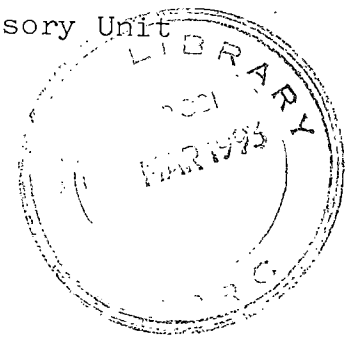
THE MARKET FOR DRIED FRUIT AND VEGETABLES IN MALAWI, TANZANIA AND ZAMBIA

Report on a consultancy undertaken
for the SADCC Post-production
Food Industry Advisory Unit



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June - August 1988

The author thanks all who helped this work reach the stage presented here. First, all who agreed to be interviewed and those who helped to arrange interviews; they are listed in an appendix all to themselves: then those who helped the collected information become this report: all of PFIAU's staff for their constant readiness to put their resources at my disposal; Mrs. Jill Wolfaardt and Agnes Kambuku for their patience with typing, editing, and retyping; Mrs. J. Salbany for the Portuguese translation and Seán MacGarry for the diagrams.

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MERCADO PARA FRUTOS E HORTICOLAS SECOS EM MALAWI, TANZANIA E ZAMBIA

Consultoria levada a cabo para a Unidade Consultiva de Pós-produção das Indústrias Alimentares da SADCC.

Sumário do Relatório

A secagem de hortícolas, ao sol, é tradicional nestes três países e já se fez investigação suficiente sobre métodos melhorados e secadores melhorados, solares, para a tecnologia de secagem pelo sol a ser oferecida àqueles que poderão, potencialmente, usar este método.

A maior parte das áreas nestes três países sofrem ou de escassez de hortícolas frescos ou de um excesso de fruta fresca, dependendo das estações do ano.

Os métodos tradicionais de secagem da mandioca, que podia ser usada mais extensivamente como uma suplemento dos cereais básicos, precisam de ser melhorados.

Todos estes métodos podiam ser utilizados para melhorar a segurança alimentar das populações destes Estados Membros da SADCC. O objectivo deste estudo foi a identificação dos produtos e dos mercados que beneficiariam com a introdução de uma tecnologia de secagem, de custo efectivo, e dos produtos em base experimental assim como das localidades onde poderiam ser estabelecidos projectos piloto para que se fizesse uma testagem, in vivo, dos factores empíricos do mercado e dos parâmetros práticos e económicos de tais empreendimentos.

No Malawi:

1) Verificou-se que os próprios pequenos produtores e os intermediários que vendem hortícolas nos mercados da cidade de Lilongwe ficam cerca de quatro meses por ano sem hortícolas frescos, enquanto os fregueses sofrem com a falta de hortícolas ou com os preços elevados destes produtos durante dois meses por ano. Propõe-se que os instrutores (formadores) dos programas de mulheres, na Divisão de Desenvolvimento Agrícola de Lilongwe (Lilongwe Agricultural Development Division), que inclui os distritos de Lilongwe, Dedza e Ntcheu, sejam ajudados de modo a expandirem o seu trabalho actual na revitalização dos métodos tradicionais de secagem de hortícolas e de fabricação de compotas, de modo a incluírem métodos de secagem pelo sol, melhorados, na esperança de que, com o aumento da possibilidade de secagem de hortícolas, os aldeões sejam encorajados a produzir um excedente de hortícolas suficiente para satisfazer esta procura, podendo isto ser feito tanto com hortícolas frescos como com secos.

2) A divisão de enlatamento da ADMARC (Associação de Desenvolvimento e Comercialização Agrícola - Agricultural Development and Marketing Corporation) mostrou, recentemente, que há um mercado urbano considerável para frutas secas: bananas, mangas, papaias e ananázes, e, a ARDMAC, por si só, não parece ser capaz de satisfazer esta procura. Propõe-se que o Sr. e Sra. Chirwa, produ-

tores de sumos e molhos de fabrico caseiro, em Blantyre, recebam apoio, com ajuda da SEDOM (Organização para o Desenvolvimento de Pequenas Empresas do Malawi - Small Enterprises Development Organization of Malawi), para a sua tentativa na secagem de frutas para o mercado urbano.

3) O Sr. R.N.F.Sauti, da Estação Experimental de Bvumbwe, Limbe, tem uma proposta, já pronta, para um projecto piloto de secagem e moagem de mandioca, em escala comercial, e de armazenamento de farinha de mandioca. Recomenda-se que este projecto seja apoiado.

Na Tanzania:

1) A secagem tradicional de hortícolas é muito usada nas zonas áridas do centro do país, Dodoma-Tabora-Shinyanga, mas podia ainda oferecer maiores benefícios dos que oferece actualmente. Sugere-se que a secagem de hortícolas selvagens, tradicionais, seja incluída no programa do Centro de Formação Rural de Ipala, perto de Dodoma, para que o povo WaGogo, de pastores, nesta região seja encorajado a adoptar, uma agricultura sedentária.

2) A cidade de Dar es Salam sofre de falta de tomates em Fevereiro e Março, todos os anos. A produção de hortícolas está aumentar e podia aumentar ainda mais se se encontrassem mercados, na região de Iringa, em projectos com a assistência da agência de desenvolvimento Irlandesa CONCERN. Propõe-se que estes projectos sejam ajudados na secagem de tomates, para venda, tanto em bocados como em pó, em Dar es Salam nos meses em que o abastecimento de tomates frescos é limitado. Os trabalhadores em CONCERN, nas partes de melhor irrigação na região de Iringa, ao Norte, deviam também ser encorajados a secarem hortícolas para venda nas zonas vizinhas.

3) A maior parte das áreas produtoras de fruta, no país, podiam beneficiar com a introdução de métodos de secagem de modo a reduzir-se as perdas de colheitas de frutas, que são em abundância. Até regiões como Tanga, que já tem uma fábrica de enlatamento de fruta, podiam beneficiar desta tecnologia porque a capacidade da indústria de enlatamento, não é, de longe, suficiente para a quantidade de fruta fresca colhida, quando em estação. Têm de ser feitas mais investigações para se identificar os potenciais implementadores desta proposta. Para começar, os possíveis beneficiários da tecnologia podiam ser a União de Cooperativas de Rungwe-Kyela (Rungwe-Kyela Cooperativa Union), a sul de Mbeya, e os produtores na região de Tanga.

Na Zambia

1) Há uma cooperativa agrícola que está a fazer a secagem de hortícolas e faz compotas, na Missão de Chikuni, na Província a Sul. Os resultados do seu secador de hortícolas podiam ser melhorados e estão à procura de novos mercados nas cidades, por causa da dificuldade em obterem pronto pagamento dos seus fregueses actuais, que são, na maior parte, instituições governamentais na Província do Sul. Propõe-se que seja ajudada na aquisição de vidro para o secador de hortícolas e que se lhes façam outras modificações em relação ao plano do secador, e que os resultados do mercado dos produtos sejam controlados mais cuidadosamente.

2) Há falta de hortícolas, durante todo o ano, no mercado da cidade de Monze. Propõe-se que a secagem de hortícolas seja introduzida aos grupos de nutrição no distrito de Monze, que estão a ser assistidos por instrutores do programa de Desenvolvimento da Diocese de Monze (CR) em co-operação com o Responsável Distrital de Agricultura, para que, tanto a produção de hortícolas como o abastecimento ao mercado da cidade aumente se a secagem puder garantir um mercado para o excedente da produção de hortícolas, na estação..

3) Na cidade de Mpike, o abastecimento de hortícolas é melhor do que em Monze, mas há ainda faltas dependentes da estação. Propõe-se que seja actualizada a formação sobre a secagem de hortícolas que está já a ser providenciada pelo Responsável Distrital de Agricultura e que os membros do Movimento da Juventude Rural Agrícola Católica no distrito sejam encorajados a utilizar métodos melhorados de secagem de modo a que os hortícolas excedentes possam ser secos e vendidos na cidade durante a estação em que há falta de hortícolas frescos.

4) O abastecimento de hortícolas frescos aos mercados da cidade de Lusaka não chega a ser metade da estimativa das necessidades da cidade, e, embora os produtores nos distritos de Mumbwa a Mkushi e perto da cidade possam produzir mais, se o fizessem, só baixariam os preços ao produtor sem tornarem os preços mais baratos para o consumidor. Sem uma redução dos 200%-300% do aumento de preços de hortícolas e fruta nos mercados da cidade, a compra destes produtos nestes mercados não pode aumentar. A solução mais simples para este problema seria que uma empresa para-estatal já existente, tal como a empresa Zambia Horticultural Products Ltd. (Zamhort) interviesse nas estações de fartura comprando aos produtores a um preço mínimo garantido, e vendendo directamente ao consumidor, quando estes produtos estiverem fóra de estação, a um preço máximo garantido. Se isto não resultar, tem de se pensar em fortalecer os Programas da Comissão Nacional de Alimentação e Nutrição e em aumentar o número de grupos de nutrição na cidade, que poderiam ajudar a população urbana pobre a obter a semente e cultivar os seus próprios hortícolas. A secagem havia de garantir que nada fosse desperdiçado e devia assegurar o abastecimento de hortícolas durante a estação em que há falta de hortícolas frescos. Devia também melhorar o estado de nutrição da população mais pobre, porque em Lusaka come-se hortícolas secos em todas as estações do ano, cozinhados com amendoim esmagado, que providencia uma fonte das muito necessárias proteínas.

1. INTRODUCTION

AIM AND OBJECTIVES OF THIS STUDY

Aim:

To enhance food security in the selected SADCC Member States through improving the preservation of fruit and vegetables, thus reducing their seasonality and extending their time and geographic markets.

Objectives:

To identify fruit and vegetable products and markets which would benefit from the introduction of cost-effective drying technology.

To recommend trial products and locations where selected drying technologies could be tested *in vivo* to allow the empirical market research and practical determination of the skill and economic parameters of such enterprises.

GENERAL INTRODUCTION:

Most of the region covered in this study experiences considerable seasonal variation in the availability of fresh fruit and vegetables. This results in wastage of otherwise saleable fruit, of which there is a glut in one season, and, more seriously, seasonal shortage of food, due to the non-availability of vegetables. Traditional eating patterns over this region are:

(a) a light snack in the morning; this is often in fact eaten about 9 a.m. in rural areas, after people have already done two or three hours work in their fields, and

(b) two substantial meals, early afternoon and in the evening, each consisting of a stiff porridge ('ugali'/'nsima'/'bwali') made from grain meal (maize,

millet, or sorghum) or meal made from dried cassava or plantain, depending on the agroclimatic characteristics of each region, with a relish consisting of boiled meat or vegetables. In small areas the stiff porridge is replaced by rice, or by boiled or fried whole plantains.

Fruit, boiled sweet potatoes or cassava, small savoury items like groundnuts, cowpeas or cooked insects, may be eaten between meals, but these are considered as merely snacks; enjoyable if they are available, no cause for concern if they are not, and never replacing a "real meal". One is not considered to have eaten if one has not had stiff porridge and relish.

With increasing population, meat from the hunt no longer plays a significant role in most people's diet, and with the deteriorating economic situation, the meat of domestic animals is eaten less frequently. Vegetables thus play a very important part in the diet, as being the main form of relish. Seasonal shortages can even in some cases mean that if there is no vegetable available, some main meals may be omitted since one does not eat stiff porridge or other staples without relish.

Drying of vegetables in direct sunlight was a traditional response to the seasonal shortages of vegetables, and one that one would expect, could play a more significant role now that relish more often consists of vegetables only. The vegetables most commonly dried in the three countries, varying little from region to region, are the traditional green leaf vegetables: leaves of pumpkin, bean, cassava, some wild vegetables, notably varieties of amaranthus, and okra; also okra pods. Since these are often cooked with tomato and/or onion, some tomato

may in some places be dried with the green leaves. More recently introduced "foreign" green vegetables; all the varieties of cabbage and lettuce, are rarely dried; although in some areas drying of rape is significant. Traditionally, some wild fruits were dried to extend their season, but the drying of fruit was not considered important, just as fruit was, and in most cases still is, considered merely as a snack, while vegetables are an essential part of a real meal.

Although traditional sundrying has been falling into disuse in some areas, the need for preserving vegetables to ensure a constantly balanced diet is perhaps growing, and small farmers could make better use of fruit, for their own consumption or for the market, if they were able to extend its season of availability by preserving some of the crop. This consultancy was commissioned and undertaken with these considerations in mind.

It is possible now to obtain, by quite simple techniques, better dried products than are produced by traditional methods. Drying processes have been studied, and different designs of dryers developed for drying different products. The knowledge of drying methods and dryer design is accessible to anyone who searches the literature: this consultancy was commissioned and undertaken in order to find a few of the many possible ways in which that knowledge could be transferred from the academics and the pure scientists to users who could derive real benefit from applying the technology. This benefit could be in the form of better nutrition due to obtaining a better dried product or a new dried product, or a better income due to being able to market surpluses of fruit or vegetables that would previously have gone to waste.

TECHNICAL ASPECTS

The drying of vegetables in order to preserve them for consumption outside the growing season is known in all the countries covered by this study. Drying of grain crops, such as maize, millet and sorghum, is also well known, and, in areas where they are used as staple foods, cassava and plantains are also dried.

Traditionally, all of these are dried by laying them in the sun, on the ground, on a flat rock, or for maize, in a raised crib or on the roofs of houses where these are flat.

Vegetables and most fruit suffer greater losses of nutrients when dried by these simple methods in the sun than do the grains and other staples. The nutrients which are most easily lost are ascorbic acid (vitamin C) and beta-carotene, which becomes vitamin A.

Vitamin C is lost because as soon as vegetables or fruit are cut, and especially if their temperature is raised, enzymes which are also present in the vegetable or fruit begin to decompose the vitamin C. This can be prevented by either briefly boiling the material in water or steam, to destroy the enzymes (this is done traditionally to green leaf vegetables in some places), or by treatment with sulphur dioxide, either as smoke from burning sulphur or as sulphite or metabisulphite salts dissolved in water; this method is usually used for fruit. We need to note that if vegetables are pretreated (blanched) with boiling water or steam, they must not be boiled for too long or the heat alone will decompose the vitamin C.

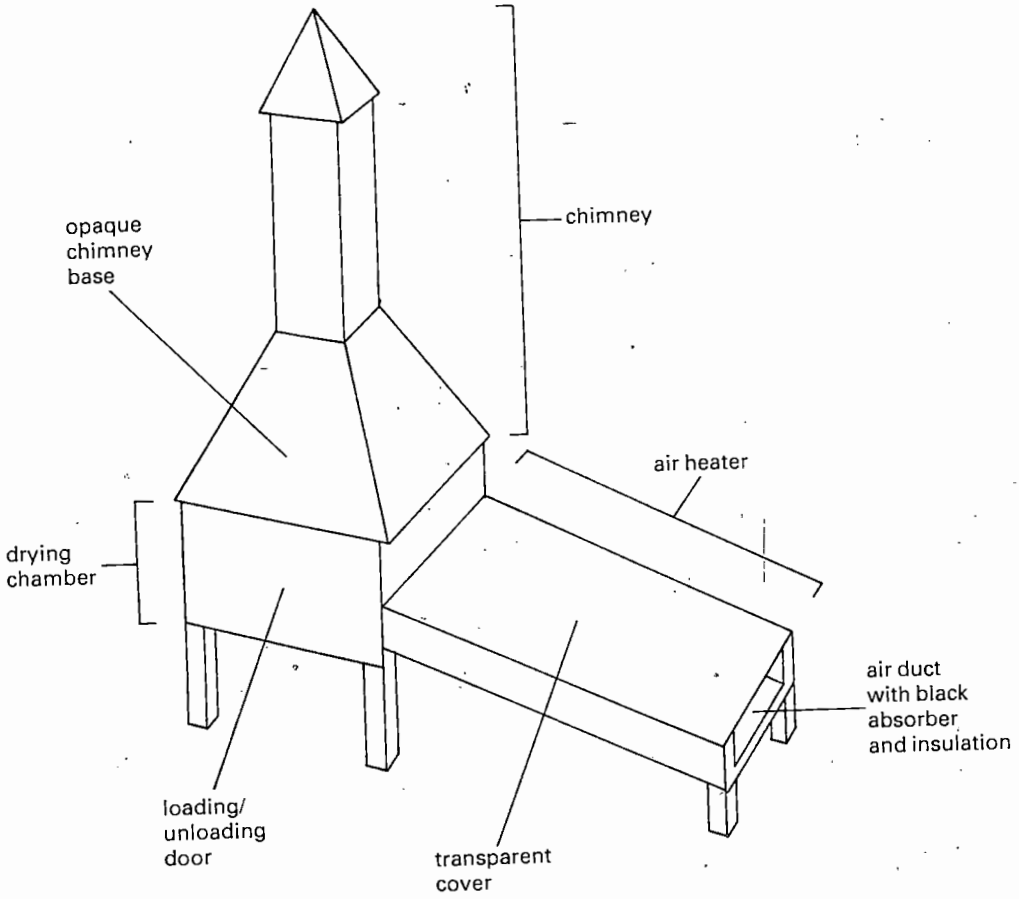


Fig 1. Indirect natural convection solar dryer

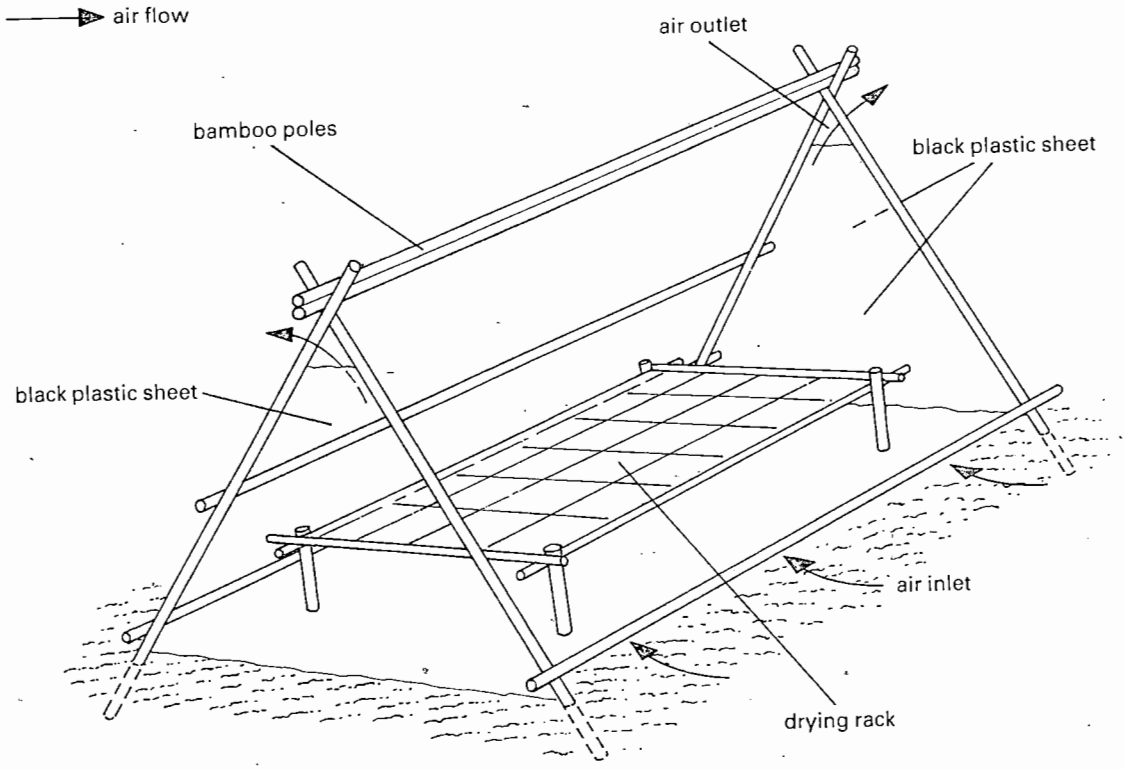
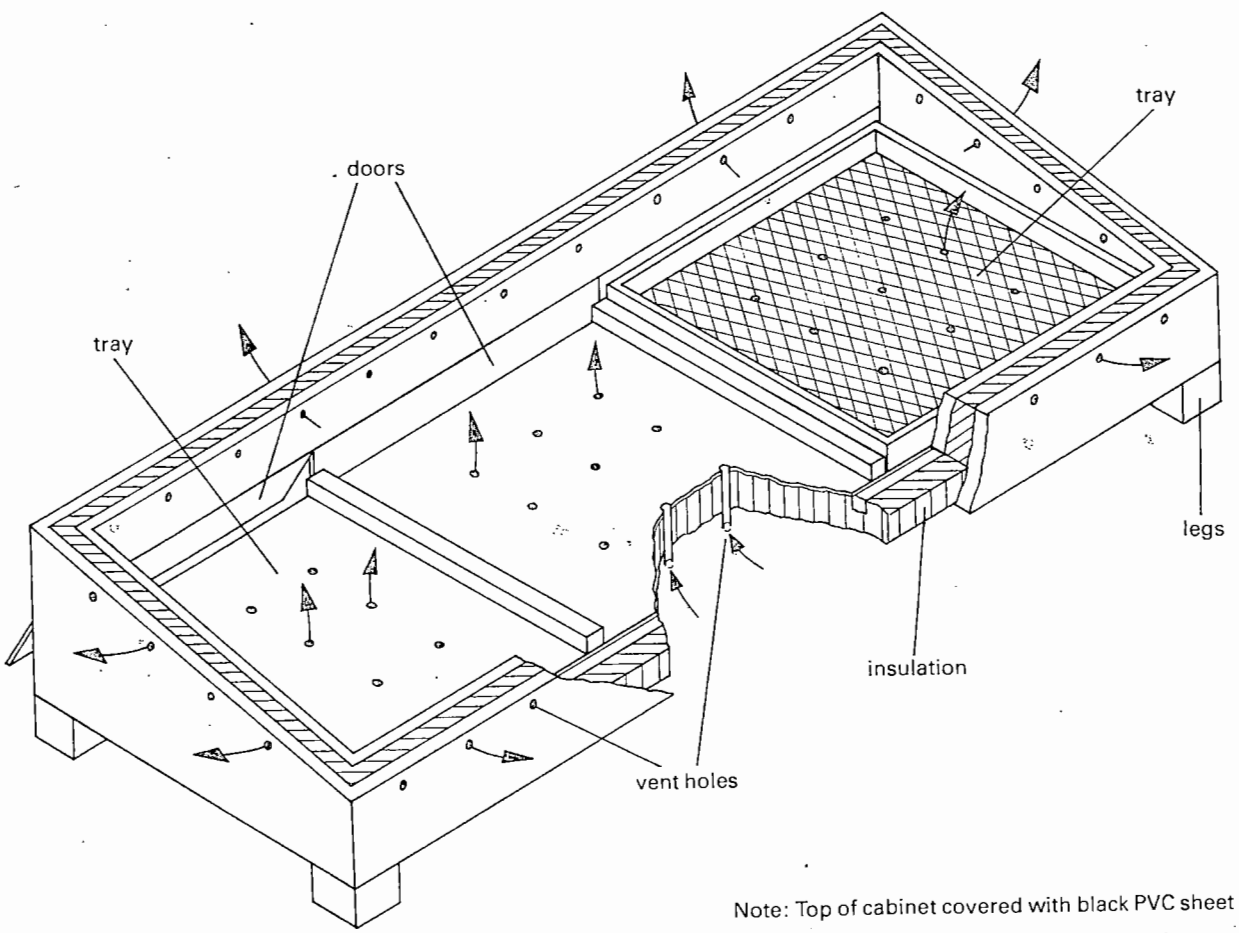


Fig 2. Solar tent (Doe, 1979)



Note: Top of cabinet covered with black PVC sheet

Fig. 3 Cabinet dryer (Brace Research Institute, 1965)

Beta-carotene is destroyed by direct sunlight, and this is the reason why the appearance, texture and taste of traditionally-dried green vegetables are so different from those of the fresh vegetable. This loss can be prevented by drying the material in the shade. A number of designs of dryers are known which can be used for this purpose. These dryers can use either solar energy or some other source of heat. In this study we are mainly concerned with solar dryers.

Solar dryers can be classified as forced convestion dryers, which use another source of power than the sun (e.g. most often an electric fan) to speed the flow of air through or over the material to be dried, or natural convection dryers, which rely solely on heat from the sun to produce a movement of air through or over the material. We are mainly concerned here with natural convection dryers.

These come in two forms; those in which the solar collector, which heats the air used to dry the material, is separate from the drying chamber, in which the material is placed, and those consisting of just one compartment.

Figure 1 shows a dryer in which the air to be used for drying is heated in a separate panel, then flows through the drying chamber under natural convection. The transparent cover of the air heating panel is best made of glass, which makes best use of the greenhouse effect: its transparency to visible light is high, and to infrared radiation is low, so that over 95% of the incident light from the sun passes through to be absorbed by the black lower surface of the panel, while very little of the infrared radiation (heat) radiated from the black lower surface escapes through the glass. Polythene can be used if glass is not available, but it is not so durable, and both more opaque than glass to visible radiation and more transparent than glass to infrared radiation. (See appendix for more detailed treatment of dryer design considerations.)

For best results, both the bottom of the panel and the walls and roof of the drying chamber need to be made of materials that are good insulators of heat.

Figures 2 & 3 show two types of dryers in which the air heating chamber and the drying compartment are one and the same. The covers of both are often made of transparent plastic, in which case the dryers are described as direct solar dryers (the material to be dried is exposed to direct solar radiation), but in order to preserve the beta-carotene in green vegetables or yellow-red fruit, such as mango and pawpaw, the cover of the cabinet dryer and all the walls of the tent dryer should be of black plastic (e.g. PVC) sheet.

It seems possible that satisfactory drying without much loss of beta-carotene (and thus of vitamin A) could be obtained by placing the material to be dried on trays exposed to the air under shade (e.g. under the wide eaves of a roof) in a place where there is a good air draught. This does not seem to have been investigated thoroughly enough.

Different products need different drying conditions, so direct sunlight does no harm to grains or cassava, and it is essential if a satisfactory product is to be obtained in the drying of grapes.

THE FRAMEWORK OF THIS STUDY

The area of interest can best be outlined by defining the terms fruit and vegetable:

Vegetable is taken to mean any plant or part of a plant which is usually cooked and eaten as relish with a starch staple.

Fruit is anything which is botanically described as a fruit and is eaten by people.

With regard to the products under consideration, three situations can be defined where drying could possibly be introduced or improved:

(1) where there is a seasonal shortage of the product (traditional sundrying of vegetables is a response to this situation),
(2) where there is a seasonal glut of product (this is more often observed for some fruit, such as mangoes)
(3) where an existing drying technology or dried product could find a wider use (e.g. dried cassava pounded to make flour).

Cassava may not be a vegetable as defined above, but it is not a fruit, and in some areas it is cooked and eaten as a snack. Some consideration will therefore be given to all its uses.

With regard to potential "markets", four can be defined:
(1) export,
(2) sale in town, or mainly to higher-income groups,
(3) national food security, and
(4) household food security.

Of these, (1) is not a direct subject of this study. No. (4), although not properly speaking a market, is of great importance, and thus receives a good deal of attention in these pages. In different cases considered in the following pages, the relative importance of (2),(3) and (4) will vary, one predominating in one case and a different one in another.

The emphasis on small-scale operations means that most attention will be paid to natural convection solar dryers.

METHOD OF WORKING:

The primary aim of this study is to identify some situations where drying could be useful if it is not already being used, or where, if it is already in use, it could be used more widely or methods could be improved. Within the timeframe allotted to this study, it would be impossible to cover in detail all possible cases that exist. It is enough to detail for some cases the following:

(a) the product(s) to be dried
(b) the market for which the product(s) would be dried, and
(c) who would be the prime implementers of the project.

The key to the method is thus the identification of areas where the introduction, improvement or extension of drying technology would help growers to either improve their own food security or the market for their produce, followed by a visit to the site to confirm or deny the supposition on the spot and to identify the likeliest implementers by name after discussion with them. For each country, therefore, such information as could be found in libraries or obtained from officials of the country's High Commission in Harare was gathered before visiting the country.

On arrival, officials and experts were interviewed; government officials, and officials of development organisations, some because their interest in this area of work was already known, and some because their organisation is well established on the ground in the area(s) likely to be visited. In this connection, the investigator was able to use contacts with, especially, Church organisations which are involved in promoting development. The information gathered from these sources was used to choose likely products and production areas, and likely consumer areas. Some of these areas were then visited, chosen with an eye to the greatest likelihood of a successful possible project being identified. As well as meeting likely implementers and relevant local officials, local produce markets

were surveyed everywhere possible. From data collected on these visits, recommendations are made.

Since the purpose of the study was to identify areas where drying could be the best solution to a local need, some comparison needed to be made in a number of cases with other possible methods of processing fruit or vegetables; canning, making jam or sauce, or extracting juice. If some one of these methods should prove to be the most appropriate way of meeting a local need, then clearly there would be no point in trying to promote drying.

Extraneous circumstances, such as a free weekend or more before the officials and experts could be interviewed, in some cases dictated that likely-looking areas be visited first; such would be the fruit and vegetable markets of the capital city, or a district where some activity of interest was already known to be going on.

This report divides itself into a chapter on each country visited, a chapter bringing together the conclusions and recommendations of the report and a final chapter of general remarks. Appendices containing information that clarifies or enlarges on material in the main report are added at the end.

2. MALAWI

The Situation:

Looking at the overall situation, Malawi seems to have achieved the chief aim of its National Rural Development Programme (NRDP) 1966-86, of becoming self-sufficient in food. By 1981, the only food items imported to a value of over US$ 1 million in a good year were dairy products and eggs, and wheat flour, both of which categories might be considered luxury goods.

The aim in the coming years is to increase smallholder income by increasing cash crop production and improving yields of existing food crops. This goes beyond the earlier aim of helping smallholders to make the most of simple methods and easily available material, such as cattle manure. Government agricultural officials are to co-operate with District Development Committees (DDCs)by:

- advising on better horticultural methods, and use of improved seeds, fertiliser and pesticides in food crop production
- promoting soil and water conservation, by irrigation and by boxed ridging
- promoting the use of animal power, and, where relevant, motorised tillers, offering free training scheme on these
- providing credit, both seasonal for annual inputs, and medium term over 3-5 years for equipment and improved livestock
- promoting beef and milk production by stall feeding, improving the local breeds of cattle and marketing assistance.

All this is needed if smallholders are to hold their own against estate agriculture, which uses only 2,5% of the land, but raised its total production 168% between 1973 and 1987, against a 30% increase in the smallholder sector over the same period, or from 13,9% to 24,9% of total agriculture production.

The structures for implementing the NRDP are the three main departments of the Ministry of Agriculture:

Department of Agriculture, or Agricultural Extension (DCA),

Department of Animal Health and Industry (DAHI), and

Department of Agricultural Research (DAR).

Under the DCA and DAHI, the country is divided into 8 Agricultural Development Divisions (ADDs), each of which has a number of Rural Development Projects (RDPs), each covering several Extension Planning Areas, each of which has a number of village extension workers. Important for the subject of this study is the women's programme of each ADD, employing women extension workers known as Farm Home Assistants (FHAs).

Marketing was effectively controlled by the Agricultural Development and Marketing Corporation (Admarc), which was a big buyer of all agricultural and horticultural produce, although it enjoyed no monopoly. Its strong position in the market enabled it to control the prices even of horticultural produce by intervention buying and selling, but now it only serves this purpose in the marketing of maize, groundnuts and rice. Its functions are now defined (1986) as:

- increasing explort crop production
- supplying inputs
- buying produce and processing
- establishing agroindustries

- running 100 storage depots and markets
- running farms and estates.

Admarc's canning division, producer of canned fruits, jams and juices, is in the process of being sold, so it will become a commercial company buying and selling at the best prices to make a profit for itself and will no longer be able, even if it should seem desirable, to perform its former services to growers and consumers by intervening in the market.

Although Admarc buy maize, rice and groundnuts at controlled prices, the growers are free to sell elsewhere if they wish to do so, and many do sell at lower prices to more accessible dealers, who come to the twice-weekly rural markets.

It is clear that, although national food security has been secured, this does not translate itself perfectly into an adequate food supply for the peasant producers who make up the majority of the population. Official figures admit to an infant mortality rate of 151 per thousand live births in 1985, and maybe 30% of the children born die before their fifth birthday, while two out of three of the survivors are seriously stunted by malnutrition before they reach maturity. Failures to translate high production into benefits for the growers are seen in Machinga and Chikwawa districts, which produce large quantities of mangoes, one of best sources of vitamin A, although they show the highest degree of vitamin A deficiency in the country and general malnutrition is worst in Mtundu, which has a long harvest season for Irish potatoes. Clearly this valuable vegetable is not making its way in sufficient quantities into the cooking pots and the plates of the people who grow it.

One area of interest to this study is the supply of vegetables and fruit to the markets of the still growing city of Lilongwe. Visits to the main market (Town Market) and to a number of suburban and periurban markets (Nanjiri, Mitundu, Area 25, Area 21 (Chilinde), Nathenje- the only daily market in the district, Nkhoma and Chimbiya) on market days showed a wide variety of produce on sale: maize and millet meal, green maize, groundnuts, cowpeas, sweet potatoes, Irish potatoes, varieties of cassava, beans, peas, tomatoes, peppers (both green peppers and chillis), 'cabbage', and fruit in season: orange, nartjies, guavas and pawpaws.

Traditional foodstuffs included green leaf vegetables, fresh and dried ('mfutso'): leaves of bean, pumpkin, okra ('thelele'): sweet potato and 'chewe' (wild okra leaves: not dried), with dried okra pods, cakes of 'chikande' an edible material obtained from anthills, and dried mushrooms ('bowa'). Other dried products are 'chigwada' (dried and powdered cassava leaves) and wild fruit such as 'maula' and 'masawu'. These traditional foodstuffs are still important, even in town, although drying and preparation methods have been forgotten by some, and the total range of diet probably does not still include the 100 food crops listed in a 1938 survey of the Northern Region.

These markets do seem at this season to meet the demand to buy vegetables and fruit, although there are shortages of fresh greens in the early rainy season, and of tomatoes about February. Dried vegetables are sold mainly in the season when fresh greens are not available, but the supply is always small. Prices of staples and vegetables are low in proportion to the prevailing low incomes in the

country. The urban minimum wage is K1.00/day, many industrial workers earn less than K100/month and nearly half of the urban informal sector enterprises have gross earnings of less than K100/month. For comparison, the rural minimum wage is even lower than urban (in 1987, when the urban minimum was K0.81/day, the rural minimum was 58 tambala) and many smallholders are estimated to earn less than K100 per year.

Market prices match low purchasing power; roller meal costs about K11 for a 50kg bag, a large cabbage 18t, 2-3 leaves of 'mpiru' (a green vegetable) sell for 1t. But "shop" commodities are expensive: beef K2/kg even in the markets and a 750ml bottle of cooking oil K2.77, so one notable sight is the sale of cooking oil in small quantities. It even comes in plastic sachets of no more than 100ml capacity. Such processed foods as are manufactured locally are priced beyond the reach of the majority, who earn low incomes: tomato puree K3.76/410g tin, jam K3 or more per 450g tin, fruit juices around K3/750ml bottle. More serious, as affecting essentials, is the disappearance of price control; the prices of 56 items were controlled in December 1983, but this number was reduced to 8 by December 1985, and school fees must be an intolerable burden on most families; fees for the first 5 years of primary school are K450/year in government schools, while private schools and Standards 6-8 in government schools are more expensive, so there is an average 20% dropout rate at every level of primary school every year.

Although the market seems to meet demand, but some estimate that the gap between food production and need is greatest in the Lilongwe plain, the area which supplies the city has not grown with the growth of the city since

a study was done on the sources of Lilongwe's foodstuffs in 1976, although purchases from nearby Dedza and Ntcheu districts have probably increased.

In this situation it is not surprising that in September and October very many urban dwellers cannot afford such vegetables as are available and therefore eat only one meal per day, as nsima without relish is not tasty or satisfying. The growers around the city are even worse off than their customers, being estimated by Dr. B.Mtimuni, of Bunda College of Agriculture, to rarely eat vegetables from July to November. The choice between keeping vegetables for October or selling them to buy soap or salt in July presses most housewives to choose the goods needed for immediate consumption.

Wider use of vegetable drying might help to bridge the gaps in the fresh vegetable supply. Certainly no other form of processed food is affordable. But if its purpose is not to be defeated by daily pressure to find money for essential commodities, it must be accompanied by increased production, in the hopes of increasing quantities for sale and for home consumption. Being able to dry any current surplus production will remove one constraint on further production by reducing possible waste.

Vegetable drying

Solar dryers have been built and tested by Dr. Mwinjilo, of Bunda College and the quality of the products of drying was one of his main concerns, but his version of indirect dryer costs about K40 to build. Dr. Mtimuni has, with the help of her students, built and tested a simple plastic tent dryer which costs about K6 to construct. Mrs. Ayoade, nutritionist in the Ministry of Agriculture in Lilongwe,

claims to have dried green vegetables satisfactorily in trays under shade, such as the wide eaves of Malawi rural houses. Some village women interviewed, however, claim that such drying under shade is too slow to prevent the vegetables rotting before they dry. Vendors in the town markets and their customers were asked in the present study how much they would be prepared to pay for a dryer that gives a better product than traditional 'mfutso'; those who could grasp the idea or accept that it was possible gave estimates varying from K3-5 up to K5-10, so it appears that Mrs. Mtimuni's dryer, made with black PVC sheet, which is available in the Town Market, would be accepted as a worthwhile investment by some, if they could process sufficient quantities of vegetables. Mrs.Shawa, working with the Ministry of Community Services in Blantyre, claims that these dryers, with a capacity of no more than 5kg at a time, are too small. She estimates that a dryer, to be useful, must be capable of drying 12kg at a time. Then she says that the tent dryer might be good enough for one family, suggesting that she was thinking of a single dryer serving a group. Some officials do not think there is a sufficient spririt of co-operation among the general population for a group to share the use of a dryer, but extension workers are more optimistic that farmers' clubs might accept the idea and make it work. Trainers in the women's programme of Lilongwe ADD are reviving traditional methods of vegetable drying and also teaching jam making. In Dedza and Ntcheu districts, some women they have trained make jam from pawpaws, peaches, strawberries and tomatoes, the last being the most common, as being available for a longer season. Village women interviewed in these districts said that because of the cost of airtight jars, K3-4 each, they have few jars and only make three or four jars of jam at a time per

household. This jam keeps well for several months without artificial preservative, but it is usually eaten within three weeks, when more jam is made if the fruit is available. This jam does not therefore contribute to a balanced diet in the season when fresh fruit are not available, being regarded, like the fresh fruit, as a pleasant snack food when it is available, but not missed when it is not. The cost of jars would make the selling price of the jam too high, and the village producers might find some difficulty in buying a regular supply of fresh jars, so they do not make jam for sale or plan to do so in the foreseeable future.

Tomatoes, being one of the more plentiful crops, would seem to offer an opportunity for drying also. Villagers interviewed with FHAs in Nkhande (Ntcheu district) have dried tomatoes and reckoned that if they dried more they could sell them. As to the form in which dried tomatoes would be most presentable to customers, slices or powdered dry fruit to add to relish in cooking, these FHAs said they knew of tomato powder and would teach their women's groups how to prepare it. There is an advantage in promoting this idea, that people do know what they call 'chigwada' dried leaves of cassava, ground to a powder. On the other hand, drying sliced tomatoes is already fairly widely known, even if they are usually dried in only small quantities, mixed with green leaf vegetables, which some of the women interviewed said makes a better mfutso, which keeps for a longer time.

Mangoes figure high on many people's list of new products that could be dried. It is admitted that the common small mango, being too stringy and soft-fleshed, cannot be dried ripe as slices, but several varieties which have been

introduced in recent years by Bvumbwe Research Station and seedlings of which are now available from the tree nurseries, as well as the well-known large mangoes known as mabolowa, have a firmer flesh and could be dried as slices. Further ideas on drying mangoes, such as drying the pulp of the softer varieties into mango bars, as has been tried elsewhere, seemtoo far ahead for the moment. Mrs. Mtimuni has tried drying sliced mangoes and has shown that, if attractively packaged, they meet a demand in the urban market. Mrs. Ayoade reported that dried mangoes have been tried on the staff of a number of district training centres and met a favourable response. However, Mrs. Mtimuni would see dried mangoes as most important as a diet supplement for the producers themselves, but admits that this would need a lot of education, because if people like the product as a snack, they will consume it almost immediately, rather than keeping it for when no ther fruit is available. Even efforts to educate people on the dietary importance of fruit over the radio have not achieved any noticeable change in this behaviour. It seems likely also that the everyday financial pressures would drive most producers to sell any dried fruit to buy immediate necessities rather than saving it for their own family's use later.

It seems possible from all this discussion to recommend that:

The women's programme training scheme in Lilongwe ADD be encouraged to include improved, solar, drying in its instruction on drying for village groups, testing the usefulness of both Dr. Mwinjilo's indirect dryer for groups (farmers' clubs of 10-20 members are the basic building blocks of Malawi's NRDP), and a

small black plastic tent dryer for individual families. At first these should be used to produce improved 'mfutso' from varieties of vegetables that are dried traditionally, for home use and for the market in Lilongwe. Once the method is established for drying these materials, increasing amounts of tomatoes could be dried, for home use and for sale. More market research will be needed to find which form, slices or powder of dried tomato, is more acceptable to consumers. If the producers learn to store some dried tomato for the season when they have no fresh ones, then the drying of mango slices could be undertaken, with the aim of encouraging the producers to keep some dried mangoes for the season when no fresh fruit are available, as well as selling at the lowest possible economic price in town.

It will be necessary to examine realistically whether this programme makes any significant improvement in the diet and nutritional status of the producers, or whether the pressure to sell any saleable products immediately to buy essential commodities is irresistible.

Fruit Processing

A number of enterprises are processing fruit into juice, jams and sauces, and this does seem to provide an income for some rural and urban people. More are attempting to get into this market, but the prices listed above do seriously limit possible sales. Dried products would, being cheaper to produce, reach a wider market.

Some indication of the availability of material for processing can be gained from Admarc's estimates of supply in relation to their demand. They get tomatoes and pineapples from smallholders with whom they contract to supply inputs

and buy the produce; grenadillas come from their own fields, but the supply is never able to meet demand, and strawberries they buy from a sister company which grows them. Other fruit they buy from independent smallholder producers. They buy guavas from Mkolongwe (Thyolo district) and Chiradzulu but they never get enough of the required type and now they are extending their purchasing area towards Ntcheu. Grapefruit and pawpaw, likewise, can never be obtained in sufficient quantities for their plant. They buy mangoes from the lower Shire valley up to Balaka, and bananas from Thyolo, but even in these areas a surplus still exists and a lot go to waste.

Several smaller producers are selling or preparing to sell juices and sauces which will inevitably go almost exclusively to upper-income urban consumers. 'Bliss' brand orange and pineapple juices and chilli sauce are produced by a Mr. and Mrs. Chirwa from their home in Blantyre. They were helped to go into business by the Small Enterprises Development Organisation of Malawi (SEDOM), and claim that their products were being sold before Admarc began to market products produced from practically the same recipes. Although their prices are lower than Admarc's (see Table 2-1):

Table 2-1: Comparative prices of juices and sauce in Blantyre

	Prices:	
Product:	Bliss	Admarc
Orange juice concentrate, 750 ml bottle :	K 2.80	K 3.70
Pineapple juice concentrate, 750 ml bottle :	K 2.85	K 3.80
Chilli sauce, 200 ml bottle:	K 1.70(w)	K 2.60 (approx.)

All prices are retail in Blantyre supermarkets, except (w) wholesale. Admarc's ability to supply larger quantities and more regularly has forced them to reduce production, although Mr. Chirwa still works fulltime on the project, assisted by two women employed part-time when work is available. They can produce in a day either 100 bottles of chilli sauce, 60-70 bottles of orange juice or 50 bottles of pineapple juice, using hand squeezers or a domestic electric blender. They are still determined to hold their share of the market and are even interested in producing dried fruit, in competition with Admarc, who have recently begun to market dried pineapples, mangoes, pawpaws and bananas in Blantyre. Appendix 4 compares the costs of making juice, as given by the Chirwas, with those of drying pineapples, calculated as far as possible from current prices in Blantyre. Since a much smaller quantity of pineapples would be dried in 4 days (at most two batches of 15kg, as against about 200kg) than could be made into juice in the same time, the transport costs for pineapples for drying, a fraction of the cost of shipping a full load, can only be realistic if a full load is bought on every trip made with a pickup; this full load cannot all be dried before it rots unless stored expensively in refrigerators, and as labour is only needed at specific short periods for drying, to fill and empty the dryer, this operation would make most economic sense if, of every load of pineapples bought, a larger part were made into juice and a smaller part dried.

Groups in Bolero Rural Growth Centre, in Rumphi District, and Lobi Rural Growth Centre in Dedza District are beginning to produce juices and marmalade, assisted by Mrs. Mary Shawa of the Ministry of Community Services in Blantyre. The manual juice extracting machine, costing K1 000-3 000, has just been installed in Lobi and Mrs. Shawa does not yet

have any figures on its output or running costs, although she says that its maintenance is simple. Mrs. Shawa, reporting on a recent survey of the prospects for fruit processing in Lilongwe, Karonga and Mulanje districts, said that pineapples are going to waste in Mulanje, near Admarc's cannery.

The Christian Service Committee (CSC), the joint development organisation of all the major Churches in Malawi, currently have a six-month experimental fruit juice and jam producing project, run by two young people at CSC's Blantyre headquarters, under the direction of Mrs. Mary Saukila, but the amount of expensive equipment used and the heavy dependence on purchased citric acid will need to be reduced if any producers are to use their methods to obtain saleable cheap products. A quick comparison with other peoples' recipes suggests that they could usefully treble the amount of fruit per bottle of juice and reduce the citric acid in the same proportion.

Admarc's Canning Division have just begun drying mangoes, pawpaws, pineapples and bananas in two commercial type coffee dryers using electric fans, each drying about 50-80kg fruit per day. The dried fruit is mixed with nuts and sold "at a cheap price" in some Blantyre supermarkets. The products sell very fast, but further information on prices and costs are not yet available. In spite of this, and in spite of the fact that Admarc's canning division is being offered for sale, so that it can be expected to market more aggressively in future, Mr. and Mrs. Chirwa, producers of Bliss fruit juices, are interested in going into competition with them in selling dried fruit. They already buy fruit for their existing operations over a wide area, so they should be able to use any surpluses they can find in the Southern Region.

It is recommended that they be helped, through Mrs.Chiokwa the regional manager of SEDOM in Blantyre, to begin drying sliced mangoes, pineapples, pawpaws and bananas in an indirect solar dryer and to market the products.

Securing supplies of staples - cassava

Over most of Malawi, the staple foodstuff is maize, there being very few areas which are generally too dry to give a good yield. In these areas, mainly the northern shore of Lake Malawi near Karonga and the lower Shire valley, cassava is the staple. However, variable rainfall has meant that in 2 or 3 years over the past decade, the maize crop has been inadequate, and in 1987-8, mealybug infestation severely reduced the cassava crop in Karonga. Policy should aim to use each to supplement the other in any year in which one crop or the other fails.

People in Malawi have a strong preference for white meal to make 'nsima', using super-refined maize meal whenever possible. This makes it unlikely that millet or sorghum would offer practical alternatives to maize as a staple in dry areas; even sorghum meal needs to be white to be acceptable.

Cassava, however, does grow well in arid areas, giving a large yield per hectare under most conditions, and when dried and ground it gives a white meal. Some say that its sticky texture and its taste are not popular, but most people consulted in the course of this study, including ordinary consumers, say it would be acceptable as a reserve to fall back on should the maize crop fail.

Cassava is grown in some quantities in all parts of Malawi; some sources even said that most of the country's cassava production is outside the areas where it is used as the

main staple. People from those regions, even when living in a distant town like Lilongwe or Blantyre, want to be able to buy and eat cassava just as they do at home.

There are two types of cassava; the bitter variety, used to make meal for nsima, and the sweet variety, which is usually boiled or eaten raw as a snack. It is argued by some that growers of 'snack' cassava are unlikely to change over to 'staple' cassava, but others point out that this is precisely what is happening. Traditional hospitality, which allows visitors to pick fruit or other foods for themselves uninvited, means that a large proportion of the sweet cassava planted is taken by casual visitors or passers-by. Growers are therefore switching over to planting bitter cassava, so as to lose less of what they plant.

Even those who propose encouraging a greater reliance on cassava as a staple food do admit that traditional processing and storage methods present some problems. Cassava does not keep well once it is taken out of the ground, so it is usually only harvested in small amounts at a time, leaving most of the crop in the ground for later use. Once the tuber is dug up, it is chopped or sliced and dried, the dried cassava chips then being pounded into flour. Disadvantages of this method are that it takes up land that could otherwise be used to produce another crop. A single crop of cassava, planted and grown in one year and then stored in the ground as it is being slowly consumed over a second year, ties up a whole field for two years. A second disadvantage is that even when it is left in the ground, much of the starch in cassava tubers is converted slowly to more woody

material, so that its food value decreases with time. Mr. R.N.F. Sauti, of Bvumbwe Research Station, has studied cassava processing methods and market acceptability and has now prepared a proposal for a three-year pilot project involving local commercial milling of the crop from about 30ha of cassava in one or more sites, and study of the storage properties of the resulting flour, with the aim of optimising the storage methods.

It is recommended that PFIAU support this project.

The visit to Malawi thus led to three proposals, one on processing and preserving cassava as a staple and support to basic food security, one on commercials drying of fruit mainly for the urban market, and one to improve both nutritional status and income of smallholder families by drying vegetables and maybe, at a later stage, fruit.

In the course of this study, Mr. Alex Shaibu, projects director of the Christian Service Committee, not only facilitated enquiries and interviews, but also cemented his own contacts with most of the people active in this field in Malawi, and thus, it is hoped, assisted in making a workshop on food security in Malawi, which had already been arranged by CSC for 10th-13th August 1988, more successful. The involvement of CSC in implementing these proposals, in whatever way possible, would help provide a unified thrust to projects which otherwise involve different and even disparate actors with disparate objectives.

3. TANZANIA

General situation:

Tanzania grows nearly every conceivable kind of crop within its borders though many in only small quantity, due to the great range of agroclimatological regions it includes: the north, well watered regions with effectively no dry season (two rainy seasons per year), the semiarid central area, centred on Tabora, and stretching beyond Dodoma and Shinyanga, the coast, highlands where temperate zone crops and fruits can grow - around Mbeya, and on the slopes of isolated mountains; Kilimanjaro, Mount Meru, and near Morogoro. Staple crops vary from region to region, there being areas where the staple is maize, sorghum areas, rice areas, cassava areas and banana areas. What food supply problems the country has experienced in recent years can be put down to poor management, poor transport and poor storage, which exacerbate local disruptions such as that currently caused by refugees from Mozambique especially in Mtwara district, and, more seriously, by recent droughts.

It would probably be possible to spell out an opportunity for some form of food processing in any part of the country, to help local growers make the most of the particular advantages of their area, or, in a few places, to minimise the disadvantages, e.g. by extending the season for consuming some foods into the time when very little fresh produce is available. In practice, things are not quite that simple. The drastic devaluation of the currency, by a factor of 5 or 6 over the past three years against the major Western currencies, has had an effect on prices which has not been matched by increases in wages or producer prices for agricultural products. An import liberalisation during this period has increased the flow out of the

country, of such money as there is, undermining local industry and employment. 'Kitenge' cloth from Kenya, India and China undercuts the local product, which is rarely to be found; the local shoe factory and most of the food processing industry are in serious difficulties. This would not have happened if the government was not already in difficulties which led to the acceptance of unpalatable economic prescriptions; government is still very short of money. This means that on more than one occasion during this study government officials pointed out the importance of NGO involvement in any proposed projects if they were to succeed. Locations to visit were thus chosen at least as much with an eye to where promising non-government agents of development could be fairly easily found as to a need for help achieve local food self-sufficiency or to take opportunity of a market for a plentiful local product.

The region in which local food security would seem most likely to be a major problem is the arid area taking in Tabora, Singida and Dodoma Regions and parts of Shinyanga and Iringa Regions. Over much of this area, sorghum is the most reliable staple crop, though maize has made inroads and cassava has been introduced fairly recently. It is in this area that most traditional drying of vegetables is done. A wide variety of local wild and cultivated green leaf vegetables are dried; leaves of pumpkin, sweet potato, cowpea (the leaves are known as 'safwe', the whole plant is 'kunde'), cassava, species of amaranthus, wild ('mchicha') and cultivated, 'mlenda' (like simsim) and the vegetables known as 'tsanza' and that known to the WaGogo people as 'muhilile'. Wild fruit are dried; two that were named were 'ukwaju' (tamarind) and 'rushoto' (identity uncertain). Sweet potatoes are dried, as is

cassava for flour, and in Dodoma District there is some drying of grapes, to meet a high demand for raisins in Dar es Salaam and Zanzibar.

Some conflicting accounts are given of the place of cassava in the food system. It is used to make flour for 'ugali' in Tabora, but some (e.g. Mr. Mganga, Institute of Resource Assessment (IRA), University of Dar es Salaam) claim it is not popular anywhere else, although "the flour keeps a long time" and it is used as a fallback staple in Mtwara; Mr. Sangana (Tanzania Food and Nutrition Centre (TFNC) says it is also made into flour in Mara Region, while Dr. Maeda (Sokoine University of Agriculture) says it is a popular crop in all the coastal Regions and in Mbeya, with no resistance to its use as a standby staple for 'ugali'. He is enthusiastic about mixing it, up to 25%, with other flour, to get a better taste. Others say the problem in accepting cassava flour is the sticky consistency of 'ugali' made from it, and mixing with oher flour can solve that.

Banana flour is admitted to be less popular than cassava, but is must be actually considered inferior, if not disreputable, to eat it; different informants mentioned different parts of the regions with the highest banana production as being places where banana flour is a staple, whether Kilimanjaro, Bukoba, Mbeya, Arusha, Moshi...but visiting such regions or conversation with people from a region that had been named, produced a denial and an identification of a different region as the home of banana 'ugali'. In most of these areas, bananas, when used as a staple, are more often boiled or roasted.

Produce for which there are periodic local surpluses include: tomatoes in many regions, although there are seasons when they are in short supply; November-December in Dodoma, about February in Dar es Salaam; there are

citrus and mango gluts, at different seasons, in Tanga and Morogoro; Morogoro also peaches, and temperate fruits; in Mbeya oranges, lemons, pawpaw, avacadoes (Rungwe District) mangoes and bananas (Kyela); mangoes in Tabora; Dodoma tomato glut in July, guavas also go to waste in season; bananas in Moshi and Bukoba; Iringa pineapples, pears, apples and peaches; in Njombe (east shore of Lake Nyasa) mangoes. This list is not exhaustive, and places special emphasis on areas visited in the course of this study, the information often having come from people in the areas. It is worth noting that, although many people complain about transport difficulties, it does still seem possible and profitable to ship fresh fruit long distances. Dar es Salaam gets fruit from Mbeya and Morogoro Regions, and oranges from Kilwa were on sale in Dar es Salaam in July; the Dabaga fruit bottling factory in Iringa gets some fruit from Tanga and from Kyela, in the southern part of Mbeya Region; mangoes from Tanga, which are available in July (December-January is the season in much of the rest of the country) get to the market in Morogoro and Dodoma; and growers from Tanga sell some of their fruit in Kenya. Some complain of the cost of transporting these fruits such long distances, but there clearly is a market for what is carried. Surpluses going to waste do not necessarily mean that everyone in the growing regions get enough for their own consumption; Dodoma region, which produces large quantities of tomatoes, still has the country's worst vitamin A deficiency.

Even where canning or other processing capacity exists, it can rarely cope with the supply. The National Milling Corporation's (NMC) cannery at Korogwe, in Tanga Region, can handle only 5% of the region's fruit production, though some complaints are heard that growers cannot

deliver their produce to the cannery because of bad roads and other transport difficulties.

The Ministry of Agriculture and Animal Husbandry is responsible for "godowns" (storage depots) in all districts, but complaints were heard that godowns do not offer enough storage capacity when there is a very good crop, and that their capacity is not sufficient to prevent famine when harvests are bad. The parastatal NMC is a major purchaser of most produce; they own the Tangold fruit cannery in Korogwe. However, the immediate purchaser that most growers deal with is their local Co-operative Union, although the central Co-operative Union of Tanzania complained recently of government tardiness in paying them, thus restricting their ability to buy from producers.

The Ministry of Agriculture has Regional and District offices, and in the latter are extension workers specialising in agriculture, horticulture, nutrition etc., who deal with similarly specialised field workers in the Divisions (part of a district) and villages. Dr. Maeda, at Sokoine University, sees this specialisation as an obstacle to efficient operation. He notes that the US Department of Agriculture have extension workers who receive a general training, and in the course of their work can appeal to experts at local universities, and he believes something like this system would be more helpful than the present structures in Tanzania.

Some work has been done on developing and promoting drying. Dr. Maeda, for his M.Sc., did some experiments with a modified cabinet dryer, but this design seems both too expensive and too small to be much use to villagers. His recent work has concentrated more on analysis of nutrients in stored foodstuffs, dried or otherwise. Raymond Swai, at Tengero horticultural college, near Arusha, has done a little more on sun drying.

And so to reports on the regions visited. Due to the short time available, it was not possible in most cases to travel far from the towns.

Dodoma:

This is a dry region, although at least in Dodoma district there is plentiful ground water, for those who can afford boreholes to tap it. Tomatoes are produced in plenty, although supplies do not reach everyone who needs them. Huma village, which has water to grow tomatoes, has the worst vitamin A deficiency in the country. Irrigated gardens, mostly around the city, and some in the city itself, produce vegetables for the market in the city. Most growers eat traditional wild vegetables but grow introduced cultivable varieties only for the market. Those who rely on traditional vegetables, wild or cultivated, without irrigation, experience shortages from August-September until the rainy season. More could be done to either irrigate gardens for growing these vegetables (but who would pay, the vegetables not being seen as a commercial crop?) or to encourage drying to preserve some for dry season consumption. Some drying is already done; sundrying, often on the flat roofs of houses, but losses to pests are high and capacity is small.

The WaGogo people around Dodoma are traditionally pastoralists, and thus semi-nomadic. Non-government development agents say that a large proportion of them are still nomadic, but government officials claim that only about 25% of them are not now settled. Ipala Rural Training Centre, run by the Catholic Church, has programmes designed to train pastoralists in settled agriculture.

So far next to nothing has been done to help the people cultivate the wild vegetable varieties, most varieties of amaranthus, which they prefer to eat themselves. Although

the rate of population growth is just lower than the national average in this Region (3.2% as compared with 3.3%) and the city has not become the administrative capital of the country as planned, pressure on traditional sources of vegetables is heavy, so there is a growing demand for beans and meat for use as 'mboga' (relish), a demand which is unlikely to be satisfied, at least as far as meat is concerned, because of its cost.

Mrs. Mugeya, the nutritionist in the Ministry of Agriculture's offices in Dodoma, has made some efforts to introduce spinach, cultivated amaranthus and cowpeas, and to teach cultivation of wild varieties of amaranthus. Even for the "settled" WaGogo, these activities are for the women, who stay in the village while the men still roam following their herds of cattle. In this situation, it should perhaps be asked whether the women don't have enough work in growing grain for 'ugali', with the cattle providing milk and occasional meat for 'mboga'.

Officials of the Anglican Diocese of Central Tanganyika, the local development partners of Catholic Relief Services (who did at one time run nutrition courses and projects), and of the local Churches, were interviewed. Mr. Patrick Lemanya, of the Anglican diocese, held that vegetables were certainly more important than fruit if one is looking for produce to dry. He sees the main problem as:

- inadequate production in some areas,
- failures of the NMC and the Central Region Co-operative Union (CRCU) to buy from farmers, since NMC fails to pay either growers or CRCU promptly for produce. Farmers therefore sell direct to customers. There is not, in his eyes, sufficient production to present transport problems, and there is need to make small quantity sales more convenient. Few, if any, growers need to sell in bulk.

He believes that there is need to promote the cultivation of local wild vegetables, to provide enough of familiar kinds of 'mboga': 'madyenje', which is a mixture of leaves of pumpkin and 'mlenda; 'muhilile' or 'safwe' cooked mixed with meat and milk; and 'chipari' (another wild vegetable) mixed with ground meat and pounded into a cake. More widespread drying of these vegetables would also help. Mr. Nkya, general secretary of the Lutheran Diocese of Dodoma, agrees with this, pointing out that storage needs attention also, since a significant proportion of food dried on flat roofs is lost to pests, and the amount dried is small because storage capacity is small. Asked what price proucers would be prepared to pay for a dryer that would give a better product than they were used to, Mrs. Mugeye suggested 300 to 500/-, but Mr. Bita, Development co-ordinator in this Region for the Christian Council of Tanzania (CCT), refused to give a figure, arguing that the people themselves would need to hae the opportunity to understand what was being discussed before an answer could be given.

The Anglican diocese carrying on a nutrition education programme at a hospital in Manyoni District (Singida Region; the Anglican diocese comprises Dodoma and Singida Regions and Iringa District), and sees the promotion of these ideas as fitting in well with their existing 'lishe' (human nuturition) projects, which already are operating in 30 villages. Mr. Bita is interested in the participatory research that would be needed, involving both the likely beneficiaries of the programmes and experts, since, as yet, the ideas of the experts, although valid, are not adjusted well enough to the perceptions and the customer of the would-be beneficiaries. Mrs. Mugeye and the Catholic Ipala Rural Training Centre would also be interested

enough for them and the Lutherans, Anglicans and CCT to all take parts in such a programme.

It is therefore proposed that:

> All these agents named be brought together, probably with an expert on food drying, such as Dr. Meeda, to plan a programme of participatory research into the perceived food needs, especially for vegetables, of the local small farmers and pastoralists, to lead to programmes of training in cultivating such vegetables as the users see a need for, and in more effective drying and storage of the vegetables. CCT would be a useful co-ordinating agent, since it already serves this purpose.

Mr. Sagara, the acting Rural Development Director (RDD) for the Region, indicates that government would be pleased to see NGOs undertaking any useful projects, since government's rexources are so limited. It is good to put the proposals through the correct channels.

Other topics relating to drying were discussed with some people in Dodoma. Although the Region does not produce a great amount of most fruits, and the city imports much fruit from other Regions, grape cultivation flourishes in Dodoma District. Dodoma wines have earned themselves a wide reputation, and it is easiest for producers to sell their grapes to the local winery. On the other hand, there is a great demand for raisins in Dar es Salaam and Zanzibar. Growers who want to take advantage of this need to dry their own grapes and ship the raisins at their own expense, but the few who do can get good prices for their produce; some 200/- per kg in Dar es Salaam, and maybe more in Zanzibar. Every congregation of the ELCT/KKKT (Lutheran Church) has an economic committee, and one near Dodoma is undertaking grape cultivation

and drying for this market. For reasons that will be spelled out later (see the section on Iringa) this does not seem to be an activity for which SADCC support would be recommended.

Cassava, as has been mentioned above, has been fairly recently introduced into this area, and is used either as a snack, boiled, or a source of flour to make 'ugali'. The Regional Agricultural Development Officer (RADO), Mr. Mtweve, expressed interest in what he heard of Mr. Sauti's Malawi project proposal on griding, storage and marketing of cassava. He sees storage as a problem; cassava flour cannot be kept for more than 3 or 4 months because in about that period it begins to develop weevils. Mr. Nyka said that the Lutheran Church would be pleased to co-operate in any programme to increase the benefits obtained from using cassava.

These could certainly benefit from the results of Mr.Sauti's cassava project. Perhaps they should be consulted on whether they could usefully take part in the research. Conditions are likely to be different in different countries, so the same work might need to be done in each.

Mbeya:

The area between Mbeya town and the shores of Lake Nyasa includes several different agroclimatological regions, from the fairly high and fairly warm area around Mbeya, through the high, cool and damp, area in the hills, through Tukuyu and Kyela to the low-lying hot area around the lake shore. It takes in part of Mbeya District and all of Rungwe District. The cool region around Tukuyu produces a lot of Irish potatoes and temperate zone fruit. Bananas are plentiful; pineapples do not all sell, and potatoes are in surplus. Lower down, around Kyela and the lake

shore, great surpluses of bananas and mangoes are produced, and Rungwe district is also known for its large production of avocadoes. Some bananas, pineapples, oranges and mangoes are sold in Iringa and in Dar es Salaaam, but transport is expensive. SIDO (the Small Industries Development Organisation) support a fruit juice producing plant,m processing pineapples, oranges and mangoes, but the capacity of the plant is only about 1.5 tonnes per day, nowhere near enough to cope with production. The Region produced an estimated 183 000 tonnes of fruit in 1987, including oranges, mangoes, bananas, pineapples, avocadoes, pawpaws and lemons. A jam factory in Kyela also only scratches the surface. SIDO's Regional Manager, Mr. Nyenye, and desk officers in the office of the Regional Co-operatives Officer were all interested in the possibility of drying, and encouraged the ideas of discussing possibilities with officials of the Keruku Co-operative Union, as the most active representatives of the producers. Glass for constructing indirect dryers is available, and the country imports sodium metabisulphite and sulphur; almost anything else needed for building dryers and carrying out drying operations is locally available.

They recommended discussing possibilities with the branch manager of the Co-operative Union, in Tukuyu, and with District officials. At this point, immigration officials took it into their heads to make difficulties and delays, which, combined with a tight programme (appointments already made for meetings in Iringa the next day) meant that I only reached Tukuyu after the District offices had closed, and the Co-op Union office was closing. The Branch Manager did not want to discuss business, but recommended talking to the Administrative Manager and the accountant of the co-op union, whose offices are in Kyela. They could not be found, despite a search around the town, but this was to be expected as they had long since closed their offices. No concrete recommendation

can be made for any action in this Region, although the need is apparent.

Iringa:

The main attraction of Iringa District, from the point of view of this study, was the already quite successful Dabaga cannery, which is already well known for its tomato and chilli sauces, fruit juices (pineapple, orange, mango, passionfruit and tomato), tomato puree and canned mango slices and pineapple cubes and slices. UNICEF has an official, Dr. Senappa, working on the nutrition and health aspects of food processing in the Region.

The visits identified different agents for a quite feasible development of drying in Iringa.

The Debaga cannery started operations as an activity of a tomato and fruit growers' co-operative, assisted by Catholic missionaries, in the 1950s, but now it is a privately-owned company. The manager, Mr. Desai, shows more interest, as is to be expected for an independent comeercial cannery, in finding supplies of produce to process at a steady rate all the year round in order to keep his factory running most economically, and in products for the upper income urban market, than in the chancier business providing a service to local growers and poor local consumers. Dabaga have their own farm, where they grow pears, peaches, apples and plums; they buy these fruits and also mangoes, oranges, pineapples, tomatoes and passion fruit from local farmers, but to keep their plant running they need to bring mangoes from Tanga and to buy other produce where it is cheapest and the supply is most reliable, rather than just taking what is available in their immediate vicinity. They are diversifying their products, to reduce their earlier heavy dependence on tomatoes. This led them into producing fruit juices and, this year, to start producing tinned peas, beans in tomato sauce, and spagetti in tomato sauce.

The prices of these commodities show that they can only be expected to find a very limited market, although Dr.Desai is convinced that this market is big enough to provide him with a steady income.

Dabaga products found in shops:
(mostly in Morogoro, because a short survey of shops was easier there. The products are found in Dar es Salaam, Mbeya and Dodoma, and their prices compare well with those of similar products under other brand names):

580g mixed fruit jam	125/-
320g peas in brine	70/-
450g beans in tomato sauce	70/-
450ml orange juice	60/-
350ml chilli sauce	150/-

The legal minimum wage in Tanzania is now 1500/- per month, and is unlikely to regain the purchasing power which it had before the recent exchange rate adjustments.

Dr. Kassim Shemsanga, of Sokoine University, has concerned himself very much in the past two or three years with the question of the waste of surplus fruit, vegetables and other produce. Although he has outlined a scheme which shows that a cannery in Morongoro could be kept working throughout the year using local produce, Dabaga's experience shows that the rigidities of a well-equipped cannery's operation mean either that the cannery must be planned for a capacity <u>below</u> the expected production of fruit or vegetables for processing, so as not to run short in a poor season, or aim for a capacity that may frequently exceed local supply, which leads to buying on the national, not just the local, market, and going for the most reliable supplies, in terms of quantity, quality and ability to deliver to the cannery. A comparison of the sample prices given above with an average family's

income, and a consideration of economic trends, give the lie to the hypothesis, which has been stated, that with growing urban population urban tastes will be adopted more widely. Urbanisation is a fact to contend with, as the urban population grows at 7% per year against the overall population growth of 3.3% per year, but at these prices and with expected incomes, most of the new urban population are unlikely to be able to afford "urban tastes".

Mr. Desai, when questions turned to drying, mentioned another local businessman, who is concerned with drying spices and herbs, but a conversation with this man showed that he is thinking heardly even of the urban market; only the export market is reliable and profitable enough for him.

An attempt to find out what had happened to the original fruit growers' co-operative led to meeting with local Ministry of Agriculture and Department of Co-operatives officials, and local development workers of the Irish Foundation for Co-operative Development (IFCD) and of CONCERN, an Irish development aid organisation.

The government officials reported that IFCD are involved in a small enterprise which collects and helps market vegetables from four producer co-operatives in the area of Dabaga, a village some 30-40 km from the town (and having no connection now to the cannery); the planning officer, Mrs. Mayemba, reported surpluses of tomatoes, green vegetables, Irish potatoes, peaches, apples, pears and plums, in the district. Gluts of tomatoes and onions occur every year, and at the present season (in July), the market in Dar es Salaam is flooded with this produce. This surplus is looking for a market. On the other hand, in the rainy season, when pests make tomato cultivation unproductive, tomatoes are in short supply in Dar es Salaam.

The IFCD personnel, in giving an overview of their concerns, said that Njombe District, the part of Iringa Region which borders Lake Nyasa, has great surpluses of fruit and no distribution system for the fruit. The Dabaga "fruit and vegetables co-operative" does not have much fruit. IFCD's interest is in helping people to form co-ops around viable projects and to help these co-ops with extension services and to organise for marketing. Over the six or seven years that they have been operating in Iringa District, some promising increases in local production have been achieved; of note are the 600% increase in dairy production from these co-ops, and the production of sunflower oil from their own seeds with a press introduced with help from IFCD, but almost all this increased production is sold instead of improving the diet of the producers. The economic pressures to sell all saleable produce are strong, when a sheet of galvanised iron for roofing has increased in price five-fold in two years but crop prices have not increased. Discussion of horticultural production led to CONCERN who have two agronomists, one Irish and one Tanzanian, working with projects in three divisions in Iringa region; Ismani, in Iringa District Malingali, in Mufindi District, and Imalinyi, in Njombe. Attention focussed on Ismani Division. Some other Divisions nearby produce enough tomatoes and onions under irrigation to sell their surplus to neighbouring Divisions which lack water. Supply generally meets demand, or would do if transport constraints permitted it to go where the demand is. Ismani, on the other hand, is still producing less than it needs, although a part of it is well watered. There is little fruit grown in the Division, although farmers have been buying fruit tree seedlings in 1988. The Division lies on the Iringa-Dodoma road, stretching from Iringa town halfway to Dodoma.

The SE part of Ismani Division is well watered and has good potential for vegetables and fruit production. CONCERN's aim is to help farmers in this area produce vegetables for sale to the drier parts of Ismani, and a wider market will be needed eventually. Co-operative formation is being encouraged, and building up the people's morale is especially important here. The population of the Division was about 3 500, WaHehe people up to the 1950's. Then came a migration of WaBena farmers from better-watered land to the south, so that the population of Ismani Division peaked at 65 000 in the mid-70s just before the infrastructure collapsed. The WaBena brought an agricultural system more adapted to a wetter region, growing mainly maize and knowing little, because they had so far little need, of vegetable drying. The collapse of the late 1970s led the more enterprising of them to move out, leaving a demoralised and less resourceful remnant behind.

Some beginning has been made at teaching the drying of vegetables, which should help, firstly, self-sufficiency in vegetables within the Division, and then later, drying tomatoes for more distant markets. Selling dried tomatoes to Dodoma or Dar es Salaam during the rainy season shortage has many attractions. Of these two cities, Dar es Salaam seem the likelier to be open to their produce, because transport is easier than to Dodoma. Most lorries travelling from Iringa to Dodoma, (about 100km), leave Iringa full and come back empty, so finding space on lorries already running would be difficult, and running a lorry of their own, which would be most unlikely to find a load for the return journey, would not be economical. On the other hand, many lorries that come to Iringa from Dar es Salaam arrive full and go back nearly empty. This idea seems worth supporting. CONCERN's agronomists, Elias Sambo and Jim Kinsella, can be relied upon to test each stage of the process in consultation with the people

before any big decisions are made. One question which will need to be settled before an attempt is made to market dried tomatoes is: what form should dried tomatoes be presented? Apparently an attempt was made to market powdered dried tomatoes in Moshi, and this was unsuccessful.

Anothe project on CONCERN's which will be worth studying, is the proposal to grow and dry grapes for the market in Dar es Salaam. A four-year research into the technical problems is under way. Questions this must answer include "what variety of grapes to grow?"; so far, it has been decided that they must be seedless grapes, since seedless raisins are demanded. No other local producers seem to be addressing this demand as yet. Dodum grapes are not seedless, and the difficulties facing Dodoma growers in selling raisins, as compared to selling to the winery, mean that Dodoma growers will lose little if Iringa growers get this market.

The visit to Tanzania has shown two areas where a specific drying project would be useful and practical, and shown that there are many more areas where there is a potential for the application of drying to vegetables or fruit, especially important in a country where resources for capital investment in processing are scarce and the majority of consumers are poor, while the inevitably fluctuating volume of horticultural production makes the running of more mechanised processing methods economically unattractive.

4. ZAMBIA

General:

Any Zambian can tell you the importance government places on food self-sufficiency, not yet attained but being brought closer by the government's 'lima' programme, designed to encourage small producers to grow more maize and essential foodstuffs. Much of the country gives the impression of underutilised agricultural potential, except the Southern Province, where, however, in recent years government has removed some small cultivators from land which was being sold to a multinational company for plantation crops which might bring in some foreign currency but will do nothing to reduce Zambia's dependence on food imports. The recent setting of exchange rates by auction, undertaken on IMF advices and stopped after two auctions had reduced the foreign exchange value of the kwacha by about 80%, has made it even more urgent that food imports, like all other imports, be reduced. It also makes more difficult the importation of any goods or equipment that may be needed for food production or processing.

These conditions dictate that any food processing that is undertaken should use the simplest possible methods. However, this can meet with the problem that the product may not satisfy urban tastes, an important consideration since about 40% of Zambia's population lives in urban areas, a large proportion of this being in the city of Lusaka and the Copperbelt conurbation.

Despite all this, production is not the only problem. One hears of unsold produce going to rot in some districts. Transport and processing also need to be improved.

The parastatals Namboard (National Agricultural Marketing Board) and Zamhort (Zambia Horticultural Products Ltd.) are the major bulk purchasers of produce, although marketing is through the provincial co-operative unions. Zamhort used to try to organise marketing of all horticultural produce, but farmers oversupplied, beyond Zamhort's ability to pay; delays in payment led farmers to by-pass Zamhort, who now concentrate on processing the share of the produce which they can easily obtain by making contracts with a certain limited number of farmers. Some prices of products in their main store in Kamwala show that canned fruit, canned vegetables, fruit juices and jams are expensive for the ordinary consumer.

(The minimum wage is K150/month).

Zamhort mango slices (400g tin):	K7.45
" mixed fruit jam (450g tin):	K9.25
" Mango juice (189ml foil pack):	K2.75
Zambia Sugar Co. Strawberry Jam (450g tin):	K8.02
" " " golden syrup (450g tin)	K4.02
Lyons barbecue sauce (440g bottle):	K12.50
Sunquick stawberry jam (450g jar):	K11.90
" honey (450g jar):	K18.50
Chikuni tomato jam (450g jar):	K8.70
Copper Harvest pineapple jam (450g tin):	K9.06
" " pineapple chunks (400g tin):	K8.68
" " baked beans (250g tin):	K5.45
" " peas (250g tin):	K6.01
Heinz/Olivine baked beans (450g tin):	K15.52
Bread (govt.controlled price per loaf):	K4.80

These canned and bottled products cannot be items of daily consumption for the majority of the population.

In the period of the Fifth National Development Plan (FNDP: 1989-1993) targets will be set for increased production of a wide range of fruits and vegetables, continuing the trend of the past few years, with the aims of ensuring food security, with a satisfactory supply to consumers and a quantity of selected products of high quality for export.

Mr. S. Bloomfield, concerned with planning for horticultural production in the Ministry of Agriculture and Water Development (MAWD), is the first to admit that horticultural production is one of the most difficult quantities to measure accurately. In the absence of a single body responsible for managing all horticultural marketing (which never really controlled the market), there is no direct measure available. The best he can do is to take the records of seed sales, and multiply these quantities by average yields expected under normal conditions, but then, comparing the resultant figures with observations, he must assume that a large quantity of that seed is not being used properly, and an appreciable amount may not be used at all, so that a realistic estimate of production of many kinds of produce, such as cabbage, may be no more than a third of the figure first derived from seed sales.

If productivity levels are as low as this, the total production of major commercial vegetables in 1987-8 could have been as low as 270 000 tonnes, amounting to no more than 700g/day for each of the more than one million households in Zambia.

Useful groups of producers (not forgetting that producers are also consumers) are the nutrition groups, found in most districts countrywide. They are co-ordinated by the National Food and Nutrition Commission (NFNC), who are able to give a group a grant of K500 to help them start. Some groups run farms, many run shops, a few raise chickens. Food processing is an important element in their work; traditional methods of drying traditional vegetables are stressed. Groups can also get gifts of skimmed milk powder as a diet supplement if necessary; they watch screening of children for malnutrition at their local clinics. Paid nutrition co-ordinators are employed, and there are annual meetings of representatives of all the groups with the co-ordinating committee, which operates under NFNC. Women's clubs are important in some areas.

Despite some statements heard, to the effect that urban people do not like dried vegetables, quite large quantities (more than in any town or city visited on this study) of traditionally-dried vegetables were seen on sale in the Lusaka markets, and they are apparently sold all the year round. Dried produce seen on sale in markets included okra leaves (either whole, when they are called 'mulembwe', or powdered, called 'pupwe'), pumpkin leaves, bean leaves, dried okra flowers ('lumanda'); cassava leaves are dried in areas that grow the crop. Traditional drying technology is known (although there is apparently a felt need to revive it in some places) in all the areas visited; Southern Province, Lusaka and Northern Province. There is no reason to suppose that the situation is any different in other parts of the country.

Southern Province

Due to a public holiday making officials unavailable for the first few days of the visit to Zambia, a visit was made first to the Chikuni growers' jam making and vegetable drying project, at Chikuni Mission, near Chisekesi. This grew up as an activity of a nutrition group who were growing vegetables and fruit on their individual plots, and aiming to sell their produce in the neighbouring Gwembe valley, which is unsuitable for cultivating vegetables. In 1979 the producers' co-op was registered and jam-making equipment was obtained. They also built a natural convection indirect solar dryer for vegetables, but 1984 they built a larger dryer, using an electric fan for forced convection. Since Chikuni has mains electricity, both drying and jam-making operations use quite sophisticated equipment and require careful control. The jam-making seems to get the attention it needs, but possibly the drying does not. Both were expensive to start, and setting up the project was only made possible by grants from donor agencies who were contacted through Chikuni Mission.

Chikuni jam has an established place in the market, as shown in the list of products and prices above, but supply does not meet demand. Most is sold in the main towns, while people in Southern Province complain of shortages. The Co-op say they are looking for new outlets locally (they sell most through National Import and Export Corporation (NIEC) agencies, who ship to town), but they also say they are aiming to export some jam, since exporters are allowed to retain a proportion of the foreign exchange they earn to buy essential supplies, and this, they hope, will ensure a more regular supply of chemicals. Pectin, sodium benzoate, citric acid and sodium metabisulphite are all imported and the supply is only intermittent. The co-op say that the bigger cause of their working below capacity is the difficulty of obtaining jam jars. The one factory for glass jars in Zambia makes batches of 500 000 at a time, and prefers to deal with big buyers who can take the whole batch. So the factory stands idle for longish periods, waiting for an order for another 500 000 jars. The result is that Chikuni co-op only made 40 000 jars of jam in 1987, although they estimate their plant's capacity at 75 000 jars. Fruit supply to keep the jam factory running comes from their 91 members and 20 applicants for membership, but also from other growers up to 100-150 km away, so, although their own members do not produce enough, the supply is adequate and steady through the year, the seasons for the different fruit being; December-February: mangoes; mid-February-mid-May: guavas; April-June and again in August: citrus fruit; with Cape gooseberries all the year round, and storing surplus mango pulp for making jam when other supplies run short.

The co-op still does not buy the whole saleable surplus of its immediate surrounding area, because growers can get good prices elsewhere for fresh fruit, but there still are a lot of guavas and mangoes for jam making. The co-op aim to increase their membership and to encourage members to increase production.

The dryer only operates for four months of the year, from July to October when there are plenty of vegetables and good drying conditions. They dry mainly commercial varieties of cabbage and their main market has been government institutions, which buy the dried vegetables in 20kg packs, equivalent to 200kg fresh vegetables. Due, in part, to the tardiness of these institutions in paying, the co-op is looking more to small private consumers, selling 100g packs (equivalent to 1kg fresh veg.) through NIEC agencies to urban supermarkets. The foil packets for 100g dried vegetable are no problem; a Dutch donor sent them a supply sufficient for 5 years, and they talk optimistically of earning foreign exchange to buy packs when this stock is exhausted. Weighing and sealing to 100g packets is a labour-intensive operation.

Dried vegetable production was low in 1987, 5 tonnes compared with 8 tonnes in he previous year, and an estimated capacity of 12 tonnes/year, over 4 months operation. The members blame the low level of productivity on the scarcity of vegetables in 1987, but they are not yet satisfied with the performance of the dryer. During our conversation, some points which could be improved were observed : the panel to heat the incoming air consists of two sheets of corrugated iron welded together to give the effect of parallel pipes embedded in a sheet of metal, and painted black. There is no transparent cover and air is able to flow freely in and out of the space below the panel. Air temperatures at the inlet (bottom) of the panel and at the outlet (top), with he fan running long enough to give a stable situation: the temperature at the bottom was 30°C, and that at the top was only 34°C. Addition of a transparent cover to the panel would certainly increase the temperature of the out-flowing air; glass would be best, but even polythene would be an improvement. The air ducts from solar panel to the fan and from the fan to the drying chamber could probably with benefit be redesigned. Mr. Joseph Mwale, of the National Council for Scientific Research (NCSR) keeps in touch with them and should also be able to advise on and supervise the modification of the dryer from a distance.

Although these operations are rather up-market of the main target group of this study, and, despite their apparent financial success, they have only reached their present level of productivity and quality (no-one complains about the quality of their products) with generous outside donor help, so as not to offer a model to be widely replicated, it is recommended that :

> The performance of the Chikuni producers' co-op vegetable drying and jam making factory be monitored, to gain more knowledge of the technical, organisational and economic parameters of such an operation.

There is a possibility that such monitoring will suggest some simplifications for the benefit of other intending users of the technology. It would be worthwhile to provide funds for the modifications in the dryer which have been suggested.

Chikuni, for all its success, down not seem to impinge on its immediate surroundings. In Gwembe valley, the intended consumers of the original nutrition group's produce are still short of fruit and vegetables. Even the distribution of 1 000 orange tree seedlings has not come to much, because most of the seedlings have been killed by drought. And other needs are even more apparent.

The market in Monze town had hardly any vegetables or fruit on sale on the day it was observed, and local people said this is normal. Even in the season when there are no fresh vegetables available, January-February, hardly any local people would buy Chikuni dried vegetables; this may be due to the cost (over K8 for a 100g pack) or also to a preference, if people are going to eat dried vegetables, for varieties which they have always dried; these include pumpkin (both flesh and leaves), okra (pods and leaves), and wild green vegetables such as blackjack and 'chichungwa'. These green vegetables are often cooked with pounded groundnuts.

Trainers, backed by the Catholic diocesan development programme in Monze, and the District Agricultural Officer (DAO), provide training for 78 womens' clubs. These clubs have more need to learn the nutritional value of common vegetables than to learn how to grow them. One method is to let the mother of a malnourished child observe what the child is given in hospital, a good balanced diet, and then to ask what they think cured the child. Women are being taught to make peanut butter, which was previously unknown. Some of the groups are farming, growing maize, groundnuts and some cash crops, such as cotton and sunflower. Four clubs are starting to grow cabbage for their own use and for sale. Traditional vegetable drying methods are being taught to those who may have forgotten; dried vegetables are an important part of the diet from mid-August to the end of November, when there are few fresh vegetables. Dried vegetables can easily be sold in Monze market. The trainers had noticed that the Chikuni dried cabbage, when cooked, resembles the fresh vegetable much more closely than the traditionally-dried products do, but did not know why this was. Many families produce less vegetables than they consume in a year, but the trainers estimate that if drying were more widely used, so that surpluses did not go to waste, many people would produce more than they do. As it is, there is usually an unsaleable surplus of vegetables in Monze in March; much of this could be dried.

At the Monze Agricultural College, a lecturer in the home science department, Mrs. Mavuye, does demonstrate and teach the drying of leafy green vegetables, some root vegetables, including carrots (a fairly new crop in this area) and some fruit, including tomatoes. Some people blanch vegetables by boiling, some do not. Cassava is known both as a snack and a staple in Zambia, but there is very little in Southern Province; it is mainly grown in Luapula province and consumed there and in the Copperbelt towns, so that demand, even in the growing

areas, exceeds supply. The flour does not keep more than about 2 months. A crop department lecturer attributed the low production of cassava to poor extension promotion of this crop. It is agreed to be easier to grow than maize, and to give better yields. When asked what form she thought dried tomatoes would sell best in, Mrs. Mavuye admitted that although she had heard you could powder dried tomato, she had not seen it done and had not tried herself, but she thought it could be accepted. After all, green leaves are sometimes pounded when dried, and one traditional method of treating pumpkin leaves is to pound the leaves, mix them with some ground peanuts, and dry the mixture to a cake, preserving it in this form.

Mrs. Mavuye and the womens' club trainers favoured the idea of improved drying methods, and Mr. A. Mweemba, the DAO, supports the idea, seeing it as offering a source of income, from sales in town, as well as improving the diet of the growers. He noted that traditional vegetables were usually planted between the rows in fields of maize, and that people were returning to this custom after a period in which the accepted wisdom of extension agents had discouraged it. He said that, of a total 14-15 000 households in the District, 11 715 had planted traditional vegetables this year, but the total supply is still below demand, which he estimated at 2kg/day for a family of 8, to give them two good meals. Only 25% of households in the district have enough vegetables all the year round; those who can afford them buy beans, kapenta (costing K10/kg, which lasts 2-3 days), or even tinned vegetables. Meat is beyond most people's reach, with beef costing more than K20/kg, and chicken is no cheaper than beef.

Mr. Mweemba agreed with the womens' trainers that some of the womens' clubs should build dryers to be used by their groups. He proposed that:

> Two clubs should be selected initially to demonstrate solar drying. They should be chosen from among the clubs that may volunteer when the technology has been described to them, so that one club on each side of the railway line that divides the District would build a dryer for its members' use.

Each club has up to 20 members, spread over a radius of no more than 5km. The womens' trainers, estimating an average family's vegetable consumption at 1 kg/day, reckon that each family would then need to dry 100kg

each year, in the season from March to June, making a total of 2 000kg/year/club. They said each member could be expected to contribute K10-20 towards building a dryer, maybe more, as the introduction of a savings development movement (savings clubs) is making it easier for them to assign cash to productive projects. Mr. Mweemba put his estimates of possible contributions higher, but making reasonable estimates of material prices, and assuming users will make their own bricks and cut any timber needed in the construction, two dryers capable of drying a 15 kg batch of vegetables each in 3 days could be built from the K300 lower estimate of a club's contribution. Three, at least, would be needed to provide the full drying capacity needed by the group, but this could be a useful start. Costs are spelt out in Appendix 4(b). Performance of the dryers would be more reliable if a sheet of black-painted corrugated iron could be included in the air heating panel, but this is very scarce and, if available, would be very expensive.

People do like fruit, but do not get a lot and do not miss fruit when they are not available. If any do want fruit in their diet all the year round, they would be town-dwellers or a few educated people in rural areas. The only really common fruit in the area are mangoes, bananas and pawpaws. It is agreed that a lot of mangoes go to waste since they cannot be eaten or marketed in season (January-February). Once drying of vegetables by the groups is established, they might like to try drying some mangoes.

Lusaka:

Mr. Bloomfield, of MAWD, sumed up Lusaka's vegetable supply situation as fairly satisfactory; many vegetables come from the peri-urban areas; tomatoes, onions, green vegetables. These are supplemented by growers in Mumbwa, and some large commercial farms around Kabwe and Mkushi. Although some of the production of the Mkushi area goes to the Copperbelt, prices are not so good there, so much is drawn to Lusaka. He would encourage a few large suppliers, growing under irrigation who could, he reckons, supply Lusaka adequately.

This picture, of a basically satisfactory working city market, agrees with the superficial picture one gets on visiting either Lusaka's main vegetable market ("Soweto") or suburban markets: a good variety of fresh and dried vegetables are on sale, most of the produce sells, but some perishables, such as tomatoes and bananas, remain at the end of the day which will not be fit to sell the next day, and one does not see any large numbers of unsatisfied customers. That is to say, there appears to be a supply that just exceeds the demand, but not by enough to cause gross wastage.

However, if one looks at the market from the producers' point of view, a rather different picture emerges. I joined a group of growers about 30 km outside the city on the morning they were bringing their weekly lorry load (about 5 tonnes) of vegetables to the market. After a short detour to a small market (Northmead) that caters for higher-income customers, where they sold some lettuce and other luxury items, they proceeded, as all the other growers do, to "Soweto". Almost all the vegetables bought in the city come through here; small amounts of luxury items go to the speciality markets, like Northmead and Chachacha Road, and some vendors wait for growers on the road into the city, to buy usually small amounts which they will sell in the streets or maybe in suburban markets. The police work zealously to discourage these hawkers, so it is safe to assume that the bulk of the city's supplies are delivered first to "Soweto" and retailed either there or in the suburban markets. Friday 5th August 1988 was, so the group of growers said, a bit of a slack day but business was not too far below normal levels. A box of tomatoes, for example, was selling at K65, while prices apparently reach K150 in times of scarcity. So a quick estimate of the total mass of vegetables coming into Soweto that morning would give a rough idea of how adequate was the city's supply. A count made the total no more than 70 tonnes of vegetables of all kinds, maybe less because 1-tonne and ½-tonne trucks were all counted as 1 tonne each.

Taking the total population of the city as around 930000 (somewhat under a 7.5% growth since a count of 700 000 in 1984), and the mean household size (Mrs. Luhila of NFNC quoting 1984 figures) as 6.2, this gives 75g/head or 460g total vegetables per household on that day; hardly adequate, and unlikely to be too gross an underestimate.

The growers were then asked why they did not bring more produce to market. They replied that doing so would seriously depress the prices all producers were paid, but without having much influence on the prices the consumers were paying. Markups are high, often being around 300% between the price paid to the producer and that demanded of the consumer in this same market. A bag of about 25 drumhead cabbages, bought from the grower for K35, sell at an average K5 each retail (260% markup); a bag of Chinese cabbage, sold by these growers at Northmead for K30, contained about 50 head of cabbage, which sell at K2 each (230% markup). It seems that any retailer who drops her price (they are largely women) below the accepted level, is made to feel considerable pressure to come into line. The position of the groups of young men who

unload the lorries is not clear. Some of the producers said that they organise unloading and selling to the retailers, taking a 10% levy for their services; others described them as middlemen, saying that they buy the whole contents of each lorry which they then sell off to retailers. In some cases they repackage goods (e.g. putting a boxful of tomatoes into small polythene bags) and this must entail a markup of over 10%.

Since the retail price is being maintained at an artificially high level (and these observations were not made in a season of scarcity, when prices would be considerably higher), above the capacity of an estimated 50% or more of the city's population to pay, the only way to bring consumer prices down to the level of the average consumer would be for a seller big enough to resist peer pressure from middlemen and retail vendors in the market place to undertake to influence prices by intervention buying and selling. Here is a role for Zamhort, involving a must easier aim to achieve than the original ambitious target of handling all horticultural produce marketing, and a more useful one than its present role as one processing company among many.

Failing such influence in the marketplace by a parastatal, we can only look, with little hope, at the prospects of consumers in the high-density suburbs (where housing is provided for rent to low income earners) and shanty compounds (where residents are offered serviced sites to build their own houses) growing their own vegetables. The number of residents in such areas who attempt to grow vegetables on the, sometimes diminutive, plots around their houses is small, and this, as Mrs. Luhila of NFNC maintains, is a priority area for increasing production, if nutrition groups were to form in these areas, but there are very few in urban areas. She only knew of one in Lusaka, one in Kabwe and one in Ndola. She points out that vegetables alone as the only relish will not provide a balanced diet, but makes an interesting argument for the drying of vegetables by lower-income households in Lusaka. In Lusaka, unlike the other towns and cities visited in the course of this study, dried vegetables are sold all the year round in appreciable quantities, because many urban people want to assert their origins by eating a traditional rural food from time to time. This 'mfutso' is usually cooked with pounded groundnuts, and thus makes the basis of a well balanced meal. So a programme aimed at growing more vegetables in urban low-income areas, especially in Lusaka, should include the drying of some of the vegetables and the growing of some groundnuts to eat with the dried vegetables. A programme with these aims is worth recommending. The

most problematic step is the first; forming the necessary nutrition groups. Perhaps targets should be set low at first; if a few clubs can be formed, when they begin to show results, others will want to join in. The recommended programme for such groups would be :

to provide members with seed to grow their own vegetables, as far as possible of familiar traditional varieties; amaranthus, pumpkin, sweet potato, beans. Mostly families will need more land to plant than around their houses; the city council could be asked to make plots of land available to these groups.

Some drying of traditional leafy green vegetables be encouraged; at first this could be traditional sundrying, with some attention to improved cleanliness. This would lead to a need to include groundnuts among the vegetables grown. At a later stage, solar drying could be introduced. Maybe the need will appear quite early, with the greater need to protect drying vegetables from dirt and theft in town.

A visit to the University Teaching Hospital in Lusaka in search of information on malnutrition revealed so much generalised protein-energy malnutrition among children from the city and the peri-urban area that it was clear that many poorer families very rarely give their children any protein-containing relish. Mothers, when questioned, stated that they all gave their children two meals a day of 'nsima/bwali' "with rape". The consistent repetition that the relish used was rape seems as implausible as the larger claim to provide two solid meals a day looked from the condition of the children. The nurse who translated the questions and replies did not believe it.

NFNC say that about 20% of all children in the country along the line of rail are seriously malnourished, and 30% of those away from the line of rail, with some very high concentrations of malnutrition in Lusaka's shanty compounds. Those high concentrations do exist.

Northern Province:

Observing the scarcity of vegetables in the Monze town market, and hearing of similar situations in other small towns, suggested that one more visit be made to a small town where there were prospects of being able to propose a viable project. The choice for a one-day flying visit (all that was possible in the time available) fell on Mpika, in the Northern Province. The choice was influenced more by the thought that a successful project was likely

there than by the degree of need for a project to improve the town's vegetable supply and that of its surrounding area. In fact, Mpika, being on he line of rail (Tazara) may have less need than many towns, but a need had been identified in Monze, also on the line of rail. The shortness of the time available led to considering where any group of development agents with whom I already had contact were most effective on the ground in Zambia. Questions about the Catholic Church's development programme revealed that they are best organised in the dioceses of Monze and Mbala. Travelling to Mbala would have been beyond the budget for the whole study tour, but Mpika, lying in the same diocese, but considerably nearer to Lusaka, offered itself.

On arrival at the Catholic Church in Mpika, a fortuitous gathering of several concerned people was found: Fr.Bob Lavertu, diocesan co-ordinator of development programmes, shortly to move from Mpika parish; some members of the moderately successful Catholic Agricultural Youth Movement (CARYM), and a member of the parish council, Mr. Stan Kalolo, who owns a restaurant in the town and could describe the vegetable supply situation in the town throughout the year. The market was also visited, and, to complete the picture, the DAO was interviewed, as was another restaurant owner, Gabriel Mulenga, who produces a range of jams and sauces on his premises.

The market was much better stocked with vegetables, fresh and dried, than that in Monze. Most maize grown in this area is sold, cassava and millet being kept for home consumption, but sometimes the supply is inadequate. A problem exists in connection with preparing cassava flour in wet weather. The flour has a fairly short shelf life, and in the middle of the rainy season it is difficult to dry the tubers in order to pound them. If they could be helped to find better ways of storing cassava flour in their conditions, this would be very useful. Mpika, with annual rainfall well over 1 000mm, would be a different environment from the dry areas of Malawi where Mr. Sauti proposes to carry out his cassava flour pilot project. Parallel tests in the different situation of Mpika could yield much useful information.

The vegetable supply situation in Mpika was considered fairly satisfactory. There is a shortage of green vegetables early in the rainy season, after months that have been too dry for anyone to grow vegetables without irrigation, and before new rain-fed vegetables are ready for consumption.

Tomatoes become scarce later in the rainy season, as the moisture encourages pests to multiply and few tomatoes escape their depredations. On the other hand, there are times when vegetables can be overproduced, and drying them would provide for seasons of scarcity and at the same time prevent a glut from forcing down the producer price. Traditionally dried products are available, a lot of vegetables being dried at this season (early August); pumpkin leaves, bean leaves, okra pods and leaves, the leaves sometimes being sold as powder ('pupwe'). Mr.Kalolo, the restaurant owner, reported that he gets adequate supplies of green vegetables all the year round, buying mostly from the local agricultural college, and on contract from a few farmers. Supplies of tomatoes are not so reliable; the same system leaves him either undersupplied or paying very high prices in February, although in July and August supply is abundant and prices are very low. He was interested in the idea of powdered dried tomato, which he would accept if it tasted as good as fresh tomatoes. He used to buy packet soups, but they are so expensive now (K14.75 for a packet - 2 or 4 portions - of tomato soup in Lusaka) that he makes his soups from local vegetables. The existence of 'pupwe' in powder form would help people to accept other vegetables in the same form.

The CARYM members were interested in the idea of drying some of their surplus produce. The DAO, Mr. A.Z. Sichamba, said that solar dryers had already been demonstrated in district training courses, but no feedback had been received from the trainees yet. Consideration of possible materials for constructing dryers showed that glass and clear plastic sheet would both be very difficult to obtain, but black plastic (PVC) sheet is obtainable and it would be possible to get some mesh material for making drying trays. These considerations dictate that black PVC tent dryers be used. The products could be stored in one of the two traditional ways: in sealed pots, or wrapped in large leaves, or in paper or plastic bags if they were available. Some Catholic development worker had tried drying rape and had shown that there would be a demand for the dried product if it was available.

It is recommended that:

> some of the CARYM groups in or near Mpika be helped to construct black tent solar dryers and to use them to dry leafy greens and tomatoes in the seasons when those are found in plenty, for the market or for consumption by members of their own groups.

At a later stage, consideration could be given to drying fruit that suffer seasonal glut, especially mangoes, and using this as a start to educating them on the value of fruit in the diet.

One hopeful sign here was given by the informant who estimated that local growers might sell all their maize crop, but do not sell all their vegetables. Own consumption of vegetables takes priority over cash income.

Mpika seems a good site for such a project to succeed in, and less favoured areas could be helped in the long run if producers in Mpika first show that it can work and thus encourage them to follow the example.

A long and detailed discussion with Mr. Gabriel Mulenga, proprietor and manager of Ntweno's Speciality Foods, producing tomato and chilli sauces and a range of jams and marmalades, showed once again that this scale of enterprise (he has electricity from the mains and employs two people fulltime to work alongside himself on making jam and sauce, as well as a larger number working in his restaurant) is aimed at a different market from the proposed smallscale drying. His tomato sauce sells at K11.40/400ml bottle, and his jams at around K10 per 450g jar, but he still says that the business, selling in Lusaka, Kapiri M'poshi, Ndola, Kasama and Chipata, is not very profitable. He sees no conflict over supplies if local small growers were to dry tomatoes; he buys mainly from big farmers, some as far away as Mkushi, and believes "there is plenty for everybody".

5. RECOMMENDATIONS

Listed here approximately in the order in which they occur in the report above, except that all those which refer to an immediate use for drying technology are listed before those which propose a project to be executed in more than one stage, of which drying is not involved in the first stage.

The chapter ends with some observations and suggestions applying to more than one of the three countries.

(1) The womens' training programme being carried on in the Lilongwe ADD should be encouraged to use improved, solar, drying in its instruction on vegetable drying for village women. This will given an opportunity for field testing of the dryers developed at Bunda College by Dr. Mwinjilo and the simplified version developed by Dr. B.M. Mtimuni.

Products to be dried could be introduced in stages:

(i) green vegetables which are traditionally dried

(ii) tomatoes

(iii) fruit such as mangoes

Familiarising the users with each product in turn, and emphasising its value for own family use as well as for sale, would offer a way of teaching fruit growers to see fruit (fresh or properly dried) as an important part of a healthy diet all the year round.

relevant addresses:

The Programme Manager (attn. Women's Programme)
Lilongwe Agricultural Development Division,
P.O. Box 259, Lilongwe, MALAWI

- contact persons: Mrs. Phokoso & Mrs. Chiotha, at LADD office;
  Mrs. Kaliati & Mrs. Sakalichi, FHAs, Nkhande, where some growers who are already drying vegetables and making jam were interviewed.

Dr. B.M. Mtimuni, Bunda College of Agriculture, P.O.Box 219, Lilongwe, MALAWI.

Mrs. R. Ayoade (P.O. Box 30134, Lilongwe 3), nutritionist at Ministry of Agriculture HQ in Lilongwe, and a project officer from the Christian Service Committee in Lilongwe, (c/o CSC, P.O. Box 51294), could be useful backup resource persons.

(2) Mr. & Mrs. Chirwa, producers of "Bliss" fruit juices and chilli sauce in their home in Blantyre, should be encouraged in their attempt to produce dried fruits for the lower-income urban market; bananas, mangoes, pineapples and pawpaws.

This will probably need a more sophisticated indirect solar dryer with natural convection. SEDOM, who assisted them in setting up the juice and sauce production, could provide technical backup, and possibly monitoring.

The technical resource people mentioned in proposal (1) could be asked to help this project also.

Mrs. Mary Shawa, of the Ministry of Community Services, Blantyre, and Mrs. Mary Saukila, of CSC Blantyre, women's programme, who have both worked on fruit processing, would like to be involved.

relevant addresses:

Regional Manager (Mrs. Chiokwa), SEDOM, P.O. Box 525, Blantyre, MALAWI
Mr. & Mrs. Chirwa, P.O. Box 30179, Blantyre, MALAWI.

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(3) Mr. Sauti's proposal for a pilot cassava processing, milling and marketing project should be supported.

The proposal envisages a field of about 30ha cassava as the nucleus of a project including milling of this cassava and any that surrounding farmers can be induced to bring for milling, with studies on storage life and methods, and market research on the project.

address : Mr. R.N.F. Sauti, Bvumbwe Agricultural Research Station, P.O. Box 5748, Limbe, MALAWI.

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(4) Farmers working with CONCERN in the productive SE part of Ismani Division, Iringa District, Tanzania, should be helped to introduce solar drying methods and their progress be monitored as they

(i) dry green vegetables for their own family use, for sale to other parts of the Division and possibly for sale to the towns Iringa and Dodoma, between which it lies.

(ii) dry tomatoes, for sale as slices or powder in Dodoma or (more likely) Dar es Salaam in the low season.

Dr. E.E. Maeda, of Sokoine University, (P.O. Box 3000, Morogoro) would be a useful resource person who could help this pilot project.

Mrs. Rose Mayemba, Planning Officer in the Regional offices of the Ministry of Agriculture seems the government official who would be most concerned with this.

The address of CONCERN's Iringa office is:

P.O. Box 701, Iringa.

Two similar project possibilities were found in rural areas in Zambia. Both would involve grower's groups undertaking as a pilot project for their areas, the drying of vegetables for their own use first of all, and then for the local market, in the main town of each district. Monitoring the projects should include careful attention to whether the availability of drying encourages surplus vegetable production. If the first stage is successful a second stage would be an extension of products dried to include fruit available in excess in season, such as mango: again, this would be with the aim of educating the people as to the value of fruit in their diet year-round.

(5) Would involve womens' clubs in Monze District, in Southern Province; initially two groups could each build one or more indirect dryers (with natural convection).

Resource people :

Mr. Aaron Mweemba, DAO, Monze, Zambia

Mrs. S. Mavuye, lecturer in home science, Monze Agricultural College, who is already teaching the drying of vegetables. (P.O. Box 53, Monze).

Mrs. Pasi & Mrs. Mwemba, Womens' trainers, c/o Monze Homecraft Centre, P.O. Box 66033 Monze.

(6) Would involve groups of the Catholic Agricultural Rural Youth Movement in Mpika District, Northern Province. Their representatives could, in consultation with the DAO, Mr. A.Z. Sichamba, who already includes some instruction on solar drying in district training programmes, select two groups to set up pilot dryers, from whose success the other CARYM members and other growers in the district could learn.

CARYM contacts: Mr. Evaristo Musonda & Mr. Wilson Mulenga (members of two different groups), c/o St. Andrew's Church, P.O. Box 450014, Mpika, ZAMBIA

It would help to also work in contact with the co-ordinator of development programmes for Mbala diocese - same address.

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(7) The existing vegetable drying operations of Chikuni Growers' Co-operative, in Monze District, Zambia, be helped to improve their existing forced convection solar dryer, by the purchase of glass or plastic and material to frame it, to cover the solar panel of the dryer, and for modifications in the design of the air ducts. Their operation, on which they already have the records of a few years' operation, should be closely monitored so that information of use to other intending users of the same technology, or simpler technology, can be disseminated.

Contact : Mr. Given Lubinda, Chikuni Growers' Co-op, P.O. Box 650044, Chisekesi, ZAMBIA

"SECOND STAGE" PROJECTS

i.e. Projects in which drying technology is introduced at a second stage. Both of these projects start with rather basic assistance to growing the simplest vegetables - traditional varieties, wild or cultivated. Drying these vegetables would be a step in the direction of helping the growers to support themselves from what they grow.

(8) The existing training programme of Ipala Rural Training Centre (c/o Catholic Cathedral, Dodoma), and the nutrition expert of the Regional Agriculture Office

in Dodoma, geared towards helping the WaGogo pastoral people to adopt settled agriculture should adopt these two aims:

(a) to encourage the planting of wild vegetable varieties which are already important in people's diet, and cultivating them in gardens, and

(b) to introduce improved methods of drying these vegetables, primarily for own consumption. Technical resource people may be needed; participatory research, in which the intended users are able to influence the development of technical proposals being put to them, will be essential. Mr. Bita, Development Co-ordinator for the Christian Council of Tanzania (P.O. Box 372, Dodoma), would be very useful in organising this.

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(9) If any nutrition groups can be induced to form in Lusaka's shanty compounds (or if this programme can be used as an inducement to form groups when a clear aim is seen) they should adopt the aims:

(a) to grow for their own use vegetables of the varieties they are most familiar with, for their own consumption, which will probably require plots of land for the groups in addition to the small plot around each house, for growing the vegetables, and

(b) to introduce improved methods of drying, using tent dryers or simply constructed indirect dryers; having dried vegetables in a regular supply should increase the inducement to grow groundnuts to eat with the dried vegetables. The National Food and Nutrition Commission (P.O. Box 32669, Lusaka), would seem to be the agency to carry this through.

INTERCONNECTIONS

Most work on developing and implementing technologies for the benefit of the people in the countries visited still depends too heavily on outside money, information from outside and, on occasion, foreign initiative. Useful studies have been carried out, only for the results to gather dust in some European or North American library.

Networks of experts and experimenters grow up, but different people in the same country belong to different networks, whose centres are in different Western countries so information is not shared where it is needed; networks even grow and wither according to the degree of interest shown in them by donor organisations. Some members of the Africa Energy Programme network are beginning to ask whether that has withered since it was weaned from the Commonwealth Science Council and no longer has that help to get donor funds channelled into its activities; is there sufficient overlap and interaction between this network and that represented by the participants in IDRC's Dakar workshop in July 1986? How do either of these relate to the activities on food drying of FAO and ILO? Are some existing networks superfluous?

The simple answer to all this should be: let the people who should benefit from these activities of experts, decide. But how?

Their voices can be better heard if they actually take part in all the discussions and deliberations of the experts on the progress of pilot projects such as those suggested here. Meetings between concerned people, both experts and implementers/users, could usefully be held for those active in several countries, from time to time; user-user exchanges, expert-expert exchanges, and user-expert exchanges could profit from these. Among the member countries of SADCC, Zimbabwe has more similarities with these three countries than with any of the others, and could usefully be included in exchanges between the three countries studied here. If these remarks seem to suggest that the users are more likely to know about expert B than does expert A, working in the same field as A in the same country, this needs qualifying. The people at the grassroots, peasants and their families, are unlikely to know this kind of thing, but organisations that are responsive to them might well do so. One good example of such an organisation, which grew from the grassroots and now has its head high enough above the grass to be able to channel information to and from the grassroots. is ORAP, an umbrella of grassroots organisation in SW Zimbabwe of course, even such organisations need to be re-examined periodically to ensure that they are still in contact with the grassroots. Organisations do not immediately wither if cut off from their roots, although they usually stop bearing fruit.

It is encouraging to see that potential users, or organisations that try to represent them, are aware of this kind of need. Examples of recent activities that show this are:

- the workshop held under the auspices of the Christian Service Committee in Malawi, from 10th-13th August 1988, which brought together the principal technical resource people in the country who contributed material to this present report. (Address of CSC: P.O. Box 51294, Limbe, Malawi).

- the IIED/NGOMESA workshop for NGOs on food security in the SADCC region, held in Harare 8th-10th August 1988 (NGOMESA, Mr. Kingston Kajese, c/o P.O. Box 664, Harare).

and, at a slightly different level :

- the UNIFEM/SADCC conference on women and food cycle technology, held in Arusha, 16th-20th May 1988. (Contact Ms. Janet Sambali, Tanzania National Scientific Research Council, P.O. Box 4302, Dar es Salaam).

At the very least, participants in these meetings should be aware of the work of all the people consulted in compiling this report, and vice versa. PFIAU should be aware of them. I am not proposing yet another network (tempting as that may appear to any organisation that needs to justify itself to it donors), but to strengthen existing networks and to weave together connections between existing networks.

A useful organisation in this connection, which concentrates on assisting exchanges between grassroots groups in developing countries by funding and or organising meetings, and funding exchange visits proposed to it, is IRED (Information Reseaux pour Environment et Developpement), whose southern and eastern Africa office is in Harare :

P.O. Box 8242, Causeway, Harare.

It has been mentioned in the preceding pages that the work proposed by Mr. Sauti, of Bvumbwe Research Station, would be of interest to cassava growers and consumers in Tanzania and Zambia, as well as in Malawi. Since every situation is different, it might be useful to run a pilot field, mill, flour storage facility and market research. Since the interested parties in Zambia live in an area of mugh higher rainfall than the cassava producing areas of Malawi, a strong case can be made for testing the storage of the flour in that moister climate, but there are no doubt other less obvious differences. In Mpika, the people to approach would probably be the District Agricultural Officer and the Co-ordinator of Mbala Diocese Development Programme (P.O. Box 450014, Mpika, Zambia).

The Regional Agricultural Development Officer, and some of the local economic committees of the Lutheran Church in Dodoma Region (contactable through the General Secretary for the Diocese of Dodoma, Mr. N.O.E. Nyka, c/o KKKT, P.O. Box 3033, Arusha) would be interested in the results and in helping to apply them, including any research in the field to take account of local conditions, for their region of Tanzania.

Cassava not being the main object of this study, it is not possible to do more than note the IITA cassava network, funded by IDRC, to note the workshop being held in Malawi in November 1988.

In relation to all the recommendations of this chapter, it cannot be emphasised too strongly that the time has come for involvement of the potential users of the technology in pilot projects now.

The pure scientist, quite understandably, suffers a tendency to keep research inside the laboratory until the result is something perfect to present to the world. The people who could benefit from the results of the research do not need to wait until the result is perfected; if at the present stage there is some device that is good enough for them to try, then this is the time to bring them into the process of developing the technology. The pure scientist may find that the improvements wanted by the users are not changes in the direction of what s/he thought was perfection. We all teach each other.

6. GENERAL REMARKS

It has been said in several places in this report that one problem in implementing the recommendations is that people usually do not see the importance of fruit in their diet; in some cases at least, they also do not see the importance of dried vegetables. Reasons for this are to be found in the rapid growth of population, and aggravated by urbanisation.

Whereas in most parts of the three countries considered, and Zimbabwe, there are wild fruit ripe and ready for eating in almost any month of the year and people used to always take advantage of these snacks, although some species were also dried (e.g. 'masawu'), hardly considering them as food (food is 'Ugali'/'nsima'/'bwali'/'sadza' and cooked relish, and you sit down to eat it), the rapid increase of even rural population in the past 50 years means that there is not enough wild fruit to go round. Many people, even rural people, just do not see some species of fruit any more. Hence a serious gap in diet, but one that may pass completely unnoticed.

The same applies to wild vegetables, to some extent. Wild vegetables need to be replaced by cultivated vegetables but the whole technology and culture of collecting, cooking and processing vegetables does not transfer immediately from wild to cultivated vegetables. Newly introduced green leaf vegetables will not be treated in the same way as even the green leaves of other vegetables already cultivated, such as cassava, bean, pumpkin or okra. They may not be dried, or only rarely; they may not be eaten with other nutritious foods, such as crushed groundnuts or 'dovi' (homemade smooth peanut butter, Zimbabwe) so that another important element in the diet may be lost.

They will be considered as commercial commodities, and maybe the whole crop sold to buy other essential commodities leaving the grower's family without relish, and therefore probably eating less meals; one does not eat 'ugali'/'nsima' /'bwali'/'sadza' by itself. And one no longer finds enough wild vegetables to fill that gap.

Zimbabwe has advanced further than the three countries studied here in the direction of a fully commercialised agriculture, in which all produce may be sold, and all grows from purchased and planted seed, with the addition of purchased artificial fertilizer. Although Zimbabwe's agricultural production is high under this system, a dangerous trend can be seen, illustrated at present most in the production and consumption system of maize, but clear enough when overall food production is considered. Table 6-1 and 6-2 give indices of food production (average 1979-81 = 100) for the three countries considered in this report and Kenya and Zimbabwe:

Table 6-1: indices of total food production 1979-84

country	1979	1980	1981	1982	1983	1984
Kenya	103	97	100	116	111	102
Malawi	99	98	103	107	106	107
Tanzania	97	100	103	100	104	109
Zambia	97	103	100	98	103	101
Zimbabwe	87	92	121	102	80	91

Table 6-2: indices of food production per head 1979-84

	1979	1980	1981	1982	1983	1984
Kenya	108	97	95	107	93	85
Malawi	102	98	100	101	97	94
Tanzania	100	100	100	94	94	95
Zambia	100	103	97	92	93	85
Zimbabwe	91	92	117	96	72	79

source: FAO: The state of food & agriculture,1985

The absolute level of production in each country is not so important for the present discussion as are the fluctuations from year to year. All have their ups and downs, and all seem to be on an underlying downward trend in per caput food production, but those which rely most heavily on high-technology agriculture, with hybrid seeds, high chemical fertilizer input etc., suffer the wildest fluctuations from year to year. From these figures, Zimbabwe seems the most likely, and Kenya the next, to pass from glut to famine in a year and back again almost as fast.

These figures represent the relative dependence in each country on hybrid maize, but the situation illustrated also affects domestic vegetable supply once vegetables become a cash commodity, and therein lies a lesson for all these countries. People do not just need education to teach them the food value of their vegetables, or of fruit: they need liberation from the economic pressures which force them to sell every saleable commodity they produce, because soap or school fees now (August) are more immediately important than vegetables in November.

The economic trends in all our countries are against us. Whatever "adjustment" measures any of these countries have undertaken, and whether or not those measures have increased GDP or investor confidence, they have not done anything to improve the domestic economy of 90% of households in the countries studied here, or Zimbabwe. One agronomist interviewed in Lusaka dated the recent sharp increase in malnutrition around the city to the months immediately following the "currency auctions" which so lowered the exchange value of the Zambian currency.

The small projects suggested here might, other things being equal, make a significant improvement in the medium or long term, but any assessment of their immediate success

must bear in mind that they represent a slow climb up a subsiding hillside, or an attempt to run up the down escalator.

Agents of change

In a short visit to a country, how does one identify the most promising implementers of pilot projects such as those suggested here?

The author took the short cut, probably the only way possible in the time available, of paying more attention to organisations which he already knew, trying to select the areas where their work was already reasonably successful in raising the standard of living and the level of participation by the people in activities which will determine their way of life. Church-related organisations therefore figure largely in the proposals for action to be taken. Ideally, one would look for the peoples' own organisations (ORAP, in Zimbabwe, has been cited as one example); co-operatives should be among the most visible of these, but co-operatives mean different things in different countries.

Zimbabwe was perhaps fortunate that successive colonial regimes considered the very word "co-operative" too dangerous to be uttered in the hearing of the indigenous population, who thus did not meet with co-operatives of the kind built up in colonial times in the three countries studied here. These were primarily marketing organisations, run by the colonial government, mainly as a way to induce the peasantry to grow cash crops. In all three countries, at some stage since Independence, these co-operatives were disbanded. In Malawi, no direct replacement has been attempted, though farmers' clubs are developing slowly. In Tanzania, the style of these co-ops was seen as opposed to the co-operation between all villagers aimed at in the policy of 'ujamaa'. However, in both

Tanzania and Zambia, co-operatives have been reconstituted in recent years, but they do not, especially in Tanzania, look much different from the model that was rejected in the 1960s. This might be considered too hasty a judgement but it is at least true to say that the co-operative movement in Zimbabwe (as opposed to the mass of groups pursuing some "development" aim which used the trendy label "co-operative") does have the advantage that the kind of co-op which colonial governments brought to these three countries is not a part of their history; and the advantage that, although government declared itself in favour of co-operatives at Independence, it was too busy in other areas to set up structures to regulate, or even train, co-operatives. Co-ops largely sank or swam according to their own determination to survive; few had the skills, at the start, which they soon found they needed if their co-ops were to survive, but those that learned to "swim" are real success stories. Probably wisely, such co-ops keep a low profile. Some probably exist in the three countries studied here; if they do, they are unlikely to devote much of their energy to seeking publicity, so the casual visitor can be forgiven for failing to notice many of them. It will be noticed that a few of the implementing agents suggested in the proposals of this report are co-operatives with a good track record.

APPENDIX 1:

GLOSSARY AND EXPLANATION OF TERMS

The lake known in Malawi as 'Lake Malawi', is known in Tanzania as 'Lake Nyasa'.

The language known in Malawi as 'Chewa', is known in Zambia as 'Nyanja'.

Currency Values:

Costs and income figures in each country are given in that country's currency only, this being more meaningful if it is related to income and cost of living figures in the country than to any foreign exchange rate, especially because neither Zambia nor Tanzania has adjusted fully to the disruptions caused by devaluations of over 80% in each case since 1985. At the time of writing (August 1988),

in Malawi, the urban minimum wage is K1.00/day; the rural minimum wage is lower,

in Tanzania, the minimum wage is 1500/- per month,

in Zambia, the minimum wage is K150.00 per month.

CHAPTER 1:

The terms 'sundrying' and 'solar' drying are distinguished:

Sundrying refers to traditional methods of laying material to be dried on a clean surface to dry. Vegetables may be blanched by treatment with steam or hot water before drying, though some are not. No other treatment is used.

Solar drying refers to drying by placing the material to be dried in a specially constructed dryer designed to use solar radiation to provide a draught of warm air for drying. Types of solar dryers are discussed more fully in the technical section of the Introduction and in Appendix 5.

'nsima' (Chewa/Nyanja: Malawi and Zambia) - stiff porridge used as the dietary

'ugali' (Swahili) - staple; it can be made of meal

'bwali' (Bemba: Zambia) - obtained by grinding grain (Maize, Sorghum or millet) or, in some areas, cassava or died plantains.

CHAPTER 2:

In Malawi, 'smallholder' agriculture is distinguished from 'estate' agriculture, meaning large-scale commercial agriculture, or land privately owned either by an individual or a company.

'Smallholder' can thus be understood as 'peasant'

Chewa name	English name or description	botanical name
'bowa'	mushroom (generic name)	-
'chewe'	leaves of wild okra	
'chigwada'	dried and powdered cassava leaves	'manihot esculentus'
'chikande'	cake of edible material from anthill	-
'masawu'	a wild fruit	'ziziphus mauritiana'
'maula'	a wild fruit	
'mfutso'	dried green leaf vegetables (generic name)	-
'mpiru'	leaves of green (spinach-like?) veg.	
'thelele'	okra	'sesum angustifolia'

CHAPTER 3:

'chipari'	a wild green vegetable
Division	a subdivision of a District
godown	government storage depot for produce, used as marketing depot and reserve supply for its district
'kitenge'	patterned print cotton cloth; lengths of 'kitenge', sometimes known as 'khanga', are a principal item in the dress of most Tanzanian women
'kunde'	cowpea 'vignea unguiculata'
'lishe'	human nutrition

'madyenje' (kiGogo)	'mboga' made of mixed pumpkin and 'mlenda' leaves	
'mboga'	relish; any cooked vegetable or meat dish eaten with 'ugali'	
'mchicha'	green leaves of species of wild amaranthus, used as 'mboga'	'amaranthus' sp,
'Mlenda'	green leaf vegetable used for 'mboga'	
'muhilile (kiGogo)	a green vegetable used as 'mboga-' like mchicha a variety of amaranthus	'amaranthus' sp,
'rushoto'	a wild fruit	
'safwe'	leaves of cowpea, used as 'mboga'	'Vignia unguiculata'
'tsanza'	a wild green vegetable	
'ukwaju'	fruit of tamarind	'tamarindus indica'

CHAPTER 4:

	eng. name or explanation	botanical name
	blackjack	'bidens pilosus'
'chichungwa' (chiTonga?)	a wild green vegetable	
high density suburb:	residential area for low income earners where houses, on small plots, are provided for rent or sale to occupants	
'lima'	This is, I think, an acronym for the Zambian government's programme to promote small-scale food crop production for national self-sufficiency. It is also, in most Zambian languages, the root of the verb 'to farm, plough, cultivate'	
'lumanda' (chiBemba)	dried okra flowers, eaten as relish	'sesum angustifolia'
'mulembwe' (chiBemba)	dried whole okra leaves, eaten as relish	'sesum angustifolia'
'pupwe' (chiBemba)	powdered dried okra leaves, eaten as relish	'sesum angustifolia'

shanty compound:	area set aside for housing for low income earners, where would-be residents are provided with serviced sites on which to build their own houses.	

CHAPTER 6:

'dovi' (Shona):	homemade smooth peanut butter, much used in traditional cookery.	
'(ma)sau' (Shona):	a wild fruit	'ziziphus mauritiana'
Sadza' (Shona):	stiff porridge	
'ujamaa' (Swahili):	literally "familyhood"; a word adopted to express Tanzania's understanding of socialism, and especially referring to the "'ujamaa' villages" which were to be the backbone of this policy's impelementation.	

APPENDIX 2.

ABBREVIATIONS AND ACRONYMS

Chapter 2 : (MALAWI)

ADD:	Agricultural Development Division
ADMARC:	Agricultural Development and Marketing Corporation
CSC:	Christian Service Committee
DDC:	District Development Committee
FHA:	Farm Home Assistant
MBS:	Malawi Bureau of Standards
NRDP:	National Rural Development Programme
RTC:	Residential Training Centre
SEDOM:	Small Enterprises Development Organisation of Malawi

Chapter 3 : (TANZANIA)

CCT:	Christian Council of Tanzania
CRCU:	Central Region Co-op Union
CRS:	Catholic Relief Services
ELCT:	Evangelical Lutheran Chruch of Tanzania (=KKKT)
IFDC:	Irish Foundation for Cooperative Development
IRA:	Institute of Resource Assessment
KKKT:	See ELCT.(Kanisa le Kilinjili la Kilutheri Tanzania)
NGO:	Non Government Organisation
NMC:	National Milling Company
RADO:	Regional Agricultural Development Officer
SIDO:	Small Industries Development Organisation
TFNC:	Tanzania Food and Nutrition Centre

Chapter 4 : (ZAMBIA)

CARYM:	Catholic Agricultural Rural Youth Movement
DAO:	District Agricultural Officer
FNDP:	Fifth National Development Plan
IRDP:	Integrated Rural Development Programme

Ch.4 : (ZAMBIA)(Contd.)

MAWD:	Ministry of Agriculture and Water Development
NCSR:	National Council for Scientific Research
NIEC:	National Import and Export Corporation
NFNC:	National Food and Nutrition Commission
Namboard:	National Agricultural Marketing Board
Zamhort:	Zambia Horticultural Products Ltd.

Chapter 5 : (RECOMMENDATIONS)

IDRC:	International Development Research Centre, Ottawa
IIED:	International Institute for Environment and Development, London
IITA:	International Institute for Tropical Agriculture, Ibadan, Nigeria
NGOMESA:	NGO Management Network for Easyern and Southern Africa
ORAP:	Organisation of Rural Associations for Progress, Bulawayo
UNIFEM:	United Nations Development Programme for Women

APPENDIX 3:

PEOPLE INTERVIEWED

MALAWI

Mrs. R. Ayoade - Nutritionist, Ministry of Agriculture, Lilongwe

Dr. (Mrs.) B.M. Mutimuni - Nutritionist, Bunda College of Agriculture

Mr. W. Kumwenda)
Mr. Chimbe)
Mr. Mbale) Chitedze Research Station, Lilongwe
Mr. E. Kunkwezu)

Mr. R.N.F. Sauti - Bvumbwe Research Station, Limbe

Mr. Kauye - Programme Manager)
Mrs. Phokoso - Women's Programme) Lilongwe Agricultural Development Division
Mrs. Chiotha - Women's Programme)

Mr. S. Mapila - Fisheries Department, Lilongwe

Mr. A. Shaibu - National Projects Director, Christian Service Committee

Mrs. Mary Saukila - CSC Women's Programme Field Officer, Mlanje and Mwanza

Mrs. P. Mazengere) Farm Home Assistants, Dedza district
Mrs. C. Chiusiwa)

Mr. Gweyere - Administrator) Nkhande residential training
Mr. F.H. Nihaka - Principal) centre

Mrs. Kaliati) FHAs Nkhande
Mrs. Sakalichi)

Mr. Mfune - Sales Manager, ADMARC, Blantyre

Miss F. Bondani) Experimenters on jam and juice,
Mr. E. Mitulo) CSC Head Office, Blantyre

Dr. Ray William)
Mrs. Nsanjama)
Mr. Mtabwa) Bvumbwe Research Station, Blantyre
Mrs. Luka)

Mr. Chimukwita - Vendor, Nathenje market and many other market vendors and customers

Mr. Kapalamula - Projects Manager, Malawi Development Corporation

Mr. Mac S. Nankumba - CSC regional co-ordinator, Lilongwe

Mrs. Chiokwa - Regional Manager, SEDOM, Blantyre

Many thanks are due to Mr. Alex Shaibu, of C.S.C. and his diligent and obliging driver, Mr. J. Majoni, without whose help all of the study in Malawi would have been more difficult, and some would have been impossible.

TANZANIA

Mr. R.D. Kyamba - Horticulturist, Ministry of Agriculture and Animal Husbandry, Dar es Salaam
Mr. Mganga - IRA, University of Dar es Salaam
Mr. L.H. Sangana - Tanzania Food and Nutrition Centre
Ms Janet Sambali - National Scientific Research Council
Mrs. Malonzi - Catholic Relief Services, Dar es Salaam
Dr. E.E. Maeda - Food Technology Department, Sokoine University of Agriculture, Morogoro
Dr. Shemsanga - Department of Agriculture Engineering, Sokoine University
Mr. Patrick Lemanya - Development Co-ordinator (Anglican) Diocese of Central Tanzania
Mr. M. Mtwere - Regional Agriculture Development Officer, Dodoma
Mr. N.O.E. Nkya - General Secretary, Lutheran diocese of Dodoma
Mrs. Mugeye - Food and nutrition expert, Ministry of Agriculture Dodoma
Mrs. Shamsa Magunga - SIDO Headquarters, Dar es Salaam
Mr. S.G. Nyenye - Manager)
Mr. Kalima - Regional Economist) SIDO Mbeya
Mr. Kilongo) Desk Officers to Regional Co-op Development Officer, Mbeya
Mr. Kasela)
Mr. Mbita - Development Co-ordinator, CCT Dodoma
Mr. Mwakibolwa - Regional Co-op Officer) Iringa
Mr. Muna - Regional Administrative Officer)
Mrs. Rose Mayemba - Regional Planning Officer, Ministry of Agriculture and Animal Husbandry Iringa
Mr. B.I. Desai - Dabaga Fruit and Vegetable Canning Co. Ltd. Iringa
Mr. D.P. Marwaha - Managing Director, Vacu-Lug Iringa
Brendan and Bernie O'Loughlin - IFCD Iringa
Jim Kinsella - Concern, Iringa
Elias I.M. Sambo - Concern, Iringa
Fr. Yves Marché - Ipala Rural Training Centre, Dodoma
Mr. Vincent Kepakepa, Tanzania Food and Nutrition Centre, Dar es Salaam

ZAMBIA

Mr. Given Lubinda) Chikuni drying and jam making
Mr. Peter van Schie) project

Fr. Fred Moriarty SJ - Co-ordinator, Monze diocese development programmes

Mrs. Pasi)
Mrs. Mwemba) Women's training organisers, Monze diocese

Mr. L.M. Shankoti - District Marketing and Co-operative Officer, Monze

Mrs. Scholastica Mavuye - Home Science Department, Monze Agricultural College

Mr. Kambikiya - Crop Department, Monze Agricultural College

Mr. Aaron Mwemba - District Agricultural Officer, Monze

Mr. M. Sindazi)
Mr. Spencer Bloomfield - Horticulture section) Ministry of Agriculture & Water Development

Mr. J. Mulenga - Sales Manager, Zamhort, Lusaka

Mr. F. Maimbo - Department of Agriculture, University of Zambia

Mrs. Freda Luhila - Food Science and Technology Section, National Food and Nutrition Commsssion, Lusaka

Fr. Bob Lavertu WF - Co-ordinator, Mbala diocese development programmes

Mr. Stanislaus Kalolo - Restaurant Owner, Mpika

Mr. Evaristo Musonda)
Mr. Wilson Mulenga) CARYM members, Mpika

Mr. Gabriel Mulenga - Proprietor and Manager, Ntweno's Speciality Foods, Mpika

Mr. A.Z. Sichamba - District Agriculture Officer, Mpika

Mr. Joseph Mwale - National Council for Scientific Research, Lusaka

Dr. Bhat - Senior Lecturer and Consultant)
Dr. Malik - Lecturer and Consultant) University teaching Hospital, Lusaka

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APPENDIX 4:

COMPARATIVE COSTS OF DRYING AND OTHER PROCESSING METHODS ON A SMALL SCALE

(a) Bliss juice and sauce producers, Blantyre, Malawi.

Pineapple juice v. dried pineapple - fruit bought by processor and brought to home in Blantyre for processing. Costs for one batch.

JUICE (actual costs of Bliss products processing)		DRIED (calculated costs in Blantyre)	
CAPITAL COSTS:			
electric blender (ca 1984):	K 400	$2m^2$ glass (3mm):	K142,16
2 plastic drums @ K10 each:	K 20	500 bricks: approx	K 50
40-litre aluminium basin:	K 100	same	K100
4 chopping knives @ K8.95 each:	K 35.80	same	K 35.80
4 wooden cutting boards:	K 15	same	K 15
		3 bags cement:approx	K 30
		wood for frame to glass:	K 40
		metal chimney:	K 40
		building labour:	K 40
Total Capital Costs:	K 571		K493
RUNNING COSTS:			
100 pineapples @ 30t each:	K 30.00	30 pineapples @ 30t each:	K 9.00
12.5kg sugar @ 74t/kg	K 9.25	100g $Na_2S_2O_5$ @ K9.79/kg:	K 0.98
50 bottles @ 52.8t each:	K 26.40	labour: 1 @ K2.25/ day:	K 2.25
Labour: 2 @ K2.25 ec./d:	K 4.50	Transport (see Note)	K 3.75
transport : Petrol @ K50/load	K 12.50		
electricity (est.):	K 3.40		
Total running costs/ batch	K 86.05		K 15.98
cost of processing 1 fruit: (not counting buying fruit)	56t		24t

NOTES :

1) The cost of materials added, labour etc., is less per pineapple for drying; the product, being cheaper, should appeal to a wider market.

2) The transport costs for both are taken as a fraction of Mr. Chirwa's own costing of his travel to collect a load in his pickup. A load provides 4 days work in making juice; allowing (optimistically) that a batch of pineapple dries in 2 days, that same load would take 4 weeks to dry. Pineapples will not keep that long, so, for Mr. and Mrs. Chirwa, the figures above are only valid, and the drying operation is only economic if it is carried on alongside the juice making, some pineapples being dried and some squeezed for juice from the same truckload.

(b) Chikuni growers' co-operative, Chisekesi, Zambia.

Comparing existing jam making and vegetable drying operations:

JAM MAKING		VEGETABLE DRYING		
EQUIPMENT:				
installed in 1979 at a cost of K 17 000 when minimum wage was K50/month		installed at a cost of K12 000 in 1984, when minimum wage was K75/month		
RUNNING COSTS (for 1987: minimum wage K150/month):				
15t fruit	K 15 000	5t vegetables:	K 3 000	
chemicals: approx	K 54 000	chemicals	K 1 000	
sugar (approx.12.5t)	K 50 000	electricity (@ K30/batch)	K 840	
jars (40 000 @ K2.22):	K 88 800	transport (my est.):	K 6 000	* (a)
electricity (@ K18/batch):	K 3 000			
Transport (my est.):	K 10 000* (b)			
Totals:	K220 000		K 10 840	
to process 15t fruit less cost of fruit	K205 000	to process 5t vegetables less cost of veg:	K 7 840	
materials & c/tonne processed:	K 13 667		K 1 568	

not counting labour in either case.

	JAM MAKING	VEG. DRYING	
INCOME:			
sale of 40 000 jars of jam, wholesale:	K260 000	sale of : 250kg in bulk	K 12 500 *(b)
		250 kg small packs wholesale:	K 16 250 *(b)
Totals:	K260 000		K 28 750
less costs:	K220 000		K 10 840
gross profit:	K 40 000		K 17 910
per tonne processed:	K 2 667		K 3 582

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* indicates compiler's estimate,

(a) of transport costs from distances travelled to producers and to distributors as given by co-op members, and estimated mileage cost of running their vehicle.

(b) of distribution of 1987 sales between bulk sales to institutions and sales of small packs through wholesalers.

Figures do not include labour costs: Operators estimate that the jam plant could close down for 4 months of the year without making a loss (no labour paid during closedown): the dryer is out of use 8 months of each year.

(c) Cost of tent dryer make from black PVC sheet in Malawi:

Bamboos or other light flexible poles: Collected free

black PVC sheet @ K3.00/m 1.5 wide (Town Market):

for dryer taking 14kg/load: 5.15m costing:	K15.50
for dryer taking 7 kg/load: 3.4m, costing:	K10.00
for dryer taking 5.5kg/load: 3m, costing:	K 9.00

(compare Mrs. Mtimuni's estimate K6: has she a cheaper source?)

Therefore;

Elaborately built indirect dyers cost -

up to 80% (with electric fan)

or up to 50% (with natural convection) of capital cost of jam making equipment, so although running costs are lower, and product can be therefore sold more cheaply, the dryer cannot stand idle for much longer than does the jam-making equipment.

but;

tent dryers, have a much lower capital cost, and can therefore be used for short drying season, whereas making jam or sauce from fruit for such a short season could not justify the expense of buying the equipment, and solar drying becomes the only economically feasible alternative.

APPENDIX 5

TECHNICAL OBSERVATIONS

Dryer design:

indirect dryers with natural convection (see fig. 1)

1) Usefulness of a chimney:

The purpose of the chimney seen in this design is to heat the outgoing air, thus speeding its flow up the chimney and thus increasing the flow rate through the drying chamber. As the rate of air flow increases, then the rate of drying should increase.

Some recent work by P.H. Oosthuizen (of Queen's University, Kingston, Ontario, Canada) helps to define when a chimney helps in this way and when it will not. Oosthuizen first set up a computer simulation of an indirect grain dryer with natural convection and used it to predict how a real dryer would behave. He used this to calculate its performance under real field conditions and tested his predictions against experimental results. As a result, he recommended that chimneys not be included in the design, because they have little effect on performance. The conditions under which his advice applies need, however, to be carefully examined.

Oosthuizen assumed two conditions: (a) that the temperature of the bed of material to be dried differs little from the ambient air temperature, and (b) that the chimney does not heat the outgoing air appreciably. These conditions seem to apply, as his comparison with experiment shows, to rice dryers near the equator. The present author has, on the other hand observed the great improvement in performance in a similar dryer used to dry vegetables and fruit in Harare (latitude 18°S).

For the vegetable dryer in Harare neither of Oosthuizen's conditions seem to apply: (1) vegetables and sliced fruit, being less bulky than grain, probably are heated above the outside air temperature when inside the drying chamber (more on this below), and (2) a black metal chimney, at 18°S latitude, does become heated by solar radiation and thus heats the air pasing through it. This effect is noticed even at the season when the sun is overhead at noon in Harare (November-January), although the dryer has not been used so much at that time of year, since it is the height of the rainy season.

We can conclude that a black metal chimney, which will heat the outflowing air, does markedly improve the performance of a natural convection, indirect dryer when it is used to dry vegetables and fruit.

2) Insulating the dryer:

It is important that the drying chamber and the solar panel be well insulated:

(a) the drying chamber:

The drying chamber of the author's dryer in Harare was built of brick and had at first a galvanised iron roof. The air temperature inside this dryer dropped to ambient temperature by about 4 a.m., and in the rainy season, when the outside atmosphere was very humid, condensation could occur inside the drying chamber, and the material being dried was spoilt.

Insulating this roof by gluing to it sheets of polyurethane foam about 1cm thick raised the early morning minimum temperature inside the drying chamber to some 3-5°C above ambient.

In future construction of this type of dryer, a brick or wooden roof to the drying chamber would be recommended.

There is probably still a need for systematic study of all the species traditionally dried, the differences in methods used for different species, and the effect of these methods on appearance, texture, flavour when cooked, and the amount of main vitamins and nutrients retained in each species by each method.

It is interesting to note how widespread is the custom of cooking dried green vegetables with powdered groundnuts (or, in Zimbabwe, peanut butter); the product is tasty and nutritious, but is it providing the nutrients that one usually eats vegetables for?

Some sources of further information:

B. Brenndorfer, L. Kennedy and others: Solar Dryers: their role in post-harvest processing: Commonwealth Science Council, London, 1985.

Michael G. Bassey & O.G. Schmidt (eds): Solar drying In Africa: proceedings of a workshop held in Dakar, Senegal, 21-24 July 1986. IDRC, Ottawa, 1987.

Solar Drying: practical methods of food preservation: ILO, Geneva, 1986.

Proceedings of the Expert consultation of planning the development of sun-drying techniques in Africa. FAO, Rome, 1985.

reference :

J.M. Mwale & K. Doffour-Dapaah: Final report of IDRC-sponsored vegetable drying project: Food Technology Research Unit, National Council for Scientific Research, Lusaka (undated: 1984 or later)