PN-AAK-700
ISN 1956

Postharvest Institute for Perishables

POTATO PROCESSING FOR BANGLADESH

A Report for the Bangladesh Agricultural Research Council, the Potato Research Center (Bangladesh Agricultural Research Institute), and the United States Agency for International Development (Dacca, Bangladesh)

by
Roy Shaw

for the
Postharvest Institute for Perishables
and
The International Potato Center (CIP)

GTS Report No. 82-03
April 1982

University of Idaho

in cooperation with
United States Agency for International Development
Project Title: Storage and Processing of Fruits and Vegetables
Project No. AID/DSAN-CA-0265
Washington, D.C., U.S.A. 20523

POTATO PROCESSING FOR BANGLADESH

A Report for the Bangladesh Agricultural Research Council,
the Potato Research Center (Bangladesh Agricultural
Research Institute), and the United States Agency
for International Development
(Dacca, Bangladesh)

by
Roy Shaw

for the
Postharvest Institute for Perishables
University of Idaho
Moscow, Idaho

and
The International Potato Center (CIP)
Lima, Peru

TABLE OF CONTENTS

		Page
I.	Executive Summary	1
II.	Background	3
III.	Objectives	4
IV.	Justification	5
V.	Recommended Work Plans	6
VI.	Notes	8
VII.	Budget	9
VIII.	Miscellaneous	9

I. EXECUTIVE SUMMARY

The Bangladesh Agricultural Research Institute (BARI) requested the United States Agency for International Development to obtain the technical services of Mr. Roy Shaw to consult in the identification and reduction of potato storage and processing losses. The Potato Research Center at BARI specified the following studies for the initiation of activities:

1. Development of low-cost methods for processing potatoes into a variety of long shelf-life commodities.
2. Design, testing and evaluation of nonrefrigerated storage centers for holding potatoes for 3-5 months after harvest to stabilize market prices.
3. The effects of storage conditions on local and improved varieties of potatoes.

In response to the USAID Mission request (Dacca 0326), Mr. Shaw spent the period from March 12 to April 4, 1982 in Bangladesh. His trip was sponsored jointly by the Postharvest Institute for Perishables (PIP) and the International Potato Center (CIP). The participation of PIP was under terms of USAID/University of Idaho Cooperative agreement AID/DSAN-CA-0265.

Potatoes are a staple vegetable in the Bangladesh diet, with an annual average per capita consumption of approximately 11 kilograms. The 1980-1981 harvest was estimated to be 1,164,000 metric tons, and it is anticipated that the 1985-1986 harvest will be 1,450,000 metric tons. There may be limits on the consumption, immediately after harvest, of this planned increase, so depressed prices and postharvest losses may occur.

The losses could be reduced, however, if there were appropriate facilities for storing or processing the surplus potatoes. This would spread their availability over a longer period of time and stabilize prices. The methods to be considered are:

1. Build sufficient cold storage units to store the new, higher-yielding Dutch potato varieties. These varieties do not store as well as the older, local varieties, so require special treatment.
2. Plan the marketing so that only the improved Dutch varieties, which do not store well, are consummed first. The older varieties, which store better, could be held in storage until needed. This is the system that is currently used, and it appears to be relatively effective.
3. Process the new, improved varieties in order to avoid the necessity for cold storage.

A simple, inexpensive and effective solar dehydration technology is currently in use by some farm families in Bangladesh for potato processing. The dehydrated product can be stored for long periods and transported easily. Also, it can be prepared for consumption by frying or boiling, or as an additive or extender for rice.

It is recommended that the small farm potato solar dehydration processing, as a small business (cottage industry), be expanded in order to absorb the seasonal high productions and, at the same time, to take advantage of lower prices. This would obviate the need for additional cold storage units.

Four criteria must be considered when planning an increase in a cottage industry of this type:

1. The change or expansion must fit the current system of production/storage/processing/marketing and must consider the views of the producer and consumer.
2. The change must fit the cultures of the producers and consumers. Also, it must fit government policies and must be compatible with existing infrastructures.
3. The proposed change must fill a need and must relieve a constraint in the present system. The people must preceive the need, such as the conservation of a surplus at harvest, or a role for women in the cottage industry.
4. The proposed change must be within the abilities and resources of the population involved. The clients must understand the changes and be able to relate to them. Also, they must have cash or credit to effect the changes, and consumers must be willing to pay for any price increases.

A proposed work plan identifies the need for a project coordinator, a sociologist, an engineer, and a plant physiologist in order to develop a potato dehydration cottage industry. The work plan would be divided into three phases for implementation:

Phase I. Study the existing system of potato processing in order to identify the appropriate technology to be used for the improvement and expansion of a cottage industry and/or small businesses involved in potato dehydration.

Phase II. Develop the appropriate equipment needed for the intervention method identified for expanding the potato processing system by dehydration.

Phase III. Demonstrate the appropriate technology and equipment in various places around the country and disseminate the information and results.

It is recommended that existing staff personnel in the Potato Research Institute at BARI be designated to accomplish the proposed work plan. They have the capabilities. The cost of implementing the proposed work plan might be less the US$ 10,000.00.

II. BACKGROUND

Potatoes are a staple vegetable in the Bangladesh diet; estimated consumption is at 11 kg per person per year. Encouraged by low prices much of the consumption takes place at the principle harvest in February and March.

Official statistics placed the 1980-81 harvest at 1,164,000 metric tons (MT) (60% improved Dutch varieties) from 120,000 hectares. The Potato Research Center anticipates that the current programs for new varieties and seed improvement and the possibility of multiple cropping will increase the harvest by 5% per year or to 1,450,000 MT by 1985-86. Since potatoes are harvested during a brief two months, there may be limitations on the consumption, at harvest, of the planned increase, resulting in a surplus. This surplus will depress farm prices resulting in an unfavorable economic climate to expand a nutritious, labor demanding crop. If transportation and distribution facilities are inadequate, food spoilage will occur. However, if facilities for storage and processing exist, then the surplus could be stored for consumption later.

Of the 1980-81 harvest of 1,164,000 MT, 40% (465,000 MT) were from local, older varieties. The latter are established in Bangladesh and are known for storing well. In fact, in some production areas the local varieties have been stored for as long as 10 months in farmers' storage units. The Potato Research Center currently has a program to improve these storage facilities.

The remaining 700,000 MT (1980-81 harvest) are improved varieties of Dutch origin, and need refrigerated stores for storage time beyond 3 months. The consensus of the Potato Research Center is that Bangladesh has cold storage capacity for about 200,000 MT; one-half for seed potatoes. This leaves about 600,000 MT without adequate storage, with additional needs by 1985-86. It is estimated that 300-400 storage units would be required to handle the 600,000 MT.

Three alternatives can be considered in order to handle properly the tonnage of potatoes under consideration:

1. Build sufficient cold storage capacity for the improved Dutch potato varieties which do not store well. This will require capital and energy, both of which are in short supply in Bangladesh. Nevertheless, some cold storages are now operated by entrepreneurs who purchase potatoes at 1 taca (21 tacas equals US$ 1.00) per kilogram and sell them at 4-5 tacas in November, i.e. after 8-9 months storage. Because of the profitability of this business, the entrepreneurs may eventually find the capital to build the 300-400 storage units mentioned above. It should be noted, however, that the storages should probably be used for products with a higher value than potatoes, e.g., fruits and fish.

2. Consume the improved varieties (with poor storage qualities) after harvest and place the older varieties (which store better) in storage for later consumption. Except for a small amount of improved varieties that now goes into cold storage, this is the system that is currently operating successfully. Even with the projected increase in potatoes, this system may operate for several years before a surplus appears.

3. Process the improved varieties for later consumption. It is important that such processing have low capital requirements and be easily understood as a small business or cottage industry.

   A recent survey (Poats, et al, 1982, unpublished) indicated that some farm families already practice a simple inexpensive dehydration technology. Commonly, potatoes, either peeled or not, are sliced, cooked for a few minutes in water and then solar dried. Usually this takes place when potatoes have a low price and sufficient quantities are prepared to last several weeks or months. The dehydrated product is fried or boiled and consumed as a snack or vegetable. It is also added to cooking rice to extend the quantity. There is a cottage industry that prepares the fried product for sale by street vendors.

   The making of parboiled rice is a small business enterprise, common throughout Bangladesh and especially around Dacca. Principally, the businesses operate as contractors, performing the parboiling steps for a fee, charging US$ 0.30 to US$ 0.50 to cook, dry and mill 37.3 kg of rice. The size of the enterprises vary between 4,000 and 8,000 kg of rice per day. The steps in parboiling are to steam cook the rice in clay pots or specially constructed cookers, solar dry the cooked rice on a concrete slab and then mill it to remove the bran. They have adequate facilities for cooking using the bran for fuel. They are well versed in solar dehydration and have milling equipment if needed. A potato peeler and potato cutter and perhaps drying trays are the only additional equipment needed to produce dehydrated potato. Additionally, these small-business people are well established and are familiar with buying agricultural food and selling a processed product.

III. OBJECTIVE

The background information was used as a basis for the formulation of a proposed project objective:

> To improve and expand the existing methods of processing potatoes in Bangladesh in order to utilize the planned increase in production, and to establish new small businesses or cottage industries and to improve the incomes of those already established for potato processing by dehydration.

This objective, in order to be feasible, must meet four critera:

1. Any improvement and/or expansion must be applicable to current production-storage-processing-marketing and must consider the viewpoints of the producer and consumer.

2. The proposed change must be acceptable to the culture, beliefs, and lifestyle of the producers and consumers.
   It should not be contrary to any governmental policies and the change must be compatible with existing infrastructures.

3. The proposed change must fulfill a need as perceived by the people and relieve a constraint of the present system. A surplus at harvest can be conserved for later consumption. Or, the productivity of the women, in the cottage industry, may increase.

4. The proposed change must be within the abilities and the resources of the target population. The clients must be able to understand the changes and to relate to the new system. They must have cash or credit to effect the change and consumers must be willing to pay for any increase in prices.

IV. JUSTIFICATION

Normally, potatoes are stored fresh. But as necessary storage time becomes longer (beyond a few weeks) more expensive storage is needed and losses during storage increase. At some point it becomes economically feasible to process the fresh potato for long term storage. Processed potatoes can be stored and transported under conditions not suitable for fresh potatoes. Processing, therefore, can complement or be an extension of storage.

The most common forms of processing are dehydration, canning, freezing, frying and pickling with a vinegar or salt brine. Dehydration, which reduces water content from 80% down to 10% is ideal for products that must be shipped to distant markets as it lowers transportaton costs by as much as 70%. Three factors encourage dehydration of foods:

Storage of dried foods is simple
Transportation of dried foods is easy
A favorable climate (bright sunshine and low humidity) exists where the foods are grown

There already exists in Bangladesh a basic understanding of the principles of potato dehydration and it is practiced at the cottage level. The economics of drying potatoes when the price is low, for use when the price increases, is known. Additionally, the dried potato is used to vary the diet as well as to extend the quantity of rice.

Strategy

The present production-storage-processing-marketing is now operating in a satisfactory manner. However, as the Potato Research Center achieves its objectives of increasing production by 5% each year there may be a point in the future when a surplus may exist with the current system. That point in the future must be anticipated, rather than come as a surprise. Therefore, plans to handle potato surpluses should be given high priority. It will be necessary to have available additional storage/processing to move the planned increase through a well-developed marketing system for later availability to the consumer. With proper planning for storage and processing, postharvest losses in storage and depressed farm incomes can be replaced by a sustained productivity and security for the small farmer.

It was mentioned earlier that potato processing exists to some extent within the current system as a cottage industry. It must be determined whether the cottage industry can be expanded to the extent that the projected surpluses or increases in potato production can be absorbed by these small businesses. In addition, any constraints to their expansion must be identified, as well as the solutions. All aspects of the evolution of cottage industries into small businesses must be studied.

V. RECOMMENDED WORK PLANS

It is recommended that a team comprised of the following people be designated:

1. Project Coordinator. Mr. K.U. Ahmad of the Potato Research Center could very well occupy this position. It should be his responsibility to see that members of the team work together to accomplish the objectives. The Project Coordinator will use whatever sources and resources that are available to predict the point in the future when the planned increases may result in a true surplus. This date will be used to guide the rate at which the project is implemented. It should be revised annually.
2. Sociologist. A Senior Scientific Officer (SSO) from the Agricultural Economics Division. Responsible for the social and economic factors. Reports to the Coordinator.
3. Engineer. A SSO from the Agricultural Engineering Division. Responsible for the design and building of necessary equipment. Reports to the Coordinator.
4. Physiologist. A SSO from the Physiology Section. Responsible for potato physiological knowledge necessary to produce an acceptable processed product. Reports to the Coordinator.

Implementation:

Phase I

Carefully study the existing system of processing potatoes in order to identify the appropriate technology to improve and expand the cottage industry and/or establish small businesses.

This requires only a few months, but it is by far the most important phase. If done thoroughly, positive results should be forthcoming with limited resource costs. If not done thoroughly, then considerable time and resources may be wasted and successful completion of the project may take longer than planned.

The sociologist will study the existing cottage industry and determine to what extent improvements can be made to reduce the household labor and/or expand it to utilize the planned potato production increase.

The following is typical of the information to be collected:

What equipment is used and how can it be improved?
How much time is spent in the preparation of dehydrated potatoes?
How much are produced?
How are they packaged and stored? For how long?
How are they used? Eaten by producers or sold? Fried, boiled, added to rice?
If sold, what is the market? What are special market qualities?
A preliminary economic evaluation will be made.
Identify the more progressive members of the cottage industry. They will be used for later evaluation of equipment and products.

The engineer and physiologist will assist in part of this study to understand better the constraints and possible solutions.

The engineer will, while assisting the sociologist, offer advice on least cost methods of expanding cottage industries and/or establishing small businesses. This advice will be considered in the economic evaluation.

The physiologist will, while assisting the sociologist, observe the specific market qualities of the products and how various potato varieties, prepared in different ways will satisfy the market demands or acceptances.

Phase II

After the team has identified a possible change that is applicable, acceptable, and fulfills a social and economic need the appropriate equipment must be developed. As with any development project it will be discovered that some initial ideas are not practical, while new ideas will appear. Any contemplated change must be evaluated by the operators of the cottage industry. These operators must be involved in the project from the earliest stages. For this reason, the sociologist - as a link to the people - should continually assist in the development process. This phase should take one to two years.

The engineer will react to the findings of Phase I and design, build and test prototype equipment. Equipment will be modified as the project evolves. (It was noted that the BARI Agricultural Museum contains equipment that could be adapted to peel potatoes.) Also refer to Simple Processing of Dehydrated Potatoes and Potato Starch by Roy Shaw (in print).

The physiologist will study potatoes in terms of dry matter, sugar, proteins, after-cooking discoloration, cooked flavor and texture, dried flavor and texture and storage of the dried product. This will be done on the principal varieties, keeping in mind the specific market quality requirements as determined in Phase I. Refer to Simple Processing of Dehydrated Potatoes and Potato Starch by Roy Shaw (in print).

The sociologist will work with the engineer and the physiologist. As information on equipment and market quality accumulates, the information will be taken to the cottage industry households for their evaluation. These evaluations will go back to the engineer and the physiologist to guide their work further.

Phase III

The project is not successful until the technology is adopted by cottage industries and/or small businesses. When the team is satisfied that they have developed suitable equipment that meets all four of the criteria of the objective, a prototype should be installed at suitable sites such as BARI and throughout the potato production areas.

A strong program of demonstration should be developed involving extension personnel and communication experts. All possible adopters should be invited to participate in "field days". Samples of the product should be prepared and distributed. Brochures and informational material should be prepared and distributed.

It should be remembered that changing a system is generally slow and tedious. The more progressive will be the first to adopt the new equipment and concepts. Later, adoption will be made by smaller farmers and those with fewer resources. The passage of months or years will be necessary before the acceptance becomes general throughout Bangladesh.

VI. NOTES

The above applies primarily to the production of solar dehydrated potatoes. In the event that the sociologist in Phase I identifies potato flour as being an important item then the dehydrated potato need only be milled for that product. Potato starch is not a serious consideration at this time. Starch requires potatoes not necessary for the food chain because of excess quantity or poor quality. At this time such potatoes are not available in Bangladesh, although the sociologist may find to the contrary.

Potato alcohol is a capital intensive, complex operation and is generally uneconomical in all but 3 or 4 European countries where potatoes are subsidized. Therefore, it should not now be considered in Bangladesh as a means of absorbing potato surpluses.

The use of existing staff is recommended to implement the work plans because they have the capability of accomplishing this objective. If resources are available, a short study time into India or Peru should be considered for the engineer, and perhaps the physiologist.

VII. BUDGET

An accurate budget is difficult to prepare as costs are unknown. The sociologist will need travel money as will the engineer and the physiologist. The major equipment items are the peeler, the cutter and the drying trays, both for cottage industry and small business. Physiology will need cooking vessels and laboratory items. From previous experience in other countries the following is suggested:

Phase I:	US$ 1,500. Mostly for travel and items for physiology.
Phase II:	US$ 2,500. Equipment construction, testing, modifying. Some travel. Add US$ 4,000 if the engineer does a study tour in India or Peru.
Phase III:	US$ 2,500. Field testing of equipment. Market testing of products.

These are very conservative estimates.

VIII. MISCELLANEOUS

Attention is called to others working on potato dehydration. They could well become involved in this project as unofficial cooperators because they could probably make valuable contributions.

Dr. A.Q.M. Qudousur Rahman
Division of Food Science and Technology
BSCIR Laboratories

Dr. Abul Quasem PSO
Regional Agricultural Research Station
Hathazari, Chittagong

Mrs. Jinnat Ara Begum, Head
Department of Food Technology & Rural Industries
Bangladesh Agriculture University
Mymensingh

There is a shortage of journals and standard potato references in Bangladesh. The following should be purchased for ready use by the staff of the Potato Research Center.

The American Potato Journal
Potato Research (European Potato Journal)
Potato Processing by W.F. Talburt and Ora Smith
Potato: Production, Storing and Processing by Ora Smith
Simple Processing of Dehydrated Potatoes and Potato Strach by Roy Shaw. (Copy will be donated when published in 1982).