

# Application of value-adding technologies in Thailand

Gassinee Trakoontivakorn\*

Institute of Food Research and Product Development, Kasetsart University, 50 Phahonyathin Road,  
Chatuchak, Bangkok 10900, Thailand

## Abstract

Thailand is a tropical country with various kinds of fruits and vegetables available all year round and in substantial amounts. As most agricultural products are limited by their perishability, postharvest technologies are necessary for either prolonging the shelf life of fresh produce or processing agricultural goods into value-added products. Food science and technology can be used to solve problems in these areas. Fundamental food processing such as dehydration, fermentation and preservation are widely practiced. Based on this type of basic processing, many food products are produced either by trial-and-error or through knowledge passed down through the generations. Farmers' housewife groups and small scale-food producers are examples of those who use such knowledge. In addition, government organizations, universities and research institutes now offer many technology-transfer programs to expand knowledge and improve product quality.

The Institute of Food Research and Product Development (IFRPD) is directly involved in the goal of adding value to agricultural products, and undertaking research and technology-transfer programs, as well as offer training courses and various other services—e.g. related to R&D, food quality assurance, and food processing equipment—to empower small food entrepreneurs. Besides that, IFRPD's researchers also act as consultants for medium-size food companies.

In the food market, if there is plenty of processed food available, but with limited variety, the volume of sales for food producers selling the same product will be affected. In this case, research can strengthen the food industry by introducing a wider array of value-added products. In addition, as health concerns of consumers continue to increase, in both developed and developing countries, identifying foods with particular health functions or medicinal properties, or using such properties to add value to foods, can increase sales. This implies that functional foods will have a bright future.

## Introduction

In agriculture, obtaining a high crop yield may not ensure that a farmer makes a profit, as other factors, such as competition in the market, can influence whether the produce can be sold or not, and at what price it sells. Therefore, having knowledge only of production may not be enough for farmers. For this reason, equal importance should be placed on postharvest management of agricultural products as well as production, particularly in relation to technology input. Having a better knowledge of postharvest management would help farmers to reduce their losses and hence improve their standard of living.

In Thailand, expansion of production of livestock, aqua-products, fruits and vegetables is being promoted. Many regions of the country are suitable for growing fruits and vegetables, and sometimes overproduction is encountered. In order to reduce losses and make better use of harvested products, communities need to process their raw agricultural products. However, products from communities or small businesses may face problems in terms of product quality, shelf life, or marketing. A variety of government sectors can assist in teaching such businesses to improve the quality of their products.

The Institute of Food Research and Product Development (IFRPD) has much experience in adding value to agricultural materials, such as food products. Thirty-four years ago, high-protein food products were

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\* Email address: <ifrgnt@ku.ac.th>.

emphasized. Subsequently, the target increasingly became improving the income for people at the 'grass-roots level', such as in rural communities, and this has continued to the present day. Many food-processing technologies were transferred. Now, in the era of promoting good health, IFRPD is also undertaking research on functional foods by investigating the potential of indigenous vegetables. Information on antioxidant and/or antimutagenic activity, for example, could increase the production area and volume of sales for these commodities.

## Government involvement and technology transfer

DEVELOPMENT of the Thai economy is now characterized by rapid growth of industry, commerce, and services. Several governmental sections are involved in driving the national economy, with roles in planning, funding, research and development, and support. Each function is equally important in successfully running a national project. In 2001, the government began a campaign, known as 'One Village One Product', to improve the Thai economy from the grass-roots level by promoting community business through a wide variety of value-added products from agricultural materials, both food and non-food products. The governmental units involved are shown in Table 1.

## Kasetsart University and technology transfer

'Kasetsart University' means university of agriculture. The Department of Agriculture, Department of Forestry, Department of Fisheries, and Department of Agro-Industry cover all aspects of agriculture. Besides these, there are three more institutes working on adding value to agricultural material as follows.

**Institute of Food Research and Product Development (IFRPD)** has been the foremost research and development (R&D) institute of food in Thailand. It was founded as the R&D Unit of the Preserved Food Organization under the Ministry of Defense. Later, it was transferred to Kasetsart University and was accredited with status equivalent to a faculty in 1968. IFRPD's main function is to undertake food R&D using agricultural resources, to increase the quality and quantity of food products to meet the demand of the local people and food industrial development in Thailand.

**Kasetsart Agricultural and Agro-Industrial Product Improvement Institute (KAPI)** was established in 1991. Its main objective was to support R&D of value-added non-food products from raw agricultural materials.

**The Office of Extension and Training** was organized in 1959 and advanced to its present status—equivalent to that of a faculty—in 1973. The Office of Extension and Training is responsible for disseminating information and providing non-formal education services to the public. Its activities include producing extension publications, radio and television programs, conducting training courses, organizing exhibitions, providing subject-matter specialists for training programs, producing audio-visual materials for both instructional and extension programs, and providing venues for meetings and training courses.

## IFRPD and technology transfer, research and product development

IFRPD conducts R&D in food processing, food product development, process improvement, food preservation, quality control, food fermentation, and equipment design. Research is based on fundamental and applied aspects of food science and technology, with emphasis on the development of Thai food agricultural industries. IFRPD also undertakes R&D on technology

**Table 1.** Thai government departments involved in the food and non-food product areas.

Food products	Non-food products
<i>Ministry of Agriculture and Cooperatives</i>	<i>Ministry of Agriculture and Cooperatives</i>
Department of Fisheries	Department of Agriculture Extension
Department of Livestock Development	<i>Ministry of Industry</i>
Department of Agriculture Extension	Department of Industry Extension
<i>Ministry of Industry</i>	<i>Ministry of Labour and Social Welfare</i>
National Food Institute	Department of Skill Development
Department of Industry Extension	<i>Ministry of University Affairs</i>
<i>Ministry of University Affairs</i>	Universities and Institutes
Universities and Institutes	<i>Ministry of Education</i>
<i>Ministry of Education</i>	
<i>Ministry of Public Health</i>	

know-how for food production at the semi-commercial level. Various potential raw materials and resources are developed for utilization and value-adding to obtain new agricultural food products.

### **Technical services**

IFRPD provides consultancy services in the areas of food processing, R&D and manufacturing feasibility to food manufacturers and food industries. In addition, the information center and the library collect and disseminate information on food research and related subjects—both hard copies and electronic databases. Searches and printouts of articles on particular issues can be requested.

In response to the demands for the training courses, IFRPD has provided both local and international training programs to university students, food industry staff, and other interested people. The subjects for these courses include, for example, food science and technology, food processing and quality control, product development and food preservation, processing of fruits and vegetables, rice and soybean processing and utilization, food fermentation, and agricultural waste utilization.

### **Pilot plant equipment and facilities services**

For manufacturers, IFRPD provides thermal process determination and processing services at the pilot-scale level for feasibility and/or marketing studies, as well as design and provision of pilot plant equipment and facilities, in areas such as processing lines, canning and extrusion cooking, machinery for making cookies and noodles, wine and fruit juice equipment, drying equipment etc.

## **IFRPD and value-adding technologies**

### **Solving the problem of malnutrition**

Solving malnutrition was an issue in the Third National Economic and Social Development Plan (1972–1976). The national plan was complemented with an IFRPD project, the Protein Food Promotion Project of 1972–1974. The IFRPD program on nutritional foods actually began in 1968 and included the Developing Protein Food Project in 1970–1972. One of the key objectives of the program was that the raw materials used must be domestic agricultural products. Raw materials or by-products of these agricultural resources were used, such as mungbean, soybean, sesame, fish powder and rice. The high-protein, low-cost food products that IFRPD developed were baby food, canned concentrated soybean milk, textured

vegetable protein, soy snacks and protein-enriched rice noodles.

For baby food, the aim was to formulate a food containing nutrients at a level prescribed in the national standard suitable for babies of three months and older. The product was made from extruded rice and soybean flour mixed with vitamins and minerals. Studies of consumer acceptance in rural areas showed that 87% of mothers on test panels accepted the product.

Two processes for producing textured vegetable protein (TVP) were developed. The first one, developed in 1968, utilized a by-product of mungbean from a bean thread factory, soybean residue from soy milk, and dried fish powder. The product was found to have some disadvantages, including low productivity, long processing time, fluctuating quality dependent on the quality of the raw materials, dark color, inconsistent toughness, and long rehydration time. Therefore, a second formula was developed using soybean flour processed through a thermoplastic extrusion process. By using a cooker–extruder, TVP could be produced at a rate of 150–200 kg/h with more palatable color of yellowish brown. Over the last 15 years, the market volume of TVP has generally increased, as shown in Figure 1. At present, there are several food factories producing TVP to meet the demand for vegetable protein in Thailand.

### **Preserved foods**

IFRPD has endeavored to make use of the many agricultural commodities produced in Thailand, including grains, fruits, vegetables, and animal products. The fundamental food-processing techniques of dehydration, fermentation, sugaring and pickling were adapted for tropical fruits and vegetables, and the knowledge transferred along with the development and promotion of nutritional foods in 1969. During 1982–1986, the Fifth National Economic and Social Development Plan was in effect and had a strong emphasis on rural development through the Rural Poverty Eradication Program. The objective was to improve the standards of rural people. Within this program, IFRPD was in charge of adding value to agricultural products.

In the 1970s, besides the National Economic and Social Development Plan, there were Royal Projects that related to food processing and preservation, and IFRPD was also involved in these projects. The fruit that was intensively developed was peach. At that time, pickled peach was the most popular souvenir from Chiang Mai. Other peach products that were developed were dried fruit, alcoholic fruit juice, fruit juice, jam and glaze. Nowadays, Chiang Mai University is in charge in this duty.

Since the Thai financial crisis, which began in 1997, agriculture-related products, both food and non-food, have been a factor in economic recuperation. Many

production. Together with the government’s ‘One Village One Product’ program, this has led to various types of preserved foods being ‘reborn’ and introduced to the public.

Current activities in this area include:

- technology transfer of preserving techniques for value-added fruits and vegetables
- improving salted mango pickle quality
- introducing various tropical fruit/herb alcoholic beverages
- introducing tropical fruit vinegar.

### Adding value to agricultural by-products

IFRPD’s researchers, in cooperation with governmental and private sectors, are undertaking a project on producing *nata de coco* (‘cream from the coconut’), a dessert food made by bacterial fermentation of coconut milk. The *nata de coco* program began in 1994 and has continued under many projects:

- developing products from coconut, phase 1—November 1994 to April 1995
- developing products from coconut, phase 2—October 1995 to September 1998
- developing machines and processes for *nata de coco*—February 1999 to October 2000
- coconut jelly production for small and medium enterprises (SMEs)—March 2001 to March 2004.

Products similar to *nata de coco* have also been developed using other agricultural raw materials, such as pineapple and sugarcane. Many ways of using these products in meal preparation have been devised and introduced to consumers (Figure 2). The research group expected that within a period of 5–10 years, coconut jelly products would have a volume of sales worth as much as 10,000 million baht (THB).

### Adding value to local vegetables

The sale price of most vegetables in markets is quite low for both commercial and indigenous vegetables.

Sales of indigenous vegetables have substantially declined along with changes in eating behavior. Over the past 30 years, high-protein foods have been promoted, and people living in urban areas adopted this recommendation by increasing their meat consumption. However, this has led to increasing health problems in Thai society, such as obesity, heart disease and cancer.



Figure 2. *Nata de coco* in a variety of shapes for preparing different dishes and desserts.

People in Asian countries such as China, Japan, Korea, Singapore and Thailand have a common belief that foodstuffs also act as medicines. The idea of using vegetables to prevent diseases has been acted on in Thailand since 1998. The properties that IFRPD’s researchers are interested in are antioxidant activity and antimutagenicity. Studies on the antioxidant activity and antimutagenicity of almost 200 species of indigenous vegetables have revealed that many plant species possess great potential as ‘functional foods’. Research to disclose the physiological functional properties of indigenous vegetables is under way in studies to evaluate antioxidant activity in northern and north-eastern foods and to identify active compounds in selected vegetables.

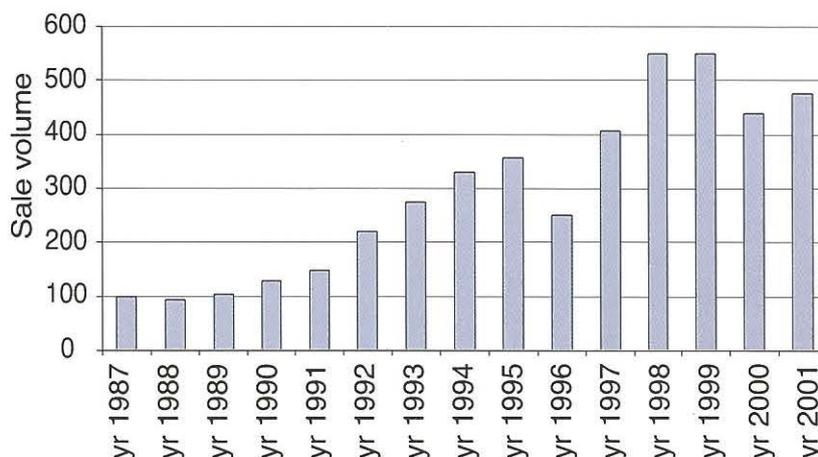


Figure 1. Sales of textured vegetable products in Thailand

Besides their use as functional foods, vegetables with high antioxidant activity are being studied as rancidity inhibitors. It is hoped that this will result in a means of extending the shelf life of deep-fried food products, together with their functional food properties.

In conclusion, food technology offers a means of processing agricultural products to produce a range of

final products. Processing raw materials is a way of adding value to increase the price obtained for these products. Transferring appropriate technologies can lead to improved product quality and production of innovative goods, and thus empower people to compete in the food business.