CSIR-FOOD RESEARCH INSTITUTE

REPORT ON FRUITS AND VEGETABLES PROCESSSING TRAINING WORKSHOP FOR AGRICULTURAL EXTENSION AGENTS OF MOFA/WIAD (CSIR-FRI/RE/TC/2009/011)

HELD AT FOOD RESEARCH INSTITUTE (CSIR), OKPONGLO, ACCRA, GHANA FROM 13TH – 14TH OCTOBER, 2009

BY

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OCTOBER, 2009

ACKNOWLEDGEMENT

The Directors of the Council for Scientific and Industrial Research-Food Research Institute (CSIR-FRI) and the Ministry of Food and Agriculture-Women in Agriculture Development (MoFA-WIAD) are grateful to all the trainers and their technical assistants from the CSIR-FRI and MoFA-WIAD and are highly acknowledged for their presence and relevant contributions. Many thanks also goes to all those who in divers ways contributed in various ways to make this training workshop a success.

ACRONYMS

AEA	Agricultural Extension Agents
CSIR	Council for Scientific and Industrial Research
DDO	District Development Officer
FSDs	Food Safety Standards
FRI	Food Research Institute
GMPs	Good Manufacturing Practices
HACCP	Hazard Analysis and Critical Control Points
MAP	Modified Atmospheric Packaging
MoFA	Ministry of Food and Agriculture
SMEs	Small and Medium Scale Enterprises
TOT	Training of Trainees
WIAD	Women in Agriculture Development

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EXECUTIVE SUMMARY

A training workshop for processing of fruits and vegetables was organized by the Council of Scientific and Industrial Research-Food Research Institute (CSIR-FRI), Okponglo, Accra in collaboration with the Ministry of Food and Agriculture-Women in Agriculture Development (MoFA-WIAD) Headquarters, Accra. The training workshop was held at the premises of the CSIR-FRI, Okponglo, Accra. In Ghana, post harvest losses of fruits and vegetables are enormous due to lack of processing, preservation and storage. The high moisture content of fruits and vegetables demands that they are processed before storage. The training workshop was therefore conducted for MoFA-WIAD Agriculture Extension Agents (AEA's) for two days to be trained on the principles, concepts and acquire technical skills in processing of fruits into juices, drying of fruits and vegetables, Food Safety and Quality Assurance, Good Manufacturing Practices and Hazard Analysis and Critical Control Points. Twenty-two AEA's representing all the regions in Ghana attended the training workshop. The format of the training was 30% theory and 70% hands-on practical demonstrations on processing of fruits and vegetables on both training days. During the training workshop water melon, citrus, grape, pineapple and mandarin were processed into juices whereas garden egg, pepper, okro, leafy vegetables, pawpaw and pineapple were dried. In addition, two training manuals entitled ''Training manual on processing of fruits into juices for MoFA-WIAD" and ''Training manual on processing of pepper, ginger, okra and garden-eggs for MoFA-WIAD" were made available to trainees as the main training documents during the training workshop. During evaluation of the training workshop, trainees expressed their sincere thanks to the organizers and requested for more of such training workshops.

1.0 **INTRODUCTION**

In Ghana the post harvest management of fruits and vegetables has been a challenge over the years. This is due to the inability of farmer processors, processors and Small and Medium Scale Enterprises (SME's) to process fruits and vegetables during glut seasons often leading to exorbitant prices of fruits and vegetables during lean seasons. Processing of fruits and vegetables is the best preservation and storage procedure to curtail this problem. In order to address imbalance in food commodity chain for fruits and vegetables, this training on fruits and vegetables was conducted to train Agriculture Extension Agents (AEA's) of MOFA-WIAD with relevant technical skills to become Trainer of Trainees (ToT's) in processing of fruits and vegetables in their respective districts in Ghana. The training was conducted for 22 (AEA's) of MOFA-WIAD from all the regions in Ghana. The training was geared to equip the trainees on basic technical information on the underlining principles, methods and techniques involved in the processing of fruits and vegetables into high quality products. In addition, it was to create awareness of the AEA's to the opportunity of processing fruits and vegetable indigenous in their district for the country as well as export. Further, it was also to inform trainees that the CSIR-FRI has the potential of assisting them to produce high quality processed fruits and vegetables for the country and export.

The two days training workshop on processing of fruits and vegetables was therefore a ToT for WIAD AEA's of a format of 30% theory and 70% practical demonstrations on fruits and vegetables processing. The 30% theory included the principles and concepts of processing of orange, water melon, citrus, grape, pineapple and mandarin into juices, drying of garden egg, pepper, okro, leafy vegetables, pawpaw and pineapple in addition to Food Safety Standards (FSDs), Good Manufacturing Practices (GMP's) and Hazard Analysis and Critical Control Points (HACCPs). A participatory approach was adopted for trainees to ask questions, comments and to make inputs during the training. After the training, it was expected that the AEA's will be able to identify indigenous fruits and vegetables peculiar to their locality and train farmer processors, processors, SME's and set-up cottage industries in their respective districts after sourcing funds from the District Assemblies with assistance from MoFA-

WIAD Headquarter in collaboration with the Food Research Institute of the Council for Scientific and Industrial Research.

DAY 1: 13TH OCTOBER 2009

2.0 OPENING AND WELCOME ADDRESS

The programme started at 9:00 am with an opening prayer by Rev. Mrs. Nyuieme Adiepena, MOFA-WIAD, Headquarters, Accra followed by self introduction of trainees from MOFA-WIAD and facilitators of the CSIR-FRI. The facilitators from Food Research Institute were Dr. Charles Tortoe, Mrs. Charlotte Oduro-Yeboah, Mr. Elvis Baidoo and Dr. Lawrence Abbey.

In his welcome address, Dr. Charles Tortoe of the CSIR-FRI said the training workshop on fruits and vegetable processing was to ensure food security through appropriate processing of high quality fruit and vegetable products. He noted that the training was to equip trainees with the relevant technical skills in processing of fruits and vegetable for preservation and storage in order to curtail losses during glut seasons and help alleviate poverty, which is common among farmer processors, processors and SME's in Ghana and Africa as a whole. He reminded trainees of the background of the Food Research Institute (FRI) as one of the affiliates and centers of the Council for Scientific and Industrial Research (CSIR). It was incorporated into the CSIR in 1968. The FRI is mandated to conduct applied research into problems of food processing and preservation, storage, marketing, distribution and utilization, in support of the food industry and also to advise the Government on its food policy. The Food Research Institute's vision is to be recognized nationally and internationally as Science and Technology (S&T) institute that is playing a key role in the transformation of the food processing industry to be internationally competitive with particular reference to product safety, quality and presentation. Finally, the Institute's mission focuses on providing scientific and technological support to the growth of the agricultural sector of the national economy in line with corporate prioritization and national

objectives. Primarily, the FRI's mission is to conduct market-oriented applied research and provide technical service and products to the private sector and other stakeholders. Dr. Charles Tortoe impressed on the trainees that it is expected of them to identity indigenous fruits and vegetables in their districts for processing and transfer the technical skills acquired during the training workshop to farmer processors, processors and SME's in their districts. In addition, the CSIR-FRI has an open-door policy to assist them whenever the need arises.

Two training manuals entitled ''Training manual on processing of fruits into juices for MoFA-WIAD" and ''Training manual on processing of pepper, ginger, okra and garden-eggs for MoFA-WIAD" were introduced to the trainees. The trainees were urged to critically read the manuals to understand and acquire technical skills for processing of fruits and vegetables. The manuals are also their additional source of reference when they return to their respective districts.

3.0 **ADDRESS BY DIRECTOR OF WIAD-MOFA**

The Director of WIAD-MOFA, represented by Rev. Mrs. Nyuieme Adiepena said the aim of processing fruits and vegetables was to alleviate poverty, increase food security and diversify opportunities for income generation in the districts in Ghana. She stated that the training workshop had three objectives. First, it was to create awareness on processing of fruits and vegetables for MOFA-WIAD AEA's. The second was for MOFA-WIAD AEA's to acquire technical skills in the processing of fruits and vegetables. Lastly, it was for MOFA-WIAD AEA's to become ToT's in their respective districts after the training. Further, Rev. Mrs. Nyuieme Adiepena impressed upon the trainees that it is expected of them to transfer the knowledge acquired during the training to farmer processors, processors and SME's in their district. They are also expected to help set-up cottage industries by identifying the unique fruits or vegetables in their locality for processing for local, regional and international markets. These tasks they can accomplish by writing proposals to their District Assemblies for support. The trainees were told that the MoFA-WIAD Headquarters, Accra was always available to assist trainees to accomplish these tasks. She applauded the excellent

collaboration between CSIR-FRI and MoFA-WIAD in the field of food processing, preservation and storage.

Fig 1. A section of trainees

Fig 2. Mr. Elvis Baidoo making his presentation

Fig 3. Mrs. Charlotte Oduro-Yeboah making her presentation

Fig 4. Dr. Charles Tortoe making his presentation

4.0 PROCESSING OF FRUITS INTO JUICES

Members of the group were introduced to fruit processing into juice by first mentioning the general fruits available countrywide and the need to process fruits to reduce post harvest losses. The general processing steps discussed are outlined as follows.

- Procurement of fruits

It was made known to trainees that it is very important to produce fruit juices using high quality raw materials. Only fresh, mature and fully ripe fruits should be used. Mouldy, insect damaged and rotten fruits should not be used and all unwanted parts should be removed. Members were also informed that during transportation of fruits to the processing site it should be ensured that the fruit is handled well. Bruised, decayed and over-ripped fruits must not be mixed with the consignment, as it will spread decay to other produce, produce

ethylene gas to cause further ripening and decay and produce more heat through respiration leading to loss of water.

- Washing and Grading of fruits

Trainees learned that fruits have to be pre–washed before processing because of the following factors: To reduce the microbial load on the fruits that might have contaminated the fruits from the soil and water supplies, from vegetation including the surface of fruits and during harvest time. Washing also reduces agro chemical residues such as fertilizer residues, insecticidal residues and to reduce field heat to cool down the inner tissues within the fruit, reducing respiration in the process and thereby improving the keeping quality of the fruit.

Typical detergents used in washing of fruits are sodium meta-silicate or meta-bisulphite. However, ordinary lime juice could be used to disinfect the water or just the use of plentiful amounts of water. Washed fruit should be immediately graded by hand. Grading removes broken and decayed fruit and is the final check on the quality of the fruit entering the processing area.

- Extraction of juice

The trainees learned that juice extraction is done with a hand presser or a kitchen blender after peeling of the fruits depending on the kind of fruit but at higher production levels, it is necessary to use a mechanised juice extractor, fruit press or a fruit mill. The juice obtained is quickly sieved/ strained with a clean muslin cloth to remove the excess pulp.

- Juice modification

This is done to achieve consistent and stable product. Trainees learned how to modify the acidity and the soluble solids. Members were introduced to the pH scale. Members learned that Product modification can take several forms; modifying the acidity (or pH), soluble solids-using citric acid to check acidity and clean water to check the sweetness level (Brix) of the juice.

- Preservation

The trainees learned how to preserve fruit juices by pasteurisation and addition of a preservative (sodium benzoate). Members were informed that the addition of the preservative was an optional step in the processing of fruit juices.

- Packaging

Members of the group were taken through a discussion on packaging of fruit juice into bottles by hot filling. Bottles were supposed to be washed and allowed to dry before filling.

5.0 **DRYING OF FRUITS AND VEGETABLES**

Trainees were taught that drying is the oldest means of preserving food and since post harvest losses of fruits and vegetables was a problem in Ghana, drying helped to preserve food for later use. The term drying was defined as essentially the process of removing moisture (or water) from a food particle. The extent of water that remains in the dried food will be equal to the moisture in the air surrounding the food particle. Some advantages of drying fruits and vegetables were also elaborated as being simple, safe and easy to learn, drying makes food keep well and also makes food compact, add variety to the food and as a result less space is needed for storage. The trainees were then taught how drying preserved food. The following details were given to the trainees. Drying removes moisture from the food so bacteria, yeast and molds cannot grow and spoil the food. When the moisture is <10%, microbes cannot grow and multiply. Trainees were taught that drying slowed down the action of enzymes, but does not inactivate them. Also dried food products becomes smaller and lighter in weight after drying.

Trainees learnt that warm temperatures during drying causes the moisture to evaporate and low humidity allows moisture to move quickly from the food to the air, the air current speeds up drying by moving the surrounding moist air away from the food. Further, drying could be achieved mechanically using hot-air oven or using solar tent and also sun-drying.

The process of blanching was explained to trainees as a pre-treatment step very necessary in preparing some vegetables for drying like pepper and garden-eggs. Blanching was defined as a process of heating vegetables to a temperature high enough to destroy enzymes (peroxidiase) present in the vegetable. Also blanching stops the action of enzymes which could cause loss of color and flavor during drying and storage. Some advantages of blanching were also detailed as follows:

- Shortens the drying and rehydration time
- Helps save some of the vitamin content

- It sets the colour
- Hastens drying by relaxing the tissue

They were taught that two types of blanching existed: hot-water and steam. For the hot water blanching, vegetables are immersed in boiling water in a wire basket. Also the bright green colour of some vegetables can be protected using sodium bicarbonate/citric acid in the blanching water example garden-eggs. The texture of soft vegetables can also be protected using calcium chloride solution. For steam blanching, vegetables are placed in a strainer over a pan of boiling water and covered with a lid to prevent the steam escaping. In steaming blanching, fewer nutrients are lost and it helps retain color and slow oxidation. The trainees were given some points to note when determining whether food products are dried. These were that dried vegetables and fruits should be brittle/crisp, shatter when hit and contain about 10% moisture.

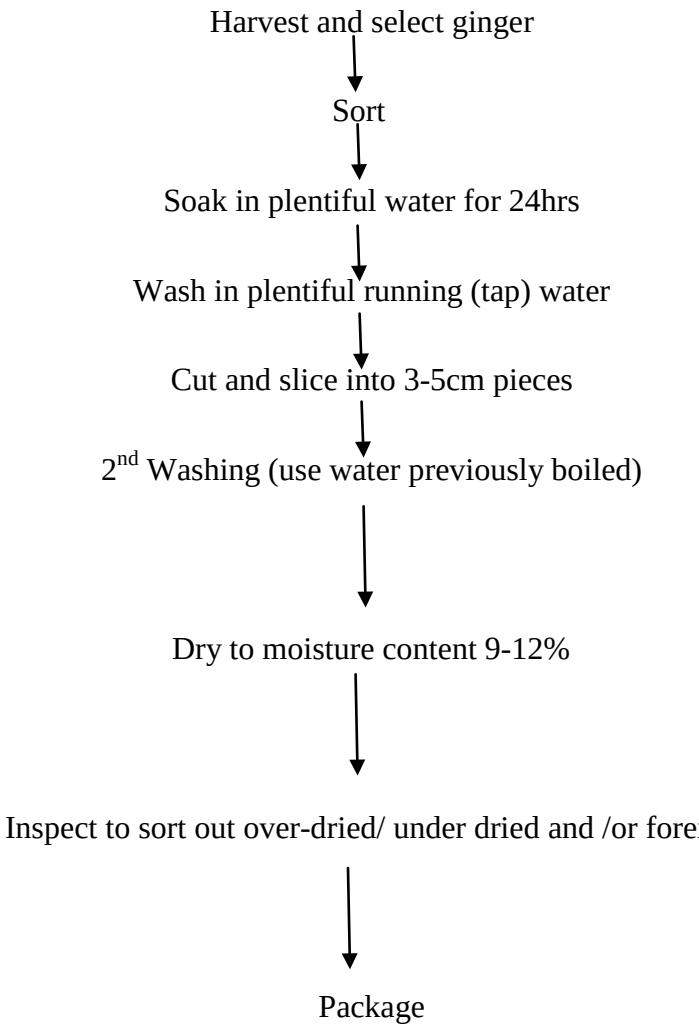
The MoFA-WIAD AEA's were trained on appropriate ways of packaging and storing of dried foods. These were that after foods are dried, they should be cooled completely, packaged into clean moisture vapour resistant container/polyethylene, sealed well if it is polyethylene and if the products are put in containers, it should be tight-fitting.

The importance of hygiene and food safety during the drying of fruits and vegetables was stressed. The definitions for hygiene and food safety were given as: hygiene is the art of preserving health, sanitary principles and practices. A safe food provides an assurance that food will not cause harm to the consumer when it is prepared and/or eaten according to its intended use. On who was responsible for food safety, the trainees were told that everybody involved with food, from the farmer to the consumer share the responsibility to keep the food supply safe. This could be done if precautions are taken to keep food protected from hazards that can increase human health risks. The trainees were taught what causes food to be unsafe. The contaminants elaborated were pathogenic microorganism or toxic substances from them, chemicals, bio-chemicals and extraneous matter such as excreta, hair, feather of animals and birds, microbes (soil, waste supplies, on skin) and chemicals-cyanide, herbicides, pesticides, fungicides and toxic metals.

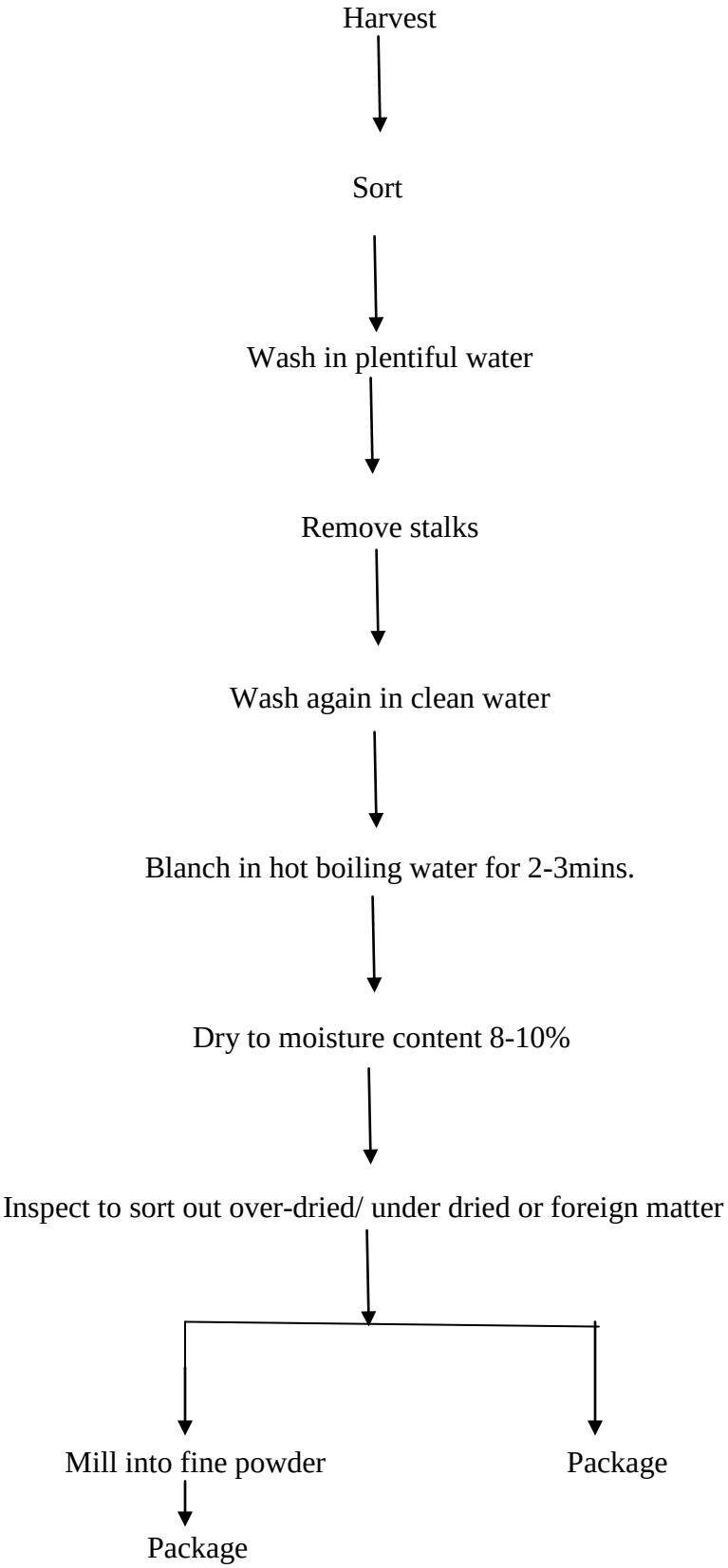
Some ways of minimizing such contamination were that all pathogenic micro-organisms should be eliminated during handling, transport storage of raw materials processing, packaging and subsequent storage and delivery to consumers.

The trainees were taught schemes for drying ginger, pepper, okro, garden eggs, pawpaw and pineapples.

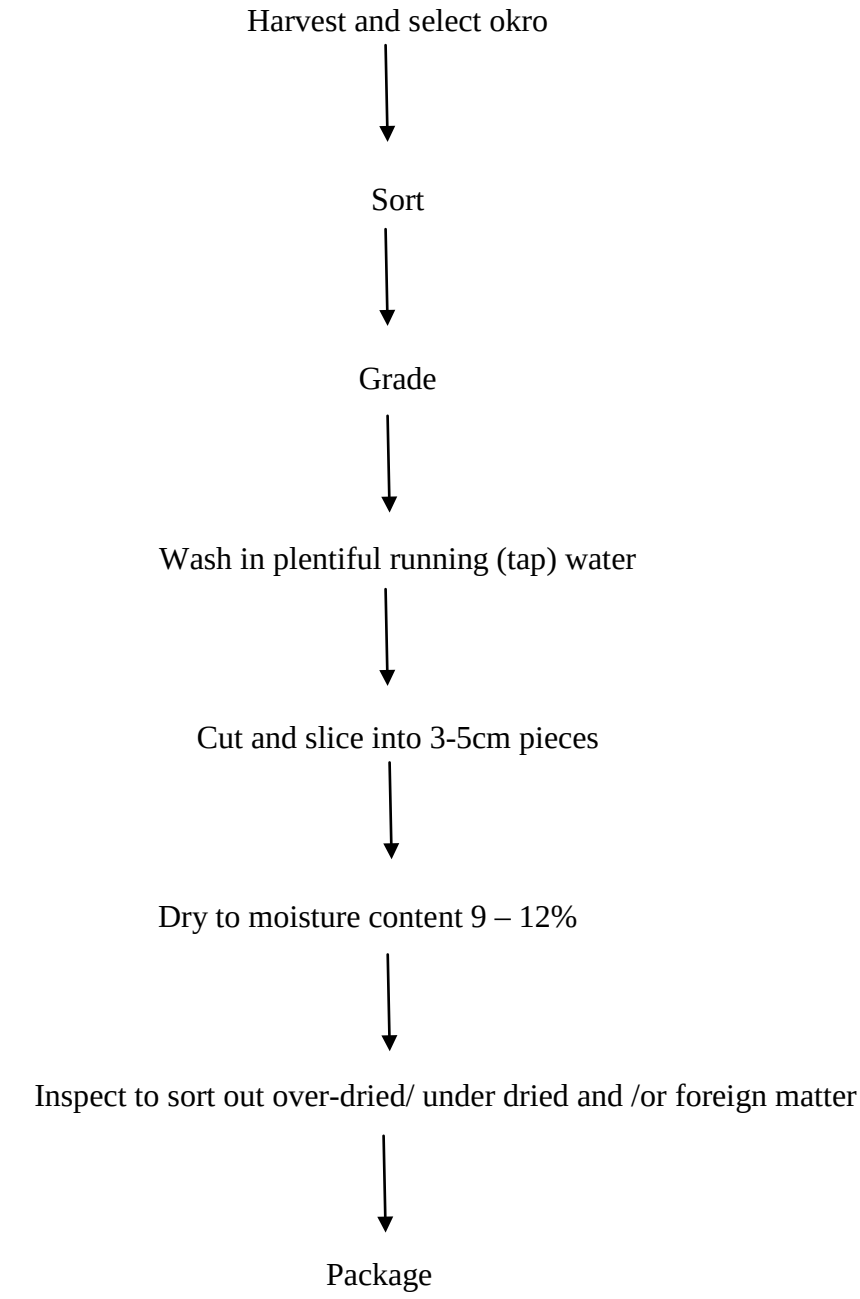
SCHEME FOR THE PRODUCTION OF DRIED GINGER



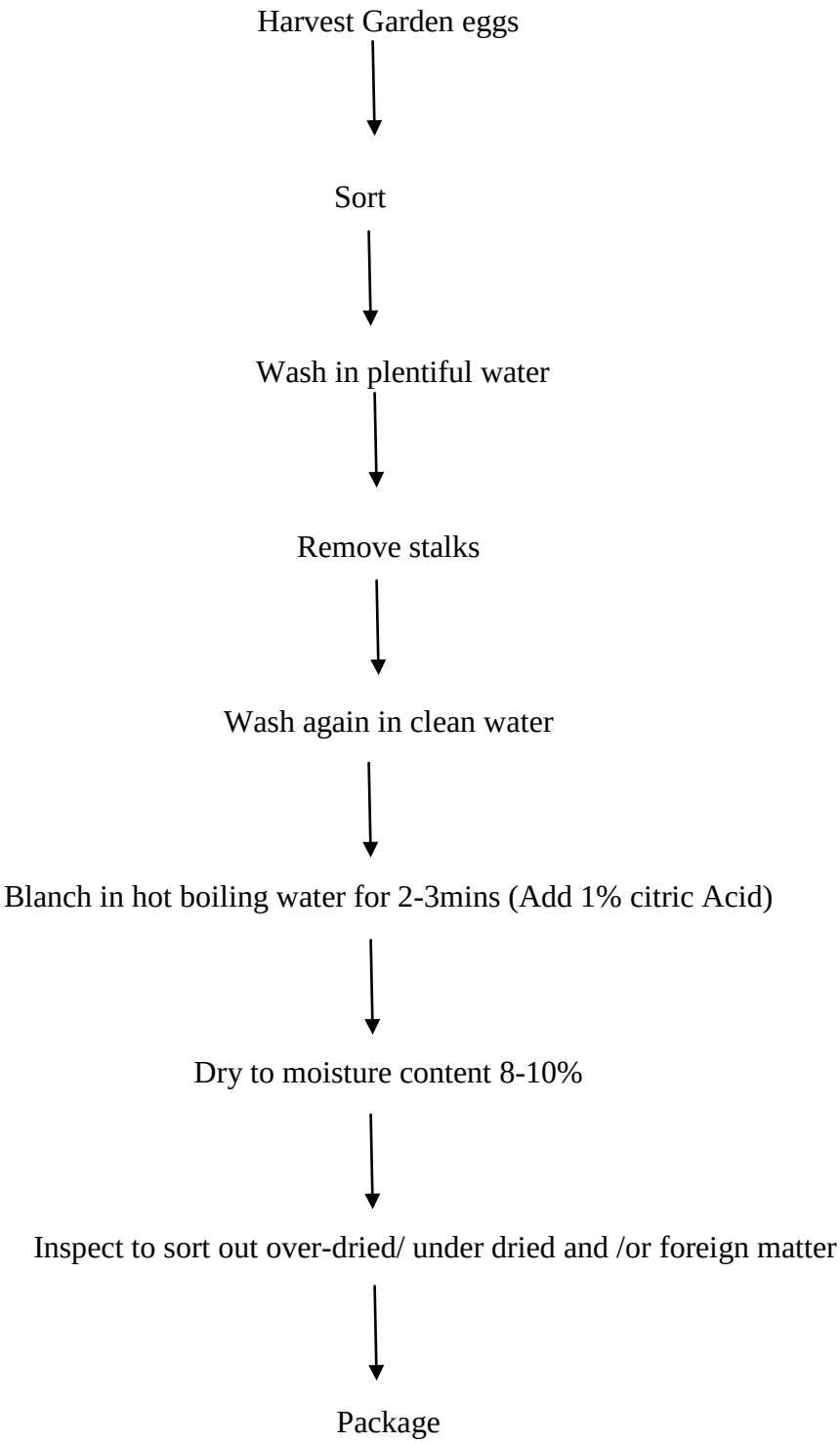
SCHEME FOR THE PRODUCTION OF DRIED PEPPER


Harvest
Sort
Wash in plentiful water
Remove stalks
Wash again in clean water
Blanch in hot boiling water for 2-3mins.
Dry to moisture content 8-10%
Inspect to sort out over-dried/ under dried or foreign matter
Mill into fine powder
Package
Package

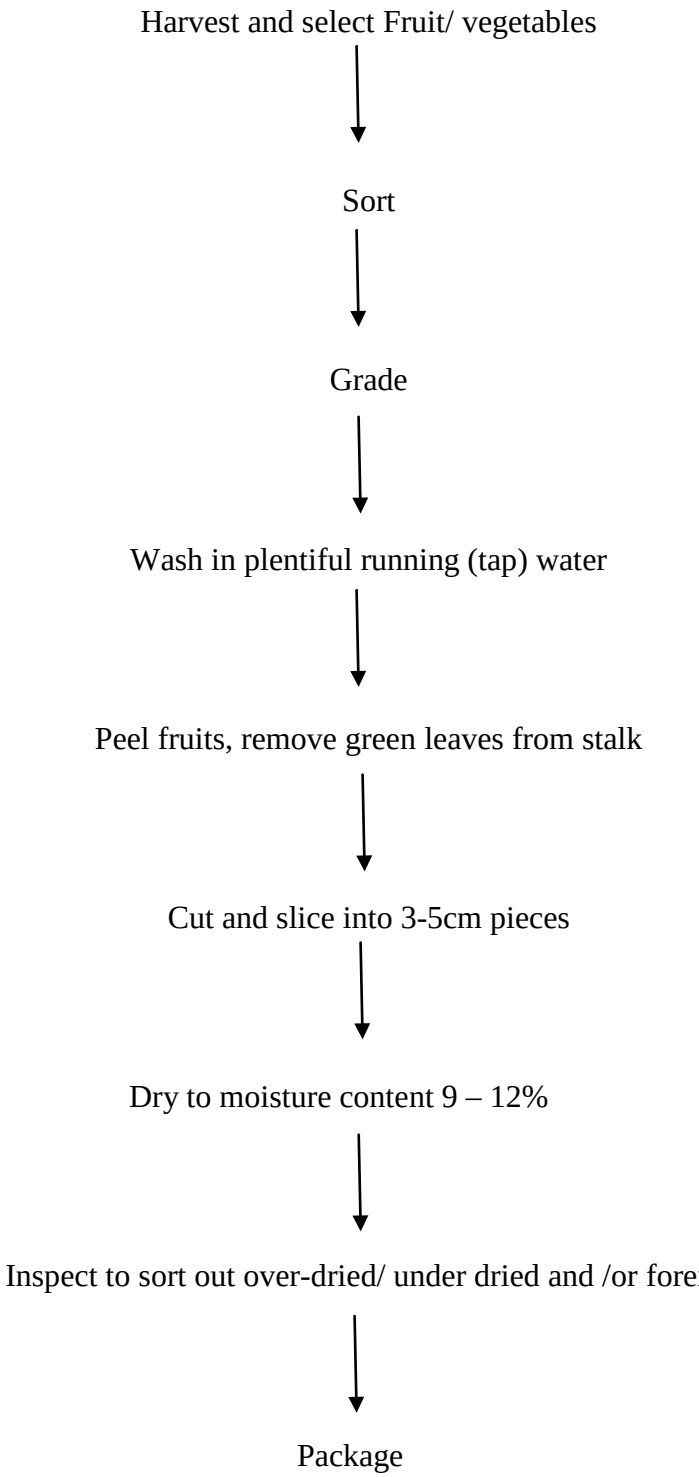
SCHEME FOR THE PRODUCTION OF DRIED OKRO



SCHEME FOR THE PRODUCTION OF DRIED GARDEN EGGS



SCHEME FOR THE PRODUCTION OF DRIED FRUITS (PAWPAW, PINEAPPLE AND GREEN LEAFY VEGETABLES



6.0 HAZARD ANALYSIS AND CRITICAL CONTROL POINTS

The trainees were taught the concepts, principles and implementation of the Hazard Analysis and Critical Control Points (HACCP) during the training workshop. The HACCP was defined as 'A quality system that aims at the production of microbioliological, chemical and physical safe products by controlling the quality of raw materials and processing operations'. The HACCP is therefore a systematic approach to the identification, evaluation and control of food safety hazard. It is a preventive system of hazard identification and control rather than a reactive one, which processors can use to ensure safer food products for consumers. In essence the HACCP system is designed to identify hazard, establish controls and monitor these controls. The HACCP system can be used at all levels of food processing such as cottage industries, small and medium scale enterprises (SME's) and large industries. The HACCP system originated in the 1960's in the United States of America when foods were developed for the space program by National Aeronautics Space Agency (NASA). The HACCP system was then adopted by Pillsbury Company and other many food processors in the United States. Today, the HACCP system is accepted international alongside the Codex Alimentarius to ensure safer foods for consumers.

In order to understand the key concepts of the HACCP essential basic terms were defined for trainees as follows:

- Hazard – Any biological, chemical and physical property that may cause an unacceptable health risk or quality defect in food. Their elimination or reduction to acceptable levels is essential to the production of safe foods.
- Critical Control Point (CCP) – Is a raw material, location or process at which control can be exercised to prevent or minimize a hazard.
- Monitoring – Is a planned program of observation and simple checks of CCP's to ensure that critical limits are not exceeded.
- Corrective Measures – Are actions that are taken immediately a CCP is monitored and found to be out of control.

- Verification – Are traditional laboratory analysis and audits carried out to ensure that the HACCP system is working effectively.
- HACCP Plan – The written document that is based upon principles of HACCP that shows the procedures to be followed.
- HACCP System – The result of the implementation of the HACCP Plan.
- HACCP Team – The group of people who are responsible for developing, implementing and maintaining the HACCP System.
- Hazard Analysis – The process of collecting and evaluating information on hazard associated with the food under consideration to decide what hazards are significant and must be addressed in the HACCP plan.
- Biological Hazards – Harmful bacteria, viruses or parasites (eg. Salmonella, hepatitis A and Cryptosporidium).
- Chemical Hazards – Pesticides, insecticides, herbicides fungicides, fertilizers, lead, tin, zinc, mercury, cyanide, lubricants
- Physical objects – Foreign objects, glass or metal fragments, plastics, insects pats, hair, filth or spoilage

Trainees were taught the 7 principles of HACCP to include:

1. Conduct a Hazard Analysis

Biological, chemical and physical property that may cause an unacceptable health risk or quality defect in food.

2. Determine the Critical Control Points (CCP's)

Operational steps, which can be controlled to eliminate or minimize the occurrence of identified hazards.

3. Establish Critical Limits

Target levels and tolerances that should be met to ensure that each identified CCPs are under control. They are stated as physical, chemical, biological or sensory parameters that are easy and rapid to monitor such as appearance, odour and pH.

4. Establish Monitoring Procedures

A control plan is established to monitor each CCP to ensure that it is under control i.e the critical limits are not exceeded.

5. Establish Corrective Actions

Measures to be taken when the monitoring results show that a particular CCP is not under control.

6. Establish Documentation and Record Keeping System

Management commitment and the system procedures and working instructions are described and assembled in a manual. Results of monitoring, corrective actions, verification and audit, training and management reviews are recorded on simple forms and kept for a defined period of time.

7. Verification

It is assured that the HACCP system is working correctly through a review of the system and chemical, physical and microbiological analysis of raw materials, intermediary and finished product by an external institution such as the Food Research Institute (FRI), Food and Drugs Board (FDB) and Ghana Standards Board (GSB).

Trainees learnt how to implement and maintain a HACCP system in a production plant and advised to seek assistance from FRI, FDB and GSB to implement a HACCP quality system in their processing unit. Thirteen stages in the implementation and maintenance was outlined for trainees as follows:

1. Commit the product to management and assemble a HACCP team

2. Description of product and its intended use

3. Elaboration of the process flow diagram

4. Confirmation of the process flow diagram on the plant

5. Identification of hazards from raw matrials to product consumption and appropriate control measures.

6. Identification of the critical control points (CCPs)

7. Establishment of the critical limits of each CCP

8. Establishment of the monitoring program for each CCp

9. Establishment of corrective actions

10. Verification and audit

11. Establishment of record keeping systems

12. Training

13. Documentation of HACCP systems (Quality manual procedures, instructions and forms)

7.0 HANDS-ON PRACTICAL DEMONSTRATIONS

7.1 PROCESSING OF FRUITS INTO JUICES

Different kinds of fruits namely pineapple, oranges, mandarin, pawpaw and watermelon were provided by the group for the training purpose. Five groups were formed and given different fruits for processing into juice as follows:

Group 1: Oranges,

Group 2: Pineapple,

Group 3: Watermelon,

Group 4: Pineapple and orange

Group 5: Mandarin and oranges.

Fig 5. Oranges purchased for processing

Fig 6. Pineapples purchased for processing

The group members collectively sorted the fruits after washing the fruits in water dissolved with a measured quantity of sodium metabisulphite.

Fig 7. Trainees sorting oranges for processing into juice

This was followed by preparing the fruits for juice extraction by peeling the fruits. The fruits were peeled and chopped according to the type.

Fig 8. Cut water melons ready for juicing

Fig 9. Peeled and cut pineapples ready for juicing

Juice extraction was the next stage and was done according to the type of fruit. Pineapple juice was extracted using the communiting mill to pulp the fruits while orange was extracted using the hand press. For water melon the seeds were removed and passed through the communting mill.

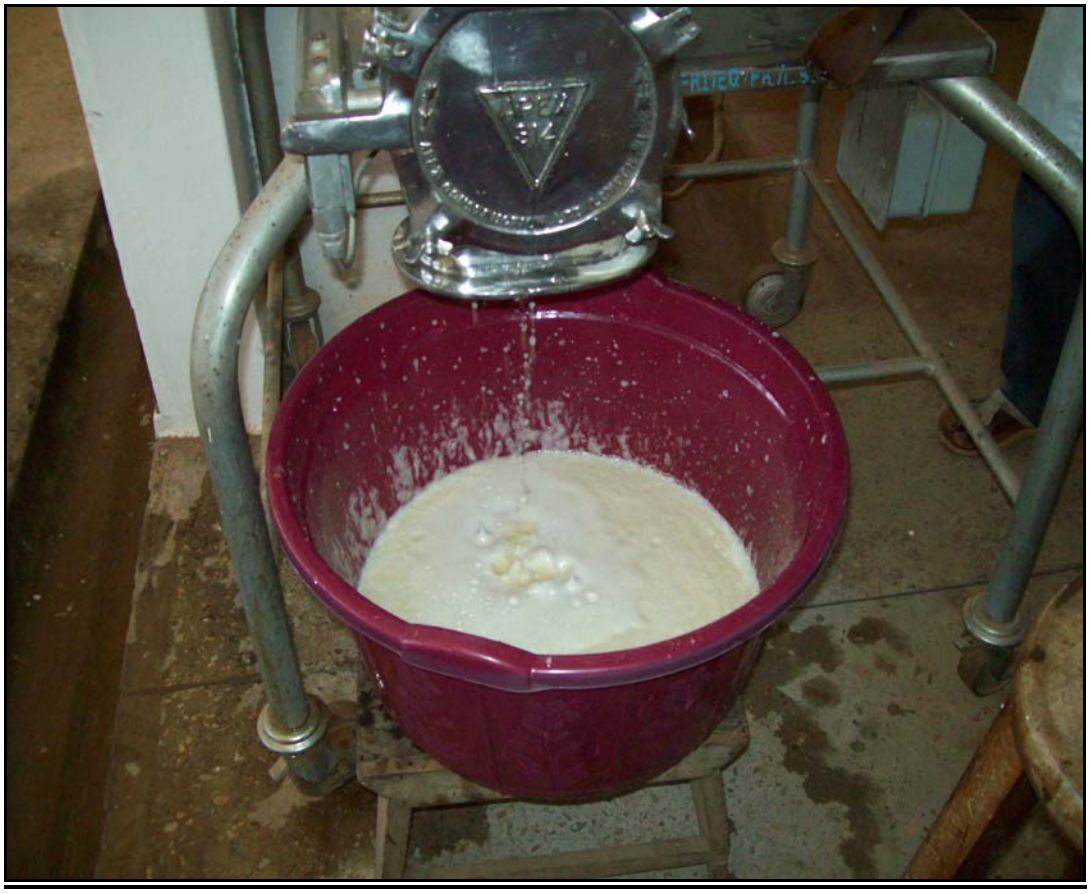


Fig 10. Juice extraction using communiting mill for pineapple

Fig 11. Juice extraction using hand presser for orange

The fruit juices obtained were quickly strained/sieved using the mesh. Fruit modification was the next processing step. The sweetness level of the juice was tested by the members of the group with a refractometer and adjusted to fall within the accepted range. The same was done for the acidity level of the fruit juices.

After modification of the fruit juices, pasteurisation of the juice was the next processing stage. The different juices produced were pasteurised for 15 minutes and allowed to stand for a while before preparing for packaging.

Fig 12. Trainees learning how to check soluble solids in juice with a refractometer

Fig 13. Trainees pasteurisation of water melon juice

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The fruit juices prepared were then hot filled into sterilised bottles and quickly dipped into ice- cold water after adding measured quantities of sodium metabisulphite to retain the colour of the fruit juices. A picture of the fruit juices by the different groups are shown below.

Fig 14. Trainees filling bottles with juice

Fig 15. Types of fruit juices produced by trainees

7.2 DRYING OF FRUITS AND VEGETABLES

The trainees were taken through the drying of the following commodities: okro, garden-eggs, pawpaw, pineapple and green leafy vegetables.

Fig. 16. Trainees properly dressed to start the drying processing

Fig 17. Trainees peeling and cutting of fruits (pineapples and pawpaw) and okro

Fig 18. Trainees busily peeling and cutting fruits

Fig 19. Trainees slicing garden-eggs and okro for drying

Fig 20. Trainees in the process of hot water blanching of garden-eggs

Fig 21. Trainees spreading sliced pawpaw for drying

Fig **22. Trainees getting ready to package dried pawpaw, okro, pineapples and garden-eggs**

Fig 23. Dried pineapple chips

Fig 24. Packaged dried products

7.3 IDENTIFICATION OF CRITICAL CONTROL POINTS

In order for trainees to understand the principles, concepts and implementation of the HACCP system, trainees were assisted to identify the Critical Control Points during the process flows for both juice preparation and drying of vegetables.

Fig 25. Trainees checking the sugar content during formulation of orange juice

Fig 26. Trainees' pasteurization of orange juice

Fig 27. Trainees' pasteurisation of water melon juice

Fig 28. Bottled orange juice

Fig 29. Bottled water melon juice

Fig 30. Drying of fruits and vegetables at appropirate temperature

Fig 31. Dried pawpaw samples ready for packaging

DAY 2: 14TH OCTOBER 2009

8.0 COMMENTS MADE BY TRAINEES DURING PRACTICAL SESSION

Many enquiries were made on how to acquire the different equipments, chemicals and other accessories for fruit juice processing. Some members promised to go back and train fruit farmers and processors in their various districts. The trainees expressed hope that it will be easy to transfer the knowledge on fruit juice processing in their various districts now that they have acquired practical knowledge on fruit juice processing.

The trainees complained about the availability of the chemicals used for sanitizing and for blanching in their districts. They also expressed that measuring spoons be used for measurement of chemicals instead of weighing scales so that they could easily adapt it in their districts. Considering the high post harvest losses in Ghana, the trainees appreciated the drying technology and said it was very necessary and could be easily done in the districts.

Trainees expressed concern about most fruits and vegetable processing sites they have visited where the HACCP concept is not been implemented. Critical Controls Limits were not identified and monitored resulting in low quality products. In some instants Good Manufacturing Practices were not observed and low sanitary conditions exist in the processing sites. Trainees agreed that in order to meet Food Safety Standards, HACCP must be implemented at all processing sites in the districts.

9.0 OBSERVATIONS MADE DURING TRAINING PROGRAMME

The members of the group generally appreciated the hands-on practical sessions. The trainees agreed that processing of fruit juices and drying technology was adaptable in their districts. They however complained about easy access to drying equipment because of lack of funds. They were excited about the drying process and appreciated what they had been taught.

The process of extending appropriate knowledge, skills and equipment to end-users is technology transfer and it must be cost effective and adaptable on a sustainable basis. During the training workshop trainees agreed to a successful adoption of fruits and vegetables processing technology at the district level. A drawback expressed by trainees was on the acquisition of food grade chemicals for formulation of juices and processing equipment. However these fears were address by advising trainees to seek support from the districts assemblies through the Ghana Government District Common Funds. A list of food grade chemical sellers was made available to trainees.

The second concern of trainees was on the use of SI unites in the training manual which is difficult for adaptation by the farmer processor, processors and SME's at the districts. In addressing this concern a conversion of the SI units in the training manual has been created. Measurements are now in spoon(s) and cup(s).

10.0 EVALUATION OF TRAINING WORKSHOP

Evaluation was done by the trainees in the area of processing of fruits into juices and drying of fruits and vegetables. In all five different fruit juices were successfully processed from pineapple, oranges, mandarin and watermelon.

The trainees were happy about the aesthetic of the dried pineapples, pawpaw, garden eggs, okro and green leafy vegetables they had dried. They were grateful for the knowledge acquired and were of the view that the drying technology if taken up in their districts will help reduce the unemployment levels and reduce post harvest losses drastically. Trainees wished that they had more training days so that they could learn about the processing of fruits into concentrates, marmalades and jams.

11.0 GENERAL DISCUSSION

Trainees expressed dissatisfaction about the duration of the training workshop as been too short. They were concerned as there were so much to learn during the training workshop but time was limited resulting in some cases where individual demonstration work was done in groups. They suggested five days training workshop in subsequent training workshops. Trainees agreed that processing of fruits and vegetables will create income generating activities in their districts, which will go a long way to improve the livelihoods of the people. Trainees accepted the task of identifying unique fruits and vegetables in the locality for processing, write proposals to source for funds from their districts assembles, transfer the technology acquired to farmer processors , processors and SME's and help establish processing centers in their districts.

The trainees agreed that the knowledge they had gained was adaptable in their districts if they have access to funds from their district assemblies. They also expressed the need for the sighting of processing plants in their districts.

APPENDIX

1.0 LIST OF TRAINEES

Name	Region	Address
1. Emma Hewton-Yankah	MOFA, Box 140, Winneba	0242-683858
2. William Tawiah Kuwsuro	MOFA, Box 32 Enchi (W/R)	0273222087 0541385058
3. Christiana E. Konu	MOFA, Koforidua	0243163054
4. Aze Emmanuel Confidence	MOFA, BOX 21, Bole, N/R	0242710806
5. Comfort Kessie	MOFA, Box 40, Volta Region -Denu	0207834802
6. Millicent Mawuli Feyi	MOFA, Box 124, Hohoe. V/R	O244036007
7. Martha Ashami Armah	MOFA, Box 140, Konongo	020-8168520 0244051951
8. Alice Dawson	WIAD, HQ	0246574291
9. Ama Pokua	MOFA, Box 65, Agona	0244258279
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