ASSESSMENT OF APPROPRIATE TECHNOLOGIES FOR POST-PRODUCTION STORAGE, PROCESSING AND HANDLING OF HORTICULTURAL PRODUCE

SUBMITTED TO

INTERNATIONAL DEVELOPMENT RESEARCH CENTRE

OTTAWA, CANADA

JANUARY 1993

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C O N T E N T S

ASSESSMENT OF APPROPRIATE TECHNOLOGIES FOR POST-PRODUCTION STORAGE, PROCESSING AND HANDLING OF HORTICULTURAL PRODUCE

1.0 INTRODUCTION :

In all developing countries efforts are being taken towards producing and distributing atleast minimum required food grain as well as horticulture produce. In all these countries, with no exception of India, the major problem still remains with inefficient handling and distribution of the produce in agriculture and horticulture sector. Efforts have always been taken in increasing production level of these sectors or increasing productivity. However, significant change in the existing structure can be achieved by introducing appropriate techniques for handling and processing of the produce.

This is more true for the perishable horticultural commodities, which have extreme seasonality, in which as much as 30% of total produce is wasted. This deprives farmers of remunerative prices for their produce.

For most of the horticulture produce the majority of losses are due to poor handling and lack of refrigeration and storage facilities. Fruits and vegetables are highly perishable having shelf-life less than a week. For the existing Indian atmospheric conditions respiration and transpiration rates of horticulture produce are higher which result into significant losses. The simple and cost effective techniques such as evaporative cooling and prepackaging in polymeric film can reduce these losses and can thereby extend the shelf-life of this produce.

For the produce like mango, the season lasts for only two months and always there is a problem of surplus. BAIF installed a mango processing plant at Vansda to attend to this problem. The current activities in this processing plant include bottling/canning of mango pulp and drying of pulp to make mango bar. Additionally few other products

with good sales potential are also being produced. These include mango squash, mango jam, raw mango powder, osmotically dehydrated mango slices etc.

Thermal processing (canning) is one of the common processes employed in India for fruit preservation with a majority of processed foods exported to the Middle East. The success of this thermal process depends on sealing the food in a container (that provides leak proof environment) and heating the container at specific temperatures long enough to render them commercially sterile. There is considerable lack of awareness or understanding of the basic principles used for successful thermal processing of foods. Also there is need to investigate utilization of cost-effective retort pouch-packaging technique as an alternative to conventional glass and metal containers.

BAIF initiated brief research studies followed by pilot trials on mango processing. These studies dealt with product development, use of alternative processes or development of new devices. These efforts have yielded interesting results which need further attention. The results are in form of new products, new standardised processes for traditional products or method for using solar and electric driers in processing. The linkages between achievements in phase I of the programme and workplan in phase II in respect of specific activities are presented in **Annexure 1.**

The proposed project aims at developing and assessing appropriate technologies for the efficient post-production storage, handling and processing of perishable horticultural produce to produce value added products on pilot basis in the existing food processing unit at Vansda (Gujarat)

Apart from these activities propagation of existing potential technologies viz. Osmotic dehydration of mango slices, drying of mushrooms, pickle processing through decentralised processing activities are also proposed. All these activities are proposed to focus as women oriented activities. Market survey, market research, optimization of product-mix, developing marketing net-work and market

promotional activities for each product and production unit are also incorporated.

2.0 OBJECTIVES :

1. To identify and introduce improved storage and transportation techniques for horticultural produce.

2. To develop drum drying technology for mango powder production.

3. To establish thermal processes for horticultural commodities by using cost-effective packages.

4. To standardise method of evaluation and verification of thermal process.

5. To promote decentralised horticultural processing units as rural enterprises.

3.0 METHODOLOGY :

The project aim is two-fold in which conducting research and utilising research results for alternate technologies forms one part and promotion of horticultural processing units forms the other. The activities envisaged under the project are, therefore, also grouped under two categories. The research studies are proposed in technologies like thermal processing, retort pouch packaging, evaporative cooling etc. The remaining activities are clubbed under 'other activities' which include promotion of decentralised horticultural processing units, market research, development of marketing strategy with necessary market promotion activities and training to the farmers and rural youth especially women.

4.0 RESEARCH STUDIES :

1. IDENTIFICATION AND INTRODUCTION OF LOW-COST STORAGE AND TRANSPORTATION TECHNIQUES FOR HORTICULTURAL PRODUCE.

Rationale :

Mostly all horticultural crops are seasonal and highly perishable. The majority of losses during storage and transportation are due to high transpiration and respiration rates (due to inadequate refrigeration and storage facilities) and poor handling practices. Simple techniques such as prepackaging in polymeric films will reduce the transpiration losses and prevent contamination. R & D leading to commercialization of low cost packaging techniques and improved handling practices could alleviate these potentially inherent deep-rooted problems. Modified atmosphere achieved through proper selection of plastic films and rigid packaging materials (wood, plastic, paper) can significantly extend the shelf-life of these produce. Such packages will also serve as temporary storage units.

Evaporative cooling is another technique which can be used as an alternative to expensive refrigeration systems. This technique makes use of drying capacity of air which is warm and dry. The difference between wet bulb and dry bulb temperatures is sufficiently large in interior regions where evaporative cooling can be successfully used to bring down temperatures reducing respiration rates and improving quality. The technique provides environment with 100% relative humidity, thereby preventing transpiration losses. Necessary material can be made available locally and skills required in construction are not very high. Thus, this technique offers good potential for constructing low-cost cold storages. It is also necessary to find out the effective way of using this technique for transportation of produce on carts.

Objectives :

1. To study and demonstrate the use of evaporative cooling chamber for storage and transportation of horticulture produce

2. To study effectiveness of modified atmosphere packaging and promote its commercialization.

Research Design :

Considerable research and development work has been carried out at McGill on the controlled and modified atmosphere storage of horticultural crops. These techniques will be extended to testing conditions mainly attending to short term storage and transportation needs. Perishable produce will be initially packed in polymeric films with low gas-permeability in attempt to create modified atmosphere inside the package. The product will be subjected to transportation and handling under conditions that normally prevail. Mango will be used in the initial studies and later other horticultural crops such as tomatoes, potato, beans, mushroom etc. will be tested.

In order to further extend the shelf-life, the packages will be transported in specially fabricated wooden containers in which the produce is cooled by simple evaporative cooling principle. The research team at BAIF will fabricate simple transportation containers for the above use. Here cooling is achieved by active evaporation of water from a surrounding wet cloth or jute bag which is kept moist by occasional sprinkling of water. This simple technique will then be modified to cover an entire load of transportation carts. Devices appropriate for the local application will be explored and standardized.

Concurrently, research on creating modified atmosphere through carefully created perforations in rigid packages will be conducted at McGill University. These

will have potential in handling a majority of tropical produce which tolerate moderate levels of oxygen and carbon dioxide.

Evaporative cooling technique for storage finds its widespread application in cooling towers. A storage room based on the above principle to handle about 10 tonnes of tropical produce at around the optimal temperature (10-15oC) will be designed and constructed near the processing facility at Vansda. Appropriate modifications will be made based on the results from the evaluation of the prototype. The goal is to standardize a low-cost, small size storage unit which can be easily assembled/installed in rural areas.

Technical staff from BAIF will be trained at McGill University in the areas of evaporative cooling and modified atmosphere packaging, specifically through perforations for handling and storage of perishable produce.

Analysis Plan :

The on-line analysis will be carried out to study the effectiveness of these techniques at both the stages, viz prototype and pilot scale.

The specific topics to be attended to during the analysis have been listed below for each technique that would be included in the study.

1. Modified atmospheric packaging :

- Comparison of modified atmospheric packaging technique with traditional packaging for extending the shelf-life.
- Cost effectiveness and market acceptance of the technique.

2. Evaporative cooling technique for transportation :

- Effectiveness of the technique in reducing losses during transportation, of the horticultural produce.

- Simplicity of constructing (fabricating) and using the technique.

3. Evaporative cooling for storage :

- Effectiveness and economics of low-cost, small size storage unit which can be easily assembled/installed in rural areas.

2. DEVELOPMENT OF DRUM DRYING TECHNOLOGY FOR MANGO POWDER PRODUCTION

Rationale :

In the mango harvesting season the yield of mango is far beyond the size of open market sale. Further, certain varieties do not posses table qualities and have to be processed. Demand for pulp of these mango varieties is very limited. In order to fully utilize the available surplus, there is a need of alternate technologies to produce diversified products. BAIF has already standardised the process techniques for dehydrated products viz. mango bar, raw mango powder, osmotically dehydrated mango slices. For drying of these products electric and solar driers are being used in combination.

Production of mango powder is not possible in existing tray dryers. So it is necessary to test the drum driers for mango powder production.

Objective :

To standardize and establish drum drying technique for the production of mango powder.

Research Design :

A drum dryer to produce mango powder will be fabricated and tested to standardize process parameters (viz. drying temperature, residense time of pulp in the dryer) to achieve desirable product quality. All these activities will be carried out with co-operative and technical advice from leading food technology research institutes in India and from McGill.

Analysis Plan :

Utilisation of drum dryer for producing mango powder is a novel idea which is not yet utilised in India. So a drum dryer will be tested not only in terms of product quality but also drying time, drying temperature, drying capacity, drying efficiency and drying cost. Other factors would also be taken into consideration before recommending this hi-tech method in rural areas. These factors will be the manpower skill requirement to operate this system, availability of spare parts and the service backup in the rural area and the reliability of basic facilities like power and water essential for smooth operation of this system.

3. STUDY OF ADAPTABLE THERMAL PROCESSES FOR HORTICULTURAL COMMODITIES FOR PACKING IN ALTERNATE COST - EFFECTIVE PACKAGES :

Rationale :

The food processing industry in India is seriously burdened with the high cost of tin plate for making the cans used for packaging the food products. Alternate cost effective packaging materials would be welcomed by the industry, if the process is feasible. The food industry is not currently geared for the technology using alternate packaging materials such as retort pouches which offer cost advantage as well as offer potential for high quality processed foods. There is some hesitation with respect to industry-acceptance because of uncertainties related to their technical viability. The technology, although developed in North America more than three decades ago, needs to be established for indigenous foods and feasibility of changing the currently available equipment for new process needs to be demonstrated. The technology offers potential for medium scale industry.

Objective :

To standardise and promote retort pouch technology in fruit processing industries.

Research Design :

The research work on using retort pouches as packaging material as an alternative to existing thermal processing, will be taken up by McGill. Processing schedule will be established for various horticultural commodities at McGill while training the staff from BAIF and the technology will be installed at BAIF's food processing plant in Vansda for mango products. Subsequent studies with local horticultural produce will be carried out at Vansda. BAIF staff will maintain the facility and demonstrate the process at

other food processing industries in a later stage of the project.

Analysis Plan :

The retort pouch packaging technique is established in developed countries and hence the emphasis during the McGill study would be on laboratory level studies on particularly mango products packed in these pouches. The parameters like retaining quality of material at high temperatures, effect on shelf-life, other possible effect of the material on the product quality will be studied. During the second stage (installation at Vansda) the additional parameters like material availability, acceptance in the Indian market and financial viability will be studied. The analysis of this stage will provide the recommendations for further extension of the technology.

4. STANDARDIZATION OF PROCESS EVALUATION AND VERIFICATION METHODS FOR THERMAL PROCESSING OF HORTICULTURAL PRODUCE :

Rationale :

Thermal processes used by a majority of food industries in India are based on techniques established elsewhere under conditions not necessarily appropriate and best suited to where it is used. There is also a lack of awareness and understanding of the basic principles used for thermal processing of foods.

Development of a simple prototype equipment for heat penetration data gathering and processing of data for established thermal process would be of utmost importance to food processors of both medium and large scale. Such a data gathering hardware and process calculation software can broaden the scope of similar applications and serve to generate revenue which can support developmental research. This will ultimately

have a major impact in improving the public health safety and product quality.

Objectives :

1. To determine time-temperature profile of test packages for various horticulture produce under commercial processing conditions.

2. To develop process calculation software useful for thermal processing of horticultural produce.

Research Design :

Depending on the product type, can size and retort operation conditions; minimum heat treatment required for thermal processing of horticultural produce will be studied and developed at McGill. Simultaneously a data gathering hardware and process calculation software will also be developed at McGill. The importance of thermal processing aspects will be then stressed at nationally organised workshops / AFST meetings (once every year).

Analysis Plan

1. Evaluation of thermal processing time and temperature based on time-temperature profile for various horticultural produce.

2. Analysis of collected data required for thermal processing and preparation of process calculation software.

5.0 COMMERCIALIZATION ASPECTS :

1. STUDIES ON PROMOTION OF HORTICULTURAL PROCESSING UNITS AS MICRO ENTERPRISES IN RURAL AREAS :

Rationale :

It is a known fact that the country like India where the population is growing exponentially every year, the pressure on land is also increasing on similar levels. Hence there is much need to introduce rural industries, especially agro processing as the raw material in form of food grains or fruits or vegetables is available in rural areas.

Although setting up an agro processing unit is a very good option, feasibility of processing mainly depends on availability of raw material, market potential for the processed products, versatility of plant to process various produce so as to maximise its capacity utilization.

BAIF has already developed some products viz. osmotically dehydrated mango slices, dehydrated mushrooms and raw mango pickles. The market potential for these products is high. Therefore, installation of village scale processing plants incorporating fruit dehydration and pickle production in Vansda (Gujarat) area are planned.

Objective :

To study the feasibility of promoting decentralised horticultural processing units as rural enterprises through action research.

Action plan :

Two small scale units for the production of dehydrated products will be installed at two villages in Vansda area (Gujarat). The villages will be selected based on initial survey of availability of mango and mushrooms in the region, if some of the produce are not grown in potential areas then feasibility to buy them from market will be studied.

Similarly two pickle production units will be established at two different villages.

In the first year one pickle production and one dehydration plant will be installed, and remaining installations will be made in the second year.

2. DEVELOPMENT OF NEW PRODUCTS AND PROCESS STANDARDIZATION :

Rationale :

Process standardization is the basic need for the processing of any horticulture process. It includes various activities to be carried out on the raw materials to finally convert them in the desired processed form. Based on market demand and value addition, new products are developed and included in the product range.

A mango processing plant at Vansda was started for the production of mango pulp. The varieties of mangoes grown in this area are alphanso, kesar, langda, and rajapuri. Alphanso and kesar pulp have very good market demand whereas other varieties have very poor market response. So understanding the need for developing new products for selling these varieties, a product range has been established. Langda pulp has been processed to prepare jam, squash, mango bar etc

and rajapuri for pickling, dehydrated mango slices and mango bar. Finally a product-mix including all the above mentioned products with their scale of production has been fixed. These activities have not only solved the problem of marketing but also added the value by several folds as compared to production of pulp and improved plant utilization capacity.

So this study will be aimed at development of new products and standardisation of their production procedure with subsequent optimization of product-mix for each enterprise.

Objectives :

1. To develop new processed products.

2. To optimise product-mix for each processing unit.

Action Plan :

The existing well equipped processing plant at Vansda will be used for developing new products and their market testing. Apart from presently established product range, several new products will be developed viz. mix-fruit jam, pulp blend for raw mango powder and mango bar production, pulp blend for canning, jack-fruit wafers, sweet mango chutney, ketch-up etc.

Once the production procedures are standardised, production economics of each product will be studied and compared with market prices to know the value addition. The products showing higher value addition than the existing processed form will be selected for market testing. Later for the successfully market tested products, market survey will be carried out so as to decide their scale of production. Finally a product-mix will be recommended for each horticulture produce.

3. MARKET STUDY AND MARKET PROMOTIONAL ACTIVITIES FOR THE PROCESSED PRODUCTS :

Rationale :

In case of horticultural produce, extreme seasonality, high perishability and need to utilize surplus in limited period gives momentum to the processing. There are about 60 mango processing units in mango producing belt of Western Maharashtra. The capacity of these units vary from 50 tonnes to 200 tonnes of pulp production per season. Inspite of these many units, demand for pulp is still high. This is mainly because of high export potential and increased demand for other processed products like jam, squash, juice etc in the local market.

Now a days markets for processed food products are becoming increasingly dynamic and competitive, their successful exploitation calls for greater investment and more frequent innovations -- in marketing strategy and in market promotional activities. Decision making must therefore be faster and less susceptible to many of the errors of intuitive judgments which are avoidable. So instead of hasty decision which may later put one in great trouble, it is necessary to carry out market research/survey to understand market and feasibility of marketing the product. Also for easy marketing of any product it is essential to study and establish marketing network in terms of bulk buyers and retailers.

Action Plan :

During the whole project period, alongwith other research studies, efforts will be taken up to strengthen marketing of existing and newly introduced products. Market survey with respect to product (specifications, sizes, brands, selling prices), demand assessment, supply position, marketing practices and demand-supply gap will be done first. Simultaneously for new processed products market acceptance will be

studied by conducting sensory tests and blind tests. Results of market survey and market testing will be used to analyse share anticipated in terms of product volume and value, pattern of demand etc. Then the need for market promotional activities for the potential products will be assessed. Ultimately all the information will be utilized for optimizing product-mix so that marketing of all the products can be done through a well organised network of retail and wholesale buyers.

4. TRAINING TO FARMERS AND RURAL YOUTH :

Major post harvest losses are due to faulty harvesting and storage practices. So the farmers need to be trained to check these losses. Since all the processing operations will be carried out by rural youth especially women, they must be aware of the production procedures, machine operations, sanitation and safety measures. Also they should have sufficient knowledge of accounting and book-keeping to run the unit independently.

Action Plan :

Training programme for farmers will be arranged in each village under project area to teach them about fruit maturity, harvesting period, harvesting method, storage and transportation practices. Periodic training courses for rural youth will be conducted in the processing plant itself. They will be trained in the technicalities involved in the processing and their importance, operations of processing machineries - their safety measures and trouble shooting, plant sanitation etc. Special training courses will be arranged on accounting, book keeping, pricing system, taxes and marketing.

6.0 RESEARCH COLLABORATION :

The range of activities proposed in the project is wide and requires continuing interaction between well set-up laboratory facilities having expertise on the particular topics and the pilot scale processing unit with personnel capable of handling the research results. Hence it is proposed to develop a strong linkage with McGill University in Canada where the Department of Food Science and Agricultural Chemistry possesses the required facilities. As mentioned in the proposal at appropriate places, the involvement proposed is clearly specified and the responsibilities divided between BAIF and McGill.

Additionally there are other areas in which linkages with Canadian organisations including small fruit processing industries can be finalised during the project implementation. The possibility of developing relationship with such organisations will also be explored in areas of research as well as mango processing as a commercial activity. Such collaborations will be formalised during the initial period of the project.

The department at McGill University has been contacted and the terms are decided upon. The proposed activity phasing is presented in **Annexure 2.**

7.0 PROJECT AREA :

An established mango processing unit at Vansda will be used to test the performance of developed techniques on pilot basis. However the basic research prior to this will be carried out at Department of Food Sciences and Agricultural Chemistry at McGill University in Canada. Two small scale processing units each for producing dehydrated products and pickles will be installed at four other promising sites in rural areas.

8.0 EXPECTED OUTCOME :

The proposed activities and research studies would contribute to development of post harvest technology in India in a multi-faceted way. The interim in-house evaluation is planned so as to assure this achievement. Annexure 3 details parameters to be used in interim and final evaluation of the project. Following is the list of expected outcomes :

1. Affordable low-cost packages for handling, storage and transportation of perishable produce.

2. Low cost technology based on evaporative cooling principle for the storage of horticultural products.

3. Alternate processing technologies for mango and other horticulture produce which will help in diverse processed products and increase the profit margin and market potential for these crops.

4. Alternate thermal processing technology employing cost-effective packages.

5. Thermal process calculation software useful for food industry.

6. Skill improvement in the area of food processing and preservation. Recommendation package briefing about a product-mix for different type of horticultural produce.

7. Value addition and assured market for the produce or products available in Vansda area.

9.0 UTILIZATION OF RESEARCH RESULTS :

The project itself is based on the principle of utilising the outcomes from previous work done by BAIF or other institutions. It also has few new topics whereupon basic research also needs to be done, viz. evaporative cooling, retort pouch packaging, thermal process evaluation, etc.

The project envisages field trials and application within its scope, however on a smaller scale. These technologies and processes can be adaptable on a very large scale within India. This is more true looking at ever expanding horticulture plantation in India. BAIF will disseminate the developed technologies and experience gained through decentralised processing activities under its project areas. Similarly publications will be produced with reference to different produce or products.

10.0 INTER PROJECT LINKAGES :

The project on assessment of appropriate technologies for post-production storage, processing and handling of horticultural produce has been developed as a forward linkage to the Tribal Development Programme being operated in Maharashtra, Gujarat and Karnataka. This will provide value addition to the produce by the tribals, also create gainful self employment opportunities for women. It will also help to promoted entrepreneurship with the help of skills training. The inter project linkages with BAIF activities are presented in **Annexure 4 A.** The interlinakges for Phase II Programmme are presented in **Annexure 4 B.**

11.0 DURATION :

It is proposed to take up the activities under the project over a period of five years.

12.0 BUDGET :

The overall budget over a period of five years is presented in **Annexure** 5 and Budget Notes for the same are enclosed in **Annexure 6.**

ANNEXURE 1

LINKAGES BETWEEN PHASE I AND PHASE II

Activity	Phase I Achievements	Phase II Work Plan
Fruit handling	1. A pilot system established to handle process and sell the fruits and their products	1. Study and promote - Evaporative cooling for transportation and storage - Modified atmosphere packaging
Process standardi-zation	2. Processes to produce and pack Mango pulp, Ambapoli and Mango bar standardised. - Pilot scale production initiated for these products	2. Standardize methods for process evaluation and verification for thermal processing - Standardise and initiate retort pouch processing and drum drying - Standardise processe for producing processed products
Product mix	3. Study initiated on optimization of product-mix from mango	3. Recommend ideal product-mix from other horticulture produce
Market study	4. Preliminary market study conducted and market testing initiated	5. Develop marketing strategy for all products

ANNEXURE 2

ACTIVITY PHASING

r. DESCRIPTION o.	Year 1 a b	Year 2 a b	Year 3 a b	Year 4 a b	Year 5 a b
. Development & introduction of evaporative cooling technique	-	-	-	----------	
, Development & introduction of modified atmosphere packaging	-	-	-	----------	
, Development & introduction of retort pouch processing	-	-	-	----------	
. Development & introduction of thermal processing software	-	-	-	-	-
. Development of drum drying technology for mango powder production	-	-	-	-	-
Development of four decentralised horticulture processing units	----------				
Development of new products and process standardisation	----------	----------	----------	----------	
Training to farmers and operators	----------	----------	----------	----------	
Planning of marketing strategy for processed products		----------	----------	----------	
Collaborations with other organisations	----------				
Overall project evaluation and recommendations			-		-

ANNEXURE 3

EVALUATION PLAN

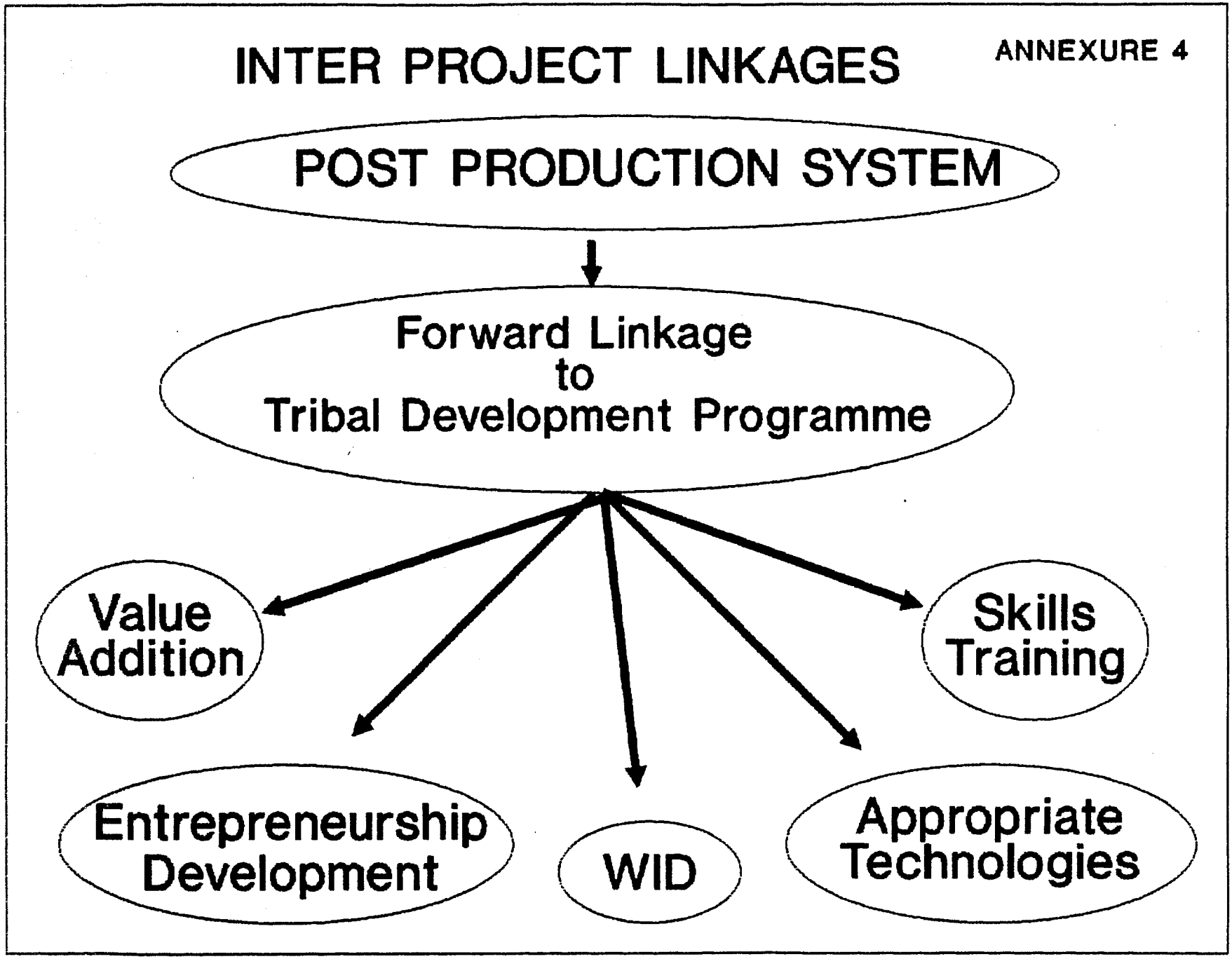
ACTIVITY	EVALUATION PARAMETERS	
	MID TERM	FINAL EVALUATION / IMPACT ASSESSMENT
1. Evaporative cooling for storage and transportation	* Prototype development * Shelf life measurements	* Field application of technique * Cost effectiveness
2. Packaging techniques - Retort pouch packaging - Modified atmosphere packaging	* Introduction of techniques	* Field application of techniques * Acceptance in market * Cost effectiveness
3. Drum drying for mango powder production	* Prototype development of drum dryer	* Optimization of operating parameters * Economic feasibility analysis

contd...

ACTIVITY	EVALUATION PARAMETERS	
	MID TERM	FINAL EVALUATION / IMPACT ASSESSMENT
4. Processing Installations		* Decentralised installations (number) * Capacity utilization * Operating period * Type of products handled * Cost-benefit analysis
5. Product - mix optimization	* Incorporation of new products to optimize product mix based on process simplicity and value addition	* Developed methodology for optimum product-mix decisions
6. Marketing	* Market study for various processed products	* Development of marketing network through distributors, dealers and retailers
7. Training	* Number of training courses organised * Preparation of training modules	* Effectiveness of training

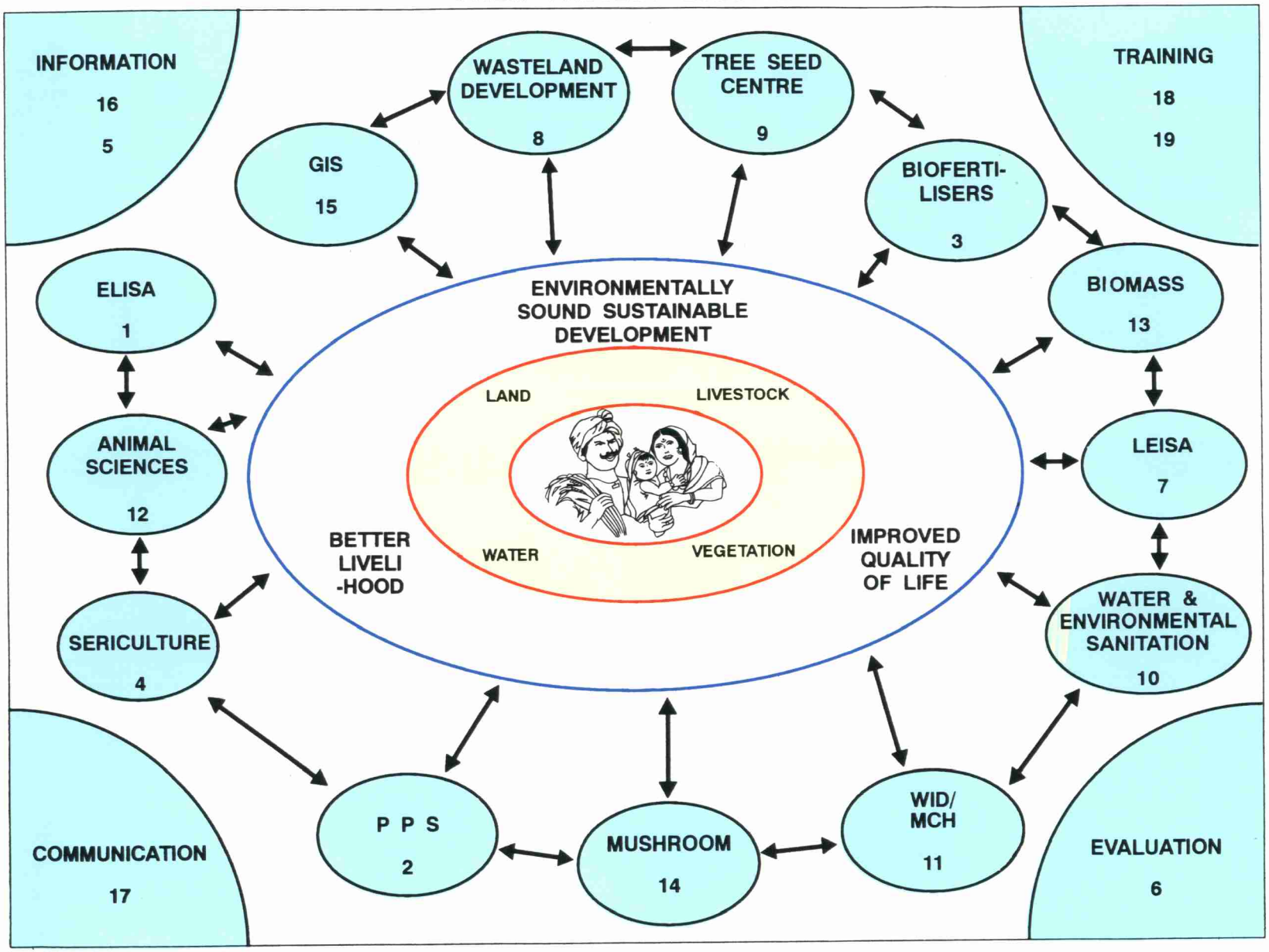
INTER PROJECT LINKAGES

ANNEXURE 4



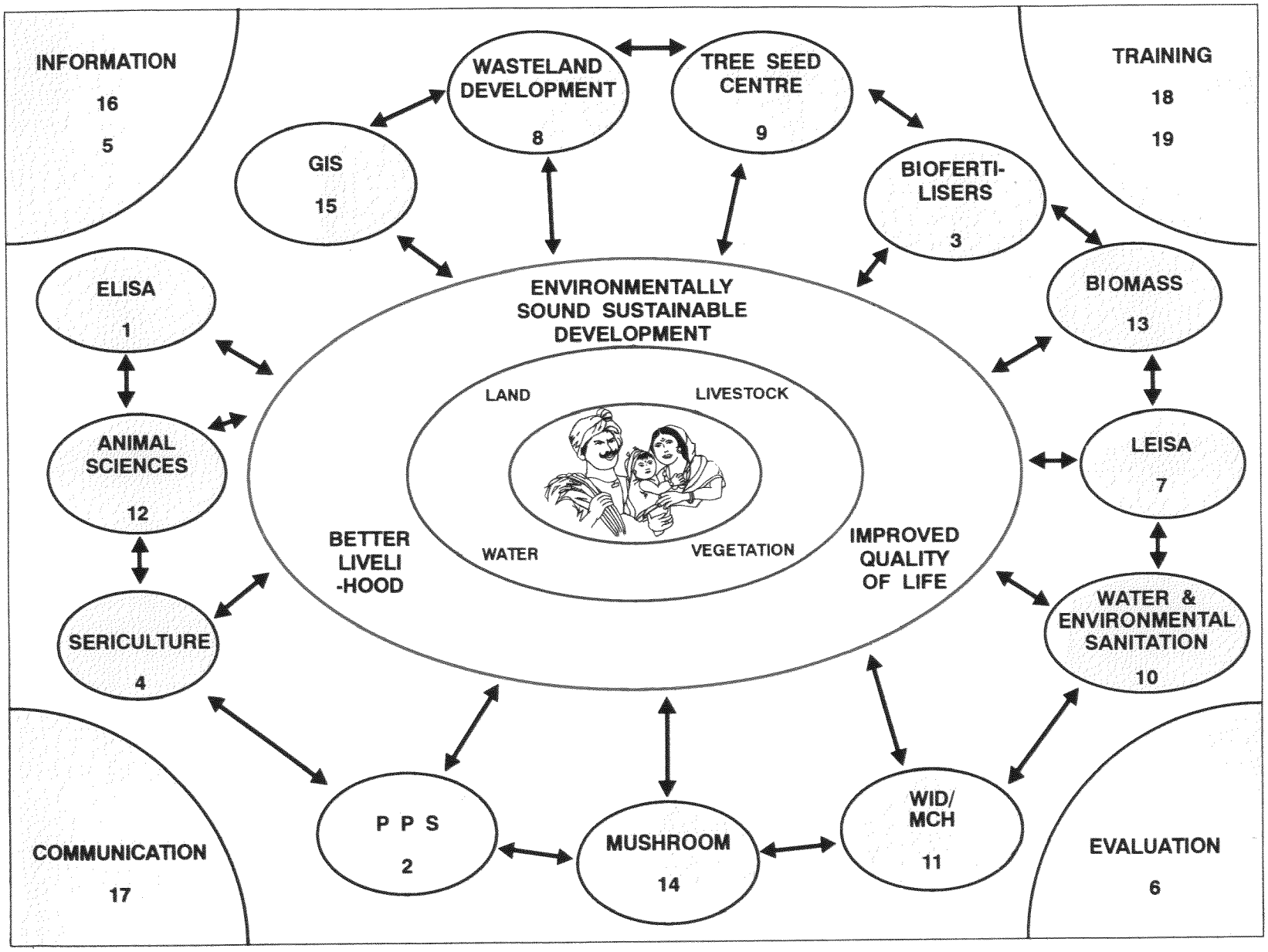
HOLISTIC PROGRAMME APPROACH

INTER PROJECT LINKAGES



HOLISTIC PROGRAMME APPROACH

INTER PROJECT LINKAGES



ANNEXURE 5

BUDGET SUMMARY

PROJECT NO. : 2
PROJECT TITLE : ASSESMENT OF APPROPRIATE TECHNOLOGY FOR POST PRODUCTION STORAGE,PROCESSING AND HANDLING OF HORTICULTURAL PRODUCE

(Rs. in '000)

Sr. No.	A/C Head	<----------YEAR----------> 1	2	3	4	5	TOTAL
	BAIF Administered :						
1.	Salaries	226	249	274	300	331	1380
2.	Research Expenses	198	288	294	179	154	1113
3.	Consultancy	40	40	40	20	20	160
4.	Reports & Documentation	15	15	15	15	15	75
5.	Training	21	95	96	21	21	254
6.	Travel	61	61	61	61	61	305
7.	Books & Periodicals	25	25	25	10	10	95
8.	Capital Equipment	847	1110				1957
9.	Infrastructure	650	705	30	30	30	1445
10.	Administrative O. H.	208	259	84	64	64	678
	SUBTOTAL (A) :	2291	2847	919	700	706	7462
	IDRC Administered						
1.	Training & Travel		200	300			500
	SUBTOTAL (B) :		200	300			500
	TOTAL CONTRIBUTION :	2291	3047	1219	700	706	7962

ANNEXURE 6

BUDGET NOTES

1. SALARIES :

The following manpower is required for the implementation of this project work

SR. NO.	DESCRIPTION	NO. OF STAFF	AMOUNT
1.	Project Co-ordinator	1	77,000
2.	Market Economist	1	44,000
3.	Food Technologist	1	44,000
4.	Plant Manager	1	40,000
5.	Allocated Expenses for Programme Monitoring Cell		21,000
	TOTAL		**2,26,000**

Note : An increment of 10% is expected over every preceeding year

2. RESEARCH EXPENSES :

1.	Raw materials (25 Tonnes for 5yr @ Rs.6/kg)	1,50,000
2.	Polymeric films	50,000
3.	Wooden containers (Nos 1000 @ Rs.25 per pc).	25,000
4.	Jute bags (Nos 1000 @ Rs.10/-per bag)	10,000
5.	Evaporative Cooling for transportation	10,000
6.	Retort pouches (Nos 25,000 @ Rs.6/per pouch)	1,50,000
7.	Market surveys (Nos 20 @ Rs.5000/per survey)	1,00,000
8.	Labour (Nos 25 @ Rs.25/day for 90 days per year)	2,80,000
9.	Small tools & equipment	25,000
10.	Market promotional activities	3,00,000
11.	Allocated Expenses for Programme Monitoring Cell	13,000
	TOTAL	**11,13,000**

3. CONSULTANCY :

Fruit processing related experts' visits @ Rs. 5,000 per visit; 8 visits - first three years, 4 visits - last two years.

4. REPORTS & DOCUMENTATION :

Expenses on Preperation of reports, presnetation material and other consumables budgeted at Rs.75,000/- for the project period.

5. TRAINING :

SR. NO.	DISCRIPTION	YEAR					TOTAL
		1	2	3	4	5	
1.	2 Video films @ Rs.75,000/film		75000	75000			150000
2.	Training courses for operators Rs.80 per participant per day, 10 participants, 15 courses.	21000	-	21000	21000	21000	84000
3.	200 Training Courses for farmers, Rs.100 per course		20000				20000
	TOTAL	21000	95000	96000	21000	21000	254000

6. TRAVEL :

At the rate of Rs.5,000 per month the annual budget of Rs.60,000 has been proposed. The allocated expenses of Programme Monitoring Cell is Rs. 5,000 for the project period. Thus totalling Rs. 305000.

7. BOOKS AND PERIODICALS :

The budget provision is mainly to cover the procurement of technical books related to horticulture processing. The membership provisions are also made for the few relevant journals. For the first three years Rs.25,000 per year and for next two years Rs.10,000 per year has been provided.

8. CAPITAL EQUIPMENT :

Capital equipment include cost of equipment and instruments required for providing research facilities at the existing processing plant at Vansda. Budget for two small scale units each for the production of dehydrated products and pickles is provided separately. So total budget of Rs.19,44,000/- is distributed over five years. Out of this amount, Rs.2,50,000 has been provided for a vehicle to be used for transport and travel. Other components are as detailed below :

I. **Equipment and instruments for reasearch :**

A. Equipment :

1.	Overpressure retort	50,000
2.	Vacuum kettle	1,00,000
3.	Drum drier (laboratory model)	1,25,000
4.	Vacuum sealing machine	1,50,000
5.	Steam kettle	50,000
6.	Bottle washing machine	15,000
7.	Label gumming machine	15,000
8.	Wood fired boiler	70,000
9.	Exhaust box	50,000
10.	Acessories	20,000
11.	Sealing machine	5,000
12.	Lug capping machine	10,000
13.	Extruder (Electrically heated)	15,000
14.	Can tester for concavity and vacuum	15,000
		6,90,000

B.	Instrumentation :		
1.	Data aquision system / PC	1,00,000	
2.	Oven and glass dessicator	15,000	
3.	Electronic Balances	35,000	
4.	Brixmeter	5,000	
5.	Incubator	15,000	
		1,70,000	
	Total for Research :		8,60,000

II. Unit for producing dehydrated products (single unit budget) :

1.	Electric dryers (2 Nos)	80,000	
2.	Diesel engine generator set	1,00,000	
3.	Balance (1)	10,000	
4.	Hand labeller	7,000	
5.	Accessories	15,000	
6.	Sealing machine	5,000	
		2,17,000	
	Total for 2 units :		4,34,000

III. Pickle processing (single unit budget) :

1.	Mango cutters (25 Nos)	1,50,000	
2.	Mixer	25,000	
3.	Mango washing tank	15,000	
4.	Carbouys (40 Nos)	10,000	
		2,00,000	
	Total for 2 units :		4,00,000

IV.	Vehicle	2,50,000
V.	Allocated Expenses of Programme Monitoring Cell	13,000
		19,57,000

9. INFRASTRUCTURE :

Land required for building a structure for research equipment, raw materials and processed products storage is available at existing processing plant at Vansda. Land and building required for two small scale units each for producing dehydrated products and pickles will be made available by local farmers. However infrastructure will have to be created through the project to initiate the activity. For this purpose an amount of Rs.14,45,000/- has been distributed over five years. Construction work is expected to be completed over first 2 years.

1. Estimation for a single processing unit :

1.	Storage structure of 10t capacity evaporative cooling principle (1000 sq.ft. @ Rs.200/- per sq.ft.)	2,00,000
2.	Building for research equipment and for storage of processed products (3200 sq.ft. @ Rs.250/- per sq.ft.)	8,00,000
3.	Furniture for processing plant	1,00,000
4.	Office furniture	25,000
5.	Shed for boiler	20,000
6.	Purchasing of racks, tables with tops alluminium sheet and other necessary items	50,000
7.	Plastic crates	1,00,000
8.	Expenditure for building maintenance	1,50,000
		14,45,000

5.2 BUDGET : IDRC ADMINISTERED

A total budget of 5,00,000 has been provided for travel & training abroad and to develop business linkages / technology transfer linkages with Canadian organisations including small scale fruit processing industries.

ONLY FOR REFERENCE

ANNEXURE 7

BUDGET DETAILS

Budget Details of McGill University Administered portion Funds to be released directly to McGill University.

Amount not considered in the total Budget of BAIF Institutional Support Phase II Programme.

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ANNEXURE 7 A

BUDGET SUMMARY
(To be Administered by McGill)

(In Canadian Dollars)

Sr. No.	A/C Head	YEAR 1	YEAR 2	YEAR 3	TOTAL
	SALARIES AND ALLOWANCES				
	Technical Help	9000	9000	9000	27000
	RESEARCH EXPENSES				
	Laboratory supplies	5000	5000	5000	15000
	Packaging materials	4000	4000	4000	12000
	Raw materials	2000	2000	2000	6000
	Small tools	4000	4000	4000	12000
	Engineering shop rental	2000	2000	2000	6000
	Pilot plant services	1000	1000	1000	3000
	SUPPORT SERVICES				
	Communications	1000	1000	1000	3000
	Secretarial	2000	2000	2000	6000
	PUBLICATIONS	1000	1000	1000	3000
	TRAVEL				
	International	8000	12000	12000	32000
	OVERHEADS (2% on travel)	160	240	240	640
		39160	**43240**	**43240**	**125640**

McGill will contribute normal overhead charges, staff time, budget administration, laboratory and office facilities, utilities, and space for visiting staff / student valued at $85,000 over three years.

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ANNEXURE 7 B

BUDGET ADMINISTERED BY McGILL UNIVERSITY

BUDGET DETAILS
(In Canadian Dollars)

Salaries : This includes part-time technical assistance to carryout some routine work and assist technical staff and visiting group leaders from Indian institutions.

Research Expenses : Laboratory supplies include routine chemicals needed for analysis, supplies needed for product development, cleaning agents, glasswares, chromatography supplies, thermocouple wires etc. Packaging materials needed include retort pouches, rigid plastics for fabricating special containers for MAP generation through perforation, cans etc. Raw materials consist of products that are used for testing. Small tools include packing glands, thermocouples, fittings, engineering materials etc. Engineering shop time is required to fabricate the containers, making necessary modifications to equipment as needed. Most of the development research work is carried out at the pilot plant which is operated on a cost sharing basis.

Support service include routine communication expenses such as long distance telephone calls, using of telefax, xeroxing etc. Secretarial help is needed for record keeping, typing reports, letters etc.

Publications include page charges for possible research publications and printing of popular articles.

Travel budget is provided to two (one in summer and a second one in winter) annual visits to India for the project leader to be accompanied by a fellow staff member in one of the visits (summer) to BAIF for collaborative discussions, monitor the progress and chart out steps to be taken during the next six months.