

# **An Appraisal of The Small-Scale Agroprocessing Sector in Rodrigues – Part 1: Manufacturing Practices and Product Quality**

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*Paper Accepted on 28 January 2010*

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## **ABSTRACT**

Rodrigues Island has an established reputation for its agroprocessed products and the agroprocessing sector plays an important role in the economy. However, there is still limited amount of information and data on the sector to devise appropriate development plans. This study was therefore undertaken to map out the characteristics of the small-scale agroprocessing sector in terms of types of products, level of use of technology and manufacturing practices and to examine the practices related to product quality and safety. 119 agroprocessors were interviewed using a structured questionnaire. The results indicate that the small-scale agroprocessing sector is mainly run by women. The major raw materials used are lime, chilli, octopus and pork. The main products are sweet and sour lime, chilli/lime pickled in vinegar and processed octopus and are usually manufactured in the kitchens of the processors. Most of the products require low cost equipment and very few specific ingredients. However, most of the products are not produced according to the regulations stipulated in the Food Act (1998). Although 98 % are aware about the concept of shelf-life of a product it is not determined in most cases. Poor labelling, especially the absence of date marking and in some cases packaging in inappropriate containers, project a negative image of the

sector. The importance of product quality, good manufacturing practices, product labeling and role of the food laboratory are discussed. Some recommendations related to improving production of raw materials, boosting of production of processed products and improving quality and safety of products are made for producing quality agroprocessed products.

**Keywords:** Rodrigues, agroprocessed products, small-scale agroprocessing sector, product quality.

## **1.0 INTRODUCTION**

Rodrigues is an island situated at some 653 km to the North East of the Republic of Mauritius. It has a surface area of over 104 km<sup>2</sup> and 37499 inhabitants in December 2007 (CSO, 2008). The economy of the island depends on agriculture, fishing and tourism. Cattle and pig rearing and vegetables and fruits growing, as well as processing, represents major sources of income and employment for the population. In 2007, there were about 5745 people employed in the agriculture, forestry and fishing sectors (CSO, 2008). The Rodriguan agriculture is moving gradually from a traditional to a semi-intensive/intensive type of agriculture (NEPAD/FAO, 2005).

The main food crops grown as at 2007 were creepers (817 t), maize (640 t), mixed vegetables (475 t), onion (389 t) and chillies (7.3 t) (CSO, 2008). The main traditional crops are maize, cassava, and sweet potato. The main fruits are lime, banana, sweetsop, mandarin, mangoes, coconut, pineapple, grapefruit and pawpaw. The main animals produced are sheep, goat, cattle, pig and poultry and which are mainly exported to Mauritius. About 11% of the population is involved in fishing activities. The fishing sector is dominated by inner lagoon artisanal fishing in small boats. Octopus, being the main seafood product, is mainly exported to Mauritius.

The Rodrigues Regional Assembly (RRA) - an autonomous body that makes policy decisions to manage Rodrigues - has set, as one of its main priorities, the boosting up of the development of the agricultural and agroprocessing sectors. The latter has been identified as having potential for creating jobs, generating income, and providing scope for increasing the value-addition of Rodriguan agricultural produce (MAFTRN, 2002). Furthermore, agroprocessing can contribute towards food security, nutrition and health and indirectly contribute to enhance the social and cultural well-being of the inhabitants.

Agroprocessing activities exist predominantly at cottage level and involve the manufacture of a wide range of traditional food products like pickled lime, pickled chillies, sweet and sour lime, honey, processed pork products such as ham and sausages, dried octopus and salted fish. All these products are manufactured from locally produced agricultural raw materials and are mainly sold to visitors in the island. Rodrigues has established a good reputation for some of its agro based products such as sweet and sour lime and pickled chilli (MAFTRN, 2002). Several of these products hold very good prospects for increasing their market shares, provided they are produced in accordance with established norms and standards. Rodrigues

has also certain attributes, more particularly, its image as a pollution-free and organic production base that may be efficiently harnessed to develop its agroprocessing sector. However, the sector is still plagued with some problems which have probably held back progress in this sector. Manufacturing practices, packaging materials have remained poor, while the lack of support systems for production and quality control has led to disparate quality of products being offered for sale. There is therefore ample scope to improve the quality, packaging and marketing, amongst others, of the Rodriguan agroprocessed products so that they could contribute significantly to the economy of Rodrigues. Globalisation and the opening up of new niche markets internationally for speciality horticultural, ethnic and organic products provide an added impetus for revitalising the sector, through export to the regional and international markets. However, with the globalisation of food trade, the focus is on strengthening the measures taken to ensure the quality and safety of foods (Orriss and Whitehead, 2000). A cursory survey of literature shows that there are no published work on the characteristics of the enterprises, and the agroprocessors, raw materials, manufacturing practices and marketing strategies among others. This lack of a comprehensive information base is viewed as a major hindrance for developing appropriate policies and strategies for the development of the sector.

This present study thus seeks to close this gap in knowledge. Its main objectives are to

- map out the characteristics of the Rodriguan small-scale agroprocessing sector in terms of raw materials, types of products manufactured, manufacturing practices
- examine the practices related to product quality and safety
- establish the marketing strategies in place
- assess the current training status and needs for the sector
- gauge the awareness of the agroprocessors on support services provided
- identify constraints faced by agroprocessors
- formulate recommendations that will facilitate the development of the sector.

The findings of this study will be presented in two parts. Part I will present the characteristics of the Rodriguan agroprocessing sector in terms of the raw materials used, the type of products manufactured, manufacturing practices, product safety and quality. The various constraints associated with these will also be discussed. In Part II, the marketing aspects of the processed products, the training of the agroprocessors and the type of services provided to the sector will be described.

## **2.0 METHODOLOGY**

### **2.1 Definition of the sampling frame**

As there was no comprehensive list (e.g, names address etc..) on the agroprocessors, a sampling frame had to be compiled by integrating information from different service providers and key informants in the sector namely:

- Small and Medium Industries Development Organisation (SMIDO)
- National Handicraft Promotion Authority (NHPA)
- Commission for Women & others
- Commission for Agriculture & others
- Associations of Agroprocessors
- Relevant key informants in the sector

Agroprocessors in the capital city (Port-Mathurin) market and road stalls were also contacted to mount the frame, given that many were not registered with the main service providers. This inventory exercise revealed the existence of a total of 119 agroprocessors.

### **2.2 Questionnaire Design**

A 22-page questionnaire was designed and it was divided into sections and included questions on the following variables:

- Socio-economic and demographic characteristics of the processors
- Type of products manufactured
- The agroprocessors' manufacturing practices and food safety measures
- Raw materials and other inputs
- Manufacturing practices
- Types of equipment and level of technology used
- Quality of products
- Marketing and price mechanisms
- Training programmes
- Types of innovation
- Information needs
- Availability of support services
- Constraints faced by the agroprocessors

The questionnaire was pre-tested with some local processors in Mauritius and the Commission for Agriculture in Rodrigues. Necessary modifications were made thereafter. The enumerators were second year graduate Rodriguan students from the Faculty of Agriculture and all had previous fieldwork experience with agroprocessors in Rodrigues. They were also trained in questionnaire administration and field work.

### **2.3 Data Collection**

All the 119 agroprocessors were interviewed. To facilitate the administration of the questionnaire design, the questionnaire was translated in Creole – the interviewees’ mother tongue. The respondents were first contacted by phone for an appointment and the interviews were held either at their place of residence or at the offices of the different Centres/Associations. This provided an opportunity for the enumerators to visit some of the production units thereby enabling triangulation of information collected. Prior to filling up the questionnaire, respondents were briefed on the objectives of the study and how their input would be beneficial to the sector. In general, all respondents were very cooperative during the interview sessions. It took on average around 45 minutes to complete the questionnaire. The fieldwork was carried out over a period of three months (June –August 2005).

### **2.4 Data Processing and Analysis**

Once completed, the questionnaires were verified for errors, incompleteness and gaps in the information collected. A codebook for coding the data was subsequently developed. For the open-ended questions, a coding frame was developed, after browsing through the responses in the completed questionnaires. A special data entry program was designed in SPSS version 13.0 for statistical analysis. In some cases, a qualitative description was provided for some of the open-ended questions. Individual questions were mainly summarized as percentages.

## **3.0 RESULTS**

### **3.1 Profile of agroprocessors**

The 119 identified agroprocessing units were scattered throughout the island (Fig. 1). They were mainly run by women (90.8%) and were mostly located at their homes. 54.6% of the agroprocessing units were run on a full-time basis. Agroprocessing activities in Rodrigues were predominantly individual (43.7%) or family- based (49.6%), with only 2.5% of businesses being constituted as an association or a company (1.7%).



- KEYS**
- Crop and Animal Based Processing Units
  - Animal Based Processing Unit
  - Crop Based Processing Unit

**Figure 1. Distribution of the agroprocessors sector-wise.**

The majority of the agroprocessors were involved in crop-based processing units which are located in the North, East and Centre of the island whilst only a few were engaged in animal-based processing units. Most of them were married (81.5%) and over 25 years of age (88.2%); the young aged between 17 and 25 years constituting 11.8% of the population as opposed to 25.2%, for the age group 51 and above. 36% of agroprocessors had completed primary level of education, 22.7% had pursued secondary education while only one agro-processor had completed tertiary education. Some 17.6% of agroprocessors had been in the business for less than one year while about 53% counted five years of experience or less in the sector (Table 1). About 28% of agroprocessors, on the other hand, had been in operation for more than 10 years. The main reasons put forward by respondents for joining the business were principally to earn a living (65.1%) or to increase their revenue (82.6%). Other important reasons included entrepreneurial drive (53.2%) and the existence of a market for the products (39.4%).

Period (Years)	% of Respondents
<1	17.6
1 – 2	12.6
3 – 5	22.7
6 – 8	11.8
9 – 10	7.6
>10	27.7
Total	100

**Table 1: Number of years business has been in operation**

### 3.2 Type of products

The majority of agroprocessors do not produce only one type of product, in fact most of them produced different types of products from the available raw materials. Some 32 different products were being manufactured by the agroprocessors. The most popular ones were sweet and sour Lime (*Limon Aigre-Doux*) (69%), lime pickles in spices (*Achard Limon*) (49.1%), lime and chilli paste (*Limon Piment*) (44.8%), chilli in vinegar (*Piment Confit*) (40.5%), octopus in chilli and spices (*Piment Ourite*) (34.5%).

### 3.3 Characteristics and storage of raw materials

The main raw materials used by the agroprocessors to manufacture these products were lime (65%) followed by chilli (55%), while animal-based raw materials were mainly octopus (47%), fish (16%) and pork (10.9%). Agroprocessors generally sourced their raw materials directly from growers (68.2%) and to a lesser extent from their gardens (24.3%) and the market (7.5%). The main raw materials were purchased either in bulk (47.2%) or in small quantities (52.8%). The choice for the source of the raw materials were mainly influenced by quality (100%) as well as price (88.4%), and to a lesser extent by regularity of supply (41.1%) and proximity of the supplier (14.3%). However, a number of problems existed with regard to raw materials, the most serious ones being their poor quality, seasonality, high prices and limited quantity of the raw materials (Table 2).



Problem	% of Respondents		
	None	Quite Serious	Very Serious
Expensive	8.1	25.2	66.7
Seasonal	9.0	21.6	69.4
Quantity	13.5	19.8	66.7
Availability	7.3	24.5	68.2
Quality	2.8	26.2	71.0
Storage	47.2	23.1	29.6
Climate	19.1	26.4	54.5

**Table 2: Problems encountered with raw materials**

The storage of raw materials was a less serious problem with 47.2% of agroprocessors not finding it to be problematic. The raw materials like chilli paste, lime paste, whole lime and chilli were very often stored in refrigerators in plastic containers. Their storage life varied between 1 and 15 days; for example, in the case of fruits, it could be 1-15 days while octopus and fish were dried and stored up to about 1 year. Pork was stored for at most for 1 -2 days. Lime and chilli were kept in brine and vinegar for several months.

### **3.4 Manufacturing practices**

#### **3.4.1 Processing techniques**

The main types of processing technique were pickling, sugar preserves (jam, sweet-sour products, fruit paste), salting/drying and curing. In general, agroprocessors used simple equipment for processing and it varied with the products. For example, 67.2% of agroprocessors used specific equipment like grinders for making pickles, as opposed to 58.2% for sugar-based preservation, 12.5% for salting/drying and 62.5% for curing. However, they expressed the need for additional equipment like juicers, electric slicers, large knives and chopping boards.

### 3.4.2 Recipes

62.7% of agroprocessors followed a recipe while manufacturing their products. The recipes were mostly traditional ones, emanating from their grand-parents and elders (43%). Some 57 % of agroprocessors stated having developed their own or learnt about it while undergoing a training programme (Figure 2).

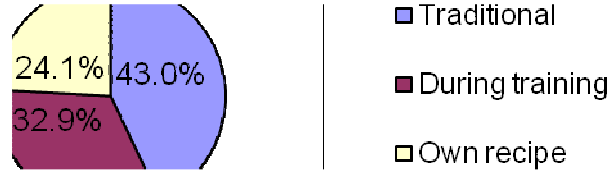


Figure 2: Sources of recipe

### 3.5 Preparation Area

The products were prepared mostly in the kitchen (84.3%) or in a special room ear-marked for that purpose in the house (12.2%). In a few cases (3.5%), where the agroprocessors formed part of an association, the preparations were carried out in a common production area. Prior to preparation, in all cases the raw materials were washed and cleaned. However, it was noted that 7.1% of the agroprocessors reported that they used chemicals prior to preparations. The majority of agroprocessors used chlorinated tap water (94.1%). However, 32.5% treated the water further, using either chemicals (79.4%) or by boiling (20.6%) before use.

After processing, the products were then packed in jars, bottles, or plastic containers. Only 18.3% of agroprocessors filled the jars with a weighed amount of finished product. The remaining ones did not weigh their products but rather filled the jars to the brim as they lacked a weighing scale. A few relied on their experience to determine the approximate weight of processed product in the jars.

The important problems agroprocessors met during the manufacture of their products were concerned with raw materials, space, ingredients and water (Table 3).

Factors affecting production	% of Respondents		
	No Problem	Quite Serious Problem	Serious Problem
Electricity	87.9	7.8	4.3
Water	73	18.3	8.7
Space	45.2	25.2	29.6
Waste	89.6	7.8	2.6
Raw Materials	23.9	37.2	38.9
Ingredients	70.4	16.7	13
Labour	82.3	13.3	4.4

**Table 3: Factors affecting manufacture of products**

### 3.6 Packaging materials

The processed products were mainly packed in glass jars (Table 4). Glass jars and barquettes were bought from the National Handicraft Promotion Agency (77.9%) and in local shops (16.8%). Some 3.5% of agroprocessors, however, bought theirs in Mauritius.

Packaging Materials	% of Responses
Glass jars	68.8
Barquettes	15.2
Plastic Containers	9.8
Others (used containers )	6.3

**Table 4: Types of packaging materials used**

Agroprocessors chose packaging materials based on their aesthetic and utilitarian qualities (Table 5).

Choice Factors	% of Responses
Better product presentation	40.7
Better product preservation	29.6
Right Sizes of packages	9.3
Availability of packaging materials	8.3
Cost of packaging materials	5.6
Ease of filling	4.6
Processing Need	1.9

**Table 5: Factors affecting choice of packaging materials**

In over 80% of cases, the packaging materials were cleaned before use. They were generally boiled, while vinegar and detergent were added to water in the case of plastic containers and 'barquettes'. Some 86.7% of

agroprocessors indicated that they encountered problems with packaging; these were related mostly to their availability (50.5%), high costs (30.5%) and defective materials (5.7%). Because glass jars were not available in sufficient quantity on the market to satisfy their entire requirements, agroprocessors often used plastic containers as alternative. However, in some cases, used jars and bottles (e.g. soft drinks) were even utilised. The lack of packaging materials on the market often disrupted production and marketing of the products.

### **3.7 Product quality and safety**

The majority of agroprocessors stated personal hygiene (cleanliness, use of gloves, hair caps, etc) as the main precautions they took to ensure quality and safety of their products. Some also mentioned that they controlled the quantity and quality of ingredients used during manufacturing the products. There existed a high degree of awareness (98.3%) among agroprocessors on the shelf-life of a product. In 60% of cases, the agroprocessors themselves determined the shelf-life of their products. Many stated that they kept a sample jar of their product at hand and monitored its taste over time. Some also kept a jar closed and observed the time it took before the product deteriorated. A few did not use any of these methods but relied on their experience. Agroprocessors had recourse to various means to ensure that their products maintained their consistency and quality over time. The most important ones were to follow the same recipe all the time (29.2%), to use the right mix of ingredients (25.6%), to adopt hygienic norms and procedures (26.9%) and to use uniform size of jars (18.2%).

The majority of producers (98.3%) stated that they controlled the quality of their products mainly through observation (37.5%), adoption of hygienic practices (12.5%), tasting of final product (12.5%) and by avoiding moisture or foreign bodies from getting into the final product. Agroprocessors mostly stored their final products in carton boxes or containers in a cool dry place. Some agroprocessors reported that bad storage conditions led to fungal growth and moisture in the final product. Agroprocessors believed that improved storage conditions, better hygiene and training will help to improve the quality of their products.

#### **3.7.1 Food Act**

Some 55.5% of agroprocessors indicated that they were aware of the Food Act (1998) of the Ministry of Health and Quality of Life. Of these, 53% learnt about it during a training programme, 29% through radio and 13% through Ministries. At the time of the survey, 60.5% of agroprocessors possessed a Food Handler's Certificate which they have obtained between

1999 and 2004. Some producers mentioned that they renewed their certificates every year.

### **3.8 Labelling of products**

About 77% of the agroprocessors stated that they labelled their products to provide information to consumers on the contents and ingredients used and to promote their products. In a high number of cases, the label included information on the name of the product, the ingredients used, the producer's name, address and telephone number of the company or producer. A few respondents also provided their logo or the name of the country. However, only 18.7% of agroprocessors mentioned the date of manufacture and 53.8% the expiry date, or the weight of the product (14.3%) on the labels. The problems agroprocessors faced with labelling were related mainly to high costs (56.3%) and faulty design of labels (27.5%). A few respondents also indicated that there was a lack of facilities (12.5%) for producing labels and they often encountered delays in delivery of labels (3.8%). The two main approaches advocated by respondents to encourage proper labelling of products were: provision of appropriate training and sensitisation programmes as well as enforcement of regulations, including the imposition of penalty on those who fail to label their products. All the agroprocessors were willing to adopt specific standards and norms with respect to hygiene, quality control and labelling of their products, so as to benefit from the Rodriguan label - a proposed quality mark for Rodriguan products.

## **4.0 DISCUSSION**

### **4.1 Background of the agroprocessors**

Agroprocessing activities exist since a long time in Rodrigues and are carried out mostly by women, as a means of supplementing income. Such a practice exists also in other parts of the world. In Sub Saharan Africa, it is estimated that 60% of the labour force find part of its work in small-scale food processing enterprises and the majority are women (ITDG, 2005). In Sudan too, food making and preservation is done by women. From farming to cooking, women in Sudan are working hard to secure as much food and income for their families as possible (Abdellah, 2004). Although, there had not been any perceptible change in the Rodriguan agroprocessing landscape, a growing interest was noted, nonetheless, in the younger generation and those who had formal secondary education to engage in the sector.

## 4.2 Types of products

Around 32 products are manufactured by the agroprocessors, mostly from chilli, lime and local fruits; the few animal-based products are manufactured from octopus, pork and fish. The large range of processed products suggests that there is a demand for these types of products. Furthermore, it also indicates the versatility in processing different plant-based raw materials into different products throughout the year. For example, pickles are made from lime, chilli, raw pawpaw, star fruit; jam is made from ripe pawpaw, pineapple, star fruit, guavas; lime can be converted into sweet sour lime, lime pickled in vinegar, lime pickled in spices, lime paste, lime and chilli paste, lime and chilli in vinegar.

## 4.3 Raw materials and ingredients

All the raw materials used for processing were sourced locally, either from the backyard or from other growers and the market. The main raw materials were lime, chilli, octopus and pork. The major problems associated with raw materials of plant origin were: high prices, poor quality and seasonality of these crops. Most agroprocessors claimed that quality of the raw materials is important, and used indicators such as the presence of external bruises and black spots on the surface of fruits, the thickness of fat in pork carcasses to assess quality of the raw materials. Poor cultural practices and harvesting/post catch handling practices also result in poor quality of raw materials and hence could affect the quality of the final product. It is noteworthy to mention that there is a market for some of the fresh products in Mauritius (Table 6) and this can thus limit the availability of raw materials to the local processing industry.

Commodity	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Lime (t)	82	86	152	151	287	62	97	232	171	110
Small Chilli(Kg)	1250	645	820	924	1765	945	1350	1860	3450	6265
Dry Octopus (Kg)	na	na	na	145	na	240	4507	8495	9120	7865
Pigs (Unit)	65	23	8	1458	1711	638	93	44	19	133

**Table 6: Export of selected commodities to the Republic of Mauritius**

Source: Adapted from the Central Statistics Office (2008)

na = not available.

The other main ingredients like sugar, honey, salt, oil and spices, are usually obtained from local shops. A few processors reported that they encountered some difficulties to obtain specific ingredients like pectin, food colour, food additives and nitrites. This could be explained by the low volume of demand for these ingredients and the absence of local agencies for import and sale of these ingredients. However, some processors imported these scarce ingredients from either agencies in Mauritius or from their contacts in the neighbouring Reunion island.

#### **4.4 Raw materials**

##### **4.4.1 Lime**

The Rodriguan lime is known as having distinct characteristics and flavour. Most of the lime produced originates from the backyard trees and thus there are no officially reported figures for lime production. Planters typically have 5 trees on average. These were fairly old trees and are subjected to few cultural and post harvest management practices (NEPAD/ FAO, 2005). The harvesting technique and post-harvest management of lime also impacted on the quality of the processed products. Usually, a stick is used to throw the lime on the ground, thus leading to internal bruising. The presence of thorns on the plant further affected quality; the produce is scratched or bruised during harvesting and thus has limited use in processing, or has a low market value. The price of lime is very low in peak production periods (0.25 MUR per unit; 1 USD= 32 MUR), with the consequence that, in some cases, producers were not interested to harvest, leaving the fruits to rot as noted during site visits. On the contrary, in the off-season period, the price can increase up to 3.00 MUR per unit. Lime is grown mainly in the coastal areas and agroprocessors located in those regions do not face any problem of supply. However, those located in the centre of the island had to buy them at quite high prices. Fresh lime is also exported to Mauritius (Table 6) where they are sold at an average price of 2.50 MUR per unit in the market.

##### **4.4.2 Chilli**

The most common chilli variety used for processing was the small chilli, locally called 'Piment Martin'. It fetches very high prices (an average 400 MUR per kg). The existence of a lucrative market for fresh chilli in Mauritius influenced its price and the availability for processing as higher volumes are being exported to Mauritius (Table 6). In an effort to boost up production, the Agricultural Services of Rodrigues recently initiated pure stand cultivation of chilli. There has been a significant rise in chilli production from 0.2 t/hectare in 2003 to 5.7 t/hectare in 2007 (CSO, 2008).

Concern had also been expressed about the genetic erosion of the variety 'Piment Martin' germplasm, which might lead to a loss of its intrinsic characteristics (In-depth interview, Agricultural Services). Some agroprocessors reported that some chilli products were adulterated. For example, big green chillies were imported from Mauritius at a very low price (75 MUR/kg) and processed into chilli paste, before being marketed as Rodriguan chilli. In some cases, pumpkin which is not an ingredient for chilli paste and chilli/lime paste was also added to the paste. These malpractices could impact negatively on the reputation of the sector and thus jeopardise its long term sustainability.

#### **4.4.3 Pig Meat**

Pig rearing is one of the major activities of the livestock sector and is carried out as a backyard activity. There has been an increase in the number of animals slaughtered from 2003 to 2005 and a slow decreasing trend was observed in 2006 and 2007 (CSO, 2008). Some of the live animals are exported to Mauritius (for example, 133 units in 2007) according to CSO (2008) for further processing. The Rodriguan pig is reputed for its lean meat and according to the Agricultural Services, it is estimated that 10-15% of the pigs slaughtered in Rodrigues are used for production of processed products. There is, however, a small number of pork processors on the island. The main Rodriguan processed products are sausages and ham, the latter being internationally reputed for its qualities and organoleptic characteristics (UNDP/FAO, 1999). However, the major constraints mentioned for the processing of pig meat were lack of land/space for expansion, difficulties for obtaining permits, price fluctuations of raw materials, low availability of casings for filling the minced meat and the high level of fat in the carcass (In-depth interview with pork producers). All these factors could explain the small number of pork processors. The setting up of a slaughter house with hygienic norms will, undoubtedly, improve the sanitary conditions during slaughter and increase the market potential of this product for either consumption as meat or for further processing.

#### **4.4.4 Octopus**

Processing of octopus consisted mostly of drying, freezing and pickling. The fresh products usually underwent primary processing namely cleaning. In many cases, the processing (drying/pickling) was done at the level of the fishermen themselves. Alternatively, the products were sold as frozen and subsequently dried by other agroprocessors, who carried out further value addition by grilling them and packaging them in barquettes (Ourite Grillé) or by pickling them in a chilli paste (Piment Ourite). These products are new types of products and highly appreciated. However the supply of raw materials may become a problem in the long run as there is a decrease in



octopus stock due to heavy fishing pressure in the lagoon (RRA, 2006). Statistics (CSO, 2008) show that octopus catches have decreased over the years (down from 580 t in 2003 to 254 t in 2007).

#### **4.5 Storage of raw materials**

Seasonality, price and availability of some raw materials (lime, chillies) were constraints for improving production of processed products. With a view to circumvent these problems, most agroprocessors preserved raw materials in vinegar or brine for periods ranging from a few weeks to several months. Octopus and fish were either dried or frozen for later use. Many agroprocessors had reported a lack of storage facilities. Mhazo *et al.* (2003) also reported that in Zimbabwe, small-scale processors lacked storage facilities to keep raw or semi-processed products for use in the off-season period. Lack of appropriate food processing equipment and cold storage facilities hinder the ability to process large volumes of product over a longer period as horticultural crops are highly seasonal and perishable. For one to continuously process fruits and vegetables there has to be some storage facilities. The general lack of cold storage facilities among small-scale processors implied that they could only process vegetables and fruits that were in season at a particular time (Mhazo *et al.*, 2003).

There is already a cold storage facility which is located at the headquarters of the Agricultural Services. However, it is not used for storage of surplus raw materials but is presently used to store glass jars. This facility could be renovated and made functional, for use by producers and processors so that both raw materials and processed products are stored so as to ensure year round availability.

#### **4.6 Manufacturing practices**

The salient features highlighted during the manufacturing process were: use of a recipe, use of simple equipment, processing in the kitchen, use of clean water (chlorinated/ treated water) and weighing of final products in only a few cases.

##### **4.6.1 Use of a recipe**

Though a high proportion of the agroprocessors stated that they followed a recipe for the preparation of the processed products, this does not necessarily mean that the products are manufactured in a consistent manner throughout the sector. From field visits and discussion, it is understood that the ingredients, in many cases, were not weighed but used approximately

with spoons and drinking glasses. Such approximations of measures (spoon, drinking glass) can be used for home use products but for sale to customers, weighing of ingredients is important. Such practices would inevitably lead to production of inconsistent and substandard products that have been noticed during the survey and inspection of finished products. Many of the agroprocessors did not actually weigh the final products to be filled in the jars-they are just filled to the brim and in a majority of cases the weight was not mentioned on the label as is required by the food labelling regulation (1999) (Government Notices, 1999). It was also noted that several products bearing the same product name were different in terms of appearance and texture; for example, the product labelled as “*Piment ourite*” (octopus in chilli paste), existed in three different forms: ground octopus and chilli paste; octopus cube and chilli paste; and irregular pieces of octopus and coarsely ground chilli. This indicates that there is a high level of inconsistency in the products despite having the same product name. Consumers expect to find the same food in every pack, having a uniform quality, every time that they buy a product. Producers must therefore control their process to produce uniformity and consistency in their products, and to do this they must learn new skills in quality assurance (Fellows, 1997).

#### **4.6.2 Preparation area**

Ideally, food should be processed in a special preparation area. This study has shown that most of the raw materials were processed within the owners’ kitchens; in very few cases, in an area designated as a processing room. Similar findings were reported by Mhazo *et al.* (2003) who conducted 26 case studies throughout the eastern districts of Zimbabwe. Most of the interviewed processors carried out their food processing activities in their home kitchens. Preparation of raw materials (grading, peeling, and cutting) was done by hand using ordinary kitchen knives. The ordinary household pots (clay, enamel and aluminium) were used for cooking jam.

It is important that a special processing room is used only for the production of food products as this will reduce the risks of contamination. Equipment that has multiple uses may also increase the risk of product contamination. A processing unit should have adequate washing facilities, water storage facilities and be free from pets. Most of these processing areas visited lacked these amenities and pets also gained access to the preparation area in some cases. The requirements for a proper layout of building and equipment have been detailed out in the food regulations (1999) Part V (Government Notices, 1999).

### **4.6.3 Equipment and level of technology**

The food processing methods in Rodrigues make use of simple and low-cost technology, comprising of simple and inexpensive equipment (grinder, boiling pans, storage containers), which often have other uses in the kitchen. The major processing techniques used are preservation by sugar or honey (jam, jelly, fruit paste), pickling (in vinegar or in spices), drying (dried fish and octopus), curing (production of ham), heat treatment and acid preservation (chilli paste). Most of the processing steps are carried out manually. Though sophisticated equipment is not required, production can be improved through the use of simple kitchen equipment like grinder, grater, drier, steriliser and a weighing scale balance. These will not only increase the speed of operations but will contribute largely to the production of consistent and quality products. Almost none of the processors had facilities for packaging (e.g., sealers) and labelling. Some of the agroprocessors have expressed their interest in acquiring equipment like fermentors, grinders and packaging machines but sourcing of these equipment remain problematic as information on types and suppliers of equipment is not readily available. Food processing equipment can be of different capacity and size. The main problems which agroprocessors faced concerning equipment were information on specifications of the equipment required (type, capacity), cost and source of equipment, spare parts, facilities for maintenance and repair. However, such type of information can be readily made available through the local service providers who may have contact with suppliers and other institutions (e.g., University of Mauritius and Agricultural Research and Extension Unit) in Mauritius.

### **4.6.4 Water Quality**

Water may be used directly in some products (brines, syrup, juices) and it is also used for washing equipment, raw materials and jars. The water should be of good quality to avoid contaminating the product (Fellow and Axtell, 2001). In this study, though, most of the agroprocessors reported that they used potable water (chlorinated, treated with chemicals), it is however believed that the quality of the water was below required standards in some cases, for the following reasons. In many areas, tap water was available on an irregular basis and only for a few hours after days and weeks. However, the present study has shown that many of the agroprocessors did not have adequate facilities for storage of potable and non-potable water. Thus, the water was collected and stored in simple type tanks. In many cases, the tap water was collected in the same tank used for rainwater collection. Furthermore, the tanks were not regularly cleaned (estimated to be less than once a year). All these factors clearly indicate that the quality of water was

poor. In cases, where chemical treatment of water was not done according to norms, the chemicals and the dosage used can represent health hazards if water is a major ingredient of the processed products.

#### **4.6.5 Packaging materials**

Good packaging is required to assure a certain shelf life for the food, and also to make the products attractive and appealing to the customer (Dietz *et al.*, 2000). Rodriguan processed foods are now mainly packed in glass jars (100g and 200 g) and to some extent in *barquettes* and plastic containers. In the past, most of the products were packed in used containers of soft drinks, sauces and other food items. This impacted negatively on product shelf-life and product presentation and eventually their marketing. According to Mhazo *et al.* (2003), in Zimbabwe too, accessing appropriate packaging materials for processed products was identified as a major constraint especially for those enterprises with a market focus. When the country's leading glass container manufacturer, suspended production, jam manufacturers who relied on the company for jam jars were left at odds. Some enterprises have resorted to using recycled glass jars. However, they were quite aware of the food safety and hygiene risks associated with this practice and some had substituted glass jars with plastic peanut butter jars knowing very well that these are not recommended for jam, as they could not be easily sterilised (Mhazo *et al.*, 2003).

Agroprocessors had benefited a lot on presentation and packaging of products both through their participation in fairs and training courses organised by the National Handicraft Promotion Agency (NHPA). There is now a good degree of awareness on the importance to pack the processed products in an appropriate and attractive packaging. The increasing use of glass jars and "*barquettes*" had considerably improved product presentation and safety. However, packaging materials were not produced locally and at times there were acute shortage of jars and this represented a major problem for the food processors. In the past, a small number of the agroprocessors had to travel to Mauritius to purchase jars in small amounts, sometimes at high prices. To overcome this problem, the NHPA started bulk purchase of glass jars and "*barquettes*" a few years back, and put them on sale to the agroprocessors. This initiative encouraged most of the agroprocessors to use jars and "*barquettes*". The Commission for Agriculture is now also engaged in supplying packaging materials. However, a small proportion of the agroprocessors was still using inappropriate containers and this is viewed as an area of concern for the sector as it can cause damage to the overall reputation of Rodriguan products.

#### **4.6.6 Product quality and safety**

Processing must be done to high standards of hygiene and production control to avoid the risk of harming or even killing customers by allowing contamination of the products by foreign materials or the growth of food poisoning micro-organisms (Fellows, 1997). Poor product quality control may constrain the development of small-scale industries (Mhazo *et al.*, 2003). Food handlers have a major role in the prevention of food poisoning (Walker *et al.*, 2003). People who handle food can also contaminate it and make it unsafe for consumption. The introduction of food safety hazards can occur at any stage of the food chain, right from the farm through the production plant and the catering service to the table of the consumers. Physical contamination of foods may occur due to presence of undesirable elements like wood, paper, rocks, hair and animal fur. Chemical contamination may be due to detergents, household disinfectants and pesticides.

#### **4.6.7 Food Legislation**

Food laws are made to protect consumers' health against malpractices by processors and also to provide a level-trading field for the players in the sector. The local food legislation is comprised of the Food Act 1998 and the Food Regulations 1999 (Government Notices, 1999). It is interesting to note that 55.5% of agroprocessors surveyed claimed to be aware of the Food Act 1998. However, this figure may not reflect the reality. The agroprocessors might have heard about the Food Act 1998, mainly during training sessions, but they might have limited knowledge of its contents, due to the limited access to the document. However, under the present set-up of the sector, the application of the Food Act may prove to be difficult as most agroprocessors carry out their activities at home, which are not allowed under the Food legislation. Since the enterprises do not have a permit and are not licensed, the Commission for Health, the authority which is responsible for the enforcement of food legislation in Rodrigues, does not have a full control over the agroprocessing activities and therefore cannot take contraventions if agroprocessors fail to abide by the Food Act. During inspections of food production premises, only advice was given to the people concerned by the health officers (In depth interview, Health Inspectorate, Commission for Health).

If the laws were to be enforced, under the present circumstances, most of the agroprocessors would not be able to continue with the production of processed products in Rodrigues. A salient example is that many products from Rodrigues cannot be put on the Mauritian market as they do not satisfy

the requirements under the Food Act (inadequacies in labelling, date marking, lack of pre-market approval). A more active participation of the MOHQL in the form of advice and training would help to improve the knowledge and skills of the agroprocessors. Section 23 of the Food Regulations 1999 (Government Notices, 1999) states that a pre-market approval permit has to be obtained in order to import or manufacture any food whereby information regarding the identity and composition of the food has to be provided to the relevant authority. It is interesting to note that a few agroprocessors have made a request for pre-market approval for some of their newly developed products.

Under the Food Act, only the Government Analyst and the Central laboratory located at the Victoria Hospital in Mauritius are the official and recognised laboratories to test foods. In view of the large amount of samples to be analysed, the process takes a long time. Also the samples need to be accompanied by a health inspector from Rodrigues, which renders the whole process of testing more expensive. Furthermore, there is limited staff in the Health Inspectorate Division in Rodrigues to monitor all the processing units throughout the island. This highlights the importance of having a food laboratory in Rodrigues.

#### **4.6.8 Food Handler's Certificate**

The law requires that all food handlers should possess a valid Food Handler's Certificate. This certificate is obtained after 6 hours of training given by a health inspector from the MOHQL, followed by a thorough medical examination of the food handler by a government medical officer. This training is delivered through the use of visual aids and oral presentation and the modules covered are given in Table 7.

<b>Training Module</b>	<b>Contents</b>
Module 1	Bacteriology; Food poisoning causes and consequences; Prevention of contamination and Food hygiene
Module 2	Personal Hygiene; Cleaning and disinfections; Pest control
Module 3	Waste disposal; Food storage and Temperature control; Penalties; Offences; Notices and orders

**Table 7: Training Modules for award of the Food Handlers Certificate**

About 60.5% of the agroprocessors in Rodrigues possessed a Food Handler's Certificate. Although a high number of food handlers had followed the training, many of them often disregarded good hygienic practices during their production process as revealed during the survey work. It is thus important that the attitude and behaviour of these

agroprocessors towards adoption of hygienic practices are changed so that they implement the knowledge acquired (Eheri *et al.*, 1997). Furthermore, it is expected that the trained food handler will have a greater level of understanding, thus leading to lesser need for supervision and improvement of the hygienic conditions under which the products are made.

#### **4.6.9 Personal hygiene**

Hygiene is considered to be the basic requirement and the first line of defence against pathogens (Huss, 1997). The Food Regulation (1999) states that the personnel should maintain clean clothing, hands and nails. Most of the processors seem to be familiar with the basic elements of food hygiene but it is equally important that these are fully implemented. The majority of the agroprocessors claimed that hygiene is the main precautions they take to ensure safety and quality of the products. However personal hygiene is one element of food hygiene and sanitation. The place where foods are manufactured, the conditions of the equipment used, the quality of the ingredients used may also impact on the quality and safety of the food.

#### **4.6.10 Product labeling**

Labels provide consumers with information about the identity and nature of product, its composition and its ingredients, where it was produced, and how long it can be kept and under what conditions (Fellows and Axtell, 2001). The Food Act 1998 and the Food Regulation 1999 (Part-1 Food Composition and Labelling) and the Mauritian Standard MS 30 are the major tools for control of labelling of foods. The Legal Metrology (pre-packaged commodities) Regulation 1994 under the Legal Metrology (Amendment) Act 1994 also set out certain requirements concerning food labelling. In this survey, 77% of the agroprocessors claimed to label their products; the main information provided were the name of the food, the name and address of the manufacturer and this is viewed as inadequate as it does not conform to the legislations. Proper labelling is regarded as an important step towards increasing the marketability of these products. The study revealed that only about 54% of the agroprocessors provided an expiry date on the label. This is an area of concern, as the consumers do not have any clue on the shelf-life of these products. The intention of providing an expiry date is to guide the consumers on the shelf-life of a food in terms of food safety and quality. In this study, the expiry dates were either handwritten or typed on a sticker, which was then affixed on the container. This in itself is an infringement to the law as it stipulates that it has to be embossed directly on the container or printed on the label. The use of stickers can lead to tampering with the labels. In fact during the study, a

few agroprocessors reported that they had replaced the original sticker for expiry date with a new sticker with a new date. This is a highly risky and illegal practice as it can pose serious health hazards to consumers.

However, there were still over 20% agroprocessors who did not label their products and yet these products were put on sale. One of the major problems identified with labelling was its high costs and lack of facilities for production of labels at an affordable cost. There was only one company that produced labels in Rodrigues. Many agroprocessors sourced out their labels from Mauritius and some had adopted attractive presentation and labels. The NHPA had organised training on design of food labels and such courses need to be given on a regular basis with appropriate follow-up to both existing and new entrants in the sector.

#### **4.6.11 Shelf-life determination**

Although 98% of the agroprocessors were aware of the concept of shelf-life of a product, only about 60% determined the shelf-life of their products. They indicated the expiry date on the label of the products. The technique of shelf-life determination was empirical as they relied on their experience, visual appearance and taste to determine the shelf-life. Such technique does not guarantee that the products are still safe and will not spoil by the expiry dates provided. Though, there has been no report of major health problems and product spoilage associated with these products, this does not imply that such problems have never occurred. This could be explained by the fact that most of the customers use the products outside Rodrigues and thus if any problems of shelf-life did occur, the information was not conveyed back to the producers in Rodrigues. Another reason could be that since the products are processed in small quantities and are sold and consumed in a relatively short period of time, the chances of detecting shelf-life problems is minimised. The NEPAD/FAO (2005) project proposals have recommended the setting up of a food laboratory for testing the products to improve product quality and safety.

### **5.0 CONCLUSION**

In this paper, the raw materials and ingredients used, the variety and the manufacturing practices of Rodriguan agroprocessed products have been discussed. A wide range of agroprocessed products are manufactured from locally grown raw materials. The main production area is the owners' kitchen. The food processing methods in Rodrigues make use of simple and low-cost technology, comprising of simple and inexpensive equipment. A majority of the agroprocessors have obtained a food handlers certificate. The manufacturing practices, types of packaging product labelling, the hygiene conditions are not up to the required standards in some cases. Shelf life is not determined scientifically and this prevents them from providing a



correct expiry dates for their products. Although the Food Act is in force very few agroprocessors complied with its regulations. The implications of some of the practices on quality and safety of the products have also been discussed.

## **6.0 RECOMMENDATIONS**

Some recommendations are being formulated to (i) improve production of raw materials, (ii) boost production of processed products and (iii) improve quality and safety of products

### **6.1 Improving production of raw materials**

#### **6.1.1 Backward linkages between producers and agroprocessors**

The linkages of the agroprocessing sector with primary producers are almost non-existent. The agroprocessors should develop or reinforce linkages, for example through contract farming with the agricultural producers and animal farmers so as to ensure a regular supply of raw materials at competitive prices.

#### **6.1.2 Production of raw materials**

The successful development of the agroprocessing sector relies on regular production of quality raw materials. Appropriate measures should therefore be taken to boost up the production of the main raw materials so as to sustain the overall progress of the sector. These measures could include aspects on , proper crop management, proper disease control, use of appropriate varieties, efficient irrigation systems, intensive cultivation of selected crops, better feeding regime for pigs and improved animal husbandry techniques. This can be implemented by the extension services, training of the farmers, setting up of demonstration plots, development of on-farm trials, production of technical leaflets and running of awareness campaigns for both the producers and agroprocessors.

### **6.2 Boosting production of processed products**

#### **6.2.1 Setting up of food processing incubators and community kitchens**

Local Food Regulations prohibit commercial food processing in domestic kitchens and require small processors to operate under hygienic conditions in approved building and with equipment that meet legal requirements. Given that the setting up of a production unit and its associated equipment

can be very expensive, it is proposed that at least one incubator preferably located in the region where the agricultural services is based and at least one community kitchen be set up in each of the five zones demarcated for extension purposes by the CoA. The design and set up of these incubators and community kitchens should be done according to the required legislation and norms. The agroprocessors can use these facilities either individually as members of associations/cooperatives.. The incubator can nurture the small-scale agroprocessors by providing rental space, shared administrative service and technical assistance at an affordable price. Similarly new and/or early stage entrepreneurs can use the incubator facilities to prepare themselves for engaging in this sector.

The community kitchens can operate as a shared-use kitchen, a relatively inexpensive rental facility that can assist potential agroprocessors in the manufacture of agroprocessed products. It can be operated by a cooperative/association and the kitchen clients can be charged a fee only for the time that they use the facility. At the same time, the agroprocessors can also benefit from the technical knowledge of other processors using the community kitchen, particularly those with extensive food processing, marketing, and business experience and know how.

### **6.2.2 Improving quality and safety of products**

In order to compete in regional markets and increase their market share, it is vital that quality and safe products are produced. It is essential that appropriate food standards for these products are developed and a food laboratory be setup. All stakeholders recognise the key role to be played by a food laboratory in improving product quality, increasing consumer confidence and creating an immediate and significant impact on improving standards. This facility is crucial if Rodrigues is to become competitive in exporting processed products.

The food laboratory needs to be equipped with the necessary resources including equipment, trained personnel and sufficient funds. The laboratory shall provide microbiological, chemical and physical testing facilities for raw materials, processed products and water used during processing. Shelf-life of products can also be determined in the laboratory. The food laboratory can be attached to Agroprocessing unit of the Commission for Agriculture (CoA). Processors should be sensitized about the importance of food safety, standards and product testing. This laboratory can also work in close collaboration with the Commission for Health (CoH) which is responsible for implementing the food legislation.

As a complementary measure, the following training courses on are also being proposed to improve quality and safety of processed foods:

- (1) Five half-day workshops on hygiene: Good Manufacturing Practices/Hygiene, sanitation and cleaning and labelling.
- (2) Five half-day workshops to those who have followed the above training on food quality and safety: food standards, food hazards, introduction to Hazard Analysis Critical Control Points (HACCP).
- (3) Five half-day workshops to all agroprocessors on shelf-life studies and simple product testing.

## **7.0 ACKNOWLEDGEMENTS**

The financial support of the Mauritius Research Council for this work is gratefully acknowledged. Thanks are due to the University of Mauritius, administrative staff of the Agricultural Services of Rodrigues, the field enumerators and to the agroprocessors who spared time to participate in the survey. For statistical analysis we thank Mr. N. Auchoybur. Finally, the editor and reviewer are thanked for their useful comments which have improved the paper.

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