

Value from village processing

Second edition

FAO Diversification booklet 4



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Preface

The purpose of the FAO Diversification booklets is to raise awareness and provide decision support information about opportunities at farm and local community level to increase the incomes of small-scale farmers.

Each booklet focuses on a farm or non-farm enterprise that can be integrated into small farms to increase incomes and enhance livelihoods. The enterprises profiled in the FAO Diversification booklets are suitable for smallholder farmers in terms of resource requirements, additional costs, exposure to risk and complexity. The products or services generated by the enterprises are suitable for meeting demand on a growing, or already strong, local market and are not dependent on an export market. However in this particular booklet, export markets are also considered as international trade in primary processed farm products can affect local markets.

The main target audience for these booklets are people and organizations that provide advisory, business and technical support services to resource-poor small-scale farmers and local communities in low- and middle-income countries. It is hoped that enough information is given to help these support service providers to consider new income-generating opportunities and how these might enable small-scale farmers to take action. What are the potential benefits? What are farmer requirements and constraints? What are critical 'success factors'?

The FAO Diversification booklets are also targeted to policy-makers and programme managers in government and non-governmental organizations. What actions might policy-makers take to create enabling environments for small-scale farmers to diversify into new income-generating activities?

The FAO Diversification booklets are not intended to be technical 'how to do it' guidelines. Readers will need to seek more information or technical support, so as to provide farmer advisory and support activities relating to the introduction of new income-generating activities. To assist in this respect,

each booklet identifies additional sources of information, technical support and website addresses.

A CD has been prepared with a full series of FAO Diversification booklets and FAO technical guides, together with complementary guides on market research, financing, business planning, etc. Copies of the CD are available on request from FAO. FAO Diversification booklets can also be downloaded from the FAO Internet site.

If you find this booklet of value, we would like to hear from you. Tell your colleagues and friends about it. FAO would welcome suggestions about possible changes for enhancing our next edition or regarding relevant topics for other booklets. By sharing your views and ideas with us we can provide better services to you.

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Peter Fellows

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Introduction

■ *Primary processing on farm as a livelihood activity*

On-farm primary processing has the potential to improve farmers' livelihoods by both increasing the amount and quality of food available to feed the family, and offering improved opportunities for income generation. Primary processing of crops can provide financial, social and nutritional benefits to individual smallholder families; it can provide opportunities for women to become more involved in commercial activities and more generally contribute towards the development process; and these benefits in turn can have an overall positive effect on local communities.

However, improving smallholder livelihoods by introducing on-farm processing also requires improvements in local infrastructure, training and support, and adequate marketing activities: for example improved utility provision and road infrastructure is needed to enable processing to take place and to transport processed crops to secondary processors and village markets; support and training may be needed to ensure that processed crops

have the required quality and shelf-life to be able to compete effectively; and there must be a local demand for processed crops from buyers who are willing to pay adequate prices to give farmers the required income.

Policy-makers and advisors therefore need to integrate on-farm primary processing into integrated development programmes that address these issues and provide training and support for such initiatives. The successful inclusion of improved primary processing in development programmes therefore requires not only technical expertise to assist smallholders to process crops correctly, but also an appraisal of the diverse and often location-specific economic, cultural and environmental conditions found in farming and food marketing systems. This will enable farmers to adopt the most cost-effective sales and marketing systems and optimise their incomes.

On-farm primary processing is commonly used to prepare crops for storage or for further processing. Examples include preparation procedures such as washing, peeling, sorting and slicing crops; preserving

crops by drying; adding value by milling to produce flours; extracting a component such as cooking oil from oilseeds; or fermenting (see FAO Diversification booklet No. 21 *Traditional fermented food and beverages for improved livelihoods*). Further processing of these crops to produce a wide variety of processed foods is known as 'secondary processing'. Further details on 'secondary processing' are given in FAO Diversification Booklet No. 5 *Processing for prosperity* and FAO Diversification Booklet No.18 *Selling street and snack foods*.

■ **Purpose of the booklet**

This booklet describes opportunities for primary processing as a livelihood activity for smallholder farmers who produce roots and tubers, cereals, legumes, oilseeds, fruits and vegetables and sell them at village markets. The aim is to create awareness and demonstrate to policy-makers and development personnel the opportunities that are available for on-farm processing, and how improvements in commodity primary processing and marketing at village level can contribute to sustainable and improved livelihoods for smallholder farmers and their communities.

Advantages of the livelihood activity

Primary processing has been seen by many development agencies and government institutions as an important method to improve the livelihoods of rural communities. It has the potential to improve nutritional status and food security, and also to improve incomes to individual smallholders and/or the wider village community. These benefits may include:

- Improved short-term storage of fresh produce without excessive losses.
- Preservation of seasonal gluts of crops that would otherwise be wasted.
- Improved health and nutritional status through consumption of crops for a larger part of the year.
- Increased incomes from:
 - sales of processed crops out of season when prices are higher, or
 - adding value to crops by processing them (e.g. milling flours or extracting vegetable oils).



FIGURE 1 *Rice Miller: Rice milling is a common type of primary crop processing in many countries*

(Photo: FAO/ 63682/INPHO)

■ ***Primary processing and the farm household***

Primary crop processing provides numerous benefits to farming households: for example, some types of processing can be easily integrated into normal household activities, particularly at a small (kitchen) scale of operation, where existing equipment, knowledge and skills of household members can be used; processing provides nutritional benefits to the household by preserving foods for periods of shortage; income from sales of processed commodities can be used to directly improve livelihoods, or to expand to other types of crop processing that may require investment in different equipment or training, but give higher returns and greater opportunities for long-term improvement to farmers' livelihoods.

■ ***Enhancing local knowledge, know-how and technology***

Many farming households have the knowledge and skills to preserve their crops, often handed down through the generations. However, the introduction of primary processing can build on and enhance local knowledge and skills by integrating new ways of processing or new types of simple technologies that provide for better preservation techniques,

greater processing efficiencies and yields, and less wastage. New skills and expertise to operate new types of equipment that are learned in order to undertake primary processing are also transferable, and may open up job opportunities for members of farming families (for example providing repair and maintenance services).

■ ***Food preservation and decreased food losses***

In most countries, the majority of crops grow in one or two defined seasons each year and, depending on the type of crop, they are likely to spoil within a few days or weeks unless they are preserved (see Table 1). Losses can occur at all stages during crop production and processing: during cultivation (e.g. damage caused by cassava mosaic virus); during harvesting and handling; spillage during transport; and also post-harvest damage caused by moulds, bacterial blight or rotting, or consumption by birds, rodents and insects (e.g. grain borers, mealy bugs, weevils, termites and mites). Losses can be up to 30-50 percent or even higher with some crops (see Table 2) or on poorly-managed farms. Smallholders who operate good farming, post-harvest, primary processing and storage practices can reduce these losses substantially.

TABLE 1 Rate of spoilage of different parts of fruit and vegetable plants

Part of plant	Time before spoilage starts (days)
Fast growing shoots	1-2
Leaves	2-3
Stems	5-50
Fruits	5-50
Roots and tubers	15-50
Seeds and oilseeds	50+
Bulbs	30-100

Source: FAO.1997. *Guidelines for small-scale fruit and vegetable processors*, FAO Agricultural Services Bulletin No. 127, Rome

TABLE 2 Post-harvest losses of selected crops

Crop	Post-harvest losses (%)	Crop	Post-harvest losses (%)
Cereals/legumes		Fruits	
Barley	9	Apples	14
Groundnuts	10	Apricots	28
Maize	16-18	Avocado	43
Millet	12-13	Bananas	20-80
Oats	14.4	Citrus	20-95
Pulses	10	Papaya	40-100
Rice	8-11		

TABLE 2 Post-harvest losses of selected crops (Cont.)

Crop	Post-harvest losses (%)	Crop	Post-harvest losses (%)
Cereals/legumes		Vegetables	
Sorghum	12-13	Cabbage	37
Soybean	10	Cauliflower	49
Teff	11	Lettuce	62
Wheat	11-17	Onions	16-35
		Plantains	35-100
		Tomatoes	5-50
Roots/tubers			
Carrots	44		
Cassava	30		
Irish potato	5-40		
Sweet potato	15-95		

Source: Adapted from Aphils, 2011, Sandifolo, 2003 and FAO, 1981

Important reasons for processing are to reduce losses and to preserve foods so that they are available out of season. This is especially important during 'lean seasons' (i.e. prolonged dry seasons or winters) when there are few fresh crops available. Primary processing is therefore intended to preserve crops to enable them to be stored between harvests. In countries that have a suitable climate at harvest time, drying is the most common form of primary processing of staple

crops, including cereals, legumes, roots and tubers. This must be carried out in such a way that the crop does not spoil before it is adequately dried, which can be a challenge to farmers if the harvest period does not correspond with dry weather. The dried crop must also be stored correctly to prevent losses arising from damage or consumption by insects, birds and rodents or spoilage by micro-organisms - especially moulds.

Fruits and vegetables may also be preserved by drying as slices or chips, or powdered (e.g. leaves), but there are many other methods of processing that can be used by smallholders to preserve them and prevent losses (see Caste Study 1). Many of these are traditionally done in smallholders' homes: for example

fruit pastes, chutneys, and fermented vegetable and fruit products, including pickles and wine (see FAO Diversification booklet No. 21 *Traditional fermented food and beverages for improved livelihoods*). Each of these products can be stored for future use, either for home consumption or for sale.

CASE STUDY 1 Tomatoes in Nigeria

Tomato is a very important source of vitamins and minerals that are essential for a healthy diet. In many countries, tomato has become an important cash and industrial crop, and in Nigeria it represents about 18 percent of the average daily consumption of vegetable food in the country.

The quality and nutritional value of fresh produce like tomato, is affected by post-harvest handling and storage conditions. Tomatoes are usually harvested when the plant is fresh and has a high moisture content. This high moisture content though increases the risk of spoilage and reduced nutritional content of tomatoes during post-harvest operations of handling, transport and marketing.

An extension programme by the local government in Imeko-Afon, Ogun State, in collaboration with the Agriculture Media Resources and Extension Centre of the University of Agriculture, Abeokuta, was conducted to train tomato farmers in preservation methods for their produce, reduce losses in a cost effective manner, and provide new and improved marketing options for their produce at local level. The various methods highlighted included:

1. Making the tomatoes into paste, juice and ketchup.
2. Preserving the tomatoes by cutting them into slices and drying them.
3. Preserving tomatoes by boiling them, removing the skins and rinsing them. After rinsing, they are put in bottles with water and a teaspoon of preservative.

Overall, the establishment of such on-farm primary processing enterprises should be encouraged as clear advantages pertain not only to the preservation of precious nutrients for the farm family, but also the advantages that small-scale farmers can gain in marketing such processed products at local and village level.

Source: Adapted from Babalola, D.A., Makinde, Y.O., Omonona, B.T. & Oyekanmi, M.O. 2010. Determinants of post harvest losses in tomato production: a case study of Imeko-Afon local government area of Ogun state, Journal of Life and Physical Sciences 3 (2) pp. 14-18

■ *Nutrition, health and safety*

A balanced diet throughout the year is needed to maintain health, and two of the main reasons for primary processing are to maintain a secure supply of food for seasons of shortage (i.e. to provide food security) and to maintain health through an adequate supply of different nutrients in the diet. Cereals, roots and tubers are primarily sources of carbohydrate, and oilseeds are sources of fats, both of which provide energy in the diet. Excepting oilseeds, all crops also supply dietary fibre and varying amounts of proteins, minerals and vitamins that are needed for health. For example, vegetables are often eaten daily as an accompaniment to staple foods in a main meal and fruits are eaten as appetisers, side dishes to main meals, snacks, juices and desserts.

In general, crops have the highest nutritional value when eaten fresh, although minerals, fibre and many vitamins are retained in preserved foods. Some vitamins are lost during processing (especially Vitamin C) but processing by fermentation can increase the vitamin content of foods because of vitamins produced in the food by the fermenting micro-organisms (see Table 3). Correct processing methods help to retain more vitamins and other nutrients, so making the stored foods more nutritious than

foods that are improperly processed. This, together with the larger amount of food available to a family if it has been correctly processed and stored (because of smaller losses through spoilage), can enable family members to have an adequate diet and maintain their health throughout the year.

Drying is one of the main methods of processing crops and when crops are dried quickly to low moisture contents (see Table 4) they are much less likely to suffer damage from mould growth. Proper drying not only reduces food losses (above) but also substantially reduces the risk of ill health or even death from poisons released into foods by some types of moulds. These are collectively known as 'mycotoxins', the most common of which is 'aflatoxin' that is produced by certain types of moulds that can grow on cereals, legumes, oilseeds or tubers, to cause potentially fatal liver damage and cancer. A second risk to health can arise from incorrectly processing moist 'low-acid' foods, including vegetables and root crops. Food poisoning bacteria are able to grow on these foods if they are not properly handled, processed and stored. Fruits, on the other hand, are mostly 'acidic' foods, and although yeasts and moulds can spoil them, the acidity prevents food poisoning bacteria from growing.

TABLE 3 Summary of nutrient changes in foods after drying and fermentation

Process/ product	Change (%)						
	Carotene	Thiamin	Riboflavin	Niacin	Vitamin C	Pantothenic acid	Vitamin B ₆
Fermentation:							
Cabbage/pickled	—	—	43	33	—	—	—
Soybean/Tempeh		41	(+817)	(+488)	73	57	19
Soybean/soysauce		(+400)	(+616)	(+667)	—	—	(+437)
Drying							
Fruits (average for apple, apricot, peach and grape)	6	55	0	10	56	—	—
Vegetables (average for peas, maize, cabbage and beans)	5	<10	<10	—	—	—	—

Source: FAO, 1997. Guidelines for small-scale fruit and vegetable processors, FAO Agricultural Services Bulletin No. 127, Rome