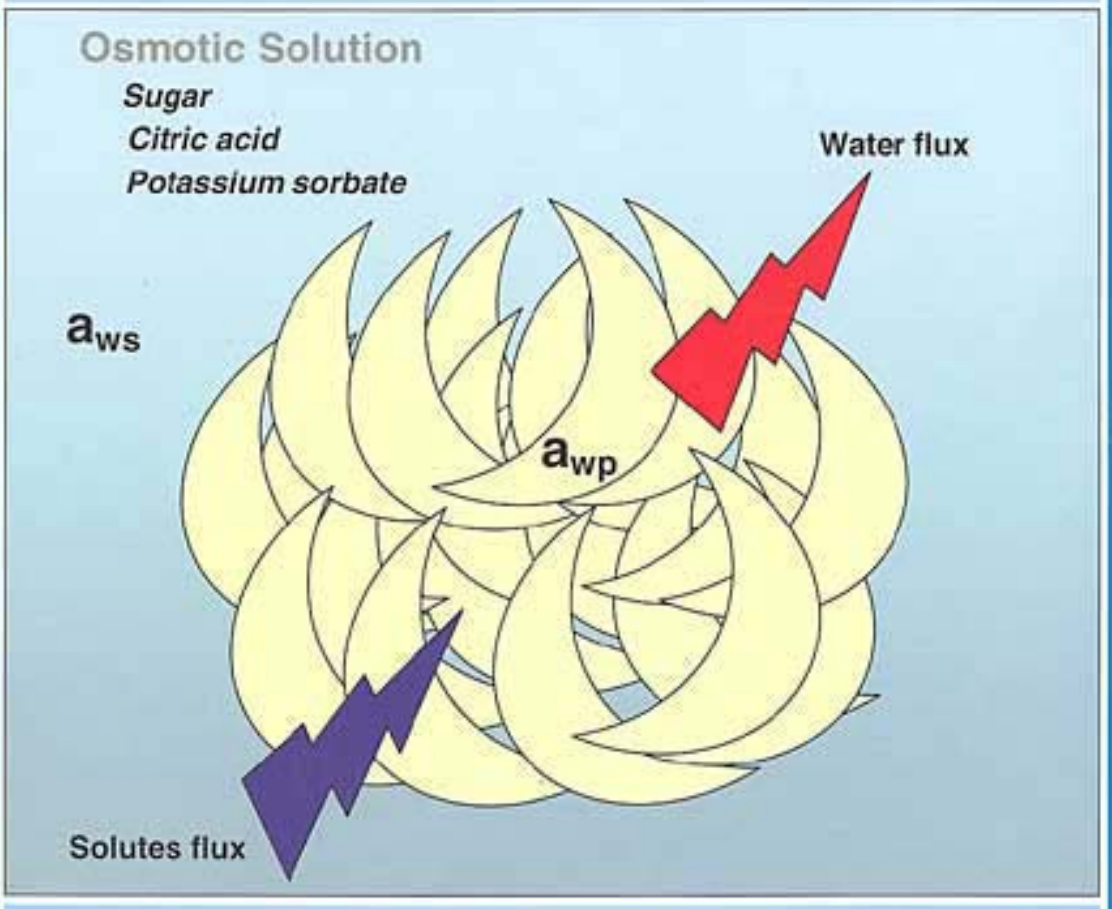
ISSN 1010-1365

FAO
AGRICULTURAL
SERVICES
BULLETIN

149

Handling and preservation of fruits and vegetables by combined methods for rural areas

Technical manual



FAO
FIAT PANIS

FOREWORD

Fruits and vegetables are nutritious, valuable foods full of flavour. However, in the low-income countries, poor care and handling of these crops frequently results in loss of quality, especially when not consumed immediately. In these countries, people are not sufficiently informed on how to make technical choices for better preservation of fruits and vegetables. This manual on handling and preservation of fruits and vegetables by combined methods has been prepared in response to needs, both real and perceived, that surplus crop can be used.

The manual is the result of contributions from a selection of different authors, mainly from countries in Latin America. It contains basic concepts and operations of processing, which are essential for a better understanding and comprehensive approach to the application of the combined methods technology. Some practical examples are described step by step, including calculations and procedures required to set up this technology elsewhere. Likewise, it includes examples of modern processing techniques required to meet the high standards of quality and hygiene for food production.

This manual is divided into five chapters. Chapter one presents a global overview on trading in fruits and vegetables, it shows trends in consumption and considers some of the socio-economic issues involved in the context of post harvest food losses especially during processing and storage. Chapter two describes some concepts of harvesting and post harvest handling, storage and pest control. Chapter three focuses on the importance of the concept of water activities (a_W), and their role in food preservation. Similarly, it describes the concept of intermediate moisture foods (IMF) and the combined methods preservation technology for fruits and vegetables. Chapter four is mostly concerned with fruits, and describes the extension of the intermediate moisture concept to products containing high moisture. The chapter includes the main preliminary operations and formulations. This includes packaging, transport, storage, use of fruits preserved by combined methods and quality control. Chapter five concerns horticultural crops and, in addition to some preliminary operations, describes a number of combined optional treatments such as irradiation, refrigeration, pickling, and packaging, transport and quality control.

Fruits and vegetables represent an important and in many cases an under-appreciated resource which could benefit from better utilisation and exploitation in the rural communities. This manual has therefore been designed as a useful reference book for food producers, traders and processors. Other users include extension agents and rural development practitioners active in the processing and preservation aspects of the food chain.

Geoffrey C. Mrema
Director
Agricultural Support Systems Division
Food and Agriculture Organization

ACKNOWLEDGEMENTS

The authors appreciate and acknowledge Dr. Danilo J. Mejía, Officer of Agricultural and Food Engineering Technologies Service (AGST, FAO, Rome), not only for the Table of Contents he proposed to the authors, but also for his invaluable help throughout the generation and editing of this manual. The authors also want to acknowledge the CYTED (Ibero-American Program to Promote Science and Technology), Subprogram XI for many years of support in developing and promoting the combined methods technology for fruits and vegetables, as well as other commodities.

HANDLING AND PRESERVATION OF FRUITS AND VEGETABLES BY COMBINED METHODS FOR RURAL AREAS

INTRODUCTION

This manual presents information related to the processing of fruits and vegetables by combined methods. It is intended to serve as a guide to farmers and processors of fruits and vegetables in rural and village areas. Information concerning the trade and production of fruits and vegetables in different countries is provided, as well as information on the processing of fruit and vegetable products. The combination of factors such as water activity (a_W), pH, redox potential, temperature, and incorporation of additives in preserving fruits and vegetables is important, and all play a crucial role in improving the shelf life of fresh and processed commodities.

The increasing popularity of minimally processed fruits and vegetables has resulted in greater health benefits. Furthermore, the ongoing trend has been to eat out and to consume ready-to-eat foods (Alzamora et al., 2000). With this increasing demand for ready-to-eat, fresh, minimally processed foods, including processed fruits and vegetables preserved by relatively mild techniques, new ecology routes for microbial growth have emerged. In order to minimize the loss of quality and to control microbial growth, and thus ensure product safety and convenience, a hurdle approach appears to be the best method (Alzamora et al., 2000). According to Alzamora et al. (2000), hurdle technology can be applied several ways in the design of preservation systems for minimally processed foods at various stages of the food chain:

- As a “backup” measure for existing minimally processed products with short shelf life, to diminish microbial pathogenic risk and/or increase shelf life (i.e., use of natural antimicrobials or other stress factors, in addition to refrigeration).
- As an important tool for improving the quality of long shelf life products without diminishing their microbial stability/safety (i.e., use of heat coadjuvants to reduce the severity of thermal treatments).
- As a synergist. According to Leistner (1994), in food preserved by hurdle technology, the possibility exists that different hurdles in a food will not just have an additive effect on stability, but could act synergistically. A synergist effect could work if the hurdle in a food hits different targets (e.g., cell membrane, DNA, enzyme systems, pH, a_W, Eh) within the microbial cell, and thus disturbs the homeostasis of the microorganisms present in several aspects. Therefore, employing different hurdles in the preservation of a particular food should be an advantage, because microbial stability could be achieved with a combination of gentle hurdles. In practical terms, this could mean that it is more effective to use different preservatives in small amounts in a food than only one preservative in large amounts, because different preservatives might hit different targets within the bacterial cell, and thus act synergistically (Leistner, 1994).

During the last decade, minimally processed high moisture fruit products (HMFP), which are ambient stable (with $a_W > 0.93$), have been developed in seven Latin American countries, under the leadership of Argentina, Mexico, and Venezuela. This novel technology was successfully applied to peach halves, pineapple slices, mango slices and purée, papaya slices, chicozapote slices, banana purée, plum, passion fruit, tamarind, whole figs, strawberries, and pomalaca (Alzamora et al., 1995). The methodology employed was based on combinations of mild heat treatments, such as blanching for 1-3 minutes with saturated steam, slightly reducing the a_W (0.98-0.93) by addition of glucose or sucrose, lowering the pH (4.1-3.0) by addition of

citric or phosphoric acid, and adding antimicrobials (1000 ppm of potassium sorbate or sodium benzoate, as well as 150 ppm of sodium sulphite or sodium bisulphite) to the product syrup. During storage of HMFP, the sorbate and sulphite levels decreased, as well as a_W levels, due to hydrolysis of glucose (Alzamora et al., 1995).

The work presented in this manual demonstrates at which stage of maturity a fruit or vegetable should be harvested, and packaged, for optimum storability, marketable life, quality, and all aspects related to final use of fresh and processed products. Some useful examples, figures, and tables concerning the preservation of fruits and vegetables by combined methods are demonstrated

This book also summarizes the basic principles of harvest and post-harvest handling and storage of fresh fruits and vegetables.