

Final Technical Report

Improved livelihoods through the development of small-scale fruit processing enterprises in Asia R8399

Executive Summary

Indigenous fruit trees are important multipurpose species for Asian smallholders to supplement and improve the quality of diets and provide fodder, fuel, timber and medicines to the poor. Mostly these fruit trees are grown in homestead farms. The utilisation and marketing of indigenous fruits is inefficient due to a combination of social, economic and technological factors.

The preliminary studies show that fruits are not utilised as they could be because of problems including, poor quality planting materials, high spoilage due to seasonal production, poor quality fruit processing, products and value added products, storage, packaging, quality assurance and weak marketing and business skills. Because of the importance of fruit tree products several consultation meetings were held in Asia to identify priority crops and their products. These are: bael (*Aegle marmelos*), jackfruit (*Artocarpus heterophyllus*), amla (*Embllica officinalis*), ber (*Ziziphus mauritiana*), sugar apple (*Annona squamosa*), tamarind (*Tamarindus indica*), persimmon (*Diospyros kaki*) and lapi (*Choerospondias axillaris*). The products which the stakeholders believed needed improved processing methods were: jam, jelly, dried pulp/fruit, candy, pickle, beverage, leather and powder, as these have local and in some cases national markets.

The specific objectives of the project were to adopt improved post-harvest methodologies and marketing strategies through training and identification of market opportunities and market linkages; to transfer improved technology for product development; and to assist stakeholders in the development of market strategies.

Outputs were obtained through partnership with NARS institutes and NGOs of Bangladesh, India, Nepal, Sri Lanka and Vietnam. 17 Resource centres were established in these countries, 3 in each country, except Bangladesh and Sri Lanka where 4 each were established. 95 trainers were selected from these Resource centres and trained to run pilot projects for the beneficiaries in processing and marketing of products. In total 2162 beneficiaries were trained, enabling them to enter into market chains to improve their livelihood. Among them 1635 were women, some potential individual entrepreneurs and some intending to be involved in processing and marketing through cooperatives.

A Training Manual on processing and small business development was produced for trainers and extension agents. 1000 copies in English were distributed. It is hoped that partners will translate into their own languages for better utilisation of the manual. 8000 posters and 10500 copies of flow charts in 8 (including English) languages were produced to reach wider audiences i.e. extension agents, NGOs, CBOs, individual entrepreneurs, traders. Fruit products produced by the beneficiaries were accepted by the consumers and some were preferred over established brands. 5 products are now included in the market chains. Women from a self help group in India are already selling their products through cooperatives. 1 entrepreneur each from Nepal and Sri Lanka and 3 from Bangladesh have started to generate income by marketing products nationally. Market research indicates that quality product(s) with good packaging have both local and national markets but for international market these products need to be refined further in addition to good packaging and branding. Further research is needed for post harvest handling, refining processing methods for wider markets and market acceptability.

Background

ICUC carried out a farmers' participatory survey in 1996 (Anthony & Haq, 1997) to identify priority species and priority areas for research and development agreed by fruit specialists of the region. This was funded by ODA (now DFID). The results were discussed at successive workshops of stakeholders and 13 indigenous fruits were identified as priority crops for

research. For the initial study the stakeholders decided to include bael (*Aegle marmelos*), jackfruit (*Artocarpus heterophyllus*), tamarind (*Tamarindus indica*), ber (*Ziziphus mauritiana*), amla (*Emblica officinalis*), persimmon (*Diospyros kaki*), sugar apple (*Annona squamosa*) and lapsi (*Choerospondias axillaris*) as many people grow these fruits in their home gardens and small orchards or gather them from the wild to supplement their basic diet. ICUC carried out a pilot project in 1997-1998, funded by the Commonwealth Science Council, on the processing of jackfruit in Bangladesh, producing a range of products such as juice, dried pulp, biscuits and toffee. In addition, young jackfruit in brine, pickles, leather, dried fruits, fruit drinks etc. can be processed, packed and marketed by rural people.

Previous work done by ICUC and its partners (Anthony & Haq 1997, Haq, 2000, ICUC 2000) and the Regional Consultation meeting (Haq & Hughes, 2002) (participants included NGOs, CBOs and private, public sectors) identified a large gap in information on the present status of harvesting and post-harvest handling and on the processing and packaging technology for underutilised fruits; although in many countries the technology has been developed but is lying on the laboratory shelves and has not reached village level processors or the small-scale entrepreneurs. They also identified that there is no information readily available on storage and marketing of products. Furthermore, information is scattered and not easily accessible to householders, small traders and entrepreneurs. In addition, available technologies need to be evaluated and adapted for local, regional and international markets. Little information also currently exists in Asia about products or marketing (local, regional and international). Often, small scale manufacturers and potential users are unaware of the technologies that may be appropriate to their needs, despite the fact that such technologies are being widely used elsewhere. The lack of information precludes spontaneous dissemination.

Smallscale entrepreneurs produce low quality products, which they have difficulty in marketing and achieve a low price (Vinning & Moody, 1997). These entrepreneurs face a huge uphill battle, as they do not have structured ideas about business practices, including how to market their produce and how to make profits that will enable the business to continue to exist in the future. But the issues involved in capacity building that are sustained over time are not simply a matter of technical know-how. It is also about understanding the processes whereby change in farming and marketing practices occur, how people can feel that they 'own' these changes and how these can be sustained in the long-term.

A survey was carried out in 5 countries (Bangladesh, India, Nepal, Sri Lanka and Vietnam) in 2002 involving stakeholders to focus on the need for research to overcome these constraints. Common constraints identified by stakeholders are often related to processing, quality control and access of producers to markets and market information. After initial analysis of the survey results, ICUC then carried out a series of discussion meetings with its network partner countries involving community groups such as women and youth groups, village level producers, NGOs, researchers and small entrepreneurs in Bangladesh, Sri Lanka and in India (a visit was made but unfortunately due to a strike no such meeting took place in Nepal). In Bangladesh, 43 participants representing NARS (15), NGOs (10), extension workers (3), traders (3), products producers (5), small entrepreneurs (4) and farmers (3) attended the meeting to discuss the recommendations and to prioritise research. Similarly in Sri Lanka, 10 members of NARS, 1 NGO, 10 extension workers, 10 small entrepreneurs and 5 traders participated this discussion meeting. In India, 2 NGOs, 5 representing NARS, 10 community producers, 10 small entrepreneurs and 5 traders were involved in this discussion meeting. In Vietnam, 12 representing NARS, 1 extension worker, 5 small traders, 3 entrepreneurs, 2 industries and 3 farmers. All of these meetings were held for a day and financed by the respective UTFANET (Underutilised Tropical Fruits in Asia Network) member countries.

These studies indicated that the issues below needed to be addressed in detail:

- Poor access to information on appropriate post-harvest and processing technologies; information is scattered and potential users are unaware of where to get information and of methodologies used elsewhere.
- Poor quality planting materials due to the poor technical skill of farmers in tree multiplication, nursery management, limited assessment of fruit tree varieties and lack of standardised propagation methods.

- High spoilage due to seasonal production thereby causing a glut in the market and low prices.
- Poor quality fruit processing, products and value added products, storage, packaging, quality assurance due to lack of information on technology and training, simple equipment, packing materials and poor knowledge on hygiene.
- Weak marketing and business skills due to lack of knowledge on structured business practices, including how to market and how to calculate profits.

The project intended to tackle the problems by developing the technical skills of women and men for product development, marketing and business management skills and access to information to strengthen national capacity building. The new and effective innovative techniques and approaches were developed, validated and disseminated through community participation and regional collaboration.

Project Purpose

The project purpose is the same as the FRP Output 4 and OVI 4.3: “Strategies for improved **sustainable livelihoods and income generation** for poor forest-dependent people developed and promoted”, contributing to improved methods for NTFP production, harvesting, processing and marketing developed and promoted by 2005. This would improve business opportunities through the commercialisation of non-timber forest products in Asia. The specific objective of the project was to improve livelihoods by developing and disseminating improved processing, storage and packaging methods, and marketing strategies through research and access to information on indigenous fruit tree species. The project objectives were addressed through establishing resource centres, providing training for improved methodologies and products and allowed beneficiaries to use the resource centre for making products to market their products either as a group or as individuals.

Research Activities

1.1 Identify partners (NGOs/CBOs) and 3 sites for resource centres in each country.

The partners and sites were identified as described below:

Country	Locations	Coordinating Partner
India	Tiptur-Lakkihalli (Karnataka)	IIHR, BAIF
	Pune-Urulikanchan (Maharashtra)	
	Kaprada (Gujarat)	
Nepal	Bosan	AEC
	Dharan	
	Lahan	
Sri Lanka	Gannoruwa	ACUC, HORDI, SEEDS
	Galle	
	Horana	
	Angunukolapalassa	
Bangladesh	Nawabganj	HRC
	Gaibanda	
	Sreepur/Gazipur	
	Jessore	
Vietnam	Huongnha Commune (Tamnong District, Phutho Province)	RIFAV
	Khoandu Commune (Lachy District, Hoabinh Province)	
	Huonglong District, Hue City, Tuathienhue Province)	

*ACUC- Asian Centre for Underutilised Crops, AEC-Agro-enterprise Centre, HORDI-Horticultural Research and Development Institute, SEEDS Ltd. RIFAV- Research Institute of Fruits and Vegetables; BAIF Development Research Foundation, HRC- Horticulture Research Centre. IIHR- Indian Institute of Horticultural Research

1.2 Identification of suitable marketable products, links established with markets/market chains and products introduced to these chains.

During preliminary survey the following fruits and products were identified:

Fruits	Products
Bael (<i>Aegle marmelos</i>)	beverages, jam, powder
Jackfruit (<i>Artocarpus heterophyllus</i>)	jam, jelly, pickle, dried pulp, leather, candy and powder
Lapsi (<i>Choerospondias axillaris</i>)	dried pulp, candy, pickle, leather
Amla (<i>Emblic officinalis</i>)	pickle, dried pulp, powder
Tamarind (<i>Tamarindus indica</i>)	pickle, juice, jam, leather
Sugar apple (<i>Annona squamosa</i>)	jam
Persimmon (<i>Diospyros kaki</i>)	drink
Ber (<i>Ziziphus mauritiana</i>)	pickle, beverage, jam, dried ber, candy, powder

List of crops products and languages of extension materials (by country)

Country	Crops	Products	Languages
Bangladesh	Ber, Jackfruit and Tamarind	Young jackfruit in brine, jackfruit bulbs in syrup, chutney, pickles, jam, candy	English, Bengali
India	Amla, Jackfruit, and Tamarind	Juice, cordial, chips, jam, pickles, leather, candy	Hindi, Kanada, Marathi, English,
Nepal	Beal, Jackfruit and Lapsi	Cordial, candy, leather, chutney, jam	English, Nepalese
Sri Lanka	Beal, Jackfruit, Sugar Apple	Jam, cordial, juice, candy, dehydrated jackfruit, Jackfruit flavoured ice cream	English, Sinhala
Vietnam	Jackfruit, Persimmon and Sugar Apple	Dehydrated jackfruit, chips, pulp in syrup, nectar from sugar apple, candy, jam and juice	English, Vietnamese

In addition, Self-Help Women's group in India also prepared papads and chips of jackfruit. Links were established with market chains for inclusion and promotion of these products. The introduction of products depended on the choice of consumers and market acceptability, hence the products introduction varied from country to country. However, the following products are introduced to the market:

Dried pulp
Pickles
Beverage
Candy
Leather

1.3 Development of action plan for each Resource Centre, incorporating detailed information on processing and marketing problems taking into account location geographic, biophysical, economic, and culturally specific issues.

Action plans were developed and submitted to FRP during quarterly report in year 1. Accordingly, each resource centre was equipped for training and implementation of pilot projects for processing, product development and small business development by the beneficiaries. The information resources were made available at the resource centres for the beneficiaries.

1.4. Preparation and printing of simple practical extension materials (fact sheets, laminated posters on processing, hygiene and product information) in local languages.

Items	No. produced	Languages
Posters	8000	English, Bengali, Hindi, Marathi, Kanada, Sinhala, Nepalese, Vietnamese
Training manual	1000	English
Flow charts for products (fact sheets)	10500	English, Bengali, Hindi, Marathi, Kanada, Sinhala, Nepalese, Vietnamese

1.5 Participatory field-testing using focus groups at producer and market level of appropriate post-harvest technologies, practices and extension materials prior to dissemination:

The following partners were involved in field testing of technologies and extension materials:

CISD- Bangladesh

AEC- Nepal

HORDI- Sri Lanka

BAIF- India

2.1 Establishment of 3 Resource Centres in each country

The resource centre will provide a base where people can access the information on processing, storage, packaging including hygiene and marketing.

Please see 1.1.

2.2 Production of training tools (manuals) in local languages for community processing, products and small business development

Please see 1.4.

2.3 Training courses for trainers

Courses were designed according to the demand of beneficiaries and the table below shows the number of Trainers trained for each partner country.

Training of Trainers Breakdown

Country	Number of trainers
Bangladesh	22
Nepal	16
India	16
Sri Lanka	26
Vietnam	15
Total	95
Planned Target	75

2.4 Community field training for beneficiaries for participatory pilot projects for processing, packaging and marketing of quality products for the local, regional and national markets. The number of beneficiaries trained are given in the table below.

Training of Beneficiaries Breakdown

Country	Beneficiaries trained	Number of women trained
Bangladesh (4 Resource Centres)	445	400
Nepal	393	306
India	446	372
Sri Lanka (4 Resource Centres)	503	195
Vietnam	375	362
Total	2162	1635
Planned Target	1875	1500

The training included harvesting, processing, product development, hygiene during production and storage, marketing and business development as these are limitations to success of rural ventures and in particular in dry fruit processing. The processing was carried out using different available methods to determine the appropriate technology for each community. The species and their products tried by beneficiaries are given in section 1.4. Traditional and new products

were developed to ensure that the selected products are those that have demand and can make immediate impact on beneficiaries.

2. 5 Dissemination of product and market information through the Resource Centres

All Resource Centres received training manuals, posters and flow charts in local languages in each country for dissemination. Partners have agreed to continue with distribution of posters including other media sources (i.e. BAIF published a special Newsletter in November, 2005). We have also provided DVDs for each Resource Centre demonstrating propagation and of methods of processing of fruit species (through project R7187). Each country partner has taken the responsibility of copying the master copy of the DVD for dissemination to wider beneficiaries.

BAIF in India, CISD in Bangladesh and HORDI in Sri Lanka have been helping beneficiaries to install road side stalls.

2.5.1. Exchange visits by lead community participants to gain experience and learn lessons from other groups within and between countries where appropriate.

In consultation with partners it was agreed that the lead participants from each country would visit Urulikanchan Resource Centre in India. The self help women group of the centre actually made progress both technically and in income generation from their products. 7 lead beneficiaries from Nepal, 3 from Sri Lanka 2 from Bangladesh and 25 participated from BAIF resource Centres. No beneficiaries from Vietnam participated in this technology uptaking process and we were told that this was due to language barrier. BAIF organised a workshop on Underutilised Fruit Species for Food-Nutrition Security and Enhanced Rural Livelihood coinciding with this learning process. The participants also attended this workshop.

3.1 Market research on the potential demand for processed fruits

Market research reports from each partner country are available now. This is being analysed by a consultant and will be available by the end of February. **(INCOMPLETE)**

3.2 Links established (including focus group meetings) with markets/market chains

Links have been established in all partner countries. The focus group meetings were held in all partner countries. The beneficiaries in India and Bangladesh have been trying to establish the linkages with banks also. The table below shows the number of products in the chain in each partner countries:

Linkages of products in the market chain in partner countries

Country	Products
Bangladesh	Jackfruit pickle, ber chutney, tamarind chutney and sauce
Nepal	Bael squash, Lapsi candy and pickles
India	Amla candy and squash, jackfruit papad, chips (traditional market chain), tamarind pickles,
Sri Lanka	Bael and sugarapple cordial, tamarind pickles,
Vietnam	Persimmon drinks
Total	15

A comparative sensory evaluation and consumer preferences of processed products prepared by the beneficiaries was carried out in each country and the results are shown in the table below.

Results of sensory evaluation and consumer preferences

Country	Evaluation
Bangladesh	Jackfruit pickle, ber chutney, tamarind chutney and sauce were chosen to be better than the available branded products
Nepal	Bael squash, Lapsi candy and pickles are preferred products
India	68.7% preferred product of Amla squash prepared by beneficiaries than the established market product. 74.1% preferred beneficiaries' amla candy than the established market sample.
Sri Lanka	77% preferred Tharindu (a brand name given by 1 beneficiary) sugar apple cordial than other similar products. Wood apple jam produced by beneficiary (brand name Ruweena) was better than established Cragills Kist products. Wood apple drink produced by beneficiary is comparable to established brand according to consumer preference.
Vietnam	Not complete yet
Total	15

3.3 Development of a database of products and market information.

This is being developed in Sri Lanka and will be completed by the end of February. The database will be available to access through ICUC-IWMI website and also from Southampton Centre for Underutilised Crops when its website will be in operation.

3.4 Capacity building and business development

One day workshop was held in each country to assess the beneficiary's experiences in processing products and marketing them. In all countries fruit processing is a part-time business and mostly beneficiaries work in a group. There is clear understanding among the groups in time sharing arrangement to use the Resource Centre and they take turns in using the facilities. They receive support from the trainer from each resource centre for the technical help. Although there is a considerable interest in processing products from underutilised fruits but there is a lack of interest in venturing out as individuals. In India 84 beneficiaries have been regularly using the resource centres, in Bangladesh only 5 and among this five, 1 is earning about £113 per month by doing a part-time processing of products and selling them. This by any standard is a good amount in Bangladesh from part time work by a house wife. More want to develop the business but all depend on venture fund and because they are poor it is very difficult to get cash help from the Bank. However, in India and Nepal there are success stories because of the NGO support (WEAN in Nepal and BAIF in India). 2 beneficiaries (1 in Nepal and 1 in Sri Lanka) with collaterals managed to get help from the bank. This allowed them to improve their products and increase their incomes. Both have media coverage to promote their products also.

3.5 Beneficiary socio-economic analysis and risk assessment

The study is in progress now. However, Sri Lanka, India and Nepal have finished the work but the results were not analysed by them yet. **(INCOMPLETE)**

Outputs

Outputs	Achievements	Comments
1. Improvement of post-harvest and processing technologies and practices	10 improved and appropriate methods for 10 products are recommended. All these methods are functional at all resource centres in target countries and used by local community.	Although 10 methods for 10 products established, beneficiaries only became interested on the basis of the demand of the products.
2. Technology transfer of post-harvest and processing technologies and practices	Focused training materials including posters, flow charts with improved methods are prepared for technology transfer through training at 17 established resource centres in 5 countries in Asia. At least 95 trainers and 2162 beneficiaries are able to practice these methods. Most trained beneficiaries use the resource centre to produce the products and market them, either through cooperatives (as in India) or as individual entrepreneurship (as in Nepal by Alternative Herbal Ltd and by Trindu in Sri Lanka.)	The partners including trainees have recommended establishment of more Resource Centres and to provide more training with some other underutilised fruits which could generate income for rural people, because of their local importance.
3. Community capacity building in enterprise development	Products and market information database was established with existing products, supply chain and demand. 5 improved products included in the market chain at the end of project. Self-help Women's group in India, 5 beneficiaries in Bangladesh, 1 each in Sri Lanka and Nepal have already started to generate income through the use of the technology. During last 3 months they have improved business and marketing chain of their products.	Although the project proposed the inclusion of 10 products in market chains, because of market demand and profitability the beneficiaries brought 5 products into the market chains.

Contribution of Outputs

a. Further strategic and focused research on post-harvest handling, in particular on various processing methods and the development of products and appropriate storage methods, need to be carried out. Promotion of the new products and sustaining the market chains will also require further development. Small-scale traders and entrepreneurs (those already involved in the project and others) need to be encouraged and supported in developing/enhancing small-scale enterprises engaged in product development, using the promoted post-harvest methods and marketing techniques at local, regional and national levels.

b. The major contribution of the project is achieved through the Resource Centres, and through technology transfer. The centres provide not only the technology but also information on the products and their marketing. This strengthens the establishment of more resource centres and providing training as this improves the skills of producers with production systems, products development and marketing to improve their livelihoods. The project benefited mostly women during the project period and additional employment was seen in the target areas. This allows the smallholders and small-scale entrepreneurs to enjoy the project impacts and would maximize exponential growth of the impact amongst the rural communities at post-project period.

c. The developed products are mostly for local markets where most beneficiaries are operating. However, they believe that financial help small-scale industrial equipment could be appropriate for developing products which can fetch market nationally and internationally.

d. Further promotion is expected to be made by all partners as they have observed the benefit from the project already. Further training and financial loans (as a micro-credit - CMES in Bangladesh have already started this) could ensure that the products are developed and promoted to the market chains. The NGO partners involved with the project hopefully will take these points into account to develop their plans for their beneficiaries. The partners have also agreed to print more flow charts in local languages for further dissemination. Southampton Centre for Underutilised Crops will continue to disseminate on- line and also through hard copies of extension materials whenever funds are available.

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