REPORT ON ROOTS AND TUBER TRAINING – CASSAVA VALUE ADDITION

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INTRODUCTION

With decades of experience in the research of various food commodities, Council for Scientific and Industrial Research (CSIR)- Food Research Institute (FRI) has successfully championed post-harvest management of roots and tuber in the forms of processing technologies and value addition. The Institute optimizes and standardizes production processes of all food commodities and transfers these technologies to different stakeholders along the food value chain including factories, SMEs, start-ups, farmers, processors, etc. Technologies developed are market- driven and transferred through capacity building exercises, workshops and training sessions.

In collaboration with the Skills Development Fund (SDF) and Premier Agribusiness Association, CSIR-FRI embarked on a capacity building exercise at Nyankumase, a village in Manya Krobo-Eastern Region. The main source of livelihood for the villagers is the production of *gari*, mainly sold in the near-by town of Asesewa at non-competitive prices due to low quality. This training was scheduled in two phases, focusing on improving hygienic handling of cassava and *gari* processing, optimizing *gari* making process, improving quality of *gari*, value addition of cassava (production of high quality cassava flour) etc. The capacity building exercise was initiated as an intervention to improve the economic status of the village by increasing market and business competitiveness of the Association. Contents of the training emanates from existing knowledge and technologies as well as adoptions and enhancements in processes to fit the community's needs and foster low cost of production.

For effective long-term retention of training contents (concepts, skills, procedures) by participants, the resource team adopted a spaced learning approach. This approach involves a successive review and practice of initial training exercises from the first phase of the project. There were therefore intensive recap sessions where trainees had to recollect concepts and procedures from previous training exercises and lectures given. This informed trainers on areas to emphasis on for each new training session, in order to bridge knowledge gab before advancing into further knowledge development.

Activities reported in this document are those of the second phase of the project, carried out in the month of August. Resource persons (facilitators) were Researchers from CSIR-FRI in the persons of Prof. Charles Tortoe, Mr. Stephen Nketia and Ms. Mariam Yakubu. A total of three hundred and seven (307) participants were trained; comprising of a hundred and five (105) males and two hundred and two (202) females.

Overall Objective

To transfer cassava processing and improvement of product quality technologies to participants.

Specific Objectives

1. To train beneficiaries on processing of High Quality Cassava Flour (HQCF).
2. To train beneficiaries on implementation of HACCP.
3. To educate beneficiaries on equipment maintenance and hygiene.
4. To educate beneficiaries on business registration and certification.

Expected learning outcomes

At the end of the training, it is expected that beneficiaries:

1. have rooted knowledge in conditions and handling of raw materials before processing.
2. have rooted knowledge in improving quality and quantity of *gari*.
3. acquire practical knowledge and skills in High Quality Cassava Flour (HQCF) production.
4. have knowledge and understanding in operating HACCP system.
5. have education on product registration and requirements of Food and Drugs Authority (FDA) and Ghana Standards Authority (GSA).
6. understand processing unit layout.
7. acquire knowledge in equipment maintenance (preventive and corrective maintenance) of equipment.

Training activities

Activities for dissemination of information and knowledge were carried out within a 4-day intensive training program. For effective participation by each member of the association, three groups were formed with each group having a leader and a facilitator (resource person). Dissemination involved theoretical and practical sessions by the three resource persons from CSIR-FRI. Recapping was accomplished through interactive sessions with beneficiaries and lecture sessions were executed by use of power point presentations. Lecture sessions were conducted in the community's church building while practical sessions were carried out outdoors, where each of the three groups could work maximally.

The first day commenced with a recap session followed by site visit to the processing unit being built by the community. Subsequent days were also preceded by recap sessions followed by lectures and practical sessions. At the end of each session, knowledge acquisition and retention was assessed by brief sessions of questions and answers. Sessions were facilitated by resource persons while activities were coordinated with the assistance of Mr. Samuel Angmor (President of Association). The final day had a session of challenges by beneficiaries concerning the success of the processing unit and lessons acquire in the course of the first and second phase of the project.

DAY ONE (3RD AUGUST, 2019) - INTRODUCTORY SESSION

Expected outcome

At the end of the day, it was expected that:

1. Participants recollect important points from previous training (phase one).
2. Facilitators ascertain the progress of the construction of the processing facility.
3. Participants recollect the quality procedures in producing improved *gari*.

Activities

Participants were welcomed to the training sessions by Prof. Charles Tortoe of CSIR-Food Research Institute. He re-introduced the resource persons as himself, Mr. Stephen Nketia and Ms. Mariam Yakubu. He outlined the program of activities of the visit and established the time for commencement and lunch time for each day's session.

Recapping session

In an interactive session, participants gave brief descriptions of knowledge and lessons learnt and acquired during the first phase of the project. Some topics covered included:

- Raw material (cassava) handling (such as sorting and cleaning).
- Processing steps for the production of quality and improved *gari*.
- Good manufacturing and hygienic practices (including cleaning of equipment and tools, sanitary processing environment, personal hygiene, etc).
- Importance of good manufacturing and good hygienic practices.
- Handling of dough during pressing stage of production process.
- Post-processing handling (packaging and marketing).
- Importance of good pre-processing and post-processing handling practices on final product.


Recap session on all activities involved in the production of quality *gari*

Pictorial recapping session

To end the day's session, participants were taken through pictures from previous sessions/visit. This was done to make them have a better representation and perception of self-engaging in quality practices in order to produce quality *gari*.

Visit to processing unit site

During phase one of the project, the Association expressed interest in owning and running a processing facility in their community. They were therefore encouraged to put up a simple processing unit structure through communal labour and assured of technical assistance from CSIR-FRI. Facilitators together with members visited the site with the purpose to ascertain the progress of work, discuss challenges impeding progress of construction and possible solutions. Groups were assigned different tasks in order to expedite construction.


A visit to processing unit site

Allocation of portions for communal labour

Participants leaving construction site

DAY TWO (4TH AUGUST, 2019) – PROCESSING OF HIGH QUALITY CASSAVA FLOUR

Expected outcome

At the end of the day, it was expected that:

1. Participants would be taken through the results of analysis on improved quality *gari* from phase one.
2. Participants know the step-by-step process of producing High Quality Cassava Flour (HQCF).
3. Participants process cassava for drying.

The second day commenced with a recap of activities of day one, followed by interpreting chemical analyses results, detailed value addition session and a hands-on practical session.

Activities

Results from processed gari

After *gari* processing practical sessions during the first phase of the project, samples of *gari* from each group were taken to CSIR-FRI for chemical analyses. Quality of the product was explained in terms of moisture, insoluble ash, cyanide content, iron content, starch content and acidity. Participants were made to understand the importance of limits of values for each parameter accepted by regulatory bodies (GSA and FDA) in order to determine quality of products.

Moisture: Moisture content was explained as the available tiny particles of water the *gari* retained after processing. It was elaborated that, the roasting step in the processing was very crucial to the level of moisture in *gari*. High moisture fosters spoilage and affects texture, tastes, smell and overall acceptability of the product on the market. Participants were made to understand the extent to which storage conditions directly affect the level of moisture in the product; because *gari* has the ability to absorb moisture from the atmosphere. Participants were informed that, the moisture content of samples of all groups were within acceptable limits though that of group one needed more roasting time.

Insoluble ash: This was described as the solid matter of product (dirt and sand) upon analyses. Insoluble ash content in samples were within acceptable limits, though group three had a slightly higher level, indicating presence of dirt or sand. Participants were taken through various ways sand and dirt could get into products; from pre-processing through processing, to final product. They were also educated on actions to take to prevent sand and dirt contaminations including, not processing when windy; cleaning of roasters before roasting and proper handling of roasters when not in use; that is, properly covering roasters instead of using them as storage of household items.

Cyanide and Iron contents: Cyanide was explained as a toxic compound found in the soil, with the ability of being absorbed by tubers of cassava. Iron was described as a mineral found in ground water such as boreholes, with a metallic rusty taste when in high levels. The cyanide and iron levels in the *gari* samples were found to be slightly high, though all values fell within acceptable limits.

Starch content: Starch content was explained as that which causes *gari* to rise when water is added, or causes the *gari* to stick together with added water. The starch content in all samples was relatively high; it was therefore recommended to the association to consider commercial production of starch as a by-product of the *gari* production process.

Acid content: Participants learnt that, acidity was that which gave *gari* a fermented taste or a sour/biting taste. The more fermented the dough the higher the acidity. Samples had very good acid levels and this enhanced the taste of the final product.

Participants were fascinated and expressed excitement over the quality of the improved gari; and were confident they would increase their profits on the market.

Interpretation of laboratory analyses to participants

Value addition (production of High Quality Cassava Flour- HQCF)

Participants were educated on the importance of adding value to cassava. This comprised of education on the role of value addition in addressing high post-harvest losses of cassava; producing HQCF; using cassava flour in composite with other flours for baking and developing alternative food products from HQCF. This session was intended to provide the Association with other ways to increase market profit.

A detailed lecture was given on the step-by-step production of HQCF. The time between harvesting of cassava and processing was emphasized as the primary difference between regular cassava flour and HQCF. HQCF is processed within 24 hours after harvesting; unlike regular cassava flour which is processed days after harvesting. With HQCF, fermentation of the dough is omitted from production process. Participants were taken through two other products that could be produced from HQCF. They were taken through a detailed flow chart of HQCF production. It was explained that, addition of plantain flour and starch to HQCF would produce *fufu* flour and the addition of a proportion of wheat flour to HQCF would result in composite flour which can be used in baking.

Participants were also taken through the different baked and fried foods made from HQCF, including spring rolls, chips, biscuits, meat pies, doughnuts and bread. A lecture was given on the step-by-step processes involved in the production of doughnuts and chips. At the end of this session, the Association was encouraged to produce, package and sell these products on the market as value added products of cassava.

Education on production of HQCF

Practical Session

Members gathered into three groups; new participants were distributed among groups. The practical session begun with cleaning tools and work environment. Freshly uprooted cassava from the farm was shared among groups. Each group cleaned, peeled, cut and washed their tubers. The cassava chunks were grated in a clean grater, milled in a clean mill, bagged in clean sacks and pressed.

Fresh cassava from the farm


Group peeling and cutting cassava


Thorough washing of cassava


Grating of cassava


Grated cassava

Bagging and pressing

DAY THREE (5TH AUGUST, 2019) – QUALITY AND SAFETY OF CASSAVA PROCESSING

Expected outcome

At the end of the day, it was expected that:

1. Participants understand the importance of quality tools.
2. Participants acquire practical skills in High Quality Cassava Flour (HQCF) production using basic methods.
3. Participants acquire the knowledge of processing chips and doughnuts
4. A HACCP team would be formed.
5. Participants would know the role of the HACCP team.

Activities

Practical Session

The day commenced with a practical session on drying of sifted cassava to produce HQCF. Participants were taught how to use cost efficient and hygienic materials as well as ways to achieve safe and quality products in the absence of modern machines and equipment. Therefore, for the drying step of the production of HQCF, a platform made of blocks, planks of wood and a large sheet of plastic was set up. Each group sifted their sack of dough and dried them on the platform. After drying, the sifted dough was milled into HQCF.

There was a recap session on knowledge and skills acquired from the previous day.

For practical recapping and recollection of quality processing of *gari*, groups processed improved *gari* after drying session.


Sifting of dough prior to drying


Drying on raised platform

Facilitator explaining characteristics of HQCF to group members


HQCF after drying

Processing of improved *gari* during recap session

Quality practice adopted

Improved *gari*

Quality and safety tools for cassava processing

A detailed session was given on the establishment of Standard Operating Procedures (SOPs), Good Manufacturing Practices, Good Hygienic Practices and HACCP. Participants were assured of having sections of these tools printed and pasted on the walls of the processing plant when the plant is in operation. This would serve as a constant reminder to processors of safety and quality rules to be followed. Participants were also educated on the importance of a HACCP team for the processing of quality products. The team would among others interpret the cassava processing manual (containing safety and quality tools) developed for the Association to members. A HACCP team of three persons was set-up; team members are: Mr. Samuel Angmor, Mr. Jonathan Tetteh Tettey-ku and Ms. Janet Ofei. Lectures highlighted the importance and benefits a proper processing unit design layout had on the production of quality products. It also included emphases on documenting and validating production processes at each time of production, monitoring of facility and equipment, protecting plant against contamination (physical, chemical and biological), proper control of production processes, monitoring of hygienic practices by HACCP team, etc. Participants were educated on the different types of hazards (biological, chemical and physical) and how they could be reduced in the different stages of production. Examples of each type of hazard were explained and participants were taught how to identify and prevent them.

The day concluded with a meeting between members of the HACCP team and the facilitators. This meeting involved further explanation of their roles as keepers and enforcers of the quality and safety system to be implemented. Their duties include application of the manual, ensuring the adherence to the Good Manufacturing Practices, Good Hygienic Practices and the HACCP system. In order to have a good relationship with buyers, the team was strongly encouraged not to compromise on quality.

Meeting with HACCP Team

DAY FOUR (6TH AUGUST, 2019) – PRODUCT REGISTRATION & EQUIPMENT MAINTENANCE

Expected outcome

At the end of the day, it was expected that,

1. Participants would acquire knowledge on business and product registration and certification.
2. Participants have education on product registration and certification requirements.
3. Participants acquire knowledge on equipment maintenance.

Activities

Practical session

The fourth day commenced with further drying of cassava flour, to emphasize the need to thoroughly dry flour before packaging in order to increase its shelf life.

Thorough drying of flour

Business registration and certification

The lecture begun with important components of a food processing factory/unit, these were given as, infrastructure, equipment and labour. These components were emphasized to be crucial in registering a processing plant/unit. Participants were educated on the importance and uniqueness of branding a product, such as a product logo. They were also educated on the regulatory bodies in Ghanaian food Industry: Food and Drugs Authority (FDA), Ghana Standards Authority (GSA), NBSSI of the Ministry of Trade and Health offices of the Environmental Protection Agency (EPA). The direct correlation between a quality product and product registration/certification was explained to participants. The session also included a step-by-step approach to requirements and procedures of product registration and certification by FDA and GSA. This included operating in a processing facility that meets food safety and quality requirements, registration of processing facility and lastly, registration of products. It was emphasized that, prior to attaining a registration number from FDA and/or GSA, the products from the center would have to be tested and results would have to meet national requirements.

Lecture and interaction session of business registration and certification

Equipment maintenance

This lecture focused on the preventive and corrective maintenance of equipment. Participants were educated on how to maintain their equipment (grater, press, mills and roasters) through proper handling, checks and cleaning procedures before and after processing, with the intention of preventing break down and poor hygiene of equipment. They were taught to wash equipment with clean water before and after use.


Facilitator explaining equipment maintenance to participants

Interactive session

This session covered the summary of training activities by participants. They recounted knowledge acquired, lessons learnt and processes followed. The session also involved a question and answer session, where participants' questions were answered by facilitators.



Participants giving summary of training workshop

CONCLUSION

Overall, the training was a success. Facilitators were overwhelmed at the enthusiasm, willingness and eagerness of participants to learn. Participants expressed their appreciation to the sponsors of the project and facilitators for the opportunity to improve their production and increase their profits. They also expressed their anticipation towards the completion of the processing facility and fully practicing the quality tools in a controlled environment. They however recommended that facilitators assist in attaining new equipment for the community and develop a new design of roasters in order to reduce the challenge of smoke inhalation.

LESSONS AND CHALLENGES

At the end of the training workshop, some lessons were learnt and challenges observed. These were documented as listed below in order to better comprehend specific social factors that impart the economic development of the community. It also gave insight into other interventions required by the community in order to fully operate a cassava processing plant effectively.

Lessons learnt were as follows:

1. A processing unit/facility is paramount to the market success of the community.
2. The community needs a better water storage system.
3. The community greatly appreciates interventions and practice what they are taught.
4. Proper guidance would inevitable aid the community's food security issues.

Challenges observed were as follows:

1. The community is need of a drying platform, as there exist none.
2. Not having electricity is a major challenge to the progress of the community.
3. The current design of roasters is posing a health hazard.
4. The equipment currently used by the community are outmoded.

APPENDIX

Communal labour towards building of processing unit