Opportunities for fermented food products in developing countries

Fermented food products offer tremendous opportunity for stimulating agro-industrial development in developing countries. This article discusses the importance of food fermentation for use in developing countries and the need for research. The following articles on *kanji*, *madila*, *gundruk* and *kawal* illustrate the application of fermentation technology for food preservation and processing around the world.

Fermentation is one of the oldest forms of food preservation technologies in the world. Indigenous fermented foods such as bread, cheese and wine, have been prepared and consumed for thousands of years and are strongly linked to culture and tradition, especially in rural households and village communities. Bread making probably originated in Egypt over 3,500 years ago. Fermentation of milk started in many places with evidence of fermented products in use in Babylon over 5,000 years ago. There is also evidence of fermented meat products being produced for King Nebuchadnezer of Babylon. China is thought to be the birth-place of fermented vegetables and the use of *Aspergillus* and *Rhizopus* moulds to make food products.

Fermentation is a relatively efficient, low energy preservation process which increases the shelf life and decreases the need for refrigeration or other form of food preservation technology. It is therefore a highly appropriate technique for use in developing countries and remote areas where access to sophisticated equipment is limited. Fermented foods are popular throughout the world and in some regions make a significant contribution to the diet of millions of individuals.

In Asia the preparation of fermented foods is a widespread tradition. The fermented products supply protein, minerals and other nutrients that add variety and nutritional fortification to otherwise starchy, bland diets. For instance soy sauce is consumed throughout the world and is a fundamental ingredient in diets from Indonesia to Japan. Over one billion litres are produced each year in Japan alone. *Gundruk* which is a fermented and dried vegetable product is very important for ensuring food security for many Nepali communities especially in remote areas. The annual production of *gundruk* in Nepal is estimated at 2,000 tons. *Gundruk* is an important source of minerals particularly during the off-season when the diet consists of mostly starchy tubers and maize, which tend to be low in minerals. In Africa fermented cassava products (like *gari* and *fufu*) are a major component of the diet of more than 800 million people and in some areas these products constitute over 50% of the diet.

The benefits of food fermentation

The fermentation of foods can bring numerous benefits to people in developing countries. Fermented foods play an important role in providing food security, enhancing livelihoods and improving the nutrition and social well being of millions of people around the world, particularly the marginalised and vulnerable.

Fermentation enhances nutritional quality through the biosynthesis of vitamins, essential amino acids and proteins, improved digestibility of protein and carbohydrates, improved bioavailability of minerals and the degradation of anti-nutritional or toxic factors. It improves food safety by eliminating harmful toxic compounds and preventing the growth of spoilage or food poisoning organisms. In addition to its nutritive and preservative effects, fermentation enriches the diet through the production of a diversity of flavours, textures and aromas. It improves the keeping quality of foods and also reduces cooking times, which in turn reduces the energy consumption required for the preparation of foods.

Fermentation plays a significant role in the preservation of perishable raw materials. In the fresh state, all foodstuffs have a limited life

IT/Mike Ledbetter

Production of fermented soya products in Indonesia

Keywords
Fermentation, developing countries, traditional, nutritional improvement, enzymes, biotechnology.


IT/R Velaochaga

Fermentation is an important stage in breadmaking

span. This is highly dependent on the nature of the raw material and the prevailing ambient conditions and the hot, humid conditions of the tropics greatly accelerate the decomposition process. These conditions however (high temperature, high humidity) also provide ideal conditions for fermentation. Left alone, most food stuffs will ferment naturally – some with desirable end results and others with less desirable and even poisonous end-products. With knowledge of the fermentation process, conditions for fermentation can be modified to encourage the growth of beneficial micro-organisms.

Fermentation is a cheap and energy efficient means of preserving perishable raw materials. There are several options for preserving fresh produce including drying, freezing, canning and pickling. However many of these are inappropriate for use on the small-scale in developing countries. For instance small scale canning is usually not economically feasible and has serious food safety implications. Fermentation requires very little sophisticated equipment, either to carry out the fermentation or for subsequent storage of the fermented product.

Documentation of traditional processes and optimisation of production methods

Although foods have been preserved by fermentation for thousands of year, it is likely that the microbial and enzymatic processes responsible for the transformations were largely unknown. It is only recently that there has been a development in the understanding of these processes and their adaptation for commercialisation. Most of the research into fermentation processes has been directed towards the large scale processes such as wine making, brewing, vinegar production and bread and cheese production. Small scale fermentation technologies, such as those in use in developing countries have been relatively neglected. Although the basic principles of fermentation technology no doubt apply to these products, subtle differences in the micro-organisms present, the raw materials and the fermentation conditions are responsible for the diverse range and individual tastes and textures of products which are formed.

Because of the tremendously important role indigenous fermented foods play in food preservation and their potential to contribute to improved nutrition, it is imperative that the knowledge of their production is not lost. Moreover, considering the potential of fermented foods to contribute to the growing food needs of the world it would be useful to gain a full understanding of the processes to enable them to be optimised and for the development of starter cultures and inoculants.

There is a need for research to address these issues and encourage individuals to collect and document the traditional fermented foods native to their own region and diet. Several agencies and organisations recognise the importance of traditional knowledge and fermented foods and are working towards these aims:

- Several research institutes and scientists in Africa, Asia and Latin America are recording information on traditional fermented foods.
- Intermediate Technology is actively collecting information about traditional food products from Africa, Asia and Latin America. The first volume of products was published in 1997. Volume 2 will be published in 1999 and regional publications on the traditional food products of Bangladesh, Southern Africa and the Andes are planned.
- The European Union has just completed an audit of the traditional food products of Europe. The results are being published in a series of publications.
- The Special Programme on Biotechnology and Development Cooperation for the Netherlands Government was established in 1992 to improve the access of developing countries to biotechnological expertise and innovation with a focus on using biotechnology for the benefit of small-scale farmers and producers.
- The Food and Agriculture Organisation of the United Nations sees the value in collecting and preserving this source of knowledge and in improving the application of biotechnology at the small scale in developing countries (Rolle, 1997)[1].

References

1 Rolle, R. S. (1997). Review: Technical opportunities and challenges to upgrading food bioprocessing in developing countries. Food and Agriculture Organisation, Rome.

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Kanji – a traditional carrot drink

Dr. Berry of the Central Food Technological Research Institute (CFTRI) in India describes an unusual traditional fermented carrot beverage which he considers has potential for production by small enterprises.

Carrots are widely cultivated all over the world and are eaten both cooked and raw. They are a rich source of carotene, which is converted to vitamin A in the body. They are also rich in minerals and in India are considered to have many medicinal properties. In Northern India carrots, especially a variety that is deep purple in colour, are fermented to make a traditional ready to serve drink known as *kanji*. *Kanji* is very popular and considered to have cooling and soothing properties and to be of high nutritional value.

Traditional preparation of *kanji*

After thorough washing the carrots are finely grated. Each kilogram of grated carrot is mixed with 7 litres of water, 200 g of salt, 40 g of crushed mustard seed and 8 g of hot chilli powder. The mixture is then placed in a glazed earthenware vessel which is almost entirely sealed, leaving only a tiny hole for gases released during fermentation to escape. The mixture is then allowed to ferment for seven to ten days. The type of fermentation that takes place is known as a lactic fermentation which must be carried out in the absence of air. Lactic acid bacteria produce lactic acid which reduces the pH (ie increases the acidity) to a level that prevents the growth of food poisoning organisms. The final product is slightly acidic in taste and has an attractive purple-red colour. After fermentation the drink is strained through fine muslin and has to be consumed within 3 or 4 days after which it goes bad. Each kilogram of grated carrot yields just over 7 litres of *kanji*. A typical analysis of *kanji* is shown in the table.

pH	3.15
Acidity %	0.43
Brix°	4.50
Salt %	2.50
Total sugars %	1.94
Reducing sugars %	1.10
Minerals as ash %	0.40

Preservation of *kanji*

Scientists at the Research Institute examined the possibility of preserving *kanji* to extend its shelf life and so make it suitable for commercial production. As traditional *kanji* production can only take place during the carrot season the feasibility of producing the beverage from dried carrots was also investigated. The product made from dried carrot was found to be perfectly acceptable. Two different methods of extending the shelf life were examined; preservation using preservatives and pasteurisation.

- It was found that *kanji* could be preserved for 6 months with no loss of colour, aroma and taste by the addition of 0.03% sodium benzoate and 0.01% sulphur dioxide (approx. 0.2% potassium metabisulphite).
- In view of the general trend away from the use of chemical preservatives, pasteurisation was considered as an alternative option. The juice was heated to 85°C and hot filled into glass bottles. These were capped with crown caps and heat processed in boiling water for 25 minutes after which they were allowed to cool. Storage tests at elevated temperatures (40°C) showed no change in colour, flavour or taste after 6 months.

It is believed that commercialisation of *kanji* production is possible given these very simple methods of processing.

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IT/Patrick Mulvaney

Carrots provide the base for a refreshing fermented beverage

Keywords

Carrot, *kanji*, fermented, beverage, India, food processing

Improving *Madila* – a traditional fermented milk from Botswana

Mrs Omo Ohiokpehai and Jim Jagow of the Botswana Food Laboratory describe the improvement of a traditional fermented dairy product from Botswana. It shows how a simple technical investigation may open opportunities for improving incomes through small scale commercialisation.

In the rural areas of Botswana, most households rear cows. The milk is commonly fermented to make *madila*, a very popular traditional product which is consumed by most people. The traditional process is quite long taking between 10 and 15 days.

The traditional method

Fresh milk is filtered through a strainer and then placed in an enamel bucket. This is then kept in a warm place for 24 hours to initiate fermentation. The soured milk is then poured into a woven polypropylene sack and a further bucket of one day old soured milk is added each day over a seven or eight day period. During this period the *madila* continues to ferment. The bag is then hung from a beam for three or four days during which time the whey drains away through the woven bag. Finally the *madila* is removed from the bag and mixed with fresh milk in a ratio of 4:1 before consumption or sale.

Keywords

Milk, fermentation, *madila*, dairy, food processing, small scale

Improving the traditional method

The Food Laboratory of the Botswana Technology Centre has investigated *madila* production with the objective of reducing its preparation time and improving the levels of hygiene and sanitation.

Fresh milk was heated to 70°C and, when cool enough to handle, was filtered through cheese cloth. All utensils were placed in boiling water and then stored in a bucket full of water to which a few drops of bleach had been added until required. When the milk had cooled to about 30°C a small amount of commercial *madila* was added as a starter culture. The mixture was then kept in a warm place at 40-45°C (wrapped in blankets if necessary to retain the heat). Fermentation was allowed to continue for four days, adding more cooled pasteurised milk each day as in the traditional method. On the fifth day the *madila* was strained through a clean jute bag after which cold pasteurised milk was added until it had the correct acid taste (pH between 3 and 4).

Taste tests showed the final product to be comparable with traditional *madila* and we believe that this improved method can be adapted for use in rural areas. The main advantages of the improved method are:

- the methods used are more hygienic and the product safer to consume
- the yield of final product is greater
- the preparation time is halved.

We now wish to isolate and identify the micro-organisms involved in order to produce a standard starter culture, similar to those available for yoghurt production. This would ensure the production of a standard product and perhaps open the door to small scale commercial production of this traditional product from Botswana.

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Kawal – a traditional fermented product from Sudan

Kawal is a strong smelling Sudanese, protein-rich food. It is prepared by fermenting the leaves of a wild African legume, *Cassia obtusifolia*. It is usually cooked in stews and soups and used as a meat replacer or a meat extender.

The *Sickle Pod* plant (*Cassia obtusifolia*) is a wild legume that grows in Sudan. The leaves should be collected late in the rainy season when the plant is fully grown. All the stems, pods and flowers should be removed.

If they are not removed, the final product is bitter. The leaves should not be washed. It is thought that natural micro-organisms on the leaves are important for the correct fermentation.

The leaves of the leguminous plant are pounded into paste without releasing the juice. The paste is placed in an earthenware jar and covered with sorghum leaves. The whole jar is sealed with mud and buried in the ground up to the neck in a cool place. Every three days the contents are mixed by hand.

The fermentation takes about fourteen days. The fermentation is extremely complex. The main micro-organisms are *Bacillus subtilis* and *Propionibacterium spp*. Lactic acid bacteria including *Lactobacillus plantarum*, yeasts including *Candida krusei* and *Saccharomyces spp* and moulds including *Rhizopus spp* are also involved.

After about fourteen days, the strongly smelling black fermented paste is made into small balls and sun-dried for five days.

Gundruk – a traditional Nepalese fermented food

Gundruk is made from fermented leafy vegetables. It is very popular in Nepal, where it forms part of the daily diet, consumed as a side dish with the main meal and as an appetiser. During the off-season, when the diet consists of mostly starchy tubers and maize which tend to be low in minerals, *gundruk* is an important dietary supplement. The annual production of *gundruk* in Nepal is estimated at 2,000 tons, mostly produced at the household level.

During the months of October and November, fresh harvested leaves of mustard, radish and cauliflower are available in abundance. It is impossible to consume such large quantities in the fresh state, therefore methods for their preservation have been adopted. The leaves undergo a type of lactic acid fermentation, thus preserving the leaves for consumption later in the year. Most lactic fermentations involve the addition of salt, but *gundruk* is an example of fermented leaves which are fermented without the addition of salt.

Salt is traditionally added to the raw materials to encourage the growth of lactic acid producing bacteria at the expense of other non-desirable organisms. The lactic acid produced by bacterial fermentation lowers the pH of the product and prevents the growth of other spoilage organisms. In general, foods with a pH lower than 4.6 can be considered as safer foods.

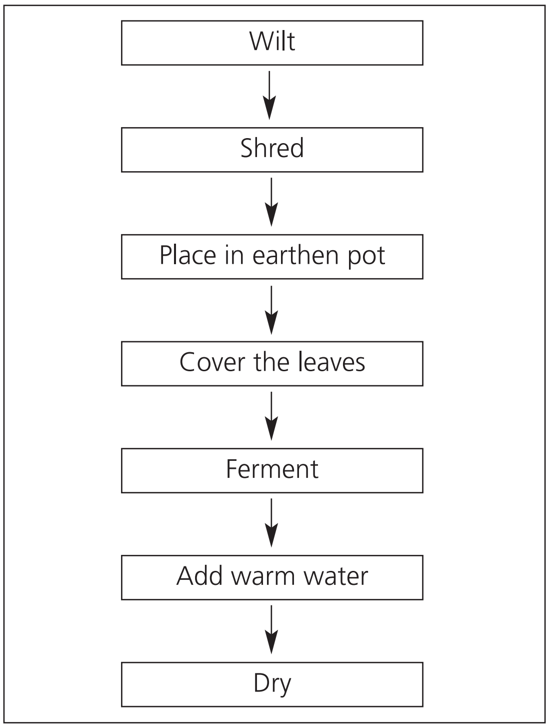
With the preparation of *gundruk*, the lactic acid bacteria are not given any assistance to multiply. The fermentation depends on the natural selection of lactic acid producing organisms. However, once they start to colonise the leaves, these organisms proliferate rapidly and soon form the optimum conditions required for growth. The process is very simple and can be carried out at the home with minimum equipment or effort.

Raw material preparation

Fresh leaves are harvested and allowed to wilt for one or two days, after which time they are shredded with a knife or sickle. The shredded leaves are tightly packed in an earthenware pot and warm water (at about 30°C) is added to cover all the leaves. The pot is then kept in a warm place (about 18°C) for between five and seven days. The product is tasted – a mild acidic taste indicates the end of fermentation – and the *gundruk* is removed and sun-dried.

The bacteria responsible for the fermentation are predominantly *Pediococcus* and *Lactobacillus* species. During fermentation, the pH drops slowly to a final value of 4.0 and the amount of acid (as lactic) increases to about 1% on the sixth day.

Procedure for processing leafy vegetables



One of the disadvantages of the traditional process of *gundruk* fermentation is the loss of 90% of the carotenoids, probably during sun-drying. Improved methods of drying might reduce the vitamin loss.

The dried product can be stored in airtight containers for several months.

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Keywords
Fermented food, Nepal, leafy vegetable, *gundruk*

Gundruk is a valuable supplementary food in Nepal

IT/Lindel Carne

Small scale processing of cocoa

In this article Walter Rios, Intermediate Technology's senior food technologist, describes the work that has been carried out to process cocoa into chocolates. As he demonstrates, traditional artisan chocolate producers can considerably increase their incomes by using the technology to make high quality chocolate confectionery.

Keywords
Cocoa, chocolate, Peru, food processing, income generation

At the time of writing, the exchange rate was 2.8 soles to the US$.

The cocoa tree *(Theobroma cacao)* is a native of the dense tropical Amazon forests where it flourishes in the semi-shade and high humidities.

The Mayas of the Yucatan and the Aztecs of Mexico cultivated cocoa many hundreds of years ago. Montezuma, Emperor of the Aztecs, consumed regularly a preparation called 'chocolatl' made by roasting and grinding the cocoa beans, followed by cooking with water, maize, anatto, chilli and various spices. The richness of this mixture no doubt had some connection with the Aztec belief that the cocoa tree was of divine origin and later led the Swedish botanist, Linnaeus, to give the name 'Theobroma' – Food of the Gods – to the genus including the cacao species.

In Peru, the principle areas of cocoa production are around the towns of Cuzco, Jean and to a lesser extent Cajamarca, where it is processed to a crude form of chocolate which is widely used, dissolved in hot milk, for breakfast. Around Cajamarca a small piece of soft cheese is commonly added to the drink.

Cocoa is processed at three distinct levels:

- by small artisan producers
- by small enterprises, principally in the cities of Cuzco and Lima
- by large companies in Lima.

This article is largely concerned with the methods used by the very small scale artisan producers.

Luxury chocolates, attractively presented

IT/Roger Basil

Artisan processing of cocoa beans

The pods of the native criollo cocoa are opened and the beans removed. Depending on the particular region, they may or may not be fermented. Good fermentation, during which the typical rich chocolate flavour develops, is a critical step for the production of a good quality, well flavoured product. When fermentation is practised it is done in heaps covered with plastic sheet, in sacks or in wooden boxes. The beans are then sun dried and sell for s/2.50 to s/3.00 per kg. It seems extraordinary but there appears to be no price differential between good flavoured well fermented beans and unfermented ones with little flavour. It is suspected that the decision to ferment is largely influenced by tradition and perhaps the increased acceptability of the product to buyers.

Artisan production of crude chocolate

Some producers remove the outer testa, or skin, of the bean prior to processing (a step known as decorticating), others do not. Although the yields are 13% lower when the beans are decorticated, the quality of chocolate from these beans is superior as it is less fibrous and 'gritty'. Again it is believed to be tradition and easier marketability that are the key factors influencing choice.

The beans are then ground in stone faced mills. Metal hammer and plate mills are unsuitable as they cannot grind the beans sufficiently finely. The mills may be hand or motor powered. Nowadays most chocolate producers depend on service milling which costs s/1.00 per kg. The milled beans leave the mill as a semi- fluid, plastic mass due to the frictional heat developed in the mill which melts the cocoa butter. The mass is then poured into round wooden moulds and allowed to cool and solidify. The crude chocolate sells for between s/16 and 20 per kg.

The science of chocolate making

The science of chocolate making is very complex but in essence the main difference between the crude artisan product and high quality chocolate is related to two factors:

- the presence of a brilliant shiny surface which is achieved by the addition of extra cocoa butter
- careful control of temperatures during chocolate making in order to develop the correct fine crystal structure.

To make high quality chocolates a special blend, called 'couverture', which contains added cocoa butter has to be made. Couverture may be sweet (with added sugar) or bitter. The first step that was examined was the extraction of cocoa butter from beans. After this, formulations were developed using couverture chocolate.

Extraction of cocoa butter

A simple screw press, similar to those used to extract oils, was found to be suitable for the extraction of cocoa butter from beans. Batches of fermented, dry, decorticated beans were used. Each batch was 9.5 kg, the capacity of the press.

First the beans were coarsely milled in a hammer mill and then gently warmed before being pressed. The liquid cocoa butter emerged from the press casing, leaving a high fat cake, or 'cocoa powder' behind. The yield of butter obtained was found to be extremely temperature dependent. In Jean, where the ambient temperature is 30°C, 3.1 kg of butter was obtained from each 9.5 kg of beans. In Cajamarca with ambient temperatures of only 16°C, only 1.3 kg of butter was obtained.

The crude cocoa butter was then filtered through cloth and allowed to solidify.

Production of chocolates

Making good quality chocolates requires both technical knowledge, artistic skills and great attention to detail.

A typical recipe for a sweet couverture is:

	Quantity (kg)	*Unit cost (s/kg)*	*Total cost (s)*
Cocoa cake	1.13	12	13.60
Powdered milk	1.0	8.65	8.65
Sugar	1.72	2.00	3.50
Cocoa butter	1.3	25	33.40
Margarine	0.25	4	1.00
Total	5.4		60.15

These ingredients are placed in a double boiler or *baine marie*. The pan used must be absolutely dry. It is very important that the water in the outer boiler does not boil for there is a danger that steam will contact the melting chocolate. An ideal water temperature is 80°C. The mix is constantly stirred until it melts. The temperature of melting should be between 50 to 55°C, outside this range the crystallisation characteristics and 'mouth feel' will be altered. Great care must be taken to assure that no drops of water or steam contact the mixture. The presence of even one drop of water will diminish the shine and brilliance of the finished chocolates.

IT/Roger Basil

Small scale processing adds value to cocoa

The mix is then removed and must next be subjected to a thermal shock which develops the correct crystalline structure. This can be done by either pouring the mix onto a cold marble slab or by placing the pan in cold water. When a drop of chocolate feels cool when placed on the lips it is cool enough (25 to 30°C) for moulding.

In Peru flexible plastic moulds, in a wide range of shapes (moons, ovals, bottles etc) are widely available. These are recommended as they are cheap, light in weight and do not cool the chocolates rapidly. Because they are flexible it is very easy to 'pop' the finished products from the moulds.

The filled moulds are allowed to cool. In warm areas it helps if they are placed in a refrigerator for a short time. The moulds should then be left to stand in a well ventilated room for at least eight hours before removing them from the moulds.

The cleanliness and dryness of the moulds is very important to producing high quality chocolates. If the production process is continuous and the chocolates are easily removed from the moulds without leaving a residue, it is not essential to wash the moulds as this will increase the time required and also adds the danger of introducing water. However, if the moulds are left empty for any period of time, it is essential that they are cleaned to ensure they are dust free and hygienic. If they are to be cleaned it is sufficient to use just hot water. Detergents or soap should never be used as they contaminate the flavour. It is essential that the moulds are absolutely dry before use.

IT/Roger Basil

Luxury moulded chocolates for sale

Profitability of Artisan chocolate production

		Soles
100 kg beans at s3/kg		300
Losses (stones, dirt etc)	5%	
giving a yield of	95 kg	
Milling costs (1s/kg)		95
Loss if decorticated	13%	
giving final product yield of	83kg	
Total costs		395
Sales value of crude chocolate (s/18 per kg)		1495
Family income for processing 100 kg beans		1100

Problems and how to resolve them

If the chocolates:	then
have yellowish marks	the moulding temperature was too low
are sticky	the moulding temperature was too high
are gritty in the mouth	they were left too long in the refrigerator
have a dull surface	a drop of water entered during melting

Adding value to the Artisan process

IT Peru has been investigating the potential for small producers to improve their process, thereby producing high value chocolates which can be used to generate income.

Somewhat larger enterprises always decorticate prior to milling as they can produce a higher quality product. At this scale, a series of three stone mills are used, each set to a finer grind, producing a smoother, less gritty chocolate which sells for a higher price.

At the small scale, the artisan finds it difficult to compete with the larger processors as the latter are able to produce a higher quality product.

The Agro-Processing Project at IT Peru believes that this increased income fully justifies the investment in a press and the other minor items of equipment that will be required to establish a chocolate making centre.

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How much value is added by making quality chocolates?

- We have seen above that a typical income from processing 100 kg of cocoa beans to artisan chocolate is s1100.
- Between 1.3 and 3.1 kg of cocoa butter can be pressed from 9.5 kg of beans. In the following calculation it is assumed that a somewhat below average yield of 2 kg is obtained.
- Further processing of 100 kg of beans will produce 21 kg of cocoa butter and 79 kg of cocoa powder or cake.
- We have also seen that 1.3 kg of cocoa butter can produce 5.4 kg of finished sweetened chocolates that sell for s/20 per kg. Thus 21 kg of cocoa butter will make 21/1.3 × 5.4 = 87 kg of chocolates. This will also use 18 kg of cocoa press cake.

The producer thus has 79 – 18 = 61 kg of cake that can be used to make artisan drinking chocolate. The income from this activity will thus be 61 × s/18 = s/1090.

The finished chocolates sell readily for s/20 per kg so the income from each batch made is s/108 with the raw materials costing s/11 per kg. Therefore for each 5.4 kg batch of chocolates, there is a profit of s/48.

Because 1.3kg of cocoa butter are required per batch, it is possible to make 16 batches of chocolate from the original 100kg of beans. The sales value of this is 108 × 16 = s/1728.

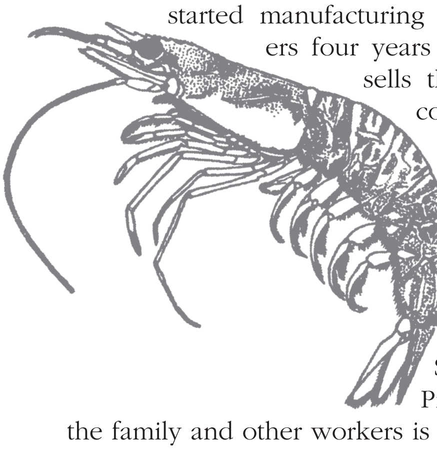
The total income from 100 kg beans is thus s/1728 plus s/1090 from drinking chocolate powder which is equivalent to s/2818. This is in comparison to s/1100 when only producing artisan chocolate.

Small-scale manufacture of shrimp crackers

Shrimp crackers are a popular snack food in South East Asia, particularly in Myanmar, which is the focus of this article. The production process is relatively simple and can quite easily be carried out at the small scale in the home to provide a supplementary source of income. As always, particular attention must be paid to the hygiene and quality control in order to produce a safe, attractive, consistently good product.

In this article Dr Peter Steele of the Food and Agricultural Organisation (FAO) describes one of the 35 enterprises he visited in Myanmar in October, 1997 in a mission to explore a number of income generating activities. With assistance from FAO, the Cottage Industries Department of Yangon has delivered a successful training course in fish cracker production. South-South transfer of information and expertise is mainstream to FAO's work and consideration is now being given to the preparation of a manual based on the information collected during the mission. We are very pleased to be able to present this first ever article from Myanmar.

The owner of this micro-enterprise, Ma Khin Ma Ma of Mawlamyinegyun Town, started manufacturing shrimp crackers four years ago and now sells throughout the country including in the main towns of Yangon and Mandalay under the trade name 'Nilar Shrimp Chip'. Production by the family and other workers is seasonal, from October to February, after the end of the main rainy season. The owner also earns an income from his small mechanical engineering workshop. Despite the numerous markets that have developed for the brand, production remains little more than cottage scale.



Method of production

The skins, heads and tails of the shrimps are removed and then finely chopped. They are then mixed with a liquid paste comprising mainly tapioca flour, salt, monosodium-glutamate, baking powder and a small quantity of water. The mixture is steamed in concentric saucepans in layers 100 mm thick and then stored in a cool place for four days, during which time the mixture shrinks and becomes hard.

1kg fresh shrimps

tapioca flour

salt

monosodium glutamate

baking powder

water

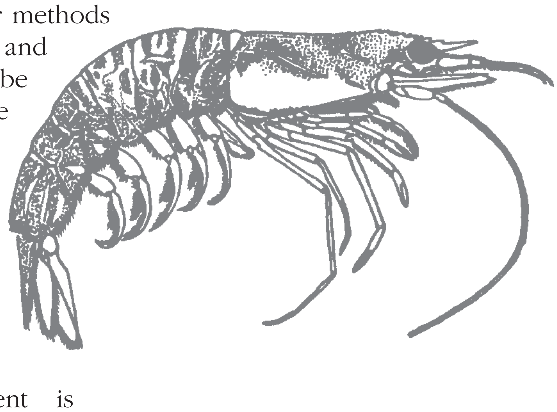
After four days the surface of the hardened mixture is thoroughly cleaned. They are then cut into fine chips using a table mounted hand-operated disc slicer. The round chips, some 30-40 mm diameter and 1mm thick, are dried in the sun and packaged into clear plastic bags 200 × 300 mm with a loose label insert and a second label heat sealed along the top of the bag with a carry handle looped through.

Customers cook the chips in very hot oil for a few seconds before they are eaten.

Economic factors

While time did not allow for a detailed economic examination of production costs, this small enterprise shows it is clearly profitable.

Very little specialised equipment is required – a slicer, which is not essential for very small scale production, will cost about 1,500–2,000ks. Concentric steam saucepans are readily available in local markets for 500–600ks each unit (of 4–5 pans). Apart from these, a cool storage area and a sun drying tray or mat are required. Heat sealing in plastic bags is essential if the chips are to be retailed uncooked. An electric hot-wire heat sealer will cost about 3,000ks. In areas without electricity, other methods such as a candle and saw blade can be used to seal the packets. Street food vendors can make use of temporary sealing – as the chips produced are sold within a day or two. The only expensive ingredient is



Keywords

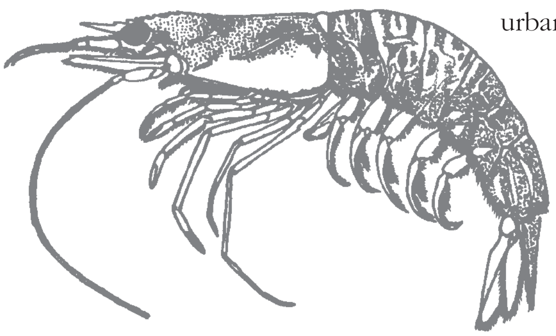
Myanmar, shrimp processing, small enterprise, income generation

The financial information is described in *Kyats* (ks) which, at the time of the visit, were equivalent to 250–270 ks to the US$.

fresh shrimps which are purchased at 200ks/kg. Each kg of shrimps yields 400 g of usable meat. The owner has developed a recipe which produces 1kg final product from each kg of fresh shrimps. Polythene bags are purchased from Yangon at a cost of 1,300ks for 1200 bags. Labels are printed locally. The total cost of packaging is estimated at 2ks/packet. The final product is sold retail for 65ks per 160 gm pack (which is 406ks/kg). Given the low cost of all the ingredients, except shrimp, this cottage enterprise is clearly very profitable.

Constraints

Shrimp chips have become a popular snack food and many variations exist made of fish, with different flavours and colouring. Several manufacturers have established production facilities in Bogalay in competition with Nilar Shrimp Chip. There is now a considerable demand for occasional novelty in the diets of even the poorest villagers in the Delta. Marketing remains the main constraint to new entrants. Access to urban people or travellers is essential, where income can be earned from the sale of either 'take-home-quick-to-prepare-foods' or 'food-on-the-move'. Taste, freshness, appearance and image will determine the success of the new entrant into this market. For home use, chips make a welcome variation to an otherwise uniform diet, for those who can afford the time and effort involved with making them.



It is obvious that the production of shrimp crackers has potential for income generation at the home level. However, in order to fully realise the potential, it is advisable that a full training package is available, covering all aspects of business development in addition to the specific food technology. In addition to the training, it is also beneficial if loans are available to trainees to enable them to hire or purchase the necessary equipment to put the training into practice.

Readers who would like further information on the training courses and other income generating programmes supported by FAO should contact Dr Peter Steele at FAO, Via delle Terme di Caracalla, 00100 Rome, Italy.

Courses

Course news

Agromisa announce the forthcoming A-week

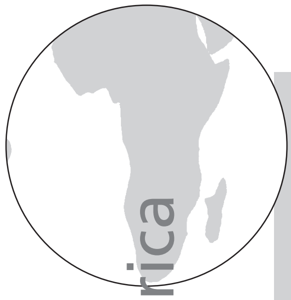
A-week is a joint venture organised by Agromisa and The Institute for Applied Communication and Innovation (ITV). It is an intensive five-day, practically oriented course on Participation in Local Development, aimed at development workers who have little or no experience in the use of participatory methods.

Dates: 26 to 30 October 1998 and 19 to 23 April 1999.
Venue: Leur, the Netherlands

Cost: To include all meals overnight stays and course materials for the week;
Dfl 2500 (UK £830) for participants from organisations
Dfl 800 (UK £270) for individuals.

The language of the course will be English.

For further information contact: Agromisa, PO Box 41, 6700 AA Wageningen, the Netherlands.
Telephone: +31 317 412217
Fax: +31 317 419178
e-mail: agromisa@worldaccess.nl



Training to process fruit

This article on training in fruit processing was written by Joyene Isaacs, Laetitia Moggee and Phillip C. Fourie, from INFRUITEC. With the recent changes in South Africa, there are exciting new opportunities for those previously denied such basic rights.

The article below describes the outline of a basic course in fruit processing and the impact of such training within a community.

South Africa is a country of contrasts, where a small proportion of inhabitants have had access to land, finance and information while the majority were denied the most basic rights. With the recent change in government and democratisation, the previously disadvantaged suddenly gained opportunities through policy changes. Organisations changed their operational framework to accommodate these changes and to facilitate the transfer of technology and information. INFRUITEC is one of the organisations that has adopted a changed mission to ensure disadvantaged communities access to the technology of the past forty years.

Resource-limited communities often lack the skills, practical experience and knowledge of technology to add value to their products. Technology transfer in processing techniques enables farmers and entrepreneurs to gain additional skills and add value to their products. Through this initiative they can increase their income and create opportunities for job creation for unemployed community members. Through interaction and participation, the Fruit Information and Research Service (FIRS) of INFRUITEC strives to redress the constraints experienced by rural communities. Processing training is not done in isolation, but forms part of an overall fruit production strategy, where an improved range of fruit (particularly alternative crops) and value-adding skills are addressed.

The FIRS team works with a range of poor communities in several locations. This article deals with communities within Western Cape Province, of Haarlem and Buysplaas. The main sources of income are subsistence farming, seasonal employment on adjacent commercial farms, state pensions and small-scale hawking of fruit bought from the surrounding commercial farms. Among the population of three to four thousand are many farmers with good agricultural skills and knowledge of vegetables and deciduous fruit.

Each community selects a responsible person to facilitate training courses, meetings, workshops and the general flow of information. FIRS informs the different communities about training opportunities and, through community meetings, persons are selected to attend these training courses. Only ten people are invited to attend each training course, which can accommodate illiterate or functionally illiterate persons. With the technical and developmental experience of the trainers, the course can be adapted for farmers, rural animation officers and extension officers. Each decentralised training course is tailor-made for the participants and will be adapted for illiterate persons where necessary.

Outline of the training course

The training course usually begins with an informal introductory session, designed to introduce participants to each other and to break the ice. After the introduction, a needs assessment is carried out to identify the participants' needs, expectations and fears from the course. This is carried out by giving all participants three cards on which they write their needs, expectations and fears. These cards are displayed in a prominent position and referred to throughout the course and at the end-of-course evaluation. When participants are literate, each one is given a manual which contains all the information on the different processes that will be demonstrated, as well as recipes. The training takes the form of short lectures on each processing technique, which are also demonstrated. Lectures also use videos, slides and visual drawings for better understanding and are presented in the official language of the participants so that interpreters are not needed.

A typical course on fruit processing generally covers the following topics:

- introduction
- needs assessment
- building drying racks and drying techniques
- fruit preparation
- sulphuring techniques
- hygiene
- fruit products – jams, leather, chutney
- evaluation

Practical exercises, such as the building of drying racks and preparation of fruits, are carried out in pairs or in teams, to help build confidence. Participants are asked to examine and evaluate each others work and to comment on the methods used. The preparation of fruits, from harvest through to sulphuring

Keywords

South Africa, fruit processing, training, jam, fruit leather, drying


INFRUITEC

Preparing fruit for drying

and drying are demonstrated and the teams then prepare their own fruits.

Hygienic aspects of processing are addressed by way of a lecture and by using the previous day's experience to cross-check hygienic practices. This makes the participants realise that they often omit the most basic procedures such as hand washing, fruit washing or cleaning the drying racks before starting with the preparation of the fruit.

The different fruit products, such as leathers, jams and chutneys are introduced with a demonstration and the participants then make their own. At all times, the participants are asked to share their knowledge and experiences by recounting their own methods of production and any problems they encounter. Acknowledging and using the local indigenous knowledge of participants is a good way of strengthening the relationship between participants and trainers.

In addition to all the technical aspects of the course, some time is also allocated to group mixing and socialising, where the participants get the opportunity to discuss and share experiences and problems. Outside guests from relevant food industries are often brought in to share their knowledge.

At the end of the course, there is an evaluation to determine its value and success and how far it went to meeting the expectations and needs of the participants and also whether their fears were allayed. Each participant receives an attendance certificate and takes away the products they have made during the course.

After three months, post-course evaluation is carried out by visiting the participants in their communities and work places to discuss any potential problems or further training needs. Follow-up workshops are also held where participants and other community members can come along to gain further information on specific processing queries.

Facilities

The Montagu Training Centre is a basic building with no elaborate facilities for processing training. There are a few lecture rooms, a large hall and a small kitchen. A hostel is connected to the main building where the participants can be accommodated.

INFRUITEC trainers use training materials that can be transported from one community to the next. Equipment that can be bought locally, such as gas stoves, knives, spoons and bowls are used rather than demonstrating large, unaffordable imported equipment. Communities often have no electricity but gas is readily available in rural areas, therefore electrical equipment is avoided. Participants therefore associate themselves with the training environment and feel more comfortable in these circumstances.

The success of the course

Following the course at the Montagu centre in the Western Cape, several participants have already commenced training other people in their communities. Some participants are using newly learned skills to expand their economic activities to raise their income. They have also prepared many products for marketing and cannot keep ahead of the demand. Follow-up visits will be made after the course to all the participants to give them assistance with training other members of their respective communities. The course proved that there is a great need for the local population in South Africa to be trained to do their own processing and there are plans to extend this course to other regions.

Problems encountered

A follow-up evaluation in the communities was made by INFRUITEC trainers to assess the problems with the training course:

- The target groups is not uniform (i.e, literacy, experience and confidence levels differ) so the course has to cater for all participants, which makes it difficult to gauge participant's understanding.
- Materials (i.e, the availability of bottles, fruit out of season and ingredients) is a limiting

factor for community members.

- Participants had to leave their part-time jobs on the farms to attend the course and their participation meant a loss of income for their families. However, payment to participants would lead to an increase in applications for training courses and would not provide an acceptable solution.
- Although good quality products are produced, the lack of marketing skills to promote their own products limits their hope of achieving success.
- Although participants are very keen to start processing, lack of finance to pursue their own small-scale business is a major constraint.
- Language problems can occur if groups are mixed. The help of interpreters may be needed.
- During fruit drying training, the availability of consistent sunlight is a high priority which is not always possible and could obstruct the progress of the training course.

Lessons learned

Several important lessons have been learned from this training programme. The feedback from evaluations and follow up in the field is being used constructively to improve the course for future trainees. Some of the more pertinent lessons learned are highlighted below:

- Through using PRA methodologies, participants relaxed and learnt more processing techniques.
- Practical demonstrations enhanced the learning curve of participants, but the short lecture strengthened their grasp of the technology.
- The course design facilitated team work and the sharing of local indigenous knowledge.
- The evaluation at the end of the course gave trainers useful insights for future courses and designs to accommodate different target groups.
- The size of the group should not exceed ten persons, because attention to individuals is important in a diverse group.
- The processing training must use locally available fruit.
- Within this course design illiterate persons could be accommodated.

It is envisaged that, with the evaluation comments received from trainees and, based on these important lessons learnt, the INFRUITEC training course will continue to expand and to improve to meet the needs of the participants.

For further information on the courses offered by INFRUITEC, please contact the authors at INFRUITEC, Private Bag X5013, 7599 Stellenbosch, Republic of South Africa

Production of fruit leathers

INFRUITEC

Book Lines

Transformation Alimentaire du Manioc (Cassava Food Processing)

Edited by T Agbor Egbe, A Brauman, D Griffon and S Treche. ORSTOM Editions, 1995, Paris.
ISBN 2 7099 1279 1

This book is the proceedings of an international seminar on cassava processing. It concentrates mainly on Africa as cassava assumes most importance in this continent. While the majority of the papers are written in French, each one contains an English abstract.

The book begins with an overview of the status of cassava processing and utilisation and the various traditional practices in different countries. It then gives a detailed account of the current knowledge of micro-organisms involved in the fermentations of cassava. Cassava is traditionally fermented to improve the food safety by hydrolysing cyanogenic glycosides to liberate cyanide. Other forms of processing are usually engineered towards the preservation of cassava roots and the removal of cyanide, since these two factors are of prime importance to the consumer.

A chapter is dedicated to the different processes involved in producing a range of cassava products. Finally, methods designed to improve traditional processing methods are described, along with potential opportunities for producing novel foods from cassava. Because cassava products are so diverse, the Editors have included a glossary of local names and processing terms which proves very useful to those interested in cassava processing.

Value-added products from Beekeeping

by R. Krell – FAO Agricultural Services Bulletin 124.
ISBN 92-5-103819-8

This large 400 page publication presents a comprehensive and practical review of information on honey, wax, pollen, propolis, royal jelly, venom, adult and larval bees. It also includes a very comprehensive chapter on cosmetics which include bee products in their formulation. The style is easy to read and the publication is very well illustrated with photographs and drawings. The author has clearly met the target set in the preface 'to provide a resource guide, ideas and a practical cookbook of bee products'.

The wide range of bee based products that could provide beekeepers and small enterprises with opportunities for income generation is particularly interesting. There is information on how to use the pollen collected from bees in the production of breakfast cereals and candy bars. It was a surprise to learn that there is a market for dried bees venom. The potential to use bees products for producing cosmetics is considerable. Honey can be used in the production of tonics, anti-irritants and emolliants; bees wax can be used in depilatories and sebum restorants and royal jelly in elastifiers, firmers and revitalisers.

A comprehensive bibliography and contacts list is provided.

Internet news

The Internet is the global network of computers that is revolutionising communications. There is now a huge wealth of quality information on food processing that is available instantaneously on the Internet. To access this information, it is essential to have a computer, a modem, telephone line and an account with an Internet Service Provider. The 'modem' converts the 'digital' information used by a computor into the 'ananalogue' information that is required for telephonic transmission. For field workers and others based in remote villages this might not be the most appropriate means of collecting information, but those fortunate enough to have access to the equipment, it is an exciting and rapid way of gathering and disseminating information

You can search for information on an infinite number of topics. Food processing is no exception. There are already hundreds (if not thousands) of 'sites' with information on food processing. We developed this new page to bring you information about developments and new food processing sites on the Internet.

Food links

A very useful site for accessing information on food processing has been developed by the Food Links project of IDRC in Canada. They have searched the Internet and produced an annotated list of useful sites on post harvest activities including food processing. This can be found at http://www.idrc.ca/foodlinks/browse.html.

INPHO

The Food and Agriculture Organisation of the United Nations is proposing to develop an Information Network on Post Harvest Operations. This would make validated information on all aspects of post harvest operations available on the Internet.

Food Chain

Food Chain will be available on the Internet at http://www.oneworld.org/itdg. Readers will be able to visit the site and print out the information directly. This is a new activity for us and we would be most grateful if readers would let us know if they find this useful.

Food and Nutrition Internet Index (FNII)

FNII is a fully searchable web site describing and indexing food and nutrition resources available on the internet. This can be found at http://www.fnii.ifis.or

Royal Tropical Institute

This site is particularly useful for links to other sites on development and electronic libraries. http://www.kit.nl

The Internet Access Group on Africa (IAGA)

'What potential does this technology have for Africa? How can it be harnessed to bring about social and economic development? What are the costs and benefits of introducing this technology on a mass scale?' Contact: mikebc@globalnet.ac.uk; or visit http://www.users.globalnet.co.uk/~mikebc

AGRO Research on the Web

National agricultural research institutes in developing countries can now be linked, at no cost, to the internet and World Wide Web. This will enable them to access and disseminate research information far more quickly. The service has been developed by International Service for National Agricultural Research (ISNAR), part of the CGIAR network.

Uvachada – an alcoholic liqueur

Alcoholic liqueurs are popular in the Amazon region of Peru. A particular type of liqueurs known locally as macerados are prepared from grapes or other fruits or herbs, steeped in a pure alcohol – *aguardiente* – distilled from sugar. The process is a traditional one, often carried out in the home and with little attention paid to hygiene and quality control. In this article Alex Puerta of Intermediate Technology (IT) Peru describes methods to improve the quality of *uvachada* with the aim of producing a product of an assured quality to capture the growing markets for the liqueur in urban centres. It also investigates the potential for producing the liqueur from other local fruits.

Keywords
Peru, *uvachada*, alcohol, beverage, grape

Many visitors to the San Martin area of Peru, which lies on the edge of the Amazon Basin, are surprised to find grape production in a steamy tropical climate. For the last twenty years small farmers around the hamlet of San Antonio de Cumbaza have dedicated themselves to grape cultivation. They have a major economic advantage over growers in other parts of Peru in that they obtain three harvests a year. Much of the grape harvest is used for the production of wine; however, the methods used are often very simple and unsophisticated, with little attention to the control of fermentation, hygiene and quality control. The poor wine that results however finds a market, at low cost, in local markets and stores.

Given the characteristics of the local grapes, an alternative local method of processing is to make a product called *uvachada*, which is essentially a wine fortified with alcohol, sweetened with sugar and containing whole grapes. *Macerados* is the local name for all types of liqueur made in this way. It is a delicious liqueur and is very popular both inside and outside the region. Although it is generally only produced in the San Martin region, there is a good market for the product in Lima. At the moment, this market is an informal one, with visitors to the San Martin area buying the liqueur and taking it back to Lima. The IT Agro-processing Programme in Peru is interested in upgrading this and similar types of product, with a view to their commercialisation to generate increased incomes for the farmers of San Antonio.

Extraction of sugar cane juice

IT/Mike Battcock

Principles of making *macerados*

Uvachada is one of a range of traditional products, locally known as macerados, which consist of fruits, herbs, roots and in some cases insects and snakes steeped in strong alcohol to extract flavours or active components. The current IT agro processing project in Peru has been reviewing traditional methods of macerados production with a view to improving the processing and the quality of the final product so that it can be marketed in the cities.

As can be seen in the flow diagram, the production of macerados involves common steps which can easily be better controlled to provide products of higher and more standard quality. Regardless of the type of fruit used in their production, preservation of the products will depend on the quality and quantities of the other raw materials used. Similarly, final quality also depends on quality control at the various stages of production; syrup preparation, mixing, steeping or soaking and storage time.

One very important ingredient is almost pure alcohol, produced by the fermentation and distillation of sugar cane juice. In Peru this is known as aguardiente, and in San Martin is produced in small rustic stills. It is very important to measure, by density, the strength of the aguardiente and, even more important for public safety, to be sure of and guarantee its purity. Similarly, the quantity of sugar made into syrups for sweetening macerados must be controlled and measured with a specific gravity spindle. Finally quality control checks are needed on the alcohol and sugar levels in the final product.

Production of *uvachada*

As *uvachada* production is an important source of income in San Martin it was decided to examine ways to control the quality of production in order to increase incomes. The process is shown in the flow diagram.

A new *macerado* made from Cocona fruits

Cocona *(Solanum topiro)* grows profusely in San Martin where its fruits are very popular. In view of this popularity it was decided to prepare a liqueur, similar to *uvachada*, from this fruit. The method is very similar to that used for *uvachada*, with an additional steeping stage where the chopped fruit pieces are soaked in syrup for two days to extract the flavour. The liquid is then sieved and filtered before the aguardiente is added and the same method is followed as for the uvachada.

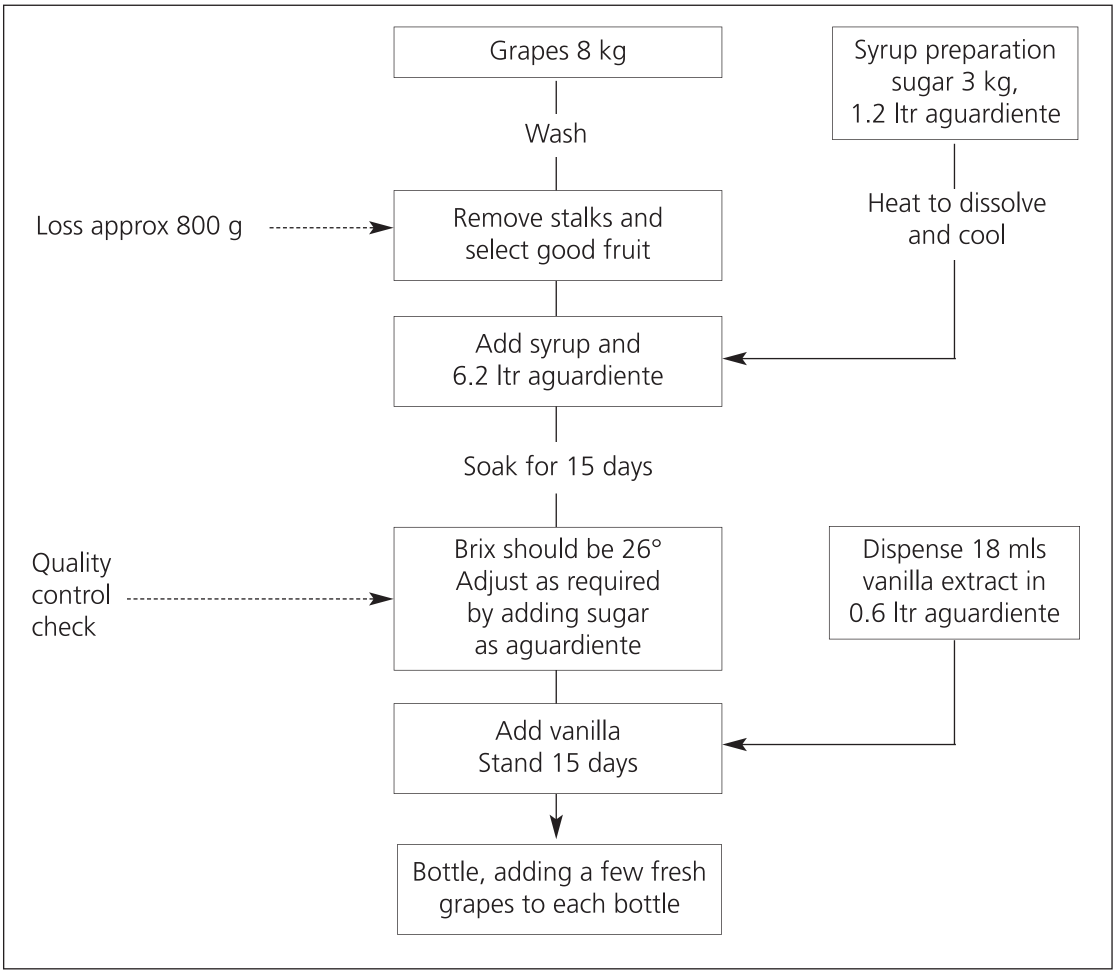
The potential of using other fruits in a similar way is being explored by the team in San Martin, with a view to producing a range of products of high standard which can be supplied to outlets in urban centres.

For further information contact Intermediate Technology Peru, Casilla 18-0620, Lima 18, Perú, Fax: 0051 44 824024

IT/Walter Rios

Bottling of uvachada

Flowchart of uvachada production



Cultivation of the oyster mushroom in traditional brick pots

Mushrooms are a popular and nutritious food throughout the world. However, for many they are often an unaffordable luxury. This article from Ethiopia describes how oyster mushrooms can easily be cultivated at home, utilising agricultural waste residues, so providing the family with a nutritious supplement to the diet.

The author – Dr Dawit Abate – has kindly agreed that this interesting article, originally published in The Mycologist (November 1995) can be reproduced in Food Chain, to give readers the opportunity of finding out how they can grow mushrooms, a highly valued commodity, at home.

Keywords

Ethiopia, mushroom, cultivation, small-scale processing, waste utilisation, agricultural residue

As in many African countries, wild mushrooms (known as *Enguday* in Ethiopia) are collected and consumed in many parts of Ethiopia, however this opportunity is limited to a few months of the rainy season. Cultivated mushrooms are a highly valued product and are often either not available in the market or are unaffordable for most families. During an investigation of the cultivation of edible mushrooms on agricultural residues, it was found that traditional clay pots, known as Ensra, can successfully be used to grow mushrooms for home-use.

Ensra are common in all households, rural and urban, as they have a multitude of uses. They are used to fetch and store water, to brew traditional beverages and to store grain and are available in a variety of sizes. They are made by traditional potters and are available in local markets relatively cheaply.

Waste agricultural residues provide ideal substrates for the growth of mushrooms. In earlier investigations, Dr Abate found that cotton waste, eucalyptus (*Eucalyptus camaldulensis* and *E. globulus*), wood chips, tef straw (*Eragrostis tef*) and mixtures of these raw materials, supplemented with 1% wheat bran, were optimal substrates for the cultivation of oyster mushrooms. These three agricultural waste materials are some of the most readily available cellulose rich materials in Ethiopia.

Preparation of inoculum

An inoculum is a culture containing the immature fungal spores. When the inoculum is placed on a substrate which gives it nutrients and given ideal conditions for growth (optimum temperature and water content), it multiplies and matures. In this case, the inoculum was prepared by adding the fungal culture to a substrate of eucalyptus wood chip and wheat bran (in a ratio of 1:1). This mixture was placed in a plastic bag and pasteurised to destroy any unwanted spores. The plastic bags were then incubated at room temperature to allow the mushroom mycelia to grow and penetrate the starter culture mixture.

Five ensra, each of about 30 litres capacity, were purchased from the market in Addis Ababa. Nine holes, 5 cm in diameter, were carefully drilled in each one.

Preparation of substrate

The substrate was made from an equal mixture of eucalyptus wood chips and cotton waste, supplemented with 1% wheat bran. The substrate was moistened with water for three hours and then transferred into the ensra and heated in an oven for about one hour. This pasteurised the substrate and killed any fast growing moulds.

Inoculating the substrate

The excess water was removed and after cooling the substrate was inoculated with a 5% (wt/wt) inoculum. The holes of the pot were then plugged with cheese cloth and the inoculated pots were incubated in a well ventilated, dark room. For this purpose, an experimental mushroom house had been constructed from natural plant materials. This room sheltered the ensra from direct sunlight while at the same time allowing natural ventilation, maintaining the temperature at 20°C and creating a humid environment (a relative humidity of 80–90%). The relative humidity of the surrounding air was only 60% which is sub-optimal for growth of mushrooms. In dry climates, the low relative humidity is a limiting factor in the cultivation of mushrooms. By using ensra in controlled conditions, a micro-climate can be created which is more conducive to fungal growth.

The holes of the ensra are important for aeration of the substrate and also as an outlet for the mushroom fruiting bodies. After about fifteen days incubation, when the mycelia could be seen, the cheese cloth plugs were removed from the holes. The pots were occasionally watered to keep the substrate moist.

About thirty days after inoculation, immature fruit bodies started to develop and to grow out through the holes in the ensra. Mature fruit bodies developed faster through holes nearer the base than through the upper holes. The fresh fruit bodies were harvested as they matured and production of new fruit bodies continued for five days after the first ones were harvested. The total productive period was forty days from the date of inoculation until production ceased. The largest mushroom harvested was 19 x 11 cm and weighed 104 g. In general, the weight of mushrooms was found to be bigger than when grown on open beds using the same substrate. A total yield of 2.5 kg mushrooms per pot was obtained, which is equivalent to about 0.36 kg fresh weight per kg dry substrate used.

If a family owns several ensra and uses different inoculation times, it is possible to get fresh mushrooms throughout the year.

The use of mushrooms

Mushrooms contain about 30% protein on a dry weight basis and are also a rich source of vitamins and minerals. In Africa, mushrooms are traditionally preserved by smoking over an open fire or by sun drying for two to three days. The oyster mushroom has a rich taste and could easily be acceptable as a component of the various traditional Ethiopian foods. It has been noted that many people in Africa see a much closer association between mushrooms and meat than between fungi and plants or vegetables.

Technology transfer

This simple procedure to cultivate mushrooms on cheap, readily available agricultural residues can be practised by individuals, particularly women, to supplement the protein needs of the family. It could also form the basis of a small income generating business.

There are problems associated with the transfer of technology for mushroom cultivation, but this method illustrates how it can be adapted for use at the home level, utilising locally available materials and equipment. One of the major constraints however, is the supply of starter inoculum or spawn. A system is required, maybe through the local agriculture extension service, for the provision of starter inoculum.

Dr Abate

Ensra (traditional clay pots) are ideal for mushroom cultivation

The author, Dr Dawit Abate, acknowledges financial support from Ethiopian Science and Technology Commission. *For further information on the culture of oyster mushrooms, he can be contacted via the Department of Biology, Addis Ababa University, PO Box 1176, Addis Ababa, Ethiopia.*

The Happy Bread and Biscuit Factory

This short article describes a successful rural bakery, established and managed by Ms Rina Akhter after receiving training and financial support from a local development group.

In 1990, Ms Rina Akhter inherited a piece of land from her father. She decided, however, that she could sell the land and use the proceeds to start a small bakery business. She chose to start a bakery as her grandfather had previously taught her the skills of baking.

In 1996, Rina joined the PEP-BRDB (Productive Employment Programme of the Bangladesh Rural Development Board), where she took a Tk 3000 loan which contributed to the establishment of the bakery and the purchase of equipment. Her husband, Md Jahangir Hossain, a small scale trader, supported Rina by helping with the marketing of products.

Within one year, Ms Akhter had repaid the first loan and took out a second one (Tk 9000) to improve and expand the facilities and equipment. She also repaid this loan within a one year time period.

The bakery has been very successful, both in terms of increased income for her own family and the creation of employment and the supply of baked goods in the area. Presently, thirteen people are employed on a full time basis – seven involved in the production and six in the marketing and sales. Daily production rates are in the order of 50kg bread, 30kg different variety of biscuits, 5kg cake, 100 pieces of Danish pastry and patties. The products are very well received in the area. She has one van which is used to distribute the goods to local areas - Goalanda bazaar, Momin Khat hat, Daulidia, Char Chandpur, Harkati para and Rajbari Sadar. Within the immediate vicinity are five other small bakeries, which all provide competition for Ms Akhters products. Rina usually sells all her daily production as there is a good local demand and the people like her products.

Key words

Bangladesh, bakery, small-scale, training

At the time of writing, the exchange rate was Tk 70 to UKstlg1.

IT/Mike Battcock

Bakery goods on sale in Bangladesh

Analysis of the daily cost of production

Item	*Cost (Tk)*
120 kg flour	1560
16kg soybean oil	800
30kg sugar	900
10kg dalda (vegetable fat)	550
miscellaneous	400
wages (13 staff)	650
Total	4860
Total daily sales	5100
Daily net profit is	240

Working on a 30 day month, the monthly net profit is Tk 7200

Bakery goods are sold on credit, which creates problems with the cash flow of the business. Ms Akhter believes that a further loan would ease the problems of cash flow and ensure more efficient and smooth running of the business.

In addition to the credit and loans service supplied by PEP-BRDB, Ms Akhter has benefitted from training in various skill areas including management, business development and food processing. At the beginning, Rina faced several problems such as availability of capital, space to produce and equipment and utensils. Gradually, with the help of PEP-BRDB and her own commitment to the business, the situation has improved. Rina puts the success of her small business down to a combination of the different skills training and the availability of credit to start the business, combined with her own enthusiasm, determination and hard work.

For further information on training and food processing projects in Bangladesh, contact Shaheda Azami, programme manager, IT Bangladesh, GPO Box 3881, Dhaka 1000, Bangladesh

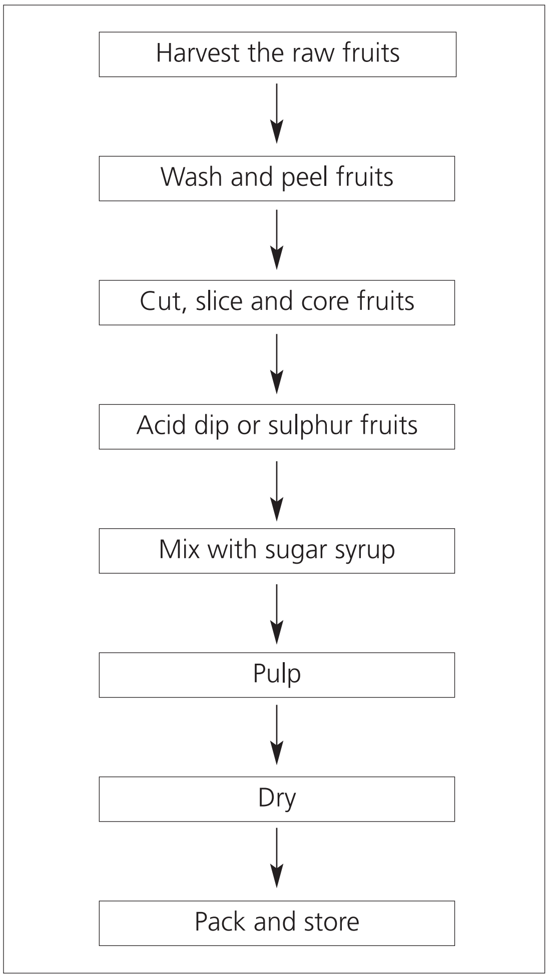
Fruit leathers

The production of fruit leathers is an attractive alternative method of processing fruit to extend its shelf life. Fruit leathers are dried sheets of fruit pulp which have a soft, rubbery texture and a sweet taste, with the distinctive flavour and colour of the raw material. Most fruits can be used for the production of leathers, including banana, mango, apricot, guava, pineapple and papaya. The leathers can either be rolled in plastic sheets and stored for a few weeks, or can be cut into small pieces for use in confectionery and baked goods. Layers of fruit leather from different raw materials can be sandwiched together to form a type of confectionery product.

The process

The preservation process is very simple and basically involves the production of a sugar-rich fruit puree which is subsequently dried. Both the addition of sugar and drying decrease the amount of free water available and therefore prevent the growth of spoilage organisms which spoil the fruit.

Production process



Selection of fruit

It is important to select ripe fruits. Overripe ones can easily become damaged and bruised. Under-ripe fruits will not have the full flavour and the colour may be poor. If bananas are used, they should be harvested before they are fully ripe, with the skin a little green. The fruits are peeled and cut into smaller pieces, both to remove any inedible pieces and to accelerate the rate of drying.

Acid dip/sulphuring

Both acid dipping and sulphuring are carried out to prevent oxidation and retain a bright colour, however, neither should be used for red fruits as it bleaches the colour. To acid dip, place the fruit pieces in lemon juice or citric acid for 5 to 10 minutes. Sulphuring can either be done by burning sulphur or dipping in sulphite. Burn sulphur (350 to 400 g/kg fruit (2 to 3 tablespoons per kg fruit)) in a sulphuring tent or cabinet. Sulphite dip – dissolve 0.3 to 0.45 g sodium or potassium metabisulphite in 1 litre of water. The length of time for sulphuring varies according to the size and thickness of the fruit pieces.

After sulphuring, boil the fruit pieces in a strong sugar solution (60 to 70% sugar) for 10 to 15 minutes, then soak in the syrup for up to 18 hours.

After soaking, pulp the fruit and syrup mixture with a liquidiser or pulper, then spread onto polythene sheets, aluminum foil or greased paper for drying. Dry at 38 to 60°C. The temperature should not be too hot or it will discolour the product. Package the dried product in moisture proof plastic and store in a cool, dry place, away from sunlight.

A fruit leather product from Syria