

CSIR-FOOD RESEARCH INSTITUTE



CSIR-FRI/TDTC-COTVET

**REPORT ON THE TRAINING OF SMALL SCALE FRUIT PROCESSORS ON VALUE
ADDITION TO FRUITS BY DRYING USING A GAS CABINET DRYER**



**CONDUCTED AT THE FACTORY PREMISES OF QUARCOO INITIATIVES,
MADINA NEW ROAD, ACCRA (20 – 21st October, 2016)**

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Table of Contents

Table of Contents	i
ACRONYMS	ii
SUMMARY	iii
1.0 Introduction	1
1.1 Objective	1
1.2 Opening Remarks	1
1.3 Participants	2
2.0 Fruit processing	2
2.1 Basic operations in fruit drying	2
2.1.1 Raw material selection and fruit handling.....	2
2.1.2 Raw material preparation	2
2.1.3 Drying	3
2.1.4 Packaging	3
2.2 Operating the gas cabinet dryer	3
2.3 Food Safety	3
3.0 Practical demonstration	3
4.0 Observations and general remarks	6
5. 0 Conclusions and recommendations	6
6.0 Closing remarks	6

ACRONYMS

COTVET – Council for Technical and Vocational Education and Training

CSIR – Council for Scientific and Industrial Research

FRI – Food Research Institute

TDTC – Technology Development and Transfer Center

SUMMARY

Following the successful design, fabrication and installation of the gas cabinet dryer at Quarcoo Initiatives, a 2-day training program was organized for staff of the company. This training was aimed at introducing staff of the company to dried fruit processing and also to orient them on the operation of the gas cabinet dryer. The training included both theory and hand-on practical sessions. Four fruits, pineapple, pawpaw, mango and coconut were used to practically demonstrate the various unit operations involved in processing dry fruits. These raw materials were selected in order to give the participants a much wider understanding of the peculiarities of different fruits. The participants were taught the details of each unit operation involved in the processing of dry fruits. They were also given an expose on food safety in food processing. The participants expressed much appreciation at having taken part in the training program because they acquired the skills and practical knowledge required to process fruits by drying. They were urged to apply the knowledge gained in their line of work in order to produce good quality dried fruits for the local and international markets.

1.0 Introduction

Processing of fruit into dry forms is one of the most expedient value addition opportunities in postharvest management. Most fruit growers in Ghana prefer to sell their produce in its raw form. However this is option characterized by heavy losses due to spoilage, which reduces the economic returns on harvests. In seasons of glut, for instance, losses of up to 30-50% has been estimated for fruits and vegetables. One of the methods available to address this situation is by drying the fruits. Apart from increasing its shelf life and making it available all year round, drying also adds more value to the raw fruit. Dried fruits are convenient and retain most of the nutrients of fresh fruits and are therefore considered healthy. Dried fruit products are increasingly becoming popular in Ghana, and this has a huge market potential.

The desire to process dried fruits has been a long standing one, but the ability and capacity to achieving this desire is limited, especially among micro and small scale enterprises. Many of these companies either lack technical expertise or equipment or may be constrained by both factors. It is based on this premise that CSIR-Food Research Institute, through the **TDTC-COTVET** funded the design, fabrication and installation of a gas cabinet dryer for two small scale fruit processing company. The gas cabinet dryer has the capacity of about 50 kg and is designed to churn out good quality dried fruits for the local and international markets. This is an important initiative in Ghana's drive towards a paradigm of adding more value to the country's raw produce. It would contribute to enhancing the earnings of fruit processing enterprises, creating more employment opportunities, improving income levels and livelihoods.

The gas cabinet dryer was installed and successfully test run with pineapple and coconuts. These two products were chosen to represent and simulate extreme moisture cases for fruits, in which the dryer may be used. In the training, however, four fruits were used in order for participants to have a better understanding of the processing peculiarities associated with a wide range of fruits. This report presents the events of a 2-day training in dried fruit processing for staff of Quarcoo Initiatives, which is one of the small scale companies selected under the Fruit Project. The training program was facilitated by researchers from CSIR-Food Research Institute.

1.1 Objective

To introduce the staff to the technology of processing dried fruits to enhance their skills and strengthen their capacity in fruit processing. Institute.

1.2 Opening Remarks

Mr Jonathan Ampah, in a short opening remark, gave a background to the training. He mentioned that the training is one of the scheduled activities under the Fruit Drying Project, which follows the design, fabrication and installation of the gas cabinet dryer. He noted that following the successful installation and trials, this training was needed to orient the production staff of Quarcoo Initiatives on the use of the new gas cabinet dryer and also equip them with the skills of processing dried fruits. He advised the participants to take the training seriously so that their technical skills would be strengthened for their benefit as individuals and the company as an entity. Trainees were urged to keenly follow the various activities earmarked for the training, especially the practical demonstration sessions. Mr Ampah concluded by assuring the Company that CSIR-FRI is always ready to partner with them to render technical and analytical services and also to provide backstopping assistance.

Mr. Quarcoo, CEO of Quarcoo Initiatives, spoke about the relevance of the project and said it is a worthwhile investment that needs to be embraced and supported for the good of processors and consumers. He said collaboration between research and industry contribute immensely to national development because it leads to solving specific problems that challenge the progress of industry. He stressed on the need for key stakeholders in food processing industry to strive to achieve excellence through partnerships. He revealed that the lack of technical and financial capacity, especially among small and medium scale companies, makes it difficult for these companies to adequately tackle challenges alone. He hoped that the fruit project would be successfully implemented and the initiative replicated in other areas as well. He hinted on continuous collaborations with CSIR-Food Research and re-echoed the need for technical backstopping during implementation of dried fruit processing in the Company.

1.3 Participants

The staff of Quarcoo Initiatives, a fruit processing company located at Madina New Road took part in the 2 day training on processing of dried fruits.

2.0 Fruit processing

Trainees were briefed about the nutritional and economic importance of fruits and the need to preserve and add value to raw fruits through processing. They were also introduced to drying as method of processing and preserving fruits. The importance of drying and the type of drying systems available for fruit drying were also discussed. Participants were also briefed about temperature, moisture content, size of slices and their effect on drying.

2.1 Basic operations in fruit drying

Participants were given a general overview of the unit operations involved in drying fruits. These processing steps ought to be carefully followed in order to ensure that good quality dry fruits are produced. After the general overview, the details of these unit operations were explained in further detail and demonstrated during the practical session. The trainees were also advised to observe hygiene and safety food processing precautions to ensure that the final product is safe for human consumption.

2.1.1 Raw material selection and fruit handling

Fruits used for drying must be of good quality since this directly affect the outcome of the final product. They were taught to use healthy, mature and ripe, but firm fruits. This would ensure that the final product has good texture and appearance and is attractive to the consumer. The participants were advised against including diseased or bruised fruits during production. In this regards, they were taken through the rudiments of sorting. This would ensure that only good quality fruits are selected for processing.

2.1.2 Raw material preparation

The participants were given theoretical and practical demonstration on washing, peeling and slicing of fruits. Washing and sanitizing are important steps in processing fruits. These unit operations is carried out by immersing the fruits in chlorine solution (sodium or calcium hypochlorite) for about 3 min. This process sanitizes the fruits by significantly reducing microbial load. Washing also reduces agro chemical residues on the fruits. Once fruits are sanitized they can then be peeled and sliced. Peeling and slicing are done manually with sharp stainless steel knives or automatically with a peeler and slicer. Trainees were shown the need to have thin and evenly-shaped fruit slices. This would enhance moisture removal from the fruits and also ensure that slices dry uniformly. The trainees were, however cautioned against cutting fruits into

very tiny bits or extremely thin slices so that the slices can be removed easily from drying trays/racks without tearing the fruit apart.

2.1.3 Drying

Drying is the most important operation in this training program because the product quality is heavily dependent on this process. The participants were taken through the details of drying fruits in the gas cabinet dryer. After slicing and evenly spreading the fruits on drying racks, the racks are arranged carefully in the dryer. Drying temperatures range between 65 and 70 °C. In order to be certain of uniform drying and good quality end products, the participants were taught how to rotate the racks during drying. The racks are swapped at a 4 hr interval during the initial stages of drying. Swapping is done more frequently as the products approach the desired moisture content. After drying the fruits are cooled at room temperature before packaging.

2.1.4 Packaging

The staff were given a general overview of packaging before its importance in relation to keeping the dried fruits was discussed. Dried fruits are mostly packaged in clear flexible polyethylene or polypropylene pouches and sealed to exclude air and moisture. They were advised to take packaging seriously because it is the only means by which the integrity of the product could be maintained after processing.

2.2 Operating the gas cabinet dryer

The trainees were given a detailed explanation of the procedures involved in operating the dryer. Operation begins with checking the gas pipes for leakages. This is followed by an initial pre-heating to a temperature 70-80 °C for 30 mins, before the sliced fruits are loaded. Temperature regulation is done by setting the gas burners to desired intensity and monitoring the temperature readings on the dial thermometers. Trainees were told that it is normal for the temperature to drop by nearly 10 °C immediately after loading as a result of product moisture and opening of the cabinet dryer. Once the samples have been loaded, the LPG regulator is adjusted until a temperature of 65-70 °C is attained in the drying chamber. When the fruits attain the desired moisture content, the source of heat is then turned off by shutting the gas supply on the LPG regulator. Drying is discontinued by removing the racks from the cabinet and allowing the fruits to cool.

2.3 Food Safety

Issues concerning safe food have become a global phenomenon because of several reported outbreaks of food borne diseases worldwide. Food safety is necessary to safeguard to health of consumers by preventing illnesses attributed to food consumption. It has several components including HACCP and GMPs, which manufacturers are encouraged to implement in order to reduce the production of unsafe food. The trainees were briefly introduced to HACCP and its pre-requisite programs as a food safety management tool. The principles of HACCP and key elements of GMPs were discussed as well as the need to observe current good manufacturing practices in food processing.

3.0 Practical demonstration

Four fruits, namely; pineapple, mangoes, pawpaw and coconut were used in the practical demonstration. These were purchased from the local fruit market at Madina and carefully sorted. The fruits selected for use in the practical demonstration were mature and ripe but firm (not applicable to coconut/copra). All the participants were made to take active part in the practical demonstration in order to equip them with the skill required to execute the unit operations involved in fruit drying.

On the 1st day of the training, the participants worked on pawpaw and coconut. The 2 commodities were washed and disinfected before peeling. The pawpaw was peeled and all seeds carefully removed, before slicing and spreading on drying racks. The coconuts were pared with a sharp cutlass and the flesh scooped out with stainless steel knife. The copra was washed twice in water before slicing and spreading on drying racks. The 2 commodities were loaded and dried in the gas cabinet dryer at 65-70 °C for 5-8 hrs.

Pineapple and mangoes were used for the practical session on Day 2. Pineapples were de-crowned by hand before washing and sanitizing. The pineapples were then peeled with a sharp stainless steel knife, de-cored, and sliced to the desired thickness. Mangoes were also subjected to the washing and sanitizing step before peeling, cutting and slicing. The fruits were spread gently on drying racks, loaded into the pre-heated dryer and dried at 65-70C for 8hrs. After drying the fruits were cooled to room temperature, packaged in flexible polypropylene pouches and sealed.



Figure 1: Participants being taken through some unit operations in fruit drying



Figure 2: Sliced mangoes and pawpaw ready for spreading



Figure 3: Spreading the sliced fruits on drying racks



Figure 4: Sliced fruits loaded into gas cabinet dryer



Figure 5: Dried pawpaw and coconut slice



Figure 6: Dried mango and pineapple slices

4.0 Observations and general remarks

The training was successful and participants appreciated the hands-on mode adopted. They all took active part and were keen on learning more. Some of them had prior working knowledge of fruit processing and observed the basic rules of hygiene during processing. Quarcoo Initiatives has implemented basic food safety measures and these include glass cover protection for light bulbs, proper personal hygiene and cleaning schemes. That notwithstanding, there is the need to fully implement a food safety system which is well regulated and documented. Table 1 presents yield for each fruit after drying.

Table 1: Yield of fruits after drying

Fruit	Quantity dried (kg)	Yield (%)
Pineapple	12.0	13.0
Mango	4.8	14.4
Pawpaw	8.4	12.4
Coconut	6.4	23.4

5. 0 Conclusions and recommendations

The training was successfully carried out and participants learnt the basic operations in fruit drying and operation of the gas cabinet dryer. Based on the training and general observations made, the following recommendations were suggested

- A shed should be erected over the dryer to keep it from direct contact with rain.
- Although they have food safety measures in place there is the need to develop and implement an HACCP in the processing facility.
- Support the company through technical backstopping

6.0 Closing remarks

Mr. Ampah congratulated the participants for making time to attend the training program and asked them to continually practice+ what they have learnt to improve their processing activities. Mr. Quarcoo also extended a word of appreciation to CSIR-FRI for the opportunity to take part in the Fruits Project, and also to the facilitators for their wonderful work. He urged staff who took part in the training to implement what they learnt for the benefit and progress of the company.