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CAIIB

Module-B Unit-6

Rural Banking

CAIIB Rural Banking Module B Unit 6-Concepts of Project, Aspects of Project Formulation & Appraisal & Model Bankable Projects

Aspects Of Project Preparation

To design and analyze effective projects, those responsible must consider all the relevant aspects, which together determine how remunerative a proposed investment will be. ***The project preparation and analysis can be divided into six aspects viz***

- Technical
- Institutional- organizational – managerial
- Social
- Commercial
- Financial
- Economic.

Technical Aspects

- The technical analysis concerns the project's inputs (supplies) and outputs (production) of real goods and services. Assumptions of a project plan will most likely need to be revised as the other aspects are examined in detail. Good technical staff are essential for undertaking this task. They will be more effective, if they have a good understanding of the various aspects of project analysis.
- The technical analysis will examine the possible technical relations in a proposed agricultural project – the soils in the region and their potential for agricultural development, the availability of water, both natural (rainfall, and its distribution) and supplied (the possibilities for developing irrigation, with its associated drainage works), the crop varieties and livestock species, suited to the area.
- The technical analysis will also examine the marketing and storage facilities required for the successful operation of the project, and the processing systems that will be needed.

Institutional – Organizational-managerial Aspects

- A whole range of issues in project preparation revolves around the overlapping institutional, organization and managerial aspects of projects, which clearly have an important effect on project implementation.
- It should be ensured that the project design takes into account, the customs and culture of the farmers, who are going to participate in the project. When the projects are implemented by organizations, the analysts should examine to verify that they are manageable. The organizational design, ability of the project director and technical staff, etc., need to be examined while appraising the project.

Social Aspects

- The project analysts are also expected to examine carefully, the broader social implications of the proposed investments.
- Social considerations should also be carefully considered to determine if a proposed project is as responsive to national objectives, as it can be. There is a question about creating employment opportunities.

Commercial Aspects

- The commercial aspects of a project include the arrangements for marketing the output produced by the project and the arrangements for supply of inputs needed, in order to build and operate the project. On the output side, careful analysis of the proposed market for the project's production is essential to ensure that there will be an effective demand, at a remunerative price.

Financial Aspects

- The financial aspects of project preparation and analysis encompass the financial effects of a proposed project on each of its various participants. The analyst will need budget projections that estimate year by year, future gross receipts ad expenditures, including the costs associated with production and the credit repayments.

Economic Aspects

- The economic aspects of project preparation and analysis require a determination of the likelihood that a proposed project will contribute significantly to the development of the total economy and that its contribution will be great enough to justify using the scarce resources it will need.
- The point of view taken in the economic analysis is that of the society as a whole. The techniques of economic analysis help identify those projects that make the greatest contribution to the national income. Although the analysis will determine the amount of the income stream generated over and above the costs of labour and other inputs, it does not specify who actually receives it.

Project Life Cycle

There tends to be a natural sequence in the way projects are planned and carried out, and this sequence is often called the **"project cycle".** we will divide it into **identification, preparation and analysis, appraisal, implementation, and evaluation.**

Identification of projects

- The first stage in the cycle is to find potential projects. Suggestions for new projects usually arise because some agricultural products are in short supply-or will be in a few years if production is not expanded or imports increased. The analysis may be based on general knowledge or upon a more systematic examination of market trends and import statistics.

Preparation And Analysis of projects

- Once projects have been identified, there begins a process of progressively more detailed preparation and analysis of project plans. This process includes all the work necessary to bring the project to the point at which, a careful review or appraisal can be undertaken, and, if it is determined to be a good project, implementation can begin.
- Thorough preparation and analysis increase a project's efficiency and help to ensure its smooth implementation in the future, so that the additional time and money required will probably be returned many times over by the increased return from the investment.

Appraisal of Projects

- After a project has been prepared, it is generally appropriate, for a critical review and appraisal. This provides an opportunity to re-examine every aspect of the project plan to assess whether the proposal is appropriate and sound, before large sums are committed.

Implementation of projects

- The objective of any effort in project planning and analysis clearly is to have a project that can be implemented to the benefit of the society. Thus, implementation is perhaps the most important part of the project cycle.
- There are some aspects of implementation that are of particular relevance to project planning and analysis. The first, is that the better and more realistic a project plan is, the more likely it is that the plan can be carried out and the expected benefit realized. Second, project implementation must be flexible. Circumstances will change, and project managers must be able to respond intelligently to these changes.

Evaluation of Projects

- Evaluation may be undertaken when the project is in trouble, as the first step in a replanning effort. Careful evaluation should precede any effort to plan follow-up projects. And, finally, evaluation should be undertaken when a project is terminated or is well into routine operation.

Minor Irrigation Schemes

- The banks need to ensure that the type of MI structure (Dug Well, Bore Well, Shallow Tube well, etc.) are considered for finance depending upon the soil conditions / rock formation in the blocks / districts in which the finance is provided. The technical guidance of the State Department is essential with regard to the feasibility of the structure.
- Further, the ground water development programs are taken up for implementation in "safe" and "semi critical" blocks based on ground water assessment undertaken by the State Groundwater Board in the respective block. The banks therefore have to ensure that the clearance is obtained from the

concerned department of the State Government for formulation of minor irrigation schemes.

- Before approving loan for electric pump sets, the bank shall satisfy itself that the village is electrified and that timely power supply would be available to the beneficiary for operation of the pump set.
- The banks shall ensure that adequate after sale services and repair facilities are provided by the manufacturers / dealers installing the pump set on beneficiary's well.
- Before advancing loans for underground pipelines system, the bank shall verify the invoice order in regard to the quantity of pipes required by the farmers and shall also ensure that entire length of pipelines for which loans advances are actually laid.

The following norms shall be adhered to by the banks for ensuring financial viability and bankability of the MI schemes:

- **Unit Costs:** The unit costs of for various MI investments are finalized by NABARD in consultation with all the stake holders like the state and district level government departments, bankers field officers & farmers. The unit costs also guide the bankers and the government departments in extending support to the beneficiaries.
- **Cash flow analysis based on farm models:** After satisfying themselves with regard to technical feasibility of the MI schemes proposed to be financed by them, the banks shall ensure financial viability and bankability of the proposals/schemes. For this purpose, they need to undertake farm model exercise/analysis, in which they need to see the crops which have been originally cultivated in the farm and the crops which would be cultivated in the post development.
- **Fixation of Repayment Period based on cash flow:** While fixing the repayment period, the bankers need to take into account the cash flow, incremental cash flow, etc. so that the loan can be repaid by the borrowers in convenient instalments. As the cash flow would not be adequate enough in the initial year of investment, gestation period is considered requiring the borrower only pay the interest due on the loan. Thereafter the principal and the interest are recovered in suitable annual instalments coinciding the harvesting season during which the farmers will be placed with funds.

Financing Micro Irrigation Structures

The banks shall ensure adherence to the following norms, while financing drip irrigation schemes:

- The system to be installed by farmers in their farms are designed by a technically-competent firms.

- Availability of adequate water of suitable quality (chemical and physical) on a long-term basis shall be ensured for smooth operation of the system.
- The installing agency shall prepare a plan and field layout of the system and suggest efficient design of the system along with the cost of each item.
- The installing agency shall furnish performance guarantee for the efficient operation for the system as also ensure timely and adequate after sales service for trouble- free working of the system.
- The banks shall carry out periodic monitoring of the implementation and assess the performance of the system at the field level.
- There shall be arrangement to safeguard the pipes (main and lateral), drippers/emitters and other accessories against theft, robbery, fire, etc.

While financing sprinkler irrigation schemes the following norms have to be adhered to:

- Adequate water of suitable quality to cover the area to be irrigated is available at the scheme area.
- Design of the system for a given cropping pattern shall be done by a technically competent person/ agency, taking into account the source of availability of water, wind velocity in different seasons, soil conditions, agro-climatic situations, etc.
- A plan of the area showing field layout and cost estimate of the system shall be prepared by the implementing agency and appraised by the financing bank.
- The implementing agency/s manufacturers shall offer performance guarantee of the system for a reasonable period of time against any defect either in manufacturing of the system or its installation.
- The banks shall also ensure that arrangements are in place to safeguard the sprinkler system, pipes, accessories and motor against fire, theft and burglary.
- The bank shall conduct periodic monitoring to assess the working performance of the stem and take correcting measures wherever warranted.

Farm Mechanization

Banks can encourage tractor/power tiller financing adhering to the following terms and conditions:

- Bank finance is provided generally against new tractor and implements. Only those tractors which are approved by the **Tractor Institute of Indian Council of Agricultural Research** are financed by the banks.
- The farmer availing tractor finance should have minimum 8 acres of perennial irrigated land or 12 acres of unirrigated land so that it would be a viable proposition.
- The tractor/power tiller financed should be registered with the local Regional Transport Authority duly recording the hypothecation charge of the bank in the RC.
- Comprehensive insurance policy with the bank clause should be taken i.e., in case of claims, the bank should be able to get its dues settled from the insurance company.

Financing of Custom Hiring Centres:

The small/marginal farmers, by virtue of their economic condition are unable to own farm machinery on their own or through institutional credit. Therefore, in order to bring farm machinery available within the reach of small/marginal holdings, collective ownership or Custom Hiring Centres needs to promoted in a big way and accordingly, NABARD has formulated a model scheme and circulated amongst banks for financing this activity. ***The objectives of the scheme are:***

- To make available various farm machinery/equipment to small and marginal farmers.
- To offset the adverse economies of scale due to high cost of individual ownership.
- To improve mechanization in places with low farm power availability
- To provide hiring services for various agricultural machinery/implements applied for different operations.
- To expand mechanized activities during cropping seasons in large areas especially in small and marginal holdings.
- To provide hiring services for various high value crop specific machinery applied for different operations.

Financing Combined Harvesters

- A combine harvester is an essential equipment for the modern farm combine harvester is useful machinery invented by scientists for effective harvesting of crops and grains.
- The banks need to take into account the fixed costs such as interest costs, insurance and taxes, depreciation and variable costs such as fuel, oil and lubricants, repairs and maintenance charges and manpower expenses, etc. for arriving at the total costs and outflow. Such loans are generally recovered over a period of 8 years with one year moratorium period.

Financing Plantation And Horticulture

While financing the plantation and horticulture crops, the bankers need to recognize the costs of planting material, farm yard manure required for the farms, fertilizers, irrigation costs, plant protection chemicals, fencing etc. depending upon the technical specification indicated by the State Agriculture /Horticulture Department.

The quantum of operational cost to be capitalized is suggested by the **State Level Unit Costs Committee** constituted under the auspices of NABARD. The banks need to adhere to these guidelines so as to ensure that the finance is provided adequately.

The banks shall ensure the following technical terms and conditions while financing these activities:

- Loans shall be given to those beneficiaries who have assured water supply facilities to irrigate plants, in areas where rainfed cultivation is not possible.

- Loans shall be issued in respect of investment for raising plants in first year and maintenance in subsequent years, till the plant comes to bearing stage.
- The bank shall satisfy itself that the planting materials of the required quantity and quality are procured by the beneficiaries from reliable sources such as nurseries or Universities located in the state or any other nurseries approved by the concerned department of the State Government.
- The banks staff may provide all necessary technical guidance and supervision or otherwise shall satisfy itself that the required technical guidance and supervision is made available by the concerned department of the State Government /Commodity Board.
- The suggested soil conservation measures such as contour bunding, etc. should be completed before the layout and the works for digging for planting are taken up.
- Necessary arrangements should be made for marketing of the produce so that the beneficiaries get fair prices.
- The banks shall grant loans to individual beneficiaries based on a case appraisal and assessment of repayment capacity of the borrowers as revealed by the cash flow.

Pomegranate Cultivation

- Pomegranate prefers dry climate. During fruit development, prolonged hot and dry climate is required. Optimum temperature congenial for fruit development is 38°C. In humid climate, the fruits are severely damaged by pomegranate butterfly and do not develop sweetness. It is winter hardy and very drought tolerant.
- Pomegranate grows under wide variety of soils and can tolerate even alkalinity and salinity to certain extent.
- Vegetative propagation is recommended in establishing pomegranate. Propagation by cuttings is common. Pomegranate flowers take five to six months to be ready as mature fruits.

Cashew Cultivation

- The land should be ploughed thoroughly and levelled in case of agricultural lands. In case of forest lands, the jungle should be cleared and the land terraced or bunds constructed on sloppy lands.
- Cashew trees are generally planted with a spacing of 7 to 9 meters adopting square system. A spacing of 7.5 m × 7.5 m (175 plants/ha) or 8 m × 8 m (156 plants/ha) is recommended.
- Cashew can be planted in pits of 60 cm × 60 cm × 60 cm size in soils with normal strata. In hard lateritic soils, pits of 1 m × 1 m × 1 m size are recommended. The top soil and sub-soil are kept separately and allowed to wither under sun.
- Cashew is generally planted on the wastelands in which availability of soil moisture is always low.

Coconut Cultivation

- Coconut palm can tolerate wide range of soil conditions. However, a variety of factors such as drainage, soil depth, soil fertility and layout of the land have great influence on the growth of the palm. Soil with a minimum depth of 1.2 m and fairly good water holding capacity is preferred for coconut cultivation.
- Size of the pit depends on the soil type and water table. In laterite soils large pits of size 1.2 m × 1.2 m × 1.2 m may be dug and filled up with loose soil, powdered cow dung and ash up to a depth of 60 cm before planting.
- Square system of planting with a spacing of 7.5 m × 7.5 m is recommended for coconut.
- Regular manuring from the first year of planting is essential to ensure good vegetative growth, early flowering and bearing and high yield. Organic manure at the rate of 30 kg per palm per year may be applied with the onset of monsoon when the moisture content is high in the soil.

Tea Plantation – Financing Small Tea Growers

- Well distributed rainfall ranging between 2000 mm to 5000 mm is considered suitable for tea plantation. Monthly average maximum temperature ranging between 280 C and 320 C during April – September period is conducive for the growth of the plantation.
- Sandy loan to silty loam type of soil with pH range of 4.5 – 5.5 is ideal for growing tea.
- Planting of tea is done either in sprint (June-July) after the first few showers of rain or in autumn (Oct-Nov) while the soil is still moist and the area has irrigation facilities.
- Single hedge row or double hedge row system/method of planning is recommended by the Tea Board for tea plantations. The advisable norms are 105 cm × 65 cm, 105 cm × 75 cm, 105 cm × 60 cm × 60 cm, 105 cm × 75 cm × 60 cm for valley plantation.

Dairy Development Schemes

- The items of finance would include capital asset 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 capitalized and given as term 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.
- The bankers financing dairy units have to take into account, the capital cost viz. cost of animals, transportation cost, construction cost of sheds for animals and the cost of chaff cutter and equipment. Taking into account the income arrived at, through sale of milk and sale of gunny bags, the appraisal needs to indicate the net benefit and the year wise surplus so as to work out.
- The margin depends on the category of the borrower and it can range from 10 to 25 per cent. The banks are free to decide the rates of interest within the overall

guidelines issued by RBI in this regard. They shall also insist on the security to be provided for the advance keeping in view the extant guidelines of RBI.

Model scheme for financing Automatic milk collection unit

- **Components**: AMC station is a specially designed integrated unit which is a combination of several units i.e., automatic milk weighing system, electronic milk testing, personal computer with printer and battery for data processing and providing the output.
- **Capacity**: The capacity of automatic milk collection stations is to analyze 120-150 samples per hour.
- The machinery used should comply with the BIS specifications and the broad parameters.

Poultry Farming

Layer Farming:

Loan from banks with refinance facility from NABARD is available for starting poultry farming. provide financial assistance for the following purposes:

- For construction of brooder/grower and layer sheds, feed store, quarters, etc.
- For purchase of poultry equipment such as feeders, waterers, brooders, etc.
- For creating infrastructure items for supply of electricity, feed, water, etc.
- For purchase of day-old chicks or ready to lay pullets.
- For meeting working capital requirement in respect of feed, medicines and veterinary aid, etc. for the first 5 to 6 months.

The following essential aspects need to be determined while financing:

- Outlay of the project depends on the local conditions, unit size and the investment components included in the project.
- Margin depends on the category of the borrowers and may range from 10% to 25%.
- Banks are free to decide the interest rates within overall RBI guidelines.
- Security for the advance shall be as per RBI/ NABARD guidelines issued from time to time.
- Repayment period shall depend upon the gross surplus from the project. The loan will be repaid in suitable monthly/quarterly installments usually within a period of seven to nine years with first year, as grace period.
- The birds and other assets (poultry sheds, equipment) shall be insured.

Broiler Farming:

The following technical aspects are required to be kept in view while financing broiler units:

- A small unit for rearing of improved indigenous birds for meat purpose can be established as backyard unit by landless families, SHG members. Area of 1 sq ft per bird is sufficient. Overcrowding of birds should be avoided.

- After purchase, brooding arrangements are required to be provided to the day-old chicks in first week. Brooding can be done by using any heating source – electric bulbs. The floor should be covered with 1-2 inches of paddy/ wheat straw to avoid injuries to birds.
- The birds are to be fed with good quality concentrate feed to attain the desired marketable weight. The feed can be prepared by the farmers by mixing the available feed ingredients. The feed should be stored in clean, dry, well-ventilated room and care should be taken that fungal infection is not occurred.
- Outlay of the project depends on the local conditions, unit size and the investment components included in the project. Prevailing market prices/ cost may be considered to arrive at the outlay.
- Margin depends on the category of the borrowers and may range from 10% to 25%.
- Banks are free to decide the interest rates within overall RBI guidelines. However, for working out financial viability and bankability of model project, the rate of interest is assumed at 12.00% p.a.
- Security will be as per RBI/ NABARD guidelines issued from time to time.
- The loan repayment is determined, on the basis of gross surplus generated in the project. Usually, the repayment period of loan for broiler farming is 5 years without moratorium.
- The repayment period shall be fixed taking into account the surplus during the life cycle of the proposed investment.

Sheep Breeding

The following technical, financial and managerial aspects are to be looked into in detail while taking a view on financing the sheep breeding schemes/projects:

Technical aspects	Nearness of the selected area to veterinary centres and wool collection centre and the financing bank's branch Availability of good quality animals, in nearby livestock markets Source of training facilities Availability of good grazing ground / lands in the scheme area Availability of green/dry fodder, concentrate feed, medicines, etc. Availability of veterinary aid and marketing facilities near the scheme area.
Financial Aspects	Unit Cost - The average cost of Sheep unit. Input cost for feed and fodder, veterinary aid, insurance, etc. Output costs i.e., sale price of animals, penning, etc. Income-expenditure statement and annual gross surplus Cash flow analysis. Repayment schedule i.e., repayment of principal loan amount and interest.
Managerial Aspects	Whether the borrower belongs to shepherd's community or a person possessing ability to keep the flock intact, protect it from predators and guide it to market areas in time for shearing

Goat Rearing

The following technical, financial and managerial aspects are to be looked into in detail while taking a view on financing the sheep breeding schemes.

- A scheme can be prepared by a beneficiary after consulting local technical persons of State Animal Husbandry Department, DRDA, Sheep-Goat Co-operative society and commercial farmers.
- Any area having sufficient irrigation or reasonable grazing facilities is suitable for goat rearing activity. Generally, one-acre irrigated land can accommodate 25 goats under intensive system.
- For hot-humid climate, slatted floor raised about one meter above the ground provide good ventilation, easy cleaning and collection of dung and urine. There should be a distance of little less than 1/2″ between the planks of platform.
- Fodder arrangement/ feeding under intensive/ semi-intensive system of goat rearing, arrangement of fodder is a must. Cost of cultivation of perennial and annual fodder crops (both leguminous and non-leguminous) is included.
- The project should include the following information on technical, financial and managerial aspects in detail based on type of unit and capacity.
- Outlay of the project depends on the local conditions, unit size and the investment components included in the project. Prevailing market prices/ cost may be considered to arrive at the outlay.
- Margin depends on the category of the borrowers and may range from 10% to 25%.
- Banks are free to decide the interest rates within overall RBI guidelines.
- Security will be as per RBI/ NABARD guidelines issued from time to time.
- The animals and other assets (shed, equipment) shall be insured.

Pisciculture

Intensive Fish Farming:

Composite Fish Culture is the most popular mode of fish culture in the country. This technology enables to get maximum fish production from a pond or a tank through utilization of available fish food organisms in all the natural niches, supplemented by artificial feeding. Any perennial fresh water pond/ tank retaining water depth of 1.5- 2.0 metres can be used for fish culture purpose.

The following norms shall be kept in view by the banks while financing the intensive fish culture farming:

- Depending on the compatibility and type of feeding habits of the fishes, catla and Rohu are recommended under the intensive fish culture program.

- Technical parameters of intensive fish culture include site selection, pond development, pre and post stocking operations, stocking, fertilization, feeding, etc.
- Pond Management plays a very important role in fish farming, before and after the stocking of fish seed.
- The margin money may be considered @ 5, 10 & 15% for small, medium and large farmer respectively and 25% for companies and partnership firms.
- Subsidy is available for various items like Pond Development, construction of New Ponds, first year inputs, etc. under a centrally sponsored subsidy scheme implemented by majority of the State Governments through FFDA's for different categories of farmers.
- Repayment of the term loan availed for the purpose can be recovered in 8-10 years in equated annual instalments with moratorium on repayment of principal for the first year, as per the cash flow.
- Security from the ultimate beneficiaries may be obtained as per the guidelines of RBI issued from time to time.

Bee Keeping

Beekeeping with very low investment and skills has the potential to offer direct employment opportunity to people specially to hill dwellers, tribals and farmers. Economic model of bee keeping considers the following parameters vis

- Generation of additional employment opportunities
- Additional income to the farmers with least working capital requirement and
- Enhance the yield of flowering crops by 15% to 20%.

The features of the scheme are as under:

- The selected site should be dry without dampness. High relative humidity will affect bee fight and ripening of nectar.
- Equipment used for honey bee farming comprises of small tools. Thin & thick beekeeping brushes, stainless steel knives, Food graded plastic made queen cage, bee venom collector are some of the equipment used.
- Crops suitable for bee keeping: Vegetable crops such as Coriander, cucumber, cauliflower, carrot, melon, onion, pumpkin, radish and turnip; These crops ensure supply of nectar to the bees for production of honey in adequate quantities.
- Yield Increase due to bee pollination in honey bee farming has been noteworthy. Increase in yield have been reported due to maintenance of beehives in their fields.
- It is recommended to place hives very near the flied to save bee's energy and migrate colonies near the field at 10% flowering.

- Wax moths, ants, wasps, wax beetles, birds, tracheal mites, parasitic mite, bee mites and brood mite are the common pests to honey bees.
- Honey, bees wax, royal jelly, bee venom, propolis and pollen are the main bee products. Honey should be harvested at the end of a flowering season.

Financing Rural Godowns

The creation of small storage facilities, through construction of grain godowns, having a capacity ranging from 50 MT to 250 MT in villages may help the farmers to store their own produce as also provide storage space for rentals. The object of an ideal grain storage structure is to control and reduce the storage loses.

Capacity and dimensions: The godowns financed can be of the following sizes

- **Small sized**: Capacity of 50, 100, 200 and 250 MT
- **Medium sized**: Capacity of 500, 1000 MT and 2000 MT.
- **Large sized**: Capacity above 2000 MT.

Financing Sericulture

The general norms to be followed for selection of beneficiaries for financing sericulture are as under:

- While selection of villages /areas for financing sericulture, the bank shall ensure compactness of areas to facilitate supervision. The bank may identify suitable areas in consultation with the concerned department of the state Government of Commodity boards, etc.
- Loans under the scheme shall be given to those beneficiaries who have assured water supply facilities to irrigate plants in areas, where rainfed cultivation is not possible.
- Loan shall be issued in respect of investment for raising plants in first year and maintenance in subsequent years till the plant comes to bearing stage.
- The bank shall satisfy itself that the planting materials of the required quantity and quality are procured by beneficiary from reliable sources such as nurseries of Universities of State Government or any other nurseries approved by the concerned department of the State Government, etc.
- The banks shall work out the cash flow for the model taking into account all the costs (cost of cultivation of mulberry, rearing shed, rearing appliances, other equipment, etc.) and the benefits (cocoon yield) in order to determine the viability and bankability of the project and fix the repayment schedule, basing on the net cash surplus generated in the venture.
- As per the model scheme circulated by NABARD, the loan provided for the composite activity viz. mulberry cultivation and rearing of cocoons can be recovered in a period of five years which includes a moratorium period of one year.

Financing Mushroom Cultivation

Button Mushroom is the most popular mushroom variety grown and consumed the world over. In India, its production earlier was limited to the winter season, but with technology development, these are produced almost throughout the year in small, medium and large farms, adopting different levels of technology.

The whole process of mushroom production can be divided into the following steps:

- Spawn production
- Compost preparation
- Spawning
- Spawn running
- Casing
- Fruiting.

Spawn Production: Spawn is produced from fruiting culture / stocks of selected strains of mushrooms, under sterile conditions. Stock culture may be produced in the lab or may be obtained from other reputed sources. Fruiting culture is mainly imported from various places including foreign sources, which give higher yield than Indian strains and the spawn is produced in the lab.

The spawn should be of good quality, in terms of flavour, texture and size, apart from having potential for high yield and longer shelf life.

Compost Preparation: The substrate on which button mushroom grows is mainly prepared, from a mixture of plant wastes (cereal straw/ sugarcane bagasse, etc.), salts (urea, superphosphate/ gypsum, etc.), supplements (rice bran/ wheat bran) and water. In order to produce 1 kg. of mushroom, 220 g. of dry substrate materials are required.

Spawning: The process of mixing spawn with compost is called spawning. The different methods followed for spawning are given below:

- **Spot Spawning:** Lumps of spawn are planted in 5 cm. deep holes made in the compost at a distance of 20-25 cm. The holes are later covered with compost.
- **Surface Spawning:** The spawn is evenly spread in the top layer of the compost and then mixed to a depth of 3-5 cm. The top portion is covered with a thin layer of compost.
- **Layer Spawning:** About 3-4 layers of spawn mixed with compost are prepared which is again covered with a thin layer of compost like in surface spawning. The spawn is mixed through the whole mass of compost at the rate of 7.5 ml./ kg. compost.

Spawn Running: After the spawning process is over, the compost is filled in polythene bags / trays/ shelves which are either covered with a newspaper sheet or polythene. The fungal bodies grow out from the spawn and take about two weeks (12-14 days) to colonize. The temperature maintained in cropping room is 23 ± 20 C. Higher temperature is detrimental for growth of the spawn and any temperature below than

that specified for the purpose would result in slower spawn run. The relative humidity should be around 90% and a higher-than-normal CO2 concentration would be beneficial.

Casing: The compost beds after complete spawn run should be covered with a layer of soil (casing) about 3-4 cm. thick to induce fruiting. The casing material should be having high porosity, water holding capacity and the pH should range between 7-7.5. Peat moss which is considered to be the best casing material is not available in India, as such the mixtures like garden loam soil and sand (4:1); decomposed cow dung and loam soil (1:1) and spent compost (2-3 years old); sand and lime are commonly used. The casing soil before application should be either pasteurized (at 66-70° C for 7-8 hours), treated with formaldehyde (2%), formaldehyde (2%) and Bavistin (75 ppm.) or steam sterilized. The treatment needs to be done at least 15 days before the material is used for casing. After casing is done the temperature of the room is again maintained at 23-28° C and relative humidity of 85-90% for another 8-10 days. Low CO2 concentration is favourable for reproductive growth at this stage

Fruiting: Under favourable environmental conditions viz. temperature (initially 23 ± 2° C for about a week and then 16 ± 2° C), moisture (2-3 light sprays per day for moistening the casing layer), humidity (above 85%), proper ventilation and CO2 concentration (0.08-0.15%) the fruit body initials which appear in the form of pin heads start growing and gradually develop into button stage. The crop is suspectable to several diseases like Dry Bubble (brown spot), Wet Bubble (White Mould), Cobweb, Green Mould, False truffle (Truffle disease), Olive green mould, Brown plaster mould and Bacterial blotch. Professional help and extension advice will have to sought by the entrepreneur to adopt appropriate and timely control measures against pests & diseases.

Harvesting: is done at button stage and caps measuring 2.5 to 4 cm. across and closed are ideal for the purpose. The first crop appears about three weeks after casing. Mushrooms need to be harvested by light twisting without disturbing the casing soil.

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