

Production Technology:

Chopping of paddy straw into 1-to-2-inch length using chaff cutter.

Soaking of paddy straw with chemically treated water (Bavistin of 7.5g and formalin 125ml for 100 litres.

After 22 hrs the excess water is drained out, and paddy straw should be dried under sun until it gets the moisture content of 20%.

Prepare the beds by filling paddy straw and spawn as layer by layer. Per each bag 5 layers of spawn is filled.

Keep the prepared bags in dark room for 14-20 days for spawn growth. The bags can be arranged in hanging bag system which reduces input cost. Maintain the temperature (25 – 35°C) and humidity (80 - 90%) in dark room for proper development of spawn.

Prepare the soil for casing by adding chalk powder and formaldehyde solution (4%) mix well and rest it for a week.

After 20 days remove the bags from dark room and cut the bag into 2 halves, fill the prepared casing material of 2-3 cm thickness and shift to cropping room. The bags are arranged racks (made of either steel / bamboo / wood), daily watering should be done. Maintain the temperature (25 – 35) and humidity (80 - 85%) in cropping room for proper development of mushrooms.

After 10 days in cropping room, pin heads are developed in beds and 1st harvest can be obtain at 35th day of cultivation process.

In 45 to 50 days of cultivation process complete harvest of milky mushrooms can be done.

Harvested mushrooms are packed in a plastic tray each of 200gm and sell in the local

Value Addition Marketing

Packed mushrooms of 200gm each can be supplied to local market, supermarkets, restaurants etc., Value addition to milky mushrooms Milky Mushrooms can be dried under sun, and those dehydrated mushrooms can be packed and supplied to markets. Milky Mushroom pickles can be made and supplied to local markets. Dried mushroom powder also has demand in market.

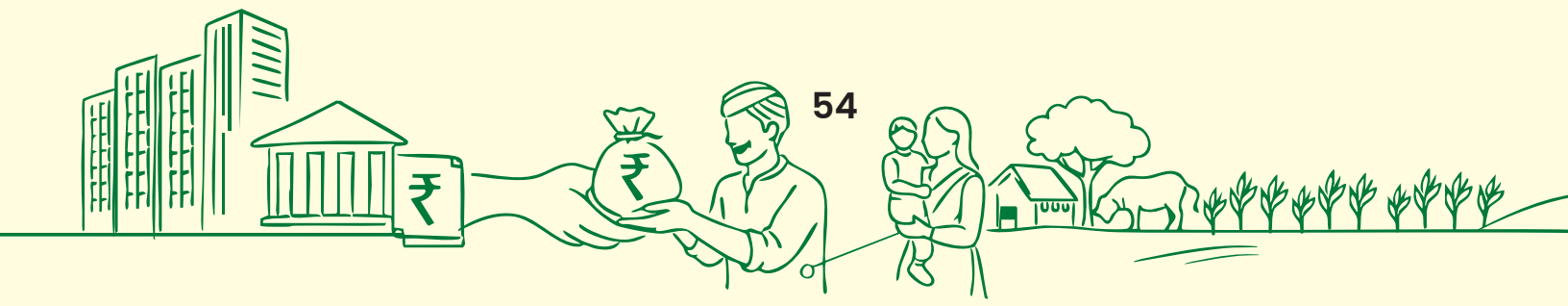
Mushrooms are marketed as fresh, dried and preserved. Market for mushrooms is growing rapidly because of their nice aroma, subtle flavour, nutritious values and special taste. Many exotic preparations are made from them like soup, pickles, vegetables etc. It is also used for stuffing several food preparations and for garnishing. But its consumption is still confined to urban and semiurban population. Mushrooms have very short life after harvesting and hence they are sold in fresh form. Their shelf life can be enhanced by processing them. Processed mushrooms are packed in special quality polythene bags or canned. This variety can be sold to far off places. Mushroom cultivation has been declared as a major thrust area by Govt. of India. However, there is huge demand- supply gap. Mushroom dish is a common item in all the big hotels. Day by day there is continuous increase in the demand of mushroom which denotes that there is huge market potential in near future.

Starting the mushroom production business requires planning and preparation. Before starting a Mushroom production, the entrepreneurs/ farmers are generally advised to undergo training. They can contact Mushroom Research Stations/Agriculture University etc. for the purpose.

SWOT Analysis

Strengths

- Mushrooms are cultivated indoors and do not require arable land. Small farmers and landless workers constitute major fraction of mushroom cultivation.
- Mushroom is a short-duration crop with high yield per unit time.
- Mushrooms are valued not only as nutritious and delicious food, but these also possess medicinal properties including anti-cancer and anti-HIV activities.



- Providing advisory services to farmers on new technologies helps to retain the client's base.
- India with a population of over one billion people; has a vast domestic market for mushrooms.
- Cheap availability of agri-horticultural and forestry wastes, and cereal grains in sufficient quantities to produce around 5 million tonnes of mushrooms in India.
- Round-the-year cultivation systems are in operation. Indian climate condition has an inherent advantage of diversification of mushroom cultivation in different regions and seasons of the country.
- Strong research infrastructure and availability of expert manpower within the country.

Opportunities

- Mushroom production provides an ideal opportunity for conversion of agro waste into wealth, quality food and organic manure and leads to high range of reduction in environmental pollution.
- Mushroom being an indoor crop provides vast opportunities for empowering rural and urban women through cultivation, production of value-added products and marketing. It also provides vast opportunities for unemployed youths to take up mushroom cultivation and marketing.
- Mushroom provides an opportunity to eliminate protein malnutrition among people having cereals as staple food.
- India can enter into a big and lucrative mushroom pharmaceutical international trade that is presently monopolized by some East-Asian countries and the US. There is big scope for diversifying mushroom export by including other mushroom species for export.
- India attaining self-sufficiency in food production, the domestic market of mushroom is likely to enlarge sooner than later.
- The collaborative arrangements of government institutions with nongovernment organizations, self-help groups and corporate sectors for processing, manufacturing of value-added products and marketing of mushrooms.

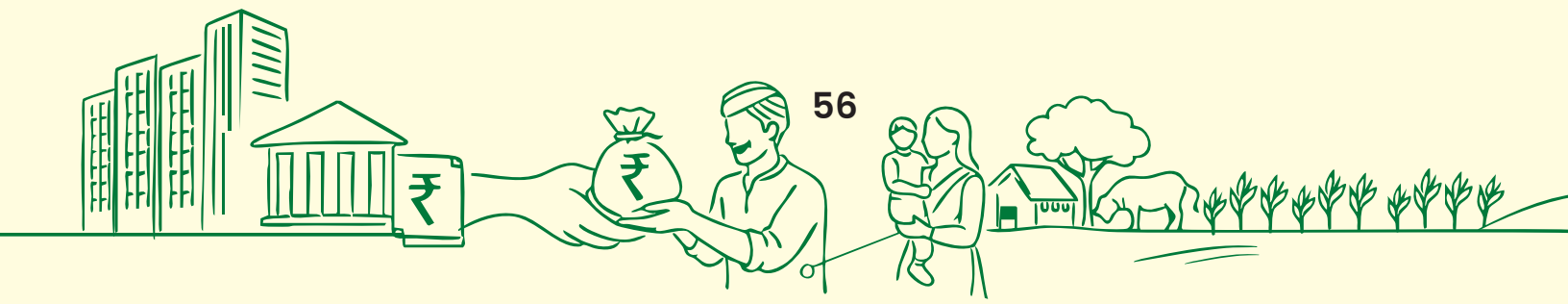
Weakness

- Mushrooms are highly perishable vegetable crop with less than two to eight days of storability.
- Presently, more than 85 per cent of the total mushroom production in the country is of button mushroom. There is less diversification with respect to mushroom species as well as mushroom products.
- Inadequate implementation and follow-up of institute-village linkage programmed for effective transfer of mushroom production technology.

- Non-availability of suitable integrated pest management (IPM) packages for major pests and diseases of cultivated mushrooms.
- Non-implementation of agricultural crop insurance schemes to the mushroom crop and absence of government-sponsored minimum support price (MSP) for mushroom crop.

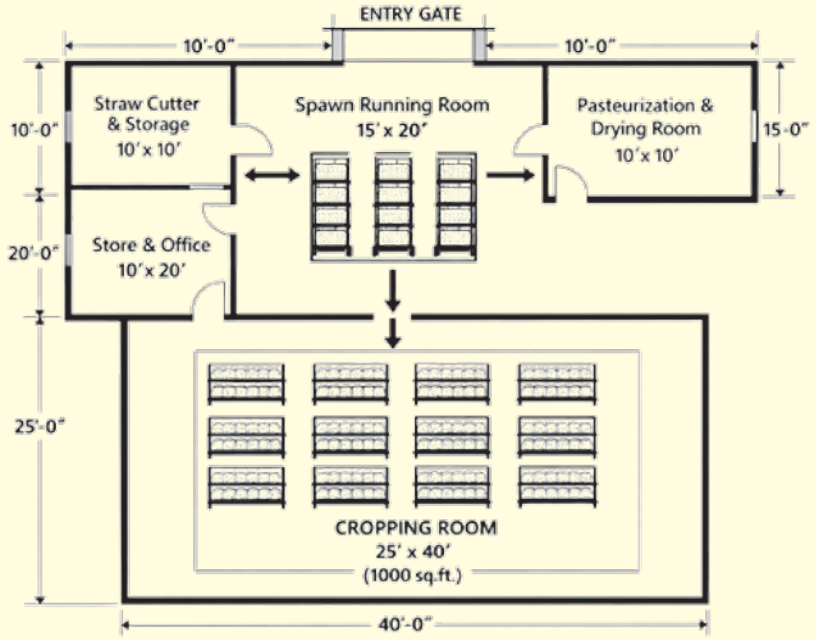
Threats

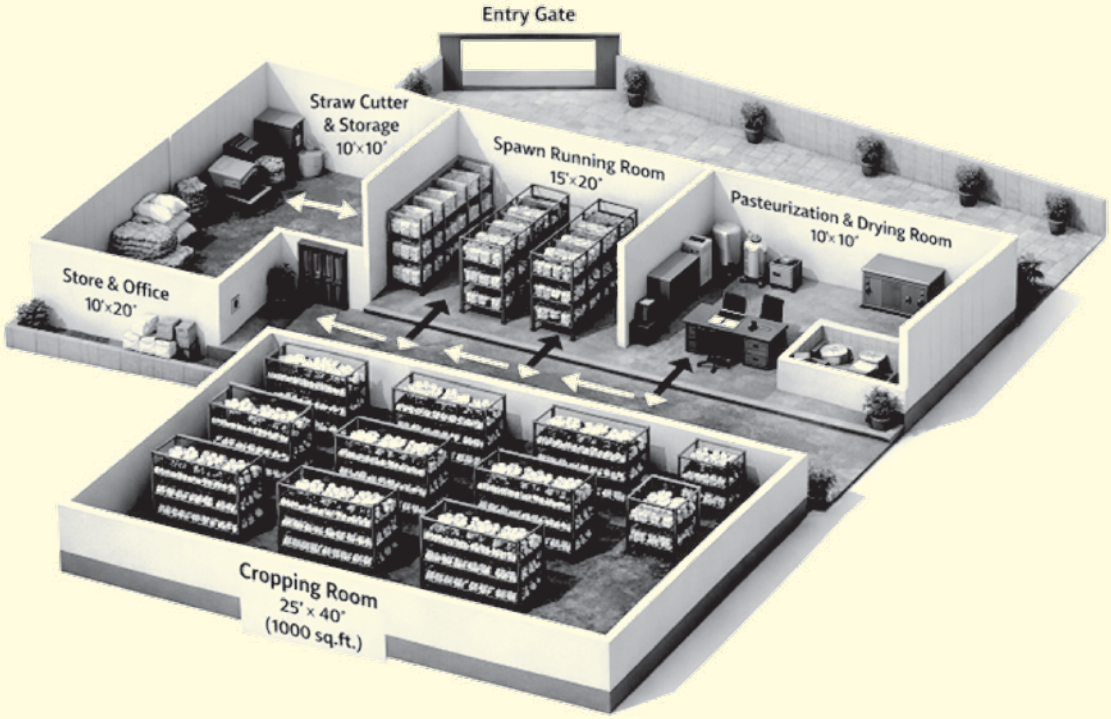
- With globalization, there is competition not only for quality produce but also for the price.
- Improper processing and packaging, especially of canned mushroom products, might lead to health hazards.
- Tough competition from East-Asian countries which are the major exporters of mushroom to the western countries.
- In the field of mushroom research, India not only lags behind in developing the varieties and technologies, but the pace is also slow as compared to other countries, which explore modern research tools like biotechnology and highly sophisticated instruments.



MUSHROOM PRODUCTION UNIT LAYOUT PLAN

Total Area: 1700 sq.ft

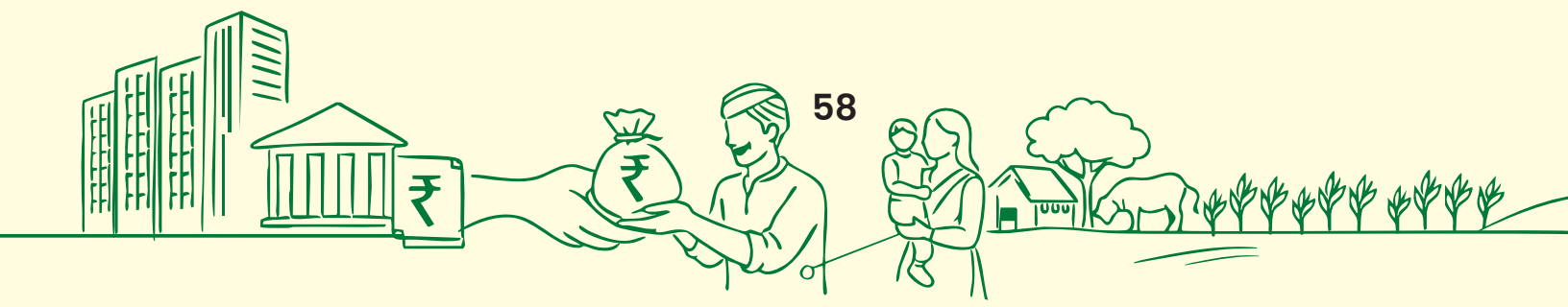




ECONOMICS OF THE PROJECT

BASICS AND PRESUMPTIONS

PARTICULARS	UNIT	QUANTITY
I. Technical Parameters		
1. Cycles during month	No.	1
2. No. of polythene bags required per cycle	NO.	1500
3. Quantum of paddy/wheat straw required	(kg/cycle)	750
4. Quantity of spawns required per cycle	Kg.	150
5. Labour requirement per cycle	man-days	60
II. Economic Parameters		
1. Cost of construction	Rs./sq.ft.	350
2. Cost of Paddy Straw	Rs./ton	10000
3. Cost of polythene bag	Rs./kg.	150
4. Cost of Spawn	Rs./kg.	90
5. Labour wage rate	Rs./man-day.	350
6. Yield per cycle	Kg.	1000
7. Sale Price	Rs./kg.	150



TOTAL COST OF PROJECT

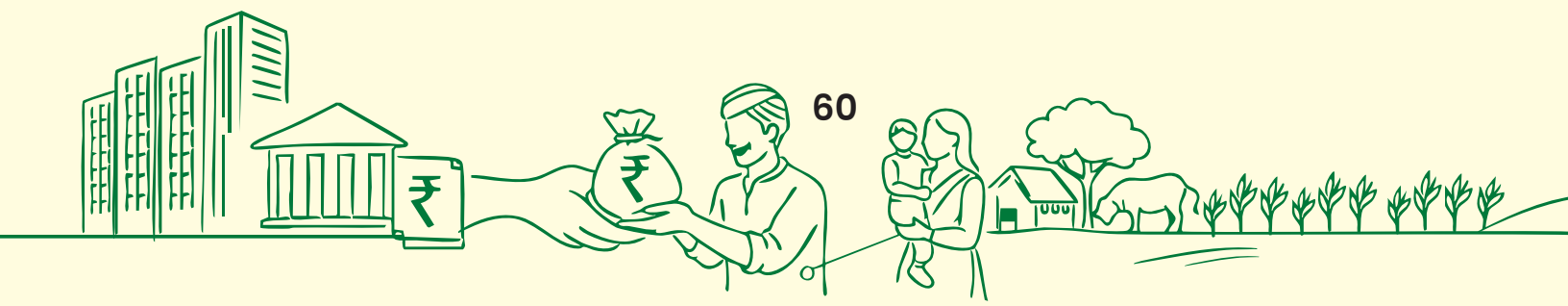
PARTICULARS	UNIT	QUANTITY	AMOUNT Rs.
I. Capital Cost			
1. Land and Site Development			
Land(lease)	5/yr		300000
Site development			10000
Straw cutter and storage room	Sq.ft.	100	35000
Pasteurization unit +drying room	Sq.ft	100	50000
Cropping room	Sq.ft	1000	300000
Spawn running room	Ls.	300	150000
Store Room+office	Sq.ft	200	60000
		TOTAL : 1	**905000**
2. Machinery & Equipment's			
Humidifier	no	6	60000
Water Sprayer	no	2	7500
Chaff Cutter	no	1 (2Hp 3phase)	28000
Auto clave	no	2	295000
Solar water heater	no	1	44500
Weighing machine	2 (10kg and 50kg)		10000
Sealing machine	1 (30cm)	1	13000
Racks	rack	27 (customized)	100000
Generator (10kv luminous)/ups	1 (10 to 15kw)	1	50000
Drying machine	No	1	50000
Exhaust fan	No	10	10000
3. Electric work			50000
		Total : 2	**718000**
		TOTAL(1+2)=A	**1623000**

PARTICULARS		UNIT	QUANTITY	AMOUNT Rs.
II.Working Capital (One Year)				
Mushroom spawn	Kg.	90	1800	163000
Paddy/wheat straw	Rs./ton	10000		50000
Polythene bags	kg.	20	1500	30000
Fuel/power cost, water	Lumpsum			25000
Labour charges	Mandays	350	180	65000
Marketing expenses	Lumpsum			15000
Transportation	Lumpsum			10000
Miscellaneous	Lumpsum			10000
Packaging	Lumpsum			9000
			TOTAL - B	377000

Capital Cost	1623000
Working Capital (One Year)	377000
TOTAL (A+B)	20,00,000

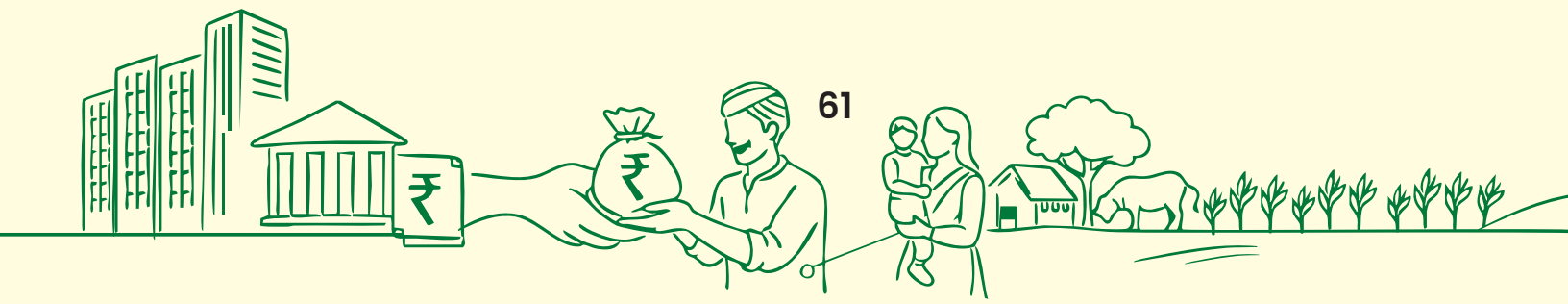
MEANS OF FINANCE

PARTICULARS	UNIT	UNIT RATE	AMOUNT Rs.
1. Term loan	%	75	15,00,000
2. Own contribution	%	25	5,00,000
		TOTAL	20,00,000



PROJECTED PROFITABILITY

PARTICULARS	UNIT	UNIT RATE	QUANTITY	IYEAR	IIYEAR	IIIYEAR	IVYEAR	VYEAR
I. INCOME								
Capacity utilized	%			75	90	100	100	100
Yield per cycle	Kg.	150	9,000	1012500	1215000	1350000	1350000	1350000
			TOTAL -A	1012500	1215000	1350000	1350000	1350000
II. EXPENDITURE								
1. Mushroom spawn	Kg	90	1800	122250	146700	163000	163000	163000
2.Paddy/ wheat straw	Rs./quintol	100	5000	37500	45000	50000	50000	50000
3. Polythene bags	/cycle	5,000		22500	27000	30000	30000	30000
4. Fuel/power cost, water	/cycle			18750	22500	25000	25000	25000
8. Labour charges	/cycle	25000		48750	58500	65000	65000	65000
9. Marketing expenses	/cycle	5,000		7500	9000	10,000	10,000	10,000
10. Transportation	/cycle	1,000		11250	13500	15000	15000	15000
9. Packaging	/cycle	5,000		6750	8100	9000	9000	9000
10. Miscellaneous	/cycle	1,000		7500	9000	10000	10000	10000
			TOTAL - B	282750	339300	377000	377000	377000
III. NET INCOME A-B				729750	875700	973000	973000	973000



FINANCIAL ANALYSIS

PARTICULARS	I YEAR	II YEAR	III YEAR	IV YEAR	V YEAR	TOTAL
Capital costs	1623000					
Recurring costs	377000	414700	414700	414700	414700	
TOTAL COST	**2000000**	**414700**	**414700**	**414700**	**414700**	
Benefit	1012500	1215000	1350000	1350000	1350000	
Depreciated value of building @10%	814500	724000.	633500	543000	452500	
Depreciated value of equipments & furniture @15%	631840	545680	459520	373360	287200	
TOTAL BENEFIT	**2458840**	**2484680**	**2443020**	**2266360**	**2089700**	
NET BENEFIT	**-450,004**	**2069980**	**2,028,320**	**1,851,660**	**1,675,000**	
Discounting Factor @15%	0.87	0.76	0.66	0.57	0.5	
NPV cost at 15% DF	1740000	315172	273702	236379	207350	2772603
NPV benefits at 15% DF	2139190	1888356	1612393	1291825	1044850	7976614
BCR at 15% DF	**2.06:1**					

F . TERM LOAN REPAYMENT	
Rate of interest - % per annum :	12
Opening balanceof term loan :	15,00,00

Year	Loan outstanding	Net income	Principle	Interest	Total repayment	Net surplus	DSCR
1	1500000	729750	238132	153231	391364	338386	1.8
2	1261868	875700	265689	125675	391364	484336	2.2
3	996179	973000	296434	94930	391364	581636	2.4
4	699746	973000	330737	60627	391364	642263	2.4
5	369009	973000	369009	22355	391364	581636	2.4
						Average DSCR	**2.2**

BREAK EVEN POINT AND RATIO ANALYSIS

PARTICULARS	1ST YEAR	2ND YEAR	3RD YEAR	4TH YEAR	5TH YEAR
FIXED COST	391364	391364	391364	391364	391364
VARIABLE COST	377000	414700	414700	414700	414700
TOTAL COST	768364	806064	806064	806064	806064
SALES	1012500	1215000	1350000	1350000	1350000
CONTRIBUTION (SALES – V C)	635500	800300	935300	935300	935300
B.E.P IN SALES % = (FC/Contribution)	**61%**	**48%**	**41%**	**41%**	**41%**

This indicative model bankable project has been prepared for Milky Mushroom cultivation. In the case of Button Mushroom, the cost of a model bankable project for a small unit may go up to **₹30 lakh**, depending on the required infrastructure, controlled environment facilities, and other technical specifications.

(Reference 1: https://horticulture.bihar.gov.in)

Reference 2: National Horticulture Board

Reference 3: Bankable project proposal on mushroom & spawn production unit (With an Investment of Rs. 20,00,000/-) FOR APICOL (The Agricultural promotion and Investment Corporation of Odisha, Ltd.)

Reference 4: ACABC-Mushroom unit

Rate of Interest

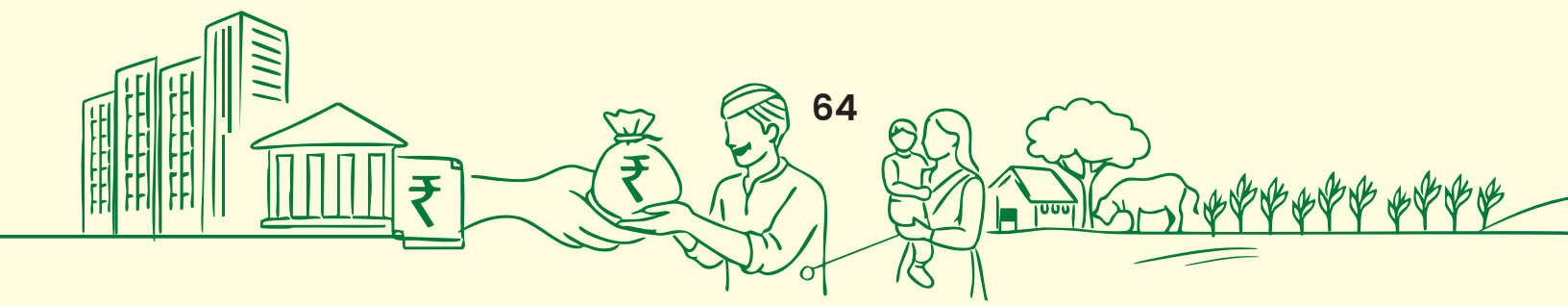
As per bank lending policy, RBI guidelines and/or schemes guidelines for availing capital subsidy/ interest subvention.

Security

As per bank lending policy, RBI guidelines and/or schemes guidelines for availing credit guarantee.

BANKABLE PROJECT ON

CAGE CULTURE



CAGE CULTURE

Introduction

Bihar is endowed with fisheries resources in the form of ponds, tanks, reservoir, water bodies etc. By adopting scientific technology and management practices with optimum use of available resources in fisheries sector could play a pivotal role in the socio-economic development and employment generation in the state. Although there is a positive trend in fish productivity during recent years, state is yet to reach self-sufficiency in fish production and meet to fulfill the demand of state consumption.

Fish can be cultured in any of the four culture systems viz. ponds, raceways, recirculating systems or cages. Fish farming in controlled or under artificial conditions has become the easier way of increasing the fish production and its availability for consumption. Farmers can take up fish culture in village ponds, tanks or any new water body and creates gainful employment to improve their financial position substantially.

About Cage Culture

Cage culture is an aquaculture production system that confines the fish or shellfish in a mesh enclosure to culture several types of shell fish and finfish species in waterbodies. Cage culture of fish utilizes existing water resources but encloses the fish in a cage or basket which allows water to pass freely between the fish and the pond permitting water exchange and waste removal into the surrounding water. Cages are used to culture in freshwaters are used for food fish culture and for fry to fingerling rearing.

Cage aquaculture, though relatively new to the inland aquaculture scenario of the state, brings in new opportunities for optimizing fish production from the reservoirs waterbodies and also developing new skills among fishers and entrepreneurs to enhance their earnings.

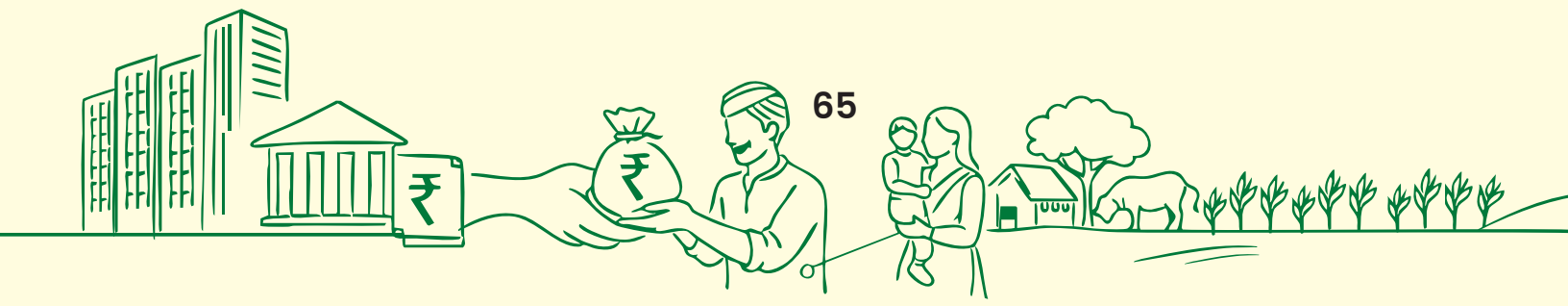
Cage Culture compared to other Fish Farming System

Advantage

- Easy installation and flexibility of management (feeding, sampling, observations etc.).
- Better control of fish population with effective use of fish feeds.
- Treatment of disease is much simple than that of pond culture.
- Requires less investment because it use existing water bodies and simple technology and swift return of investment.

Disadvantage

- Caged fish are unable to get the natural food of their choice, whereas it is readily available to the free fish.
- Feed must be nutritionally complete and kept fresh. During feeding a significant amounts of fish feed passes out through the mesh, therefore, fish require feeding many times a day.



- Crowding in cages promotes stress and allows disease organisms spread rapidly. The high fish density with the high feeding rates, often reduce dissolved oxygen and increase ammonia concentration in and around the cage, especially if there is no water movement through the cage.

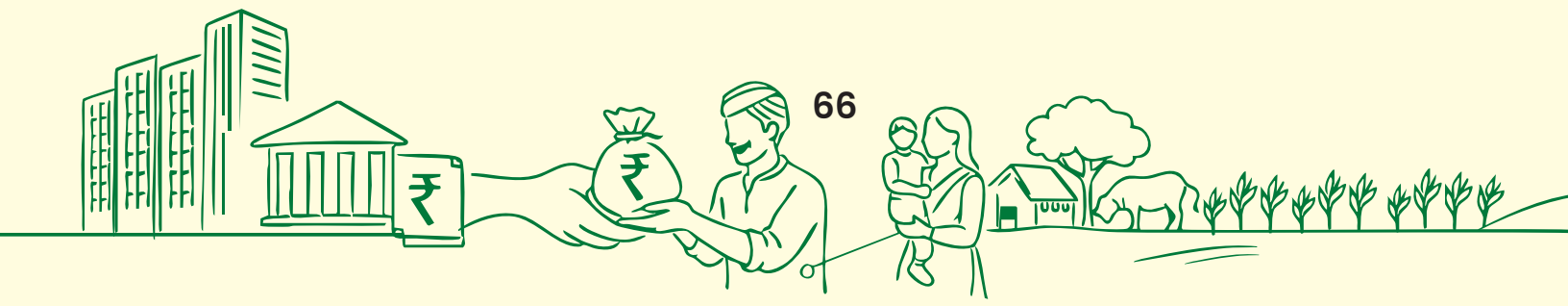
Cage Design and Components

Cage size depends on the size of the water body, the availability of aeration and the method of harvesting and can be any shape but rectangular, square or cylindrical shapes are typical. Cage shape does not appear to affect production with most freshwater species, but small cages are more easily managed than large cages and usually provide a higher economic return per unit volume.

It is a fact that cost per unit volume decreases with increasing cage size. Within the limits of the material and construction method used, size of a cage for fish culture in reservoirs can vary, but often multiple units are installed as a battery of cages with catwalks for easy access to the fish stock and floating huts. However, from operational and planning purposes, a cage with the dimensions: 6m (length) x 4m (width) x 4m (height) is considered as a standard unit and a battery comprises 6, 12 or 24 such cages, as per requirement. The cages in a battery are arranged in caterpillar design for better exchange of water thereby facilitating relatively high dissolved oxygen.

The major compenents of the cage are as under -

- Frame - Cage frame can be constructed from wood, iron, steel. Material normally used are High Density Poly Ethylene (HDPE), Galvanized pipe (GI pipe), PVC pipe etc. HDPE frames are costly but long lasting. GI pipe are cost efficient but less life span compared to HDPE. The bamboo based frames are not recommended for commercial cage fish farming due to their poor longevity and strength to withstand turbulence.
- Flotation - Floating cages require a flotation device to stay at the surface. Flotation can be provided by metal or plastic drums, sealed PVC pipe or Styrofoam. Floats should be placed around the cage so that it floats evenly with the lid about 30 cm out of the water.
- Mesh or Netting - Mesh or netting are made from wire mesh or nylon netting. Plastic netting is durable, semi-rigid, light weight and less expensive than wire mesh. Nylon mesh is inexpensive, moderately durable, lightweight and easy to handle. Mesh size has a significant impact on production. Mesh sizes for tilapia cages should be at least 1.5 cm, but 2.0 cm is preferred. These mesh sizes provide adequate open space for good water circulation through the cage to renew the oxygen supply and remove waste. The use of large mesh size requires a larger fingerling size to prevent escape. For example, a 1.0 cm plastic mesh will retain 9-gram tilapia fingerlings while a 2.0 cm mesh requires a fingerling weighing at least 25 grams with plastic or nylon netting.



- Cage Net - Knotless nylon nets are recommended for cage fabrication. The net mesh size recommended for culture of fish is inland cage culture is as under -

Type of net cage	Specification (ply)	Mesh size (mm) *
Rearing net (knotless)	10 - 12	10 - 15
Grow - out net (knotless)	20 - 30	30 - 40
Predator or outer net	25 - 30	35 - 40
Bird protection net	18 - 20	60 - 80

* Mesh bar (knot to knot) is half is half the length of mesh size (stretched mesh)

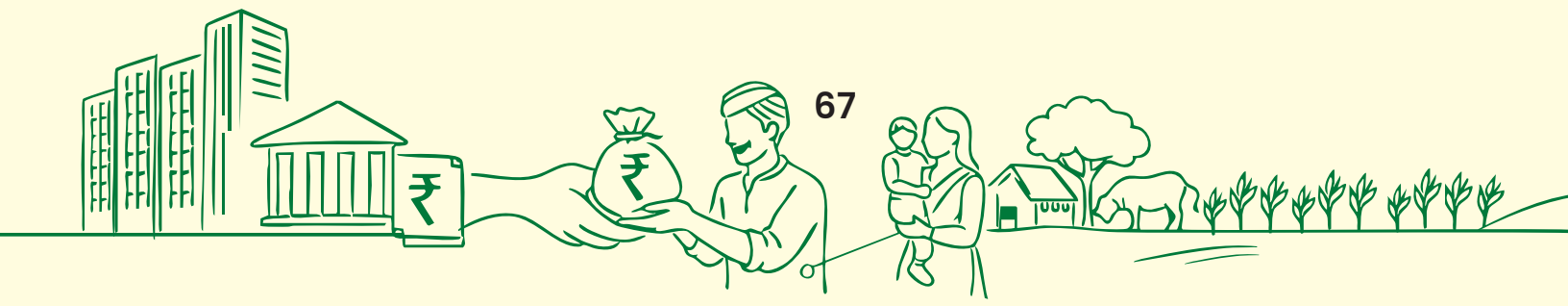
- Cage Cover - Cages should be equipped with covers to prevent fish losses from jumping or bird predation. Covers are often eliminated on large nylon cages if the top edges of the cage walls are supported 30 to 60 cm above the water surface.

Cage Site Location

Lakes, reservoirs, ponds, rivers and streams can be used as potential sites provided that the water quality is suitable and there is adequate water depth beneath the cages to allow water movement. The cage units should be built to withstand prevailing wind and wave conditions at the selected site. Due to ecological reasons, cage culture in rivers is discouraged world over. In India, the riverine ecosystems are already under severe stress resulting in habitat loss/degradation due to a number of reasons such as dams, water abstraction, low flows, river training and pollution from industrial, domestic and agricultural runoff. Cage culture in a water-starved stream will add further stress to the ecosystem and therefore cage culture is not recommended in rivers.

The following criteria should be considered before installation of cage in an existing water body-

- There should be at least 30 to 60 cm of water column below the bottom of the cage to allow waste materials to be flushed away from the cage and each cage should be seprated by at least 4.5 meter to optimize water quality.
- Locate cage in water body where the maximum natural circulation of water presents to provide natural feed and remove the waste away from the cage and runoff is not contaminated with high levels of pesticides or large amounts of livestock wastes.
- Problems with aquatic weeds, overpopulations of wild fish, surface oxygen depletion problems should not be present.
- Cage culture shall be allowed in water bodies having a surface area 1,000 ha or more at FRL. (Exception to this can be made only in case of 'very deep abandoned mines', which are less than 1000 ha in area, but too deep for practicing culture-based fisheries, subject to all other conditions prescribed in this document).
- Cage culture shall be allowed in reservoirs with an average depth of 10 m (Average depth is calculated as: Area in hectares divided by water holding capacity in m3)
- The cage site at the reservoir should have at least 10 m depth round the year.



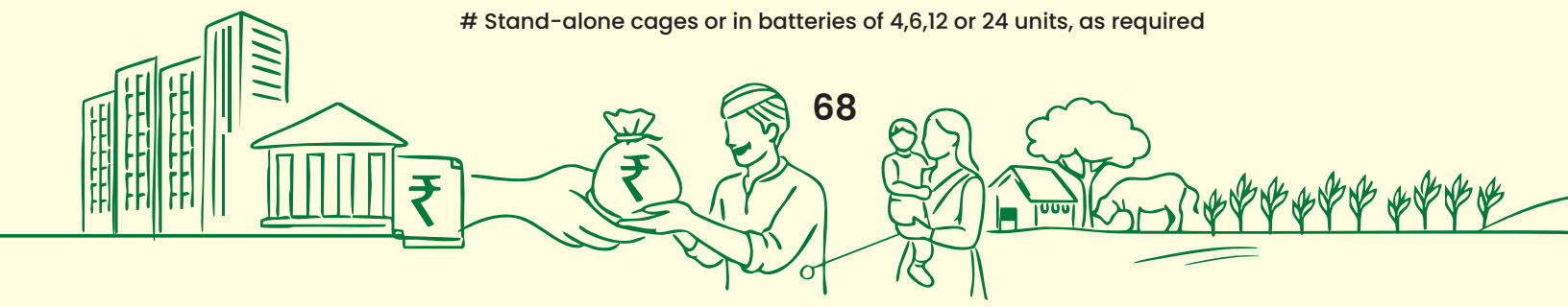
Factors Affecting Fish Production

- Dissolved oxygen: Dissolved Oxygen (DO) level and its availability are critical to the health and survival of caged fish. In general, warm water species such as catfish and tilapia need a dissolved oxygen level of 4 mg/l DO (or ppm) or greater to maintain good health and feed conversion. Dissolved Oxygen levels below 3 mg/l can stress fish. If this level goes below 2 mg/l can increase the mortality of fish.
- Temperature: The most important physical factor controlling the life of a cold-blooded animal like fish is temperature. It is critical in growth, reproduction and sometimes survival. Each species of fish has an optimum temperature range for growth, as well as upper and lower lethal temperatures.
- PH: Uptake and release of CO2 during photosynthesis and respiration affect on PH. The lowest level of pH appears at or near dawn whilst the highest is at mid-afternoon. The desirable range of early morning PH for fish production is from 6.5 to 9. Acid death point of the fish is approximately PH 4 and the alkaline death point is approximately PH 11. Slowed growth of fish, reduced reproduction, and susceptibility to disease increasing can be caused if the pH is not at the optimum range.
- Turbidity, Nitrate and Phosphate levels, Alkalinity, and Salinity are also affecting on fish culture in cage.
- Aeration can enhance water quality, reduce stress, improve feed conversion efficiency, and increase growth and production rates. Research has shown that aeration can improve cage production by 20 percent or more. Aeration is most commonly needed at night or during still, overcast days. Aeration for cages can be provided by several types of mechanical aerators. The key to aeration of cages is to create a current that moves water through the cage. Mechanical aerators like paddlewheels or vertical pumps can be placed near cages where they create currents through the cages. These types of aerators work well to aerate cages near them and within their current pattern.
- Carrying Capacity: Carrying capacity of the water body which contains the cages is a very important factor. If we over exploit the water body by exceeding its carrying capacity it will resulted in increased stress, diseases and mortality and reduced feed conversion efficiency, growth rate, survival and profit. Also it will increase the pollution which impact badly on caged fish.

Carrying Capacity and Limit of Cage Numbers in Reservoirs -

Reservoir Area (ha) <1000	Maximum no. of cage allowed #
1001 to 2000	500
2001 to 3000	1000
3001 to 4000	1500
4001 to 5000	1900
5001 to 10000	3000
>10000	5000

Stand-alone cages or in batteries of 4,6,12 or 24 units, as required



Production Management

Total production in cages increases as the stocking rate is increased. However, there is a density at which fish become too crowded and water quality within the cage deteriorates to a point that causes a decline in growth rates. High stocking rates can be used in small cages of 1 to 4 cubic meters. Optimum stocking rates per cubic meter range from 600-800 fish to produce fish averaging 1/4 kg; 300 to 400 to produce fish averaging 1/2 kg; and 200 to 250 to produce fish averaging 3/4 kg. Cages for final grow-out should be stocked when water temperature rises above 21°C and harvested when the temperature falls below 21°C.

Fingerlings Cages may be used for fingerling production. One-gram fry may be reared in 0.6 cm mesh cages at up to 3000 fish per cubic meter for 7 to 8 weeks until they average about 10 grams each. 10 gram fish can be restocked into 1.2 cm mesh cages. Cages stocked with 10 gram fish at 2,500 per cubic meter will produce 25-30 gram fingerlings in 5 to 6 weeks. After grading, 25-30 gm fish can be restocked at 1500 fish per cubic meter to produce 50-60 gram fingerlings in 5 weeks or at 1000 fish per cubic meter to produce 100 gram fingerlings in 9 to 10 weeks. Fish should be graded by size every 4 to 6 weeks. Stunted fish and females should be culled.

Final grow-out cages the optimum fingerling size for stocking in final grow-out cages is determined by the length of the growing season and the desired market size. The shorter the growing season, the larger the fingerlings must be at stocking.

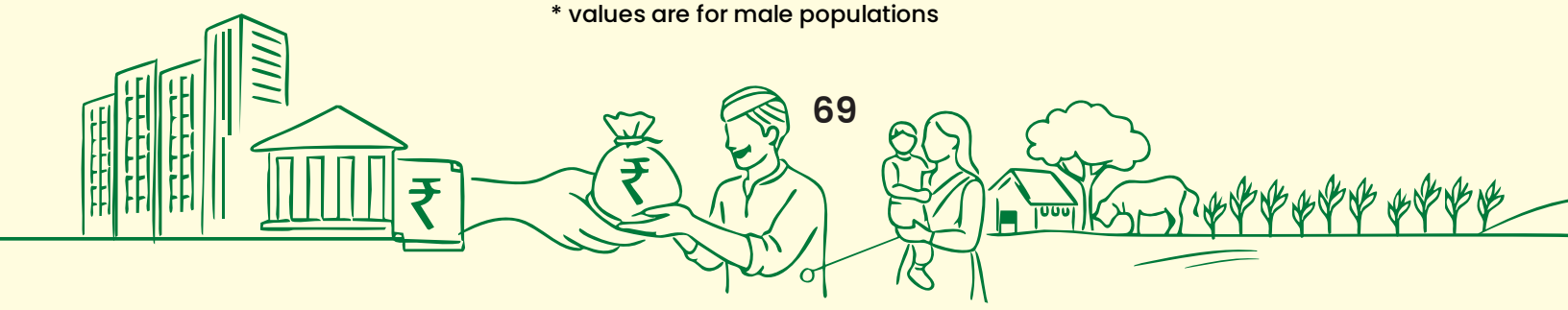
The use of male populations which grow at twice the rate of female populations will result in larger fish, greater production and a reduction in the grow-out period. Recommended stocking rate of tilapia fingerlings depends on cage volume, desired harvest size and production level, and the length of the culture period.

Example: If 10 cages are available for placement in a pond with sufficient production potential and grow out takes 20 weeks, then a cage could be stocked every 2 weeks. Beginning on week 20, the first cage would be harvested and restocked, followed by another cage every 2 weeks. A staggered system requires a regular supply of fingerlings available and the total production potential of the body of water.

Expected average final weights for different culture periods and initial weights of Tilapia -

Length of growing season (weeks)	Expected average final weight (gm)*		
-	30	60	100
12	200	270	350
16	250	340	440
20	310	410	520
24	370	480	600
28	420	550	690

* values are for male populations



Fish feed must be a nutritionally balanced which has adequate protein and energy levels, is balanced in amino acids, and in essential fatty acids, and is supplemented with a complete array of vitamins and minerals. Feeding fish twice daily at adequate rate depending on water temperature, species, size, culture and density is recommended. In general, warm-water species such as catfish, tilapia and carp can be successfully reared from large sized fingerlings on 32% protein complete diets. With high quality feeds, good growing conditions and effective feeding practices, feed conversion ratios as low as 1.3 have been obtained. Generally, feed conversion ratios will range from 1.5 to 1.8.

Body weight, Feed pellet size & Protein content are as under-

Body weight (gm)	Feed pellet size (mm)	Protein content (%)
50-150	2	28
150 -500	3	28
500-600	4	25
>600	5	22

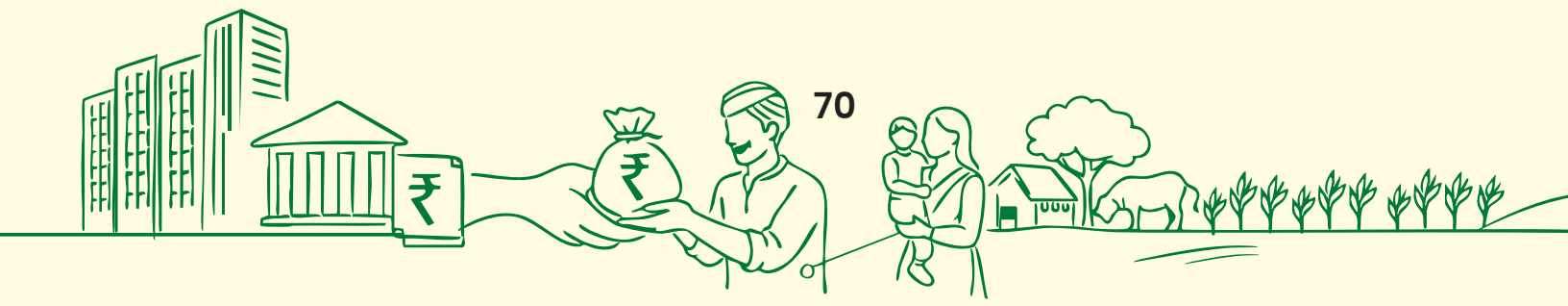
Generally, fish will adapt to any feeding time as long as it is consistent. A general rule of thumb for most warm-water fish is to feed fish all they will eat in 10 to 30 minutes when the water temperature is above 21°C.

Feeding rates for fish are calculated on a percent of body weight per day basis, based on the fish size and water temperature. Small fish consume a larger percentage of their body weight than larger fish, and all fish increase consumption as water temperatures approach optimum temperature range.

Recommended daily feeding rates, expressed as percentage of body weight for tilapia of different sizes-

Fish weight (gm)	Feeding rate (%)	Fish weight (gm)	Feeding rate (%)
1	11.0	30	3.6
2	9.0	60	3.0
5	6.5	100	2.5
10	5.2	175	2.5
15	4.6	300	2.1
28	4.2	400	1.5

Many species of warm-water fish can be overwintered in cages. Tilapia are the exception and will die as water temperatures reach about 12°C. Caged fish can be fed during the winter at a reduced feeding level. Feeding is usually most successful if done on warm, sunny afternoons.



Winter feeding schedule for caged fish-

Temperature (℃)	% of total fish weight to feed	Feeding frequency
18 -21	2.0	Every other day
16 -17	1.5	Every other day
13 -15	1.0	Every other day
10 -13	1.0	Every other day
7-9	0.5	Every other day

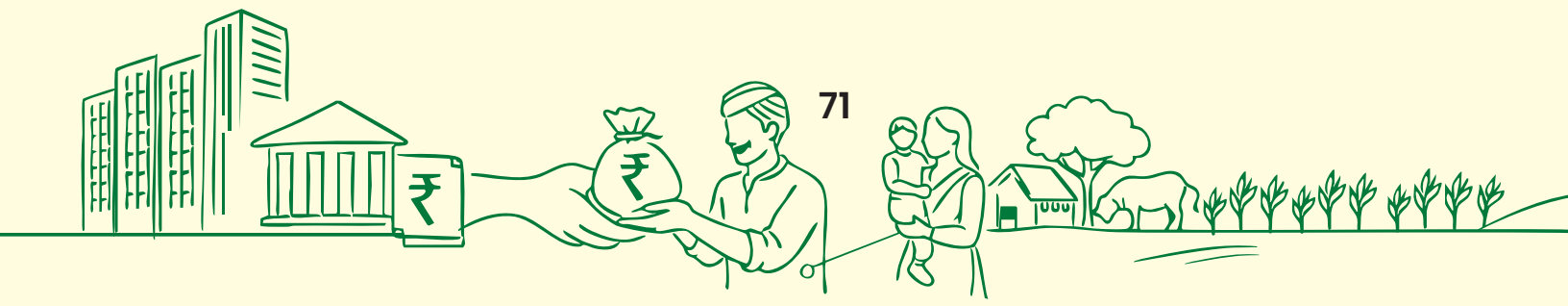
Fish Species

Many of the fish species are suitable for culture in cages. The most appropriate species or strains of Tilapia for cage culture are Nile Tilapia, T. Aurea (Blue Tilapia), Florida Red Tilapia, Taiwan Red Tilapia and hybrids between these species and strains. Apart from Pangasianodon Hypophthalmus and GIFT Tilapia, all other exotic species (including illegally introduced fishes) are strictly prohibited for cage culture.

The choice of a species for culture depends mainly on availability, growth rate and cold tolerance. Tilapia can be cultured at high densities in mesh cages that maintain free circulation of water. Eggs fall through the cage bottom or do not develop if they are fertilized. (Reproduction will occur in cages with 2mm mesh or less, which is small enough to retain eggs.

The selection of fish species for culture should be based on-

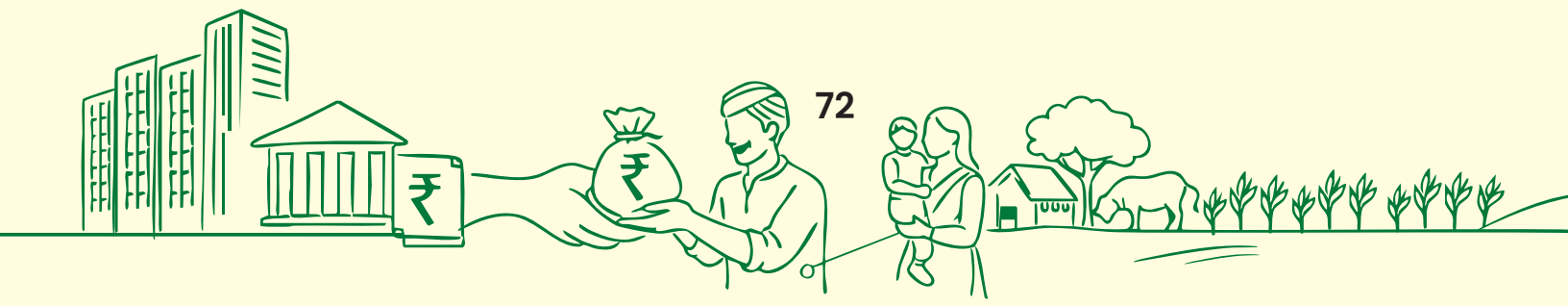
- Biological criteria, such as physiological, behavioural characteristics and level of domestication
- Marketing criteria, for example demand, price, process and production for its trade
- Environmental criteria, for example: temperature, distribution and habitat for the growth



Bankable Project

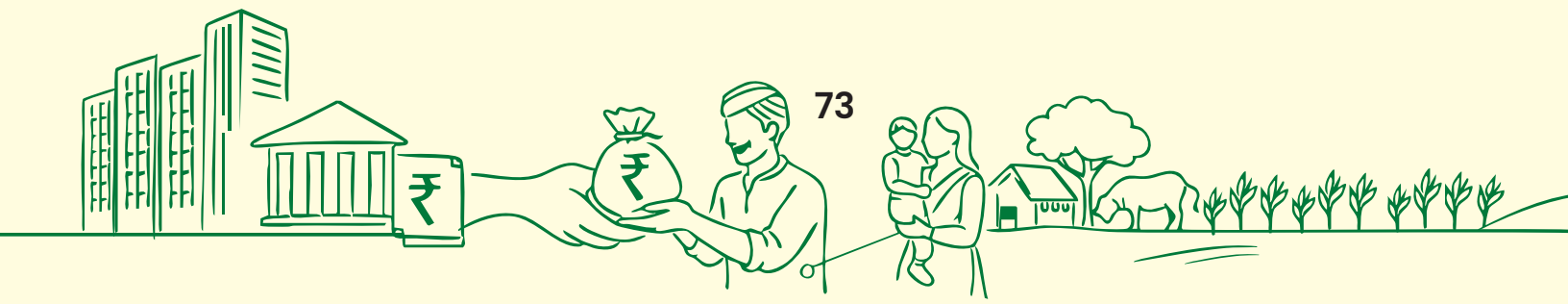
Techno-Economical Parameters and Assumptions -

S.N.	Particulars	
	Cage design	
1	No. of Battery	1
2	No. of Cages	4
3	Cage Size	6m X 6m X 6m (6m depth)
4	Cage Shape	Rectangular
	Each battery and unit of cage will have minimum one working platform and minimum one storage shed.	
	Production Treats	
5	Fish Species	Pangasius (Pangasiandon hypopthalmus) GIFT Tilapia (Oreochromis niloticus)
6	No. of fingerlings per cage	3000
7	Feed conversion ratio (FCR)	1.6:1
8	No. of growing period	180 days
9	No. of Crops per year	2 (2nd year onwards)
10	Survival	90%
11	Average size of fish at the time of harvest	500 gm (1/2 Kg)
12	No. of man days	180 per cycle
13	Labour charge	Family Labour
	Construction, Sale and Purchase Price	
14	Unit cost for febrication of cage including catwalk	Rs. 150000.00 per cage
15	Unit cost for febrication of storage shed	Rs. 30000.00 per shed
16	Unit Cost for Speed Boat	Rs. 25000.00 per boat
17	Cost per fingerlings	Rs. 4.00 per fingerling
18	Cost of feed	Rs. 30.00 per kg
19	Sale price	Rs. 150.00 per kg



- **Expenditure and Income Statement**

S. N.	Particulars	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year
	Capital Expenditure						
1	**Cost of Febrication of cage including catwalk**	600000					
1.1	Cost of Febrication of storage shed	300000					
1.2	Speed Boat	250000					
1.3	Life Jacket etc.	50000					
	Sub Total	1200000					
2	**Recurring Expenditure**						
2.1	Fish seed	48000	96000	96000	96000	96000	96000
2.2	Fish feed	144000	288000	288000	288000	288000	288000
2.3	Labour charge	0	0	0	0	0	0
2.4	Medicine	10000	20000	20000	20000	20000	20000
2.5	Misc.	10000	20000	20000	20000	20000	20000
	Sub total	212000	424000	424000	424000	424000	424000
	Total	1412000	424000	424000	424000	424000	424000
3	**Income**						
3.1	Sale of fish	810000	1620000	1620000	1620000	1620000	1620000
	Total	810000	1620000	1620000	1620000	1620000	1620000
4	**Assets in Hand Value**						
4.1	Value of closing stock	0	0	0	0	0	0
4.2	Value of cage and storage shed	810000	720000	630000	540000	450000	360000
4.3	Value of equipment	270000	240000	210000	180000	150000	120000
	Total	1080000	960000	840000	720000	600000	480000



- **Financial Analysis**

S. N.	Particulars	1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year
1	Expenditure						
	Capital expenditure	1200000					
	Recurring expenditure	212000	424000	424000	424000	424000	424000
	Total expenditure	1412000	424000	424000	424000	424000	424000
2	Income	810000	1620000	1620000	1620000	1620000	1620000
3	Net income / profit before intere	- 602000	1196000	1196000	1196000	1196000	1196000
4	Net surplus	-1026000	772000	772000	772000	772000	1196000
5	Interest on term loan	127080	127080	101664	76248	50832	25416
6	Principal repayment of term loa	0	254160	254160	254160	254160	254160
7	Net profit after repayment	-1153080	390760	416176	441592	467008	916424
8	DF at 15%	0.87	0.76	0.66	0.57	0.50	0.43
9	DF at cost/expenditure @ 15%	1228440	320544	278992	242528	210728	182320
10	DF at income @ 15%	704700	1224720	1065960	926640	805140	696600
11	NPW @ 15% DF	2960208					
12	BCR	2.20					
13	IRR	30%					
14	DSCR	3.07					

- **Sensitivity Analysis**

S. N.	Particulars	Project Period i.e. 1st-6th Year						
		Normal	A @5%	B @ 5%	A+B @ 5%	A @10%	B @ 10%	A+B @10%
1	Expenditure							
	Capital expenditure	1200000	1260000	1200000	1260000	1320000	1200000	1320000
	Recurring expenditure	2332000	2448600	2332000	2448600	2565200	2332000	2565200
	Total expenditure	3532000	3708600	3532000	3708600	3885200	3532000	3885200
2	Net income / profit before interest	5378000	5201400	4932500	4755900	5024800	4487000	4133800
3	Net surplus	3258000	2975400	2812500	2529900	2692800	2367000	1801800
4	NPW @ 15% DF	2960208	2837031	2689020	2565843	2713853	2417832	2171477
5	BCR	2.20	2.10	2.09	1.99	2.00	1.98	1.80
6	IRR	30%	23%	21%	14%	17%	12%	0%
7	DSCR	3.07	2.92	2.75	2.60	2.77	2.43	2.14

Note: Sensitivity analysis was made for 5% and 10% parameter i.e. 5% and 10% Increase in capital cost and recurring expenditure & 5% and 10% decrease in sale
A: Increase in capital cost and recurring expenditure
B: Decrease in sale
C: Increase in capital cost and recurring expenditure & Decrease in sale

- **Repayment Schedule**

Capital expenditure	1200000	Moratorium period	1 Year
Recurring expenditure (capitalised)	212000	Repayment period	5 Year
Total project cost	1412000	Project period	6 Year
Margin @10%	141200		
Term loan	1270800		
Rate of interest	10.00%		

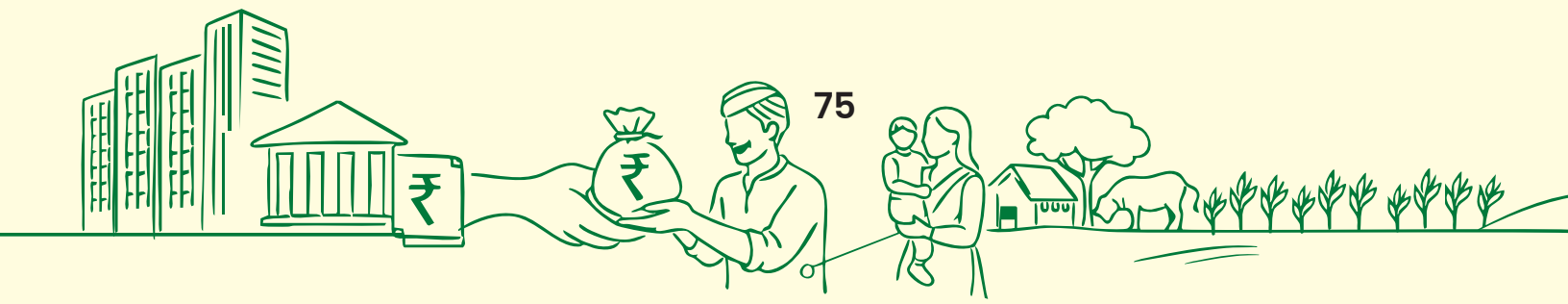
Year	Repayment Amount	Principal Payment	Interest Payment	O/s Balance
1 st	127080		127080	1270800
2nd	381240	254160	127080	1016640
3rd	355824	254160	101664	762480
4th	330408	254160	76248	508320
5th	304992	254160	50832	254160
6th	279576	254160	25416	0

Rate of Interest

As per bank lending policy, RBI guidelines and/or schemes guidelines for availing capital subsidy/ interest subvention.

Security

As per bank lending policy, RBI guidelines and/or schemes guidelines for availing credit guarantee.



नाबार्ड

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