

## **Training for Fruit and Vegetable Producers**

A three-day training program for fruit and vegetable producers was organized by the Centre of Food Science and Technology, Institute of Agricultural Sciences, Banaras Hindu University from 13–15 March, 2012. Producers and scholars from different states of India benefited from this program and acquired valuable information on fruit and vegetable production and processing practices. Here is a day-wise summary of the program that took place over a period of three days (March 13–15, 2012).

### ***DAY 1: March 13, 2012***

#### **Introduction**

##### **Dr. Anil Chauhan, Professor in Food Technology, Centre of Food Science and Technology, IAS, BHU**

Dr. Chauhan, Convener of this training program, welcomed the participants and resource persons. He emphasized the importance of fruits and vegetables in our diet and discussed the international standards that are followed with regard to utilization, marketing, packaging, production, processing and preservation of fruits and vegetables. Dr. Chauhan gave an overview of the history of traditional fruit and vegetable products in India and their use for poor farmers. He also outlined the objectives and importance of this training program and how it would benefit the participants in the future.

#### ***Introduction to AIP Objectives and CFST Mandates***

##### **Dr. Alok Jha, Coordinator, Centre of Food Science and Technology, BHU**

Dr. Jha introduced the objectives and role of Agricultural Innovation Partnership and explained the CFST (Center of Food Science and Technology) mandates to the audience. He gave a brief overview of the benefits of this training program and the role of CFST. He outlined the traditional vegetable and fruit products in India and acquainted the audience with their strengths and weaknesses. He added that farmers should come up with their own business models to gain maximum benefit. Towards this end, CFST would support all entrepreneurial farmers in different possible ways.

#### ***Current Scenario of Fruit and Vegetable Production and Opportunities for Processing***

##### **Dr. Sudhir Singh, Principal Scientist, Indian Institute of Vegetable Research, Varanasi**

Dr. Singh focused on the current scenario of fruit and vegetable production in the country and processing opportunities. He gave a brief overview of the factors affecting the export/import of fresh vegetables, post harvest management and area covered by horticultural crops. He discussed the overall status of post harvest processing of horticultural crops, which in India has only a minimal 2% share whereas Malaysia has a whopping 83% share. He said that we lose around 25–30% of fruits and vegetables due to poor post

harvest management, handling and processing facilities. Dr. Singh also discussed the status of fruit and vegetable processing, their packaging, drying for edible purposes and how the intake of fruits and vegetables impact our health.

### ***Basic Operations Involved in Fruit and Vegetable Processing***

**Dr. Rakesh Kumar Singh, Professor and Head, Department of Food Science & Technology, University of Georgia, Athens, USA**

Dr. Singh explained some of the basic operations involved in fruit and vegetable processing. He said that while a large number of fruit and vegetable processing industries have their businesses in India, due to lack of proper communication with the industry,, farmers fail to benefit from them. Dr. Singh gave a brief introduction on the export/import of fruits and vegetables in India, specially the mango and blueberry market. He also discussed packaging and preservation of fruits and vegetables and shared ideas on sanitation and hygiene, which form an important part of the whole process. He illustrated different levels of acidity in fruits and vegetables and discussed their correlation with preservation. Dr. Singh also explained the manual procedure to preserving fresh fruits and vegetables for a longer period of time.

### ***Good Agricultural Practices, Prerequisites and HACCP programs***

**Dr. D. Ramkishan Rao, Food Safety Team Leader, National Institute of Food and Agriculture, United States Department of Agriculture, Washington DC, USA**

Dr. Rao illustrated the functions of a typical food chain using a graph. He explained in detail how one could optimize similar set-ups that involve consuming fruit and vegetable products, transportation of food items, processing/packaging making them available at retail stores or restaurants, preparing at home and consumption. He also focused on different types of hazards associated with a food chain, viz. biological (due to pathogens, considered very serious, hence receives maximum attention e.g. *Salmonella*, *E. coli*, *Listeria*, *Clostridium*, *Norwalk*, *Toxoplasma*); chemical (due to antibiotics, pesticides, mercury); and physical (glass, metal, plastic, etc.) which are harmful to users. He emphasized how these hazards affect human health. Dr. Rao also explained GAPs (good agricultural practices) and HACCP (hazard analysis and critical control points) with examples.

### ***Preparation of Fruit-based Jams & Jellies (Pilot Plant Exercise)***

**Dr. S. P. Singh, Professor and Dr. Rakhi Singh, Asstt. Prof., CFST, BHU**

Dr. S. P. Singh and Dr. Rakhi Singh visited the pilot plants at CFST, BHU along with the participants and showed different techniques for preparing fruit-based jams and jellies.

## ***DAY 2: March 14, 2012***

### ***Modified and Controlled Atmosphere Packaging for Fruits and Vegetables***

#### **Dr. O. P. Chauhan, Scientist, Defense Food Research Laboratory, Mysore**

Dr. O. P. Chauhan explained the techniques that are used in Modified and Controlled Atmospheric Packaging for Fruits and Vegetables and discussed how best to deal with post harvest loss. He acquainted the trainees with food packaging practices and the basic principles of storage. He also emphasized on maturity index of different products and enumerated the factors affecting storage capacity. Dr. Chauhan provided insights on the different methods, reasons and instruments related to transpiration, pre-cooling and hydro-cooling system. He also described forced air cooling, mobile forced air cooling, ice topping and vacuum cooling systems. Dr. Chauhan briefed the audience on modified and controlled atmosphere storage for increasing the shelf life of fruits and vegetables. He also focused on other several other aspects like removing CO<sub>2</sub> from the boxes used for packaging and discussed different kinds of losses due to bad storage and packaging.

### ***Microbial Analysis of Fruits and Vegetables (Laboratory Exercise)***

#### **Dr. Arvind, Assistant Professor, Centre of Food Science and Technology, IAS, BHU**

Dr. Arvind demonstrated several experiments to the participants in the CFST laboratory and carried out microbial analyses of fruits and vegetables beneficial for human health.

### ***Drying and Dehydration of Fruits and Vegetables***

#### **Dr. Rakesh Kumar Singh, Professor and Head, Department of Food Science & Technology, University of Georgia, Athens, USA**

Dr. Singh emphasized the significant role of drying and dehydration in fruit and vegetable preservation. He focused on techniques like solar drying, freeze drying, drum drying, spray drying, foam mat and vacuum belt drying, convection air & superheated steam (tray, tunnel) and osmotic drying microwave. He exhibited different types of dryer machines viz. tunnel dryer, hot air dryer, vacuum belt and solar tray dryer. He explained many factors affecting drying e.g. temperature, humidity, air velocity, direction of air flow, type of dryer and type and size of food. Dr. Singh acquainted the farmers and other participants with different techniques used during fruit dehydration in tunnel drying and effective ways of arranging the food items while drying. He also explained to the farmers the nutritional value of dried and dehydrated fruits.

### ***Opportunities in Tomato Processing***

#### **Dr. A. K. Singh, Sr. Scientist, NDRI, Karnal**

Dr. Singh discussed the tomato processing techniques available in the market and the opportunities for small-scale entrepreneurs to tap the expertise of the existing techniques and build on them. Dr. Singh discussed different methods of preparing tomato-based products and the ingredients needed for

preparing those products like tomato pulp, tomato paste, etc. He later threw light on other tomato-based items like ketchup, *chutney*, sauce, soup, etc., which can be easily prepared at home and marketed. He also focused on how budding entrepreneurs could utilize dried tomato slices and make useful, healthy products out of them.

### ***Demonstrating Fruit and Vegetable Processing Unit Operations and Manufacturing Tomato-based Products (Pilot Plant Exercise)***

**Dr. A. K. Singh, Sr. Scientist, NDRI, Karnal; Dr. D. S. Bunkar, Asst. Prof. CFST, BHU and Mr. Mahwash Jaffri, CFST, BHU**

Dr. Singh, Dr. Bunkar and Mr. Jaffri demonstrated fruit and vegetable processing unit operations and manufacturing tomato-based products. They illustrated different methods of preparing tomato-based products like sauce, chutney, pickle and tomato-in-sauce. They recommended several well-proven methods for preparing other fruit and vegetable products to the cottage industry owners and small-scale entrepreneurs.

### ***DAY 3: March 15, 2012***

### ***Developing Antioxidant-rich Value-added Products Based on Fruits & Vegetables (Laboratory Exercise)***

**Dr. A. K. Singh; Dr. Arvind and Dr. Mithilesh Singh**

Dr. Ashish, Dr. Arvind and Dr. Mithilesh demonstrated a number of techniques to develop antioxidant-rich, value-added products based on fruits and vegetables through laboratory exercises.

### ***Low-cost Solar Drying Techniques for Fruits and Vegetables***

**Dr. Rakesh Kumar Singh**

Dr. Singh presented an informative lecture on low cost solar drying techniques for fruits and vegetables. He also explained the use and economics of these techniques.

### ***Technology Used in Preparing Pickles and Beverages (Laboratory Exercise)***

**Dr. A. K. Singh and Dr. O. P. Chauhan**

Dr. Singh and Dr. Chauhan provided an informative lecture on pickle and beverage manufacturing techniques. They emphasized on making vegetable pickles, beverages, lemon squash, orange squash, mango squash, instant soup, chutney mix etc. and briefed on food safety regulations. They discussed lactic acid fermentation, vegetable fermentation and preparing sauerkraut. They also discussed hurdle technology products and osmo-dried products, and explained restructured fruits and vegetables. After the lecture, they demonstrated several different techniques of preparing pickles, beverages, squash, soup and chutney.

## Major Outcomes of the Training Program

The training program, found quite useful by the participants, offered many new ideas. They showed keen interest in obtaining information regarding the current practices and learned different processing and manufacturing techniques for preparing various fruit and vegetable products. The participants benefited from all the lectures, shared their problems and received expert advices. The laboratory exercises meant for both farmers and entrepreneurs generated ideas in their minds for undertaking new business ventures. They expressed their interest in making vegetable pickles, beverages, squash, instant soup, chutney mix, etc. They also expressed interest in drying and dryer machines. The participants exhibited special attention towards quality control practices and safety issues. This international training program was beneficial for the entrepreneurs as well as the farmers. This program, in fact, inspired them to reach out to other farmers and entrepreneurs, share the knowledge and experience gained from this program and develop business models.

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