FINAL PROJECT REPORT:

ENHANCING CLIMATE RESILIENCE AND NUTRITION UPTAKE THROUGH THE FORTIFICATION OF CORN FLOUR WITH LOCALLY PRODUCED HIGH NUTRITION VALUE CROPS

SUBMITTED TO:

IGAD

SUBMITTED BY:

National Environment Trust Fund (NETFUND)

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Date: 28TH JULY 2016

BASIC PROJECT DATA SHEET

NAME OF GRANTEE: **National Environment Trust Fund (NETFUND)**

Project Title: Enhancing Climate Resilience and Nutrition Uptake through the Fortification of Corn Flour with Locally Produced High Nutrition Value Crops

Grant Number:

IGAD CSO Facility Code:

Partners and budget contributions (if applicable):

Partners: 1. The Government of Kenya (GOK)

Total cost 100% Total budget (for entire project): **USD 199,650.00** Cumulative expenditure **USD 199,650.00**

Country (ies): KENYA	Intervention area: KITUI COUNTY	Priority area of work and main activity focus: RESILIENCE TO CLIMATE CHANGE

	Start date	End date	Duration
Project period:	October 2014	June 2016	21Months

Intended Beneficiaries / Target Groups:	**Male**	**Female**	**Total**
No. of Mango Farmers	120	480	600

Project Purpose: The purpose of this project is to improve value addition of the mango fruit through mango powder technology.

Project Overall Goal: To improve the livelihoods of dry land communities in Kitui County through increased income earned from mango fruits.

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ACRONYMS AND ABBREVIATIONS

ARDGF	Applied Research in Dry lands Grant Facility
GAF	Green Africa Foundation
GAIN	Global Alliance for Improved Nutrition
GoK	Government of Kenya
GPS	Global Positioning System
IGAD	Inter-Governmental Authority on Development
KDC	Kitui Development Corporation
KEBS	Kenya Bureau of Standards
KEP	Kitui Enterprise Promotion
KIRDI	Kenya Industrial Research and Development Institute
KMTC	Kenya Medical and Training College
M & E	Monitoring and Evaluation
NETFUND	National Environment Trust Fund
NTV	Nation Television
O & M	Operations and Maintenance
RISE	Regional Institute for Social Enterprise
USAID	United States Agency for International Development

ACKNOWLEDGEMENT

NETFUND hereby wishes to acknowledge the generous financial support received from the Inter-Governmental Agency on Development (IGAD) without which this project could not have been possible.

Other partners who contributed significantly in in-Kind towards the *'Enhancing climate resilience and nutrition uptake through the fortification of corn flour with locally produced high nutrition value crops'* project in Kitui County include the Green Africa Foundation, County Government of Kitui and various Media companies.

Your dedication continues to make a lasting impact to thousands of Kenyans in terms of poverty alleviation, environmental conservation and in the overall health and well-being of Kenyans.

We are very thankful and indebted to you for your kind and significant support that has transformed hundreds of lives.

We look forward to sustaining a long-term and cordial relationship with you, our valued partner.

EXECUTIVE SUMMARY

In 2014 NETFUND, with funding support from the Intergovernmental Authority on Development (IGAD), commenced implementation of the project *'Enhancing climate resilience and nutrition uptake through the fortification of corn flour with locally produced high nutrition value crops'* in Kitui County of Kenya NETFUND received funding totaling USD 199,480 to undertake the project under IGAD's Applied Research in Dry lands Grant Facility (ARDGF).

The purpose of the project was to improve value addition of the mango fruit through mango powder technology with the specific outputs being:

1. Mango powder technology introduced and disseminated
2. Capacity building of women groups on mango powder processing and marketing
3. Awareness on mango powder products and nutritional value created
4. Improved value chain management for mango fruits

NETFUND has successfully implemented the project and outputs listed above have been delivered through the setting up of pilot plants in three sub counties of Kitui at three institutions namely: RISE Kenya, Murky Ordap and Kitui Development Corporation.

Activities carried out included: identification of suitable and representative plant sites and the mobilization of mango farmer groups. The project also undertook a socio- economic baseline survey to establish baseline indicators about key variables in the mango value chain which would form the basis of the project intervention.

Due to the stringent specifications provided on procurement and installation of equipment however, there was a challenge in identifying the right suppliers which caused a delay to the project for a period of time. NETFUND was to procure the Refractance® technology developed by Dr. Caleb Nindo but acquisition of the technology proved to be expensive. This challenge however provided NETFUND an opportunity to fabricate an equipment and patent the technology locally therefore availing it elsewhere within the County where it can be accessed at an affordable cost. As a result NETFUND developed a locally fabricated *Hybrid biomass and electrical dryer for crisping*© and patented it. Hammer mills, disk mills, solar driers, mixers and other major equipment were fabricated locally through specifications provided by the NETFUND Technical department.

Various trainings were held to train the farmers on installation and operations of the equipment. A total of 600 Farmers were trained on best practices of mango production in 3 sub-counties of Kitui and were provided with grafted seedlings.

The three production plants established by NETFUND are now fully operational and have produced mango flour samples currently under testing for eventual submission to the Kenya Bureau of Standards (KEBS) where they should receive certification and a formal release to the market.

The project has attracted increased media coverage and donor interest from the Global Alliance for Improved Nutrition (GAIN). A funding proposal of KES. 18Million is under consideration having succeeded through the initial two stages. The Embassy of Slovakia has also committed KES 1Million toward the project.

INTRODUCTION

Kitui County is the sixth largest County in Kenya with eight sub-counties and 40 wards. It lies between the altitude of 400m and 1,800m above the sea level with an area of approximately 30,496.5 square kilometer. According to the 2009 census, Kitui County was ranked at position 11 with an estimate population density of 2 persons per square kilometer and a population of 1,012,709 with 52% of these being women. Majority of the population is aged 50 years and below.

A large part of the county is arid and semi-arid with a small portion being arable. The county receives an average of 28 inches of rainfall with rainfall patterns being bi-modal in conformity to the general rainfall patterns in Kenya; long rains in the latter part of the first quarter of the year and the short rains in the third quarter. The long rains however, are very erratic and unreliable while the short rains are more reliable.

The poverty level in the county is extremely high averaging above 70%. The major income generating activity is agriculture and communities' livelihoods are subjected to the vagaries of climatic conditions with the major threat being droughts that have gradually increased in frequency and severity.

Agriculture is therefore an extremely challenging endeavor in county. Despite this, agriculture remains the predominant economic activity mainly through subsistence and horticultural farming. The major food crops and fruits grown include maize, pigeon peas, sorghum, millet, cassava, mangoes, paw paws, passion fruit and citrus fruits etc.

Climatic conditions in Kitui favor the growing of the mango fruit. Indeed the county is one of the major mango producing regions in the country. However due to bottlenecks in the value chain, the locals do not fully exploit this opportunity to better their livelihoods.

NETFUND in collaboration with Green Africa Foundation, with funding from IGAD and the Government of Kenya, sought to streamline the value chain processes through value addition of the mango fruit.

This project was implemented to put in place mechanisms for conversion of the mango fruit into powder form in order to lend the product to longer storage and for use as an additive to fortify other types of flour like corn flour. Mango powder would also be convertible to mango juice.

The project achieved its purpose and has given the mango farmers in Kitui County greater latitude in marketing their produce by eliminating dependence on the mango fruit's natural lifecycle. It has also presented an opportunity for building resilience to the impacts of climate change and alleviating poverty among the local population.

The specific objectives of the project were to:

1. Introduce and disseminate the mango powder technology to Kitui County;
2. Build the capacity of women mango farmer groups on the mango powder processing and marketing;
3. Create awareness of the mango powder, mango powder products and their respective nutritional value and;
4. Improve the value chain management of the mango fruit.

1. PLANNED ACTIVITIES

The planned activities for implementation during the project period were;

i. Mobilization of mango farmer groups and identification of pilot plant sites
ii. Socio-economic baseline survey
iii. Installation of Pilot Plants and Training on the Drying Technology
    - Project inception workshop
    - Installation of pilot plants and training on the drying technology
iv. Private sector engagement
    - Production of samples and first batch of fortified flour
    - Packaging and branding
    - Product promotion
v. Training of 600 farmers on best practices of mango production in 3 sub-counties of Kitui and provision of grafted seedlings to farmers
vi. Monitoring and Evaluation

1.1 MOBILIZATION OF MANGO FARMER GROUPS AND IDENTIFICATION OF PILOT SITES PLANT

Prior to the commencement of the various planned activities, the project team officially introduced the project to the County Government of Kitui, through the County Ministry of Trade and Industrialization. The project therefore managed to obtain a buy in from the local government as expressed through the official letter of support issued to NETFUND by the County Director of Trade and Industrialization (See annex 1 on page 30).

Consequently the team with guidance from the local county government began the process of identifying three pilot sites for the mango processing plants through a participatory field and technical assessment exercise. The team developed a site selection tool composed of minimum desired criteria which guided the site identification process.

Photo 1: Introduction of Project to the County Government of Kitui

The factors considered were:

i. Existing project anchors i.e. ongoing community initiatives on mango value addition; the project leveraged on established and ongoing initiatives by the community in the mango value chain.
ii. Population of the mango fruit; this ensures there is a sustainable supply of mangoes.
iii. Mango varieties; this ensures that the different pilot plants have unique product.
iv. Availability of women mango farmer groups; these are to form the targeted project population and are the envisaged direct beneficiaries of the project. It is against these that the project impacts will be measured.
v. Access to the national electricity grid; this ensured that there would be a stable and a constant power supply to run the heavily power rated processing equipment.
vi. Access to a reliable water source; this ensured that there is constant water supply that will be required in the different stages of processing.

1.2 SOCIO- ECONOMIC BASELINE SURVEY

The baseline study was jointly conducted by NETFUND, Green Africa Foundation and the County Government of Kitui in the month of November 2014.

The overall objective of this study was to establish baseline indicators about key variables in the mango value chain upon which the project sought to impact in the project intervention areas (sub-counties). The baseline information collected would also be used in the measurement of the impact of the mango powder technology on the mango farmer's livelihood.

The expected impact areas for the project were: increased household income; mango production, storage, processing and preservation technologies; mango fruit and mango products marketing and enhanced capacity of mango farmer groups and associations.

The specific objectives of the baseline study were:

i. To provide information on the initial situation of the key project impact variables (listed above) in the project pilot areas/sub-counties for measuring project effectiveness and final project impact;
ii. To help monitor the key project variables as the implementation of the project progresses overtime;
iii. To create a dataset upon which future evaluations and assessments of the changes regarding the key variables in the project intervention areas may be measured and;
iv. To generate information for use in redesigning the project activities and implementation plans.

1.2.1 METHODOLOGY FOR IMPLEMENTATION OF THE BASELINE SURVEY

SAMPLING TECHNIQUE

Two data collection methods were used namely, questionnaires at household level and focus group discussions with key informants.

The study used purposive and systematic sampling approaches for the selection of the project implementation sub-counties and farmers' households respectively.

1.2.2 SELECTION OF SURVEY SUB-COUNTIES AND KEY INFORMANTS

The household data collection exercise took place in 3 sub-counties of Kitui:

i. Sub-county 1 comprised of Kitui Central, Kitui Rural and Kitui East
ii. Sub-county 2 comprised of Mwingi North
iii. Sub-county 3 comprised of Mwingi West

The 3 sub-counties were chosen using the purposive sample approach due to a number of reasons including:

i. Mango tree concentration
ii. The variety of mangoes found in sub-county 1 is majorly the traditional mangoes growing along river beds; sub-county 2 is comprised of a mix of traditional and grafted mangoes while the sub-county 3 is comprised of mainly grafted mangoes.
iii. The existence of mango farmer groups comprising of approximately 90% women
iv. Existence of mango processing plants (juice and jam making)
v. The existence of infrastructure e.g. roads, water and electricity

The purposive sampling was also used in the selection of the Key Informants. The Key Informants Group Discussion comprised of representation from:

i. The different ministries of the county government including the ministry of cooperatives, trade, culture, environment, agriculture
ii. Mango farmer groups
iii. Business community
iv. Women groups

SELECTION OF FARMERS/ HOUSEHOLDS

Selection of the farmers/ households for the data collection was done using systematic sampling method. The list of all farmers registered under a group in the selected sub-counties was compiled based on the records provided by the county ministry of culture and by three major community women groups from each of the three sub-counties. These women groups included the Kitui Development Centre, the Murky Ordap Women Group, and the Rise Kenya Community Group from sub-counties 1, 2 and 3 respectively.

The compiled list constituted the sampling frame of a population of 4,500 out of which a sample statistic of 200 households were selected to participate in the household survey.

TRAINING OF ENUMERATORS

A total of 18 enumerators underwent a one day baseline survey training which was carried out on the 19th of November 2014.

The modules covered during the training were:

i. Overview of the project
ii. Mobile based survey and Global Positioning System (GPS) data collection
iii. Practical set-up and testing of the mobile questionnaire
iv. Roles of enumerators and supervisors and terms of remuneration
v. Daily survey worksheets

The training was carried out to familiarize the enumerators with the mobile data collection tool user interface and data entry system. The enumerators were also trained on how to operate and troubleshoot the *isurvey* mobile data collection tool and how to capture GPS position coordinates of the respective households using the application preloaded on their mobile phones.

1.2.3 DATA COLLECTION METHOD

Primary data was collected through household interviews with the mango farmers and through Key Informants Group Discussions.

HOUSEHOLD DATA COLLECTION USING ISURVEY

Household interviews were held with the head of the household or other appropriate member of the household who is directly responsible for the mango farming. The questionnaires were pre-tested during a reconnaissance survey and were administered by the supervisors.

The data collection exercise involved the use of android mobile devices by all the enumerators with preloaded semi-structured questionnaires designed on the survey web. The data collection software used for the data collection was the *isurvey* mobile application that enabled the collection and entry of both qualitative and quantitative information from the respondents. The questionnaires were authenticated using a set survey password.

The *isurvey* application came with an inbuilt GPS receiver that was used by the enumerators to capture the position coordinates of the respondents' household. The capturing of the household

GPS coordinates was done to ensure ease of monitoring of the project impacts on the same households.

At the end of an interview the enumerator would upload the survey questionnaire to the survey web hosted on an online server from where the project administrator could export the data in SPSS or Excel Formats for data cleaning, coding and analysis. The mobile application further ensured that the data is backed up by maintaining portable data formats of all the collected data, which could then be printed out or saved in soft copy.

KEY INFORMANTS GROUP DISCUSSION

A one day key informants' group discussion was carried out with the key stakeholders in the mango value chain. These included; representatives from mango farmer groups, technical officers from the county government ministries of agriculture, cooperatives, culture, trade and environment and businessmen from the county.

The key informants group discussion was conducted using a structured questionnaire (See annex 3 on page 49) and captured details on; mango production, processing, value addition and marketing.

The group discussion was facilitated by three project officers while three enumerators documented the responses from the group.

Photo 2: Key Informants Group Discussion

1.2.4 TYPE OF DATA COLLECTED

The baseline survey captured the initial situation of the key impact variables in the project pilot areas/sub-counties for measuring project effectiveness and final project impact. The baseline information collected was as below (See annex 5 on page 53 for the detailed household questionnaire):

i. Household Demographics and Income Levels:
ii. Mango Fruit Production
iii. Techniques for Storage and Preservation of the Mango Fruit
iv. Marketing of Mangoes
v. Mango Farmer Groups
vi. Mango Processing Technologies
vii. Capacity of the Respondent

1.3 INSTALLATION OF PILOT PLANTS AND TRAINING ON THE DRYING TECHNOLOGY

1.3.1 PROJECT INCEPTION WORKSHOP

Prior to the installation of the 3 pilot plants, a project inception workshop was carried out with the 3 identified project partners, namely; The Green Africa Foundation, The Kitui Development Centre, Rise Kenya and the Muky Ordap Women Group.

The objectives for the workshop were; to provide an overview of the project goals, specific objectives, outputs and expected outcomes, to validate the Project Agreement Document, to provide an overview of the Project Monitoring and Implementation framework and to review the criteria for selecting the plants' operations and maintenance teams.

Photo 3: Participants during the project inception workshop

The key outputs from the workshop (See annex 10 on page 81 for the inception workshop report) included;

i. Agreed key project deliverables by the project partners
ii. Selection criteria for operations and maintenance team
iii. A check-list of the machine pre-installation requirements
iv. Project implementation strategy and agreed activity schedule
v. Partner roles and responsibilities in the implementation of the project.
vi. Validated working agreement document between NETFUND and its partners

1.3.2 INSTALLATION OF PILOT PLANTS AND TRAINING ON THE DRYING TECHNOLOGY

The process of setting-up the pilot plants commenced with the identification and procurement of line processing equipment for each of the pilot plants. All the machines apart from the mango grinding mill were fabricated locally and in line with the required specifications (See annex 24 on page 143 for the list of the pilot plant equipment and their specifications). These specifications were meant to ensure that the fabricated machines met the minimum standards required for food processing equipment by Kenya Bureau of Standards.

After installation of the processing equipment, NETFUND carried out training on equipment handling and production. The training targeted the operations and maintenance team made up of select persons. This team was selected as per an established criteria as documented in the inception report. The pool also involved representatives picked from the women mango farmer groups. The trained Operations and Maintenance (O&M) team was later put in charge of the daily production, operation and maintenance of the pilot plants.

The infrastructural facilities hosting the pilot plants are a contribution of the women mango farmer groups. These groups leveraged on other partners, donors and the community to raise funds for the purchase of the land and construction of the buildings.

Each of the processing plants is composed of a receiving, sorting and cleaning bay; processing, packaging and storage stations. Other resources provided by the women groups include; water and electricity necessary for production.

In order to secure the pilot plants, NETFUND and the project partners have insured all the installed equipment and machinery for the 3 pilot plants. All the pilot plants are also manned by security guards drawn from registered professional security firms as is evidenced in the contractual agreements (See annex 13 on page 92). The total contribution to the project by the 3 partner women groups is approximately **USD 106,437.71** (See annex 22 on page 135 for the breakdown of partner's financial contribution).

The deliverables realized from the installation and training include:

i. 3 pilot plants fully installed and operational
ii. 15 persons trained on plants' operations and maintenance
iii. Operations and maintenance manuals ;
iv. Signed agreements and;
v. Training manuals

Photo 4: HE Dr. Julius Malombe Kitui Governor touring the KDC plant

All the 3 pilot plants are fully operational and have each employed two trained and qualified food technologists to supervise the production process. One was officially launched by the Governor of the Kitui County in a colorful ceremony that was attended by different stakeholders and investors (See annex 11 on page 85 for the Launch report). The event was also aired on one of the national television stations. Please refer to this link: (https://www.youtube.com/watch?v=1GZwp2XxWMM).

Following the successful launch and commissioning of the pilot plant, the Kitui Development Centre (KDC), proceeded to register a limited liability company known as the Kitui Enterprise Promotion (KEP) Ltd. that is to facilitate all the commercial activities of KDC. The company is owned by the community (mango farmers) and KDC on a shareholding basis of 75% and 25% respectively. (See annex 12 on page 91 for the Certificate of Incorporation).

1.4 PRIVATE SECTOR ENGAGEMENT

1.4.1 PRODUCTION OF SAMPLES AND FIRST BATCH OF FORTIFIED FLOUR

NETFUND oversaw the production of first samples of powder and the first batch of fortified flour. The production process followed a standard operating procedure and formula developed in collaboration with food technologists from the Kenya Industrial Research and Development Institute (KIRDI). A total of 0.75 tons of mango was processed by the 3 community groups. These translated to 75kgs of mango powder which was used as the basic ingredient for the production of fortified flours. Different types of fortified flours were produced i.e. fortified maize, sorghum, millet and cassava flours.

The purpose of producing the first powder samples and fortified flour was to subject them to analytical tests with the aim of establishing their physical and chemical properties as well as presence of biological life that could affect storage and consumption of the products. These analytical tests were carried out at the ISO certified Food Technology Laboratories of KIRDI. The results obtained from the tests indicated that powder samples and fortified flour products were fit for human consumption with; no presence of bacterial or other biological life, high

energy values, and low moisture content with the allowed limits of micro and macro elements (See annex 14 on page 97 for the Product Test Certificate).

1.4.2 PACKAGING AND BRANDING

The mango powder is hygroscopic in nature and thus easily absorbs moisture from the environment leading to the caking of the powder. In order to mitigate against this, NETFUND in consultation with food technologists from KIRDI developed pre-branded plastic packaging bags for the mango powder. These were thus designed with lockable ziplocks to enable long time domestic consumption without exposing the powder to the atmosphere or to other biological life forms that could lead the eventual contamination and poisoning of the powder.

Each of the community groups has a unique and distinct brand of the packaging bags.

Photo 6: Packaged Mango Powders from the 3 pilot plants

1.4.3 PRODUCT PROMOTION AND MARKET LINKAGES

Mango powder is a new and unique product to the mango value chain in the country. There was therefore need to create awareness of the product and the nutritional value thereof to the general public general public and to key mango value chain stakeholders. A comprehensive product promotion plan was developed highlighting the key strategies and avenues that would be employed to create awareness about the products with over 1,500 brochures and 1,200 fliers developed. These highlighted the background and the potential socio-economic impacts of the project as well as the health benefits of the products and formed part of the materials that were used for the products' promotion.

The key approaches used in the product promotion and market linkages included;

CONFERENCES, EXHIBITIONS AND AGRICULTURAL SHOWS

Several conferences, exhibitions and agricultural shows were leveraged upon to create awareness about the products and the project. Most notable was the USAID and NETFUND organized investor conference and expo held in Nairobi. These events were held with the aim of linking climate smart technologies and innovations to funding opportunities while creating awareness on green growth to the general public. All project beneficiaries participated in the expo while KEPs production manager and coordinator underwent a five day comprehensive pitch and presentation workshop with an aim of building their presentation capacities

The training was also meant to enable them to develop and carry out investor grade pitches.

Below is the highlight of the training:

Day 1: The beneficiaries were taken through Pitching, Introduction to BMC, Value proposition and understanding their consumers.

Day 2: The beneficiaries were taken through the distribution channels, marketing strategy and re-designing a process map showing the journey from raw material, production to consumer.

Day 3: Was dedicated to a field visit. The beneficiaries visited Eldoville factory in Karen Nairobi. This was an exciting experience where they witnessed actual processing and systems of running a factory.

Day 4: The beneficiaries reviewed their pitching canvas again and prepared presentations for the pitching exercise.

Day 5: The beneficiaries made their pitch to the NETFUND Management, coherently and confidently.

Some of the key outcomes from the workshop included:

i. A customized training for the beneficiaries based on the gaps identified in the assessment study previously carried out.
ii. Reviewed and developed the business model for the KEPs pilot plant with an aim of making them bankable.
iii. The beneficiaries were able to clearly define their consumer's persona and the respective value proposition, including the appropriate distribution channels.
iv. The beneficiaries were able to share their journey in bringing their business to the current status showed consistency which was key in boosting investor confidence. (Pitching Video Link: *https://drive.google.com/a/eyeris-pictures.co.ke/file/d/0B77HnQc-cZV6OUpLbUR0bFR2VFk/view*)
v. The beneficiaries were exposed to a world class manufacturing factory to help them visualize their futures, running their facility.
vi. The beneficiaries were able to calculate their cost per unit and possible selling price, including committing to book keeping for their own businesses.

In general, by the end of the NETFUND conference and expo, the beneficiaries were able to clearly articulate their value proposition, product description, customer persona, cost of production, distribution and marketing strategy.

Other notable platforms used for the promotion and marketing of the products included the; Nairobi Agricultural Shows (2 shows attended), Kitui Agricultural Shows (2 shows attended), Farmer to Farmer Shows in Kitui (3 shows attended), Road shows (participated in 1 show) and the Farm Africa Expo (participated in 1 expo).

MANGO VALUE CHAIN STAKEHOLDERS FORUM

NETFUND in collaboration its partner, the Green Africa Foundation, held a one day forum composed of key stakeholders in the mango value chain, mostly drawn from Kitui and the surrounding mango producing counties. The main objective of this forum was to introduce the mango product and fortified products and their nutritional value to key stakeholders in the mango value chain. The stakeholders were strategically selected to represent all the key players in the value chain from production, processing and marketing. Other key players were from the research and financial institutions (See annex 25 on page 146 for the list of participants).

Key strategies for marketing the products and different investment and loan facilities for scaling up the project were discussed. Micro-finance institutions in attendance gave a comprehensive insight into their available loan facilities for the project. The loans ranged from asset financing to loans for up scaling production, packaging and branding and for marketing the products.

Research and training institutions were represented by the department of health and nutrition of the Kenya Medical and Training College (KMTC) who highlighted the key medical and nutritional benefits of the mango powder and the fortified flours. The County Government represented by the Ministry of Tourism, Trade and Industrialization pledged its continuous support and cooperation for the project as a means of ensuring that the project remains sustainable and meets its expected impacts overtime. The government pledged to allocate funds in their 2016/2017 financial year that would go into bridging some key project gaps as well as optimizing the production process.

MASS MEDIA CAMPAIGNS

Mass media campaigns were carried out on various print and digital media platforms with an aim of sensitizing the public about the products and the project as a whole. Prior to the media engagement, the project team held a half day debriefing meeting with various invited media personalities in the Green Africa Foundation Centre in Kitui with an aim of sensitizing the media sensitization on the project goals and expected impacts.

A media release for the project was developed and distributed to various media stations (See annex 26 on page 148). Two articles on the project were developed and published on several print media i.e. The People Daily newspaper, the Sunday Express newspaper and Joto Africa magazine.

The KEPs pilot project plant was aired on national television stations, notably on the Smart Farm Program of Citizen TV, K24 TV and on the Nation TV (NTV) of particular interest was the Smart Farm program that gave a comprehensive highlight of the project, detailing the production process from the harvest of the mangoes to packaging and marketing of the products.

Four radio talks were also conducted and aired on local radio stations i.e. County FM, Athiani FM, Mbaito FM and Syokimau FM radio stations respectively.

1.5 TRAINING OF 600 FARMERS ON BEST PRACTICES OF MANGO FARMING

NETFUND through the Green Africa Foundation (GAF) sought to improve value chain management by designing and training mango farmers on best practices of mango production. The training was divided into two phases.

The first phase involved development of a Training Mango Booklet (annexed) and a Mango Farm Spray Programme. This process involved a farmer training needs assessment to identify gaps in mango farming with a total of 51 mango farmers interviewed. Different stakeholders in the mango value chain were involved in the development and validation of these documents.

The second phase involved practical and demonstrative trainings at each of the sub-counties with an average of 600 mango farmers trained and provided planting materials. The training was carried hand in hand with the establishment of 3 mango tree nurseries at each of the sub-counties and carried out in conjunction with agricultural extension officers from the Ministry of Agriculture of the Kitui County.

Photo 5: Various Trainings Held for the Mango Processing

The training sessions involved practical lessons on raising mango tree seedlings and grafting of the same at maturity. A total of 6,000 seedlings were propagated, successfully grafted and transplanted to nurseries. The transplant was planned to coincide with the December 2015 and March 2016 rains to enable rain fed propagation of seedlings. The mature mango seedlings were distributed to the mango farmers based on a distribution plan through the 3 community groups with each farmer getting an average of 10 seedlings depending on acreage of land and capacity.

1.6 MONITORING AND EVALUATION

A partners due diligence tool (annex 16) was developed and the consequent due diligence exercise undertaken with all the project implementing partners. This exercise guided the team in changing the project implementation strategy so as to improve the efficiency in delivery of the project output.

The new strategic approach included the;

a. Reallocation of some activities in the project work-plan i.e. the 'Production of Samples and First Batch of Fortified Flour by Women Groups,' to the community groups as the main implementers.
b. Installation of the pilot plants in series as opposed to the initial parallel installation approach. This would enable participatory learning of the technology by all the project partners while making improvements on the technology and machinery for the subsequent pilot plants

The project team also facilitated a technical and financial monitoring and evaluation (M&E) exercise of the project by the IGAD secretariat. This activity involved onsite and office visits to the pilot plants and one on one meetings with beneficiaries.

1.7 OTHER ACHIEVEMENTS

The project implementation team oversaw the signing of a contractual agreement between NETFUND and GAF and also reviewed the funds request by GAF for implementation of the project. The funding arrangement with GAF has been revised and processing of funds transfer was finalized on 13th July 2015.

In addition to this, the NETFUND project team has spearheaded the initiative of resource mobilization for the project with a view of expanding the scope and the sustainability of the project beyond IGAD's funding. So far the project has successfully developed and submitted proposals to other donors.

One of the proposals has been submitted to the *Marketplace for Nutritious Foods* under the Innovation Accelerator Program by the *Global Alliance for Improved Nutrition* (GAIN) with a total funding request of USD 1.8 million. The market place is seeking to support and catalyze business innovations across the agricultural value chain with an aim of increasing the diversity, affordability and accessibility of nutritious foods reaching low-income Kenyans. This proposal has successfully gone through the first round evaluation and second round onsite evaluation by the donor evaluation team. NETFUND is hopeful that this proposal will successfully receive the funds from the donor.

2. SUMMARY OF RESULTS/ OUTPUTS/ OUTCOMES

During the reporting period, the project sought to achieve four main outcomes i.e.

2.1 MANGO POWDER TECHNOLOGY INTRODUCED AND DISSEMINATED

This output was partially achieved through the household baseline survey and the key informant group discussion. A total of 532 households were successfully interviewed during the house hold data collection exercise against an expected 600 households, while a total of 18 key stakeholders in the mango value chain management in the county were reached during the key informant group discussion. Please find annexed the Baseline questionnaire, Key informant Guidelines and the respective reports detailing the results of both.

The baseline survey was carried-out using an online/offline mobile geographical positioning system (GPS) data collection tool. From this activity the project had the following tools developed and in use:

i. Baseline questionnaire
ii. An online/ offline data collection tool and entry tool
iii. Quantitative data analysis system
iv. Qualitative data analysis system
v. An online database management system
vi. Stakeholders focused group discussions questionnaire

The project team managed to successfully identify 47 women groups in the project intervention sub-counties with a total number of 1,087 women as the registered members. Please find annex 25, the report for the mobilization of the women groups.

SUMMARY OF THE BASELINE RESULTS

2.1.1 HOUSEHOLD DEMOGRAPHICS AND INCOME LEVELS

Most of the women farmers interviewed only have primary education with a few of them having attained advanced levels of education and training. Males (15%) are more educated than the females (10%) in the county. The main income activity for the interviewed households is small scale farming at 71% with a few households relying on salaries and business as their main income source. These factors explain the low levels of employment within the county with 40% of interviewed males and 35% of females being unemployed.

The median income value for the county is approximated at a value of KES. 7,000 compared to the national median income of KES. 11,475 according World Bank Country Economic Report 2015. The overall income levels for the county stand at a median of about KES 6,100. This proximity illustrates the narrow poverty gaps in the county, with most households leaving below the poverty line.

2.1.2 MANGO FRUIT PRODUCTION

The exotic/ grafted mangoes are the most preferred mangoes as compared to the indigenous mangoes. This was attributed to the fact that the grafted mangoes are less fibrous and bigger in size with high sugar contents and thus fetch better market prices as compared to the indigenous ones. The most dominant mango growing method is therefore grafting as compared to the primitive traditional methods of growing, where the seeds are

planted directly in the farms without going through a tree nursery. Unfavorable weather conditions (44%) and diseases (33%) are the factors leading to less than optimal harvest. Other factors leading to these losses were identified as; lack of access to fertilizers and pesticides, poor seed quality, unproductive land and lack of proper training in farm management.

2.1.3 TECHNIQUES FOR STORAGE AND PROCESSING OF THE MANGO FRUIT

Majority of the farmers sell their mangoes as raw fruit without processing. The only mango processing technologies practiced by farmers is juicing and jamming. These employ manual rudimentary technologies such as domestic blenders, sieves and *sufurias* (cooking pans) to convert the mangoes into juices and pulp. Most of the farmers sell their mangoes in raw fruit form. These can be attributed to unavailability and lack of awareness to mango value addition initiatives and technologies in the county.

Lack of proper mango storage facilities and poor harvesting techniques was cited as a factor leading to high losses by the farmers, since the average mango storage period is one week.

2.1.4 MARKETING OF MANGOES

Most of the mangoes are sold at the local markets and to middle-men who further sell the mangoes to the local markets of neighboring counties. Export markets have not been well exploited with only 2.1% of the farmers getting their produce to these markets.

The main reasons that were cited as discouraging farmers from selling their mangoes included:

i. Low product output
ii. Lack of access to or awareness of other markets apart from the local markets
iii. Lack of value addition techniques to the mango fruit
iv. Over-exploitation from middle-men

Lack of awareness of value addition technologies and initiatives in the country has led to poor marketing of the mango fruit where almost all of the mangoes are sold as whole fruits with negligible amounts of value addition in form of juice and jam. This situation is worsened by the fact that poor-to-no packaging methods are used by the farmers with most of them opting to sell their mangoes in sacks, carton boxes and plastic crates.

2.1.5 MANGO FARMER GROUPS

Only 36% of the interviewed farmers belonged to a farmer group, with 95% of these groups being registered with the ministry of co-operatives, Kitui County and are women farmer groups. Sixty four percent of the interviewed farmers reported that they did not belong to any group. The main reasons that were cited as to this included; lack of poor incentives, non-awareness of existence and corruption in the groups as the major reasons

The farmers belonging to registered groups cited the benefits of belonging to their groups as: provision of soft farming loans, seedlings, pesticides and training on best mango farming methods.

The main challenges faced by the farmer groups were lack of capacity for proper marketing and lack of technical support and knowledge in the value addition technologies to the mango fruit. Other challenges that were noted include poor governance and corruption among the group officials.

2.1.6 CAPACITY OF THE RESPONDENTS

Most of the interviewed farmers (80%) reported to have had no training at all. 23% of the farmers however reported to having received training on mango production and harvesting while 10% reported to have received training on post-harvest handling and record keeping. 6% of the respondents have received training on marketing and financial management.

It is also noted that the farmers have undergone little to no training on processing, value addition and nutritional value of the mangoes.

2.2 CAPACITY OF WOMEN BUILT ON MANGO POWDER PROCESSING AND MARKETING

To achieve this output, capacity building sessions were carried out for partner community groups and other mango farmers (See annexes 10, 17, 18, 19 and 27 for the training reports and technology training manuals). These sessions were aimed at creating an understanding of the project and the expected project deliverables and impact. Each of the three pilot plants have a food technologist and plant operator who have been trained to be in charge of the day to day plant operations, maintenance and production. Fifteen persons in total were trained on the mango powder technology in a process which included step to step demonstration of the whole process line from the receiving bay to the packaging line.

2.3 AWARENESS ON MANGO POWDER PRODUCTS AND NUTRITIONAL VALUE CREATED

NETFUND sought to create awareness on mango powder products and the nutritional value created as a result of consumption of the fortified mango flour.

A comprehensive product promotion plan was developed highlighting the key strategies and avenues that would be employed to create awareness about the products with over 1,500 brochures and 1,200 fliers developed and used in the awareness campaigns.

The several conferences, exhibitions and agricultural shows were leveraged upon to create awareness about the products and the project, with the most notable one being the NETFUND organized investors' conference and expo. By the end of this expo, the project beneficiaries were clearly able to articulate their value proposition, product description, customer persona, cost of production, distribution and marketing strategy.

Other platforms used in creating awareness of the project and products included; the Nairobi Agricultural Shows (2 shows attended), Kitui Agricultural Shows (2 shows attended), Farmer to Farmer Shows in Kitui (3 shows attended), Roadshows (participated in 1 show) and the Farm Africa Expo (participated in 1 expo).

A one day forum of key stakeholders in the mango value chain, mostly drawn from Kitui and the surrounding mango producing counties was held with the objective of introducing the mango product and fortified products and their nutritional value to these stakeholders in the mango value chain. During this forum, key strategies for marketing the products and different investment and loan facilities for scaling up the project were proposed.

Mass media campaigns were carried out on various print and digital media platforms with an aim of sensitizing the public about the products and the project as a whole.

A media release for the project was developed and distributed to various media stations. Two articles on the project were developed and published on several print media i.e. the people's magazine, the Sunday express and the Joto Africa Magazine.

The KEPs project pilot plant was aired on National television stations notably on the Smart Farm Program of Citizen TV, K24 TV and on the National TV (NTV). Four radio talks were also undertaken and aired on local radio stations i.e. County FM, Athiani FM, Mbaito FM and Syokimau FM radio stations respectively.

2.4 IMPROVED VALUE CHAIN MANAGEMENT FOR MANGO FRUITS

The project also sought to improve the value chain management of mango fruits by designing a training curriculum and booklet on a Best Practices of Mango Farming. These tools were employed in the training of over 600 mango farmers on best practices of mango production.

The training was carried hand in hand with the establishment of 3 mango tree nurseries at each of the sub-counties and carried out in conjunction with agricultural extension officers from the Ministry of Agriculture of the Kitui County.

A total of 6,000 seedlings were propagated, successfully grafted and transplanted to nurseries. The transplant was planned to coincide with the December 2015 and March 2016 rains to enable rain fed propagation of seedlings. The mature mango seedlings were distributed to the mango farmers through the 3 community groups with each farmer getting an average of 10 seedlings depending on acreage of land and capacity.

3. SUMMARY OF FINANCIAL MANAGEMENT

NETFUND adhered strictly to the provisions in the Grant agreement to enhance the financial management and control of the grant during the reporting period.

NETFUND has strong internal control systems that safeguard the use of assets and other resources. NETFUND is also a semi-autonomous government agency governed by various laws and regulations and all these aspects enhanced the financial management and control of this grant.

FISCAL REPORT

NETFUND received a disbursement amounting to USD 199,650.00 during the period under review and as at close of the period USD 199,650.00 had been spent on the planned activities representing 100% absorption.

Chart 1: Expenditure against Receipts

4. TIME VERSUS PROJECT IMPLEMENTATION

All the planned activities of the project have been fully implemented. The first and second quarters of the project were however, characterized by a number of challenges. The equipment for the mango powdering technology had very high technical specifications and as a result they were not readily available on the shelf of most manufacturers in Kenya. This, coupled with high import prices of the same equipment, necessitated the project team to conduct a country-wide field survey with the aim of identifying locally available alternative mango powdering technologies that would give final products with the same expected quality as the originally proposed equipment. This survey was carried out in local Industrial, Research and Manufacturing institutions and organizations within the country.

The delay in the implementation was also attributed to the fact that two of the partner community groups do not have the same capacity of resources as the KEPs whose pilot plant was in full operation by the second quarter. An extra four months beyond the original quarter timelines was accorded to two of the project partners to enable them finalize construction of the plant buildings that would host the processing equipment. The funds used to construct these factories was purely a contribution of the community into the project. This was a demonstration of the high level of commitment and ownership from the community which also contributed to ensuring that all the project activities have been implemented.

In order to mitigate these delays, the project sought for a six month 'No Cost Extension' of the project from IGAD, a request which was duly granted. As such the project's activity schedule and budget were revised to reflect the new timelines and was submitted to IGAD for approval.

NETFUND also advanced funds from the organizational budget amounting to USD 31,248.34 towards the implementation of some quarter three activities that were dependent on the oncoming rainy season. These activities included raising and grafting of mango tree seedlings and transplanting of the same at maturity, a stage which was purely dependent on the torrential rains for success. The amount was then recovered by NETFUND from the quarter three funds.

The revised activity schedule thus means that the project was implemented within the required timelines.

5. STAKEHOLDERS AND COMMUNICATION

During the reporting period, the project heavily leveraged on some strategic stakeholders to successfully implement its activities. Top of these is the **County Government of Kitui**, **which through its Ministry of Trade and Industrialization, provided technical advisory services and supervision, in the construction and installation of the pilot plants.**

The County Government through its Ministry of Trade and Industrialization has further pledged to have a budgetary and for technology transfer and further capacity building of more farmers on the mango value chain technologies.

The project also leveraged on other stakeholders from the private and public sector for the design, development and validation of the Mango Training Guide and The Mango Spray Programme. These stakeholders included; representatives from the Kenya Forest Service (KFS), Ministry of Agriculture, Horticultural Crops Development Authority (HCDA), Kenya Forest Research Institute (KEFRI), Kenya Plant Health Inspectorate Services (KEPHIS) and the South East Kenya University (SEKU).

Local radio stations in Kitui County, have contributed to increasing the awareness of the project by informing the community in the local dialect about the project benefits and the expected impacts as well as the project progress. This has been a major contributor to success of the project so far.

Efforts from the communications department of NETFUND resulted in free media publicity from various print and digital media such as the People Daily, Sunday Express Newspaper and the Joto Africa Magazine. Additionally the team got free TV and Radio interviews from Citizen TV and NTV. The free publicity realized within this period was equivalent to KES 51, 757, 512 as per the table below:

Media Channel	**Amount saved (Ksh)**
Print	2,491,032
Radio	6,894,440
Television	42,372,040
Total	**51,757,512**

6. MAIN CHALLENGES AND LESSONS LEARNT

Construction of infrastructure for the two remaining pilot plants, connecting them to three phase power and equipment acquisition and technicalities were some of the main challenges.

Except for equipment acquisition, most of the said activities were the sole responsibility of the community groups. Fundraising for infrastructure development and connecting to three phase power by the community groups took longer than expected contributing to delays in implementation.

Another key challenge in the implementation of the project was the remoteness and poor levels of infrastructural development in the project implementation areas. Some of these challenges included lack of connectivity to three phase power and water. Connectivity to these key resources was done but proved to take time.

It is paramount to carry out a thorough pre-feasibility studies to inform the design and formulation of project as part of proposal development or project preparatory. The results from the pre-feasibility studies would greatly contribute to providing insight of equipment and material cost and availability and the most suitable project intervention areas thus informing the budget and work plans accordingly.

7. LOCATION OF ARCHIEVED PROJECT DOCUMENTATION

This project progress report and all the annexed documents and reports herein, can be accessed from this link:
https://www.dropbox.com/s/r1m4bi0d0qtlhe9/FINAL%20PROJECT%20REPORT_IGAD_submitted.docx?dl=0

8. RECOMMENDATION AND CONCLUSION

Despite the challenges faced during the reporting period, the project was implemented on schedule and within the budgetary allocation.

For sustainability of the project, it is recommended that each of the community groups should be supported to develop bankable business plans for their mango processing plants and the same pitched to strategic donors and investors for replication and expansion of the pilot plants. Such donors include the Global Alliance for Improved Nutrition who is supporting projects that have demonstrated success in achieving scale and impact of projects that aligned to solving malnutrition.

Since the mango powder is a new product in the country it lacks Standards from the Kenya Bureau of Standards (KEBS). This is a key factor affecting the marketability of the products. It is thus recommended that further research studies should be carried out on the mango powder and fortified the flours to establish their optimal recommended formula and maximum shelf life. The results of these studies will not only be shared with KEBS to inform the formulating standards for the products but will also contribute to the optimization of the production process with international market grade products as an output.

It is with this regard, that NETFUND is preparing a research proposal that is aimed at; determining the effect of Solar & Biomass Drying technologies on the Physical & Chemical Stability (Water sorption, Glass transition & Microstructures) of Mango Powder during storage time. This proposal will be shared with the drought resilience platform of IGAD among other potential donors for funding consideration.

ANNEXES

ANNEX 1 **LETTER OF SUPPORT FROM KITUI COUNTY GOVERNMENT**

THE COUNTY GOVERNMENT OF KITUI

Email:
kituicounty@kenya.go.ke
When Replying please quote

Office of County Executive
Committee Member-Kitui County
P. O. Box 58 – 90200
KITUI.

COUNTY MINISTRY OF TRADE, INDUSTRY, IT & COOPERATIVES

REF: MTIIC/1/VOL1 (112) 22nd December, 2014

Chief Executive Officer

National Environmental Trust Fund,

Geomaps Centre, 7th Floor Upper Hill

NAIROBI

RE: SUPPORT IN IMPLEMENTATION OF THE PROJECT

We refer to your letter referenced NET/102/VOL.B/28 dated 14th November, 2014 on the above subject. Foremost, we are grateful for choosing Kitui to be the first County to benefit from this pilot project and in particular my Ministry to be the focal point of implementation. I therefore take this opportunity to officially welcome you to Kitui County to implement the mango value addition project. My Ministry takes this project seriously and would give you the necessary support to ensure its success.

We have had meetings with your technical staff and coincidentally the value chain of mango is one of the projects being supported by the County Government and in particular my Ministry. We would try our level best to mobilise and bring the relevant stakeholders together in the mango value chain.

As regards the launch, you will propose a date upon which we can plan to do it.

COUNTY GOVERNMENT OF KITUI
P. O. Box 58 - 90200, KITUI
22 DEC 2014
COUNTY MINISTRY OF TRADE, INDUSTRY, ICT & CO-OPERATIVES

JAMES MWINZI JONAH
CECM: TRADE, INDUSTRY, IT AND COOPERATIVE

ANNEX 2 **SUMMARY OF BASELINE SURVEY**

1.1. RESULTS

1.1.1. Household Demographics and Income Levels

1.1.1.1. Age, sex and levels of education of the respondents

13% of the mango farming population in Kitui County don't have access to formal education, while 88% have access only to primary school education followed by with Secondary school and College education. Only 4% of the population have university education (4%) as indicated in Table 1.

55% of the surveyed households are headed by women and are actively participating in mango farming with only 45% of the households being headed by men. As illustrated in table 2, it was noted that more women (53%) were educated than men (40%).

There is therefore a clear indication that most female farmers interviewed have gone through primary education with a few of them having attained advanced levels of education and training. It is evident that males have had more access to education as compared to the women. The data also shows that a higher percentage of women (15%) are not educated compared to men (10%).

Table 1 and 2: Education level against gender distribution

	Level of Education						
Gender	None	Primary school	Secondary school	College	University	Other	Total
Male	5%	21%	10%	7%	2%	1%	45%
Female	9%	29%	11%	3%	2%	1%	55%
Total	**13%**	**50%**	**22%**	**10%**	**4%**	**2%**	**100%**

GENDER		LEVEL OF FORMAL EDUCATION ATTAINED							
		Sub Counties	None	Primary school	Secondary school	College	University	Other	Total
Male		Mwingi North	21%	61%	9%	5%	1%	4%	100%
		Mwingi west	8%	44%	22%	21%	5%	1%	100%
		Kitui Central	0%	34%	49%	11%	6%	0%	100%
		Kitui Rural	0%	43%	21%	36%	0%	0%	100%
		Kitui East	0%	15%	45%	30%	10%	0%	100%
	All males		10%	46%	23%	16%	4%	2%	100%
Female		Mwingi North	27%	53%	14%	2%	2%	3%	100%
		Mwingi west	8%	60%	21%	4%	8%	0%	100%
		Kitui Central	18%	45%	26%	10%	2%	0%	100%
		Kitui Rural	17%	55%	14%	10%	3%	0%	100%
		Kitui East	12%	42%	28%	12%	2%	5%	100%
	All females		15%	53%	20%	6%	4%	1%	100%
	Overall		**13%**	**49%**	**22%**	**11%**	**4%**	**2%**	**100%**

1.1.1.2. Main source of income

The main income generating activity for the interviewed households is farming with 71% of the sample population engaged in it. The remainder of the households rely on employment and businesses as their main source of income at 11% and 15% respectively. In terms of employment, 40% of interviewed males are unemployed as compared to only 35% of females.

This can be attributed to the fact that the women have organized themselves into groups with income generating initiatives. 57% of the interviewed households dependent on farming are female headed and 45% are male headed. More females therefore practice farming as a full-time job to cater for both their economic and for subsistence needs.

55% of the mango farmers interviewed are of the age of 40 years and above, with only 20% being at the youthful stage. This is an indicator that that mango farming is dominated by the vulnerable elderly group in the county and is practiced mostly at small scale levels for subsistence purposes. This could be attributed to lack of access by the farmers to modern skills and technologies of farming.

The median income value for the interviewed households was at an approximate value of KES. 7,000, while the overall income levels for the county stand at a median of about KES 6,100.

Table 3: Age distribution against sources of income

Male		**Age (Years)**	**Farming**	**Employment**	**Self employed**	**Unemployed**	**Total**
		18 – 28	5%	0%	1%	1%	7%
		29 – 39	6%	3%	3%	0%	11%
		40– 50	20%	6%	7%	1%	34%
		51 +	37%	4%	6%	1%	48%
	All Male		67%	14%	16%	3%	100%
Female		18 – 28	5%	1%	1%	0%	7%
		29 – 39	18%	3%	2%	0%	23%
		40– 50	23%	4%	9%	0%	37%
		51+	29%	1%	2%	2%	33%
	All Female		75%	9%	14%	3%	100%
	Overall		**71%**	**11%**	**15%**	**3%**	**100%**

Main Source of Income						
Male	Current employment Status	Farming	Employment	Businesses	Unemployed	Total
	Employed	1%	12%	1%	0%	14%
	Self-employed/Farmers	29%	2%	13%	1%	45%
	Unemployed	37%	0%	2%	2%	40%
	All Males	67%	14%	16%	3%	100%
Female	Employed	0%	8%	0%	0%	8%
	Self-employed/Farmers	44%	0%	12%	0%	57%
	Unemployed	31%	0%	1%	2%	35%
	All Female	75%	9%	14%	3%	100%
Overall		**71%**	**11%**	**15%**	**3%**	**100%**

Table 4: Employment sources

1.2. Production of the mango fruit

1.2.1. Preferred mango variety

The study showed that the most preferred mango variety was apple mango (57%) followed by Maya (28%) and Ngowe (26%) in Table 5. The main reason for the preferred mango varieties was given as; good market price market price with Apple, Ngowe, Kent and Maya rating at 48%, 21%, 17% and 16% respectively. Apple mango was also highly preferred due to its big sized fruit (18%) and its sweet pulp (26%) as is shown in Table 6.

Therefore, exotic mango varieties are more preferred as compared to the local/ indigenous mango varieties. Most of the farmers planting local mangoes suffer heavy losses due to low demand for the mangoes as compared to the indigenous types. Thus the local mangoes are mostly for non-commercial household consumption.

Table 5: Mango variety

MANGO VARIETY	MWINGI NORTH	MWINGI WEST	KITUI CENTRAL	KITUI RURAL	KITUI EAST	TOTAL
Ngowe	5%	4%	6%	5%	6%	26%
Baribo	2%	2%	2%	2%	3%	10%
Batawi	6%	7%	1%	1%	4%	17%
Apple	8%	18%	13%	8%	11%	57%
Kent	8%	2%	5%	2%	6%	23%
Keitt	0%	2%	2%	1%	1%	6%
Tommy Atkins	1%	2%	1%	0%	2%	6%
Van Dyke	1%	1%	0%	0%	1%	3%
Haden	0%	0%	0%	0%	1%	1%
Sensation	0%	0%	0%	0%	1%	1%
Sabre	1%	0%	0%	0%	1%	2%
Sabine	1%	3%	1%	0%	2%	7%
Pafin	0%	0%	0%	0%	0%	0%
Maya	4%	24%	0%	0%	0%	28%
Kensington	0%	0%	1%	0%	0%	1%
Gesine	0%	0%	0%	0%	1%	1%
Nimrod	0%	0%	0%	0%	0%	1%
Dodo	7%	2%	3%	2%	1%	15%
Indigineous	9%	1%	4%	2%	2%	19%
Total	**28%**	**36%**	**16%**	**8%**	**12%**	**100%**

Table 6: Reasons for Preference

MANGO VARIETY	FACTOR FOR PLANTING THE CHOSEN VARIETY									Total
	Disease tolerant	Sweet pulp	Attractive Color	Pleasant flavor	Big sized fruit	Good Market price	Regular bearer	Off season bearer	Other	
Ngowe	8%	12%	3%	2%	9%	21%	4%	1%	2%	26%
Baribo	2%	4%	2%	1%	3%	8%	2%	1%	0%	10%

Batawi	8%	4%	3%	6%	6%	6%	1%	1%	0%	17%
Apple	9%	26%	10%	8%	18%	48%	6%	2%	4%	57%
Kent	7%	9%	2%	2%	8%	17%	4%	3%	2%	23%
Keitt	2%	3%	1%	2%	3%	4%	0%	0%	0%	6%
Tommy	2%	3%	1%	1%	2%	6%	1%	1%	0%	6%
Van Dyke	1%	1%	0%	1%	1%	2%	0%	0%	0%	3%
Haden	0%	1%	0%	0%	0%	1%	0%	0%	0%	1%
Sensation	0%	1%	0%	0%	0%	1%	0%	0%	0%	1%
Sabre	1%	1%	0%	1%	0%	2%	1%	0%	0%	2%
Sabine	2%	4%	2%	2%	2%	6%	1%	0%	1%	7%
Pafin	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Maya	9%	8%	4%	5%	7%	16%	3%	1%	2%	28%
Kensington	0%	0%	0%	0%	0%	1%	0%	0%	0%	1%
Gesine	0%	1%	0%	0%	0%	1%	0%	0%	0%	1%
Nimrod	0%	0%	0%	0%	0%	1%	0%	0%	0%	1%
Dodo	6%	4%	1%	1%	5%	8%	6%	0%	1%	15%
Indigenous	4%	8%	1%	2%	5%	9%	3%	1%	5%	19%
Total	**31%**	**32%**	**12%**	**16%**	**26%**	**57%**	**15%**	**5%**	**10%**	**100%**

1.1.1. Mango growing methods

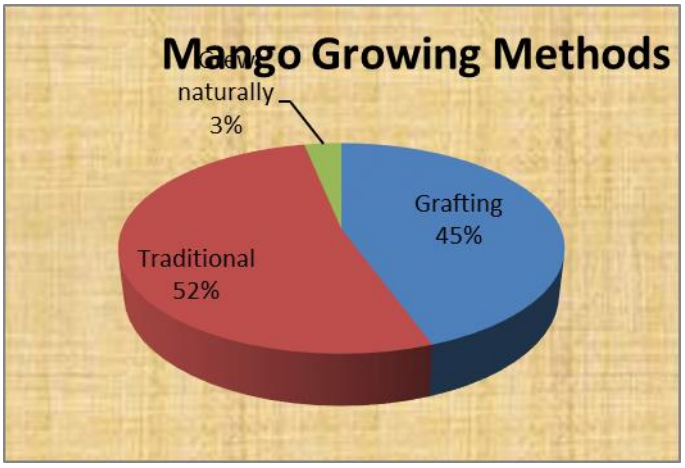


Fig 2: Mango growing methods

The dominant mango growing method in surveyed sub-counties is the traditional method at 52% followed by grafting at 45%. The traditional method is a rudimentary method of planting by digging a hole in the farms and covering the seed to germinate and therefore it does not include transplanting of the seedlings from the nurseries. No weeding or special care is applied to the germinating seedlings. Grafting is mostly done by farmers targeting the external markets for their mangoes due to the high value of the hybrid mango tree species.

1.2.2. Main reason for mango farming

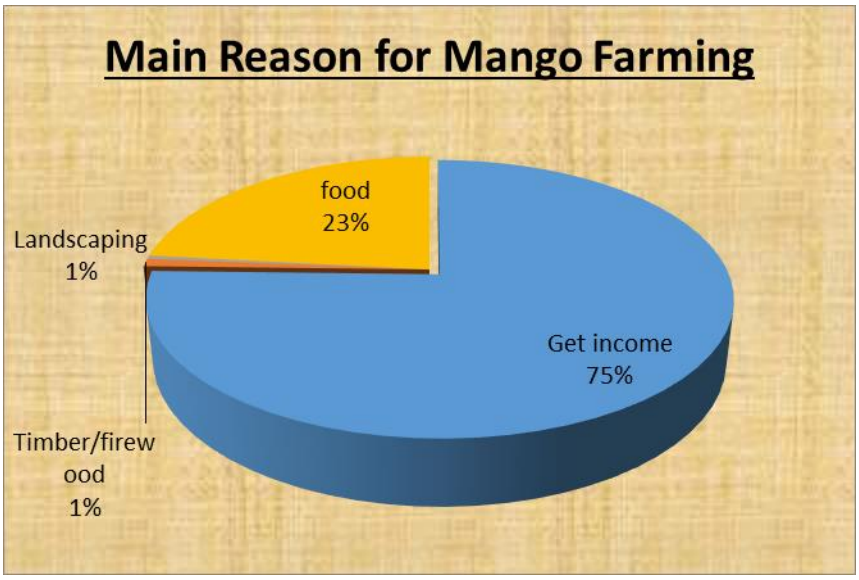


Fig 3: Reasons for mango farming

The main reason for mango farming in the surveyed sub-counties is for income generation and food (at 75% and 23% respectively). Other minor reasons for growing mango trees were; landscaping, timber and fire wood especially for the indigenous trees which overtime are considered non-profitable.

1.2.3. Type and percentage of land ownership for mango farming

95% of the mangoes are grown on land that is owned by the farmers. Only a small percentage of farmers grow the mangoes under family land with a negligible number growing the mangoes on leased land.

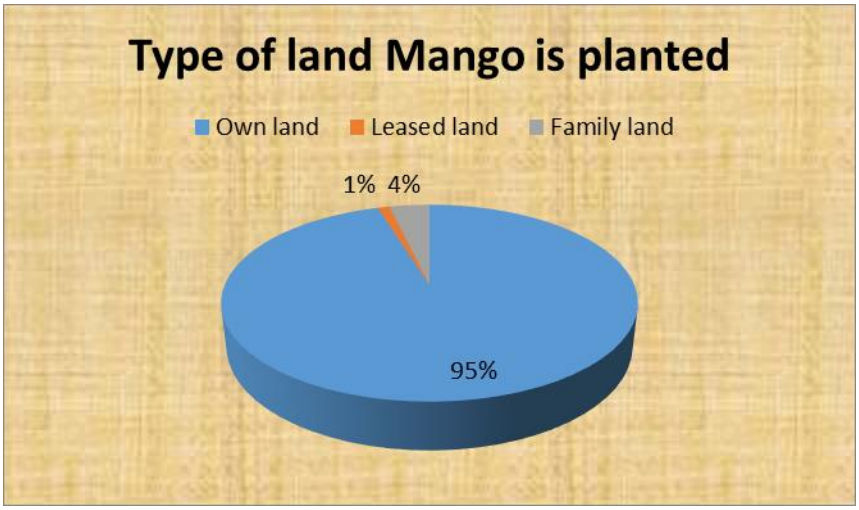


Fig 4: Mango farming land ownership

Cumulatively, 78% of the interviewed farmers are small scale farmers with 23% and 55% of the farmers growing their mangoes on less than an acre and between 1 to 2 acres of land respectively. Very few farmers plant mangoes on more than half of their land due to competition with subsistence farming.

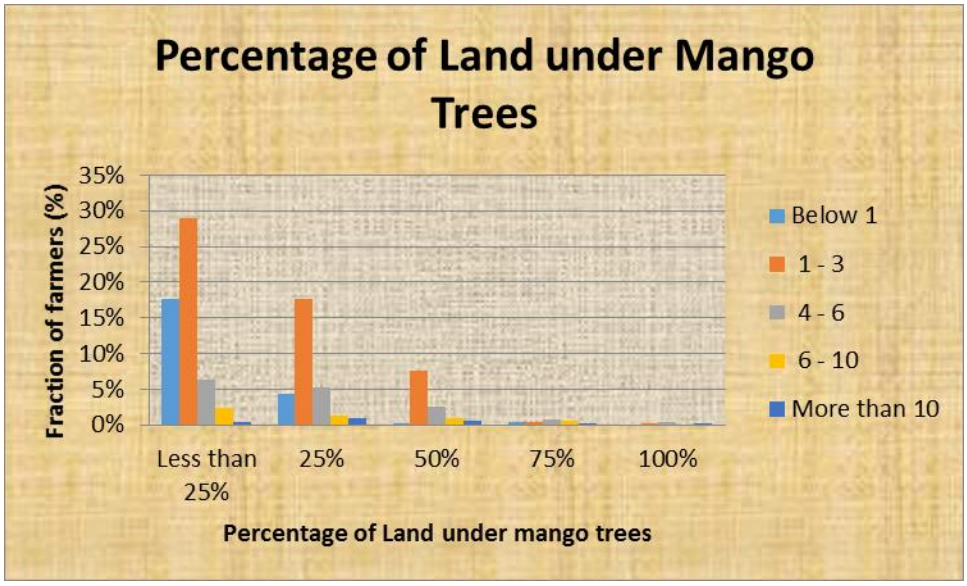


Fig 5: Percentage of land under mango trees

1.2.4. Mango harvest

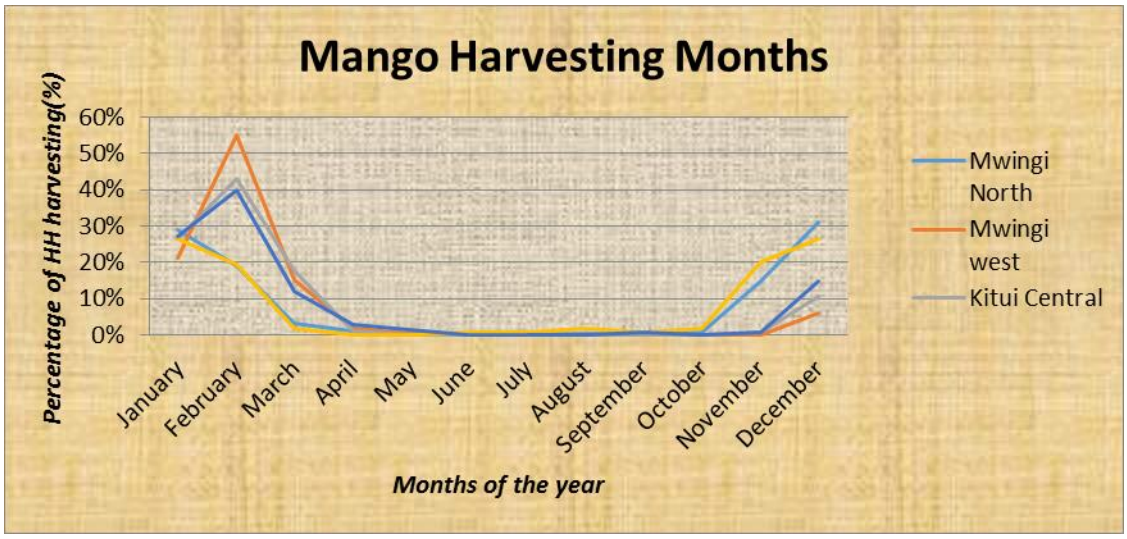


Fig 6: Mango harvesting months

The mango harvest is single season with the season ranging from between October to April. The beginning of season is characterized by less harvest, however this numbers increase gradually to attain peak levels in the month of February and start to gradually decline to the month of April.

83% of the interviewed households reported to have experienced poor mango harvest with 44% citing unfavorable weather conditions and 33% citing diseases as the major reasons for the poor harvests. The other reasons that were given were; lack of access to fertilizers (4%), poor seed quality (1%), Unproductive land (3%) and lack of training in farm management.

All the challenges experienced by the farmers are listed in the Table 7, below. With the dominant ones being; pests and diseases (67%) and poor sales (43%) because of unscrupulous business persons and agents who exploit the farmers by buying the mangoes at throw-away prices that are way below the cost of inputs undertaken by the famers in planting and or nurturing the fruits.

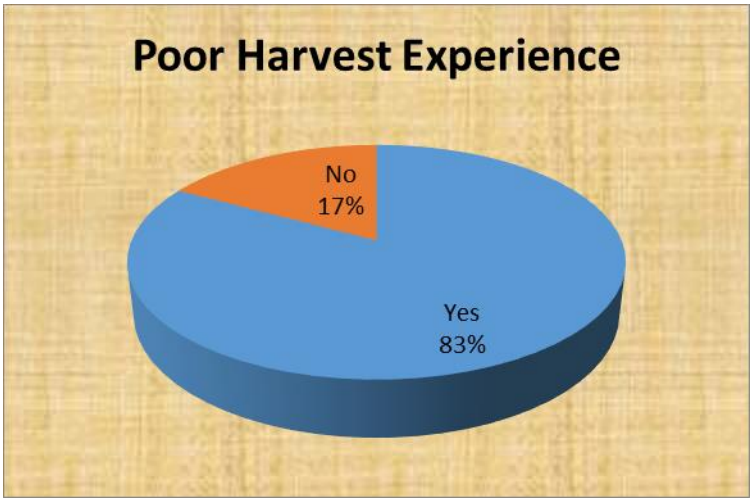


Fig 7: Poor harvest experience

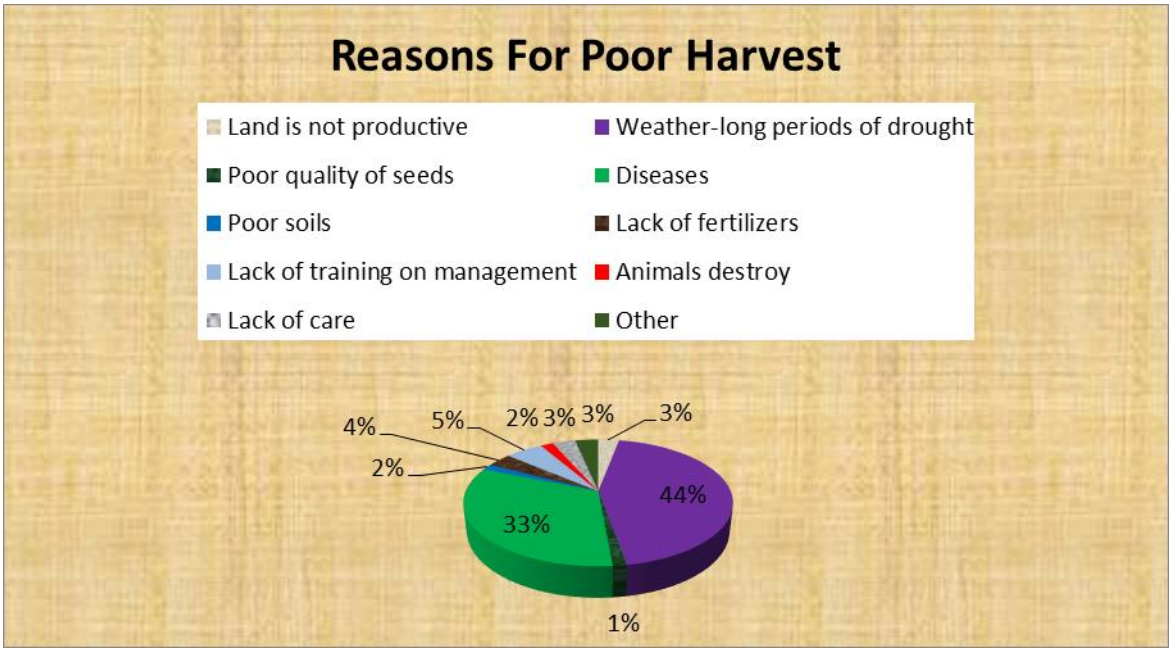


Fig 8: Poor harvest experience

CHALLENGES WITH MANGO FARMING	NAME OF SUB-COUNTY					Total
	Mwingi North	Mwingi west	Kitui Central	Kitui Rural	Kitui East	
Limited access to good quality planting materials	3%	1%	4%	1%	2%	11%
Lack of capital to purchase inputs	8%	9%	6%	4%	5%	31%
Poor infrastructure such as irrigation etc.	8%	2%	3%	3%	3%	19%
Pest and disease problems	17%	22%	10%	7%	11%	67%
Poor orchard management	1%	0%	2%	1%	2%	6%
Postharvest losses	6%	8%	2%	3%	2%	22%
Limited returns from mango production	9%	21%	8%	4%	2%	43%
Other	4%	5%	1%	1%	1%	12%
TOTAL	**28%**	**36%**	**16%**	**8%**	**12%**	**100%**

Table 7: challenges associated with mango farming

It was noted that the productivity levels of mango trees reduces with increase in the number of mango trees per farm. In general productivity levels of the mango trees falls at an average of 70% and with farmers who have planted 1 to 20 trees on their farms. The productivity levels as seen in Table 8, further indicate that only 6% of the interviewed mango farmers had all their trees being reproductive.

NO.OF MANGO TREES PLANTED	NUMBER OF PRODUCTIVE MANGO TREES								TOTAL
	None	1-20	21-40	41-60	61-80	81-100	+100	All	
1-10	1%	31%	1%	0%	0%	0%	0%	3%	36%
11-20	0%	26%	0%	0%	0%	0%	0%	2%	29%
21-30	0%	6%	3%	0%	0%	0%	0%	1%	10%
31-40	0%	3%	2%	0%	0%	0%	0%	0%	6%
41-50	0%	1%	2%	1%	0%	0%	0%	0%	4%
51-60	0%	1%	2%	1%	0%	0%	0%	0%	4%
61-70	0%	0%	0%	0%	1%	0%	0%	0%	2%
71-80	0%	0%	0%	1%	0%	0%	0%	0%	2%
81-90	0%	0%	0%	0%	0%	0%	0%	0%	1%
91-100	0%	0%	0%	0%	0%	1%	0%	0%	1%
100+	0%	1%	0%	0%	0%	1%	4%	1%	7%
TOTAL	**2%**	**70%**	**11%**	**5%**	**2%**	**2%**	**4%**	**6%**	**100%**

Table 8: Percentage of reproductive mango trees

1.2.5. Mango processing technologies

Majority of the farmers sell their mangoes as raw fruit without processing. The only processing technologies practiced by the remaining 2% of farmers is juicing and jamming. These employ manual rudimentary technologies such as domestic blenders, sieves and *sufurias* to convert the mangoes into juices and pulp. Majority of these farmers rely on women groups to market and sell their products.

Other products of processing include the mango leathers which are dehydrated mango slices. The packaging for the unprocessed and processed mango products is done manually in plastic bags.

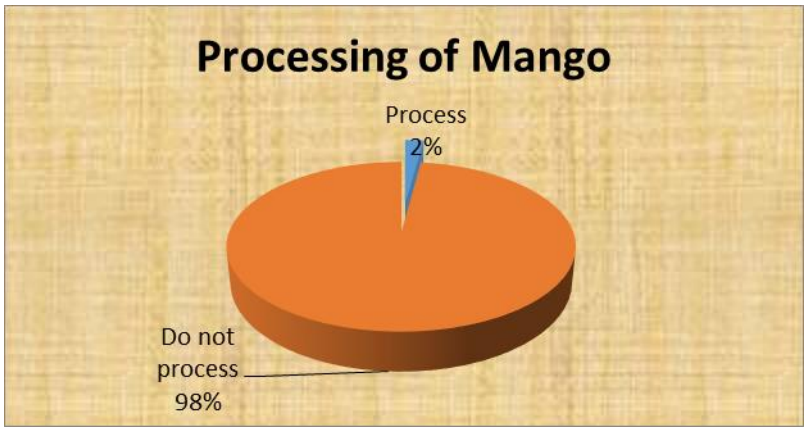


Fig 9: Mango processing

1.2.6. Awareness of mango value addition technologies

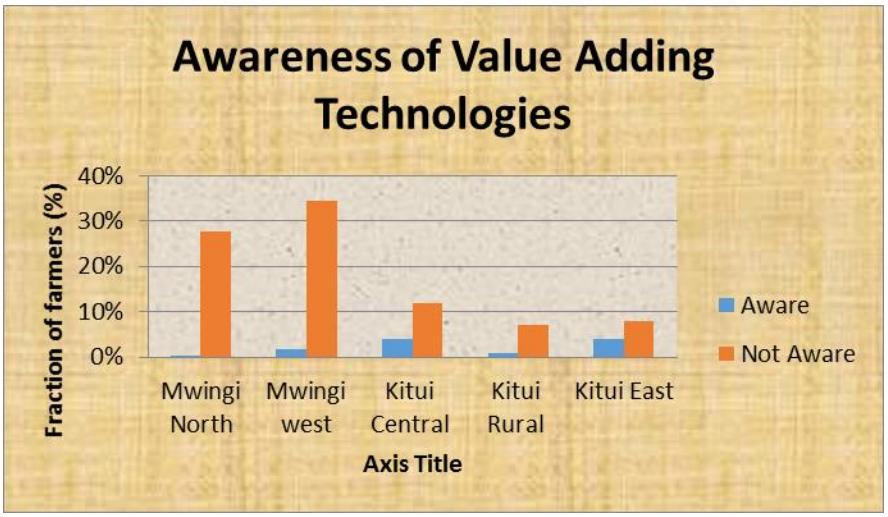


Fig 10: Awareness of mango value addition technologies

The awareness levels of mango value adding technologies vary per sub-county depending on proximity urban towns where local NGOs have organized the women into groups and have empowered them to produce mango juice and pulp, though at small scale levels. In overall, only 11% of total surveyed households in Kitui reported to being aware of value addition

technologies to the mango fruit. The awareness levels are specifically high in Kitui Central and Kitui East sub-counties with each standing at 4%. The rest of the interviewed households reported to not being aware of any value addition technology to the mango fruit.

1.2.7. Type of land desired for the establishment of a mango processing plant

The idea of establishing mango processing plants in the county was highly welcome by the mango farmers with most (27%) of the farmers were interested in the plant being established in the local markets and on community land (26%), with only 16% were interested in establishing the plants in the chief's camp. The main reasons provided were; proximity to the processing plant, ease of access and security.

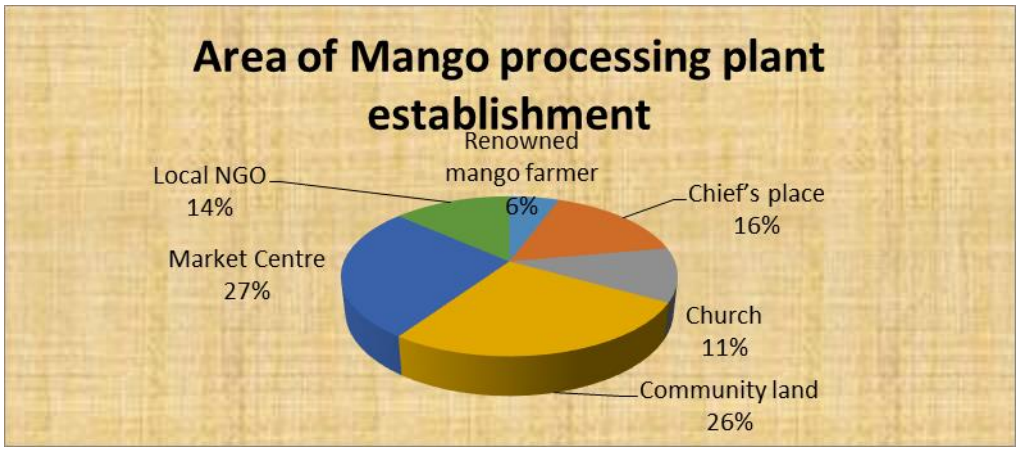


Fig 11: Type of desired land under mango processing

1.3. Storage and preservation of the mango fruit

1.3.1. Duration of harvest of the mango fruit after maturity

A large percentage (78%) of the target population wait for more than a week after maturity of the mango fruits before harvesting them. Out of this number, 38% wait for one (1) week before harvesting the mango fruits while 21% wait for a month and 19% of them harvest their mango fruits two (2) weeks after maturity.

In general, most of the interviewed farmers harvest their mangoes immediately after maturity.

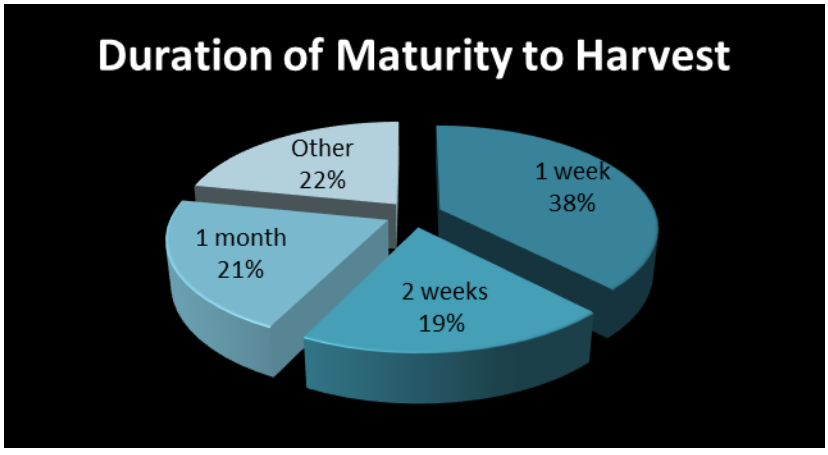


Fig 12: Duration of harvest after maturity

The difference in the timings of harvesting the mango fruit can be attributed to the fact that the farmers grow different variety of mangoes that in turn have different periods of maturity and the varying market availability.

1.3.2. Harvesting techniques

Various mango harvesting techniques are employed. These include; hand-picking (30%), shaking of the mango trees (29%), climbing on trees and hand-picking (24%), waiting for fruits to ripen and fall-down (11%) and clipping off the fruit using a stick (5%).

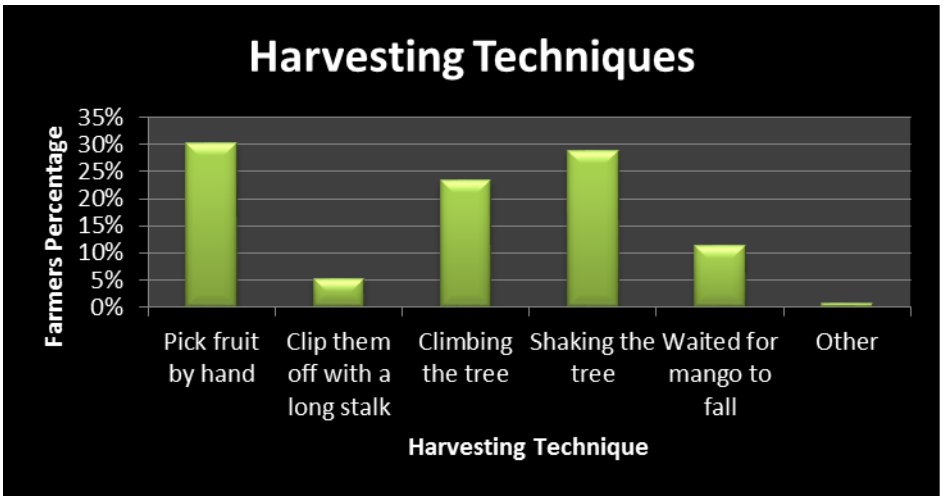


Fig 13: Mango harvesting techniques

1.3.3. Storage facilities, duration of storage and preservation techniques of mangoes

The majority of the mango farmers (44.41%) do not have storage facilities. 35.60% store the harvested fruits in their houses, 17% use a store while 1.1% store the fruits in a warehouse or a barn. The remaining 1.85% store their fruits in other areas including; a random room in the house or under the tree etc.

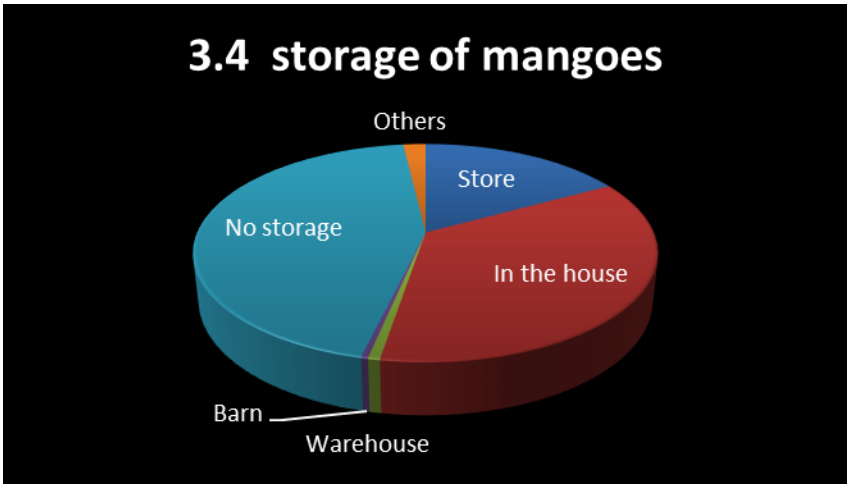


Fig 14: storage of mangoes

The farmers with storage facilities, however do not store their mangoes for more than one (1) week, due to the primitive nature of the storage facilities and techniques in place.

As seen in figure 14 below, there is almost no preservation technique for the mango fruit in practice by the farmers. A negligible number of the farmers preserve the mangoes by sun-drying.

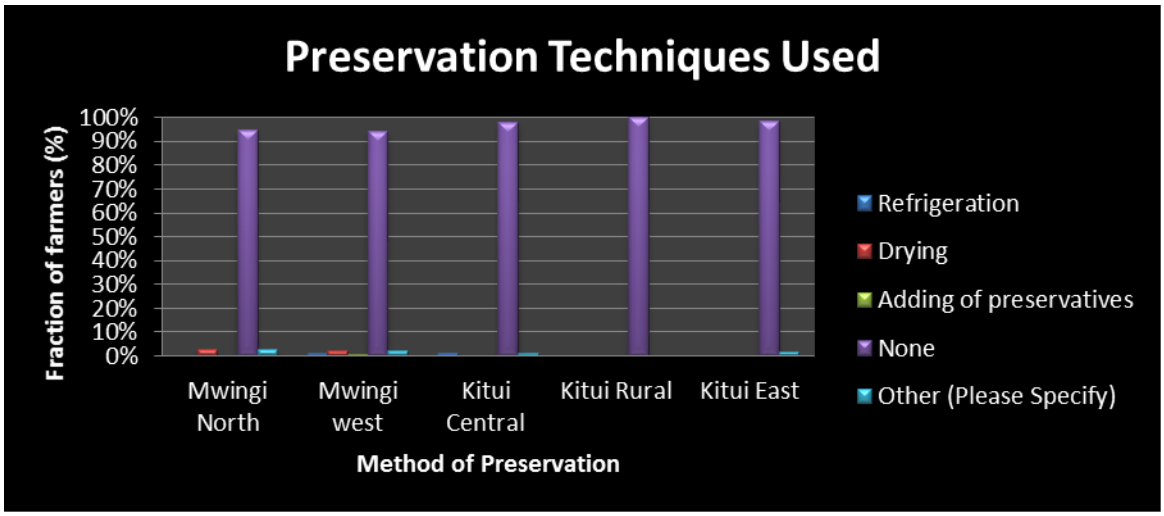


Fig 15: Preservation techniques

Table 9 below, indicates the amount of spoilt mangoes against the harvested mangoes in the last three seasons, for the interviewed farmers, i.e. 2011, 2012 and 2013 respectively. An average of 8,325.84 mangoes are harvested per season with an average of 2079.83 mangoes getting spoilt per season. This translates to an average of 25% losses in harvests alone per season. This high percentage can be attributed to the fact the farmers lack proper storage or preservation technologies and value addition techniques coupled to a saturated local market and lack of access to outside markets for the mango fruit.

Amount of Mangoes	**2011**		**2012**		**2013**	
	Harvested	Spoilt	Harvested	Spoilt	Harvested	Spoilt
Tones	8096.005	1983.396	7951.948	1968.741	8929.556	2287.338

Table 9: Tonnage of spoilt mangoes against harvested mangoes

1.4. Marketing of mangoes

1.4.1. Sales of mangoes

Most of the mango sales are done at the local market (44.4%) and to brokers of local markets in surrounding counties (48.6%). The export markets have not been well exploited with only 2.1% of the farmers getting their produce to these markets.

The main reasons that were cited as discouraging farmers from selling their mangoes included:

i. Low product output

i. Lack of access to or awareness of other markets apart from the local markets
ii. Lack of value addition technologies
iii. Over-exploitation from middle-men

Lack of awareness of value addition technologies and initiatives in the country has led to poor marketing of the mango fruit where almost all of the mangoes are sold as whole fruits with negligible amounts of value addition in form of juice and jam. This situation is made worse by the fact that poor to no packaging methods are used by the farmers with most of them opting to sell their mangoes in sacks, carton boxes and plastic crates.

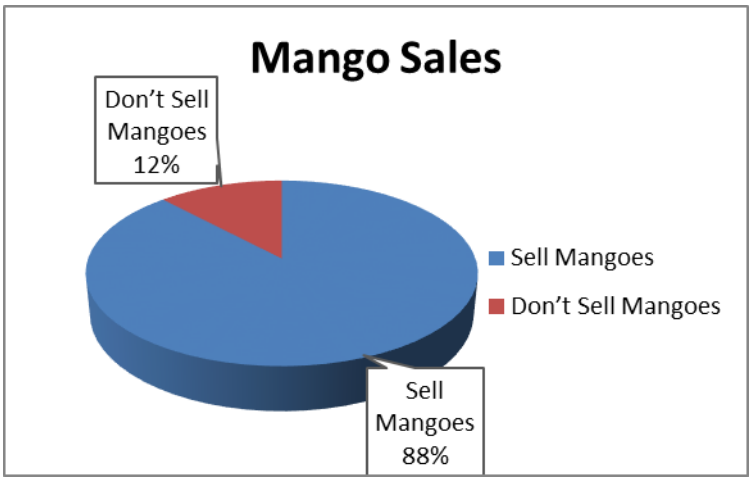


Fig 16: Sales of Mangoes

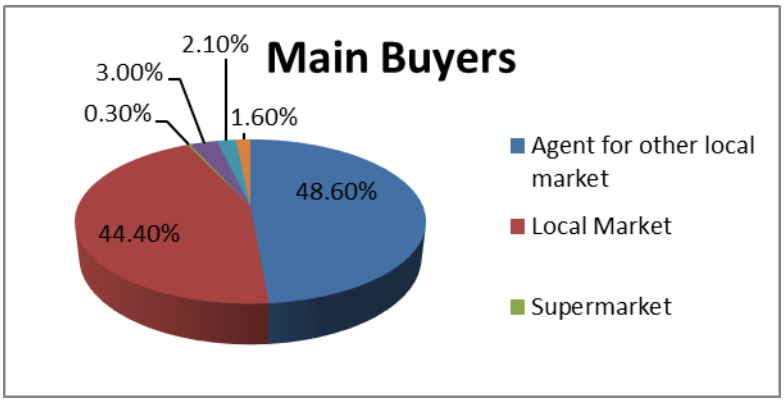


Fig 17: Main mango buyers

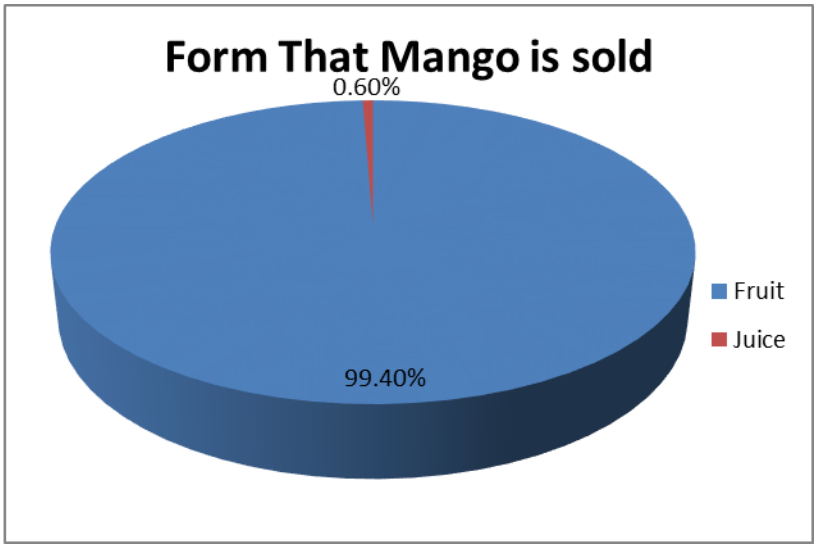


Fig 18: Form that mango is sold as

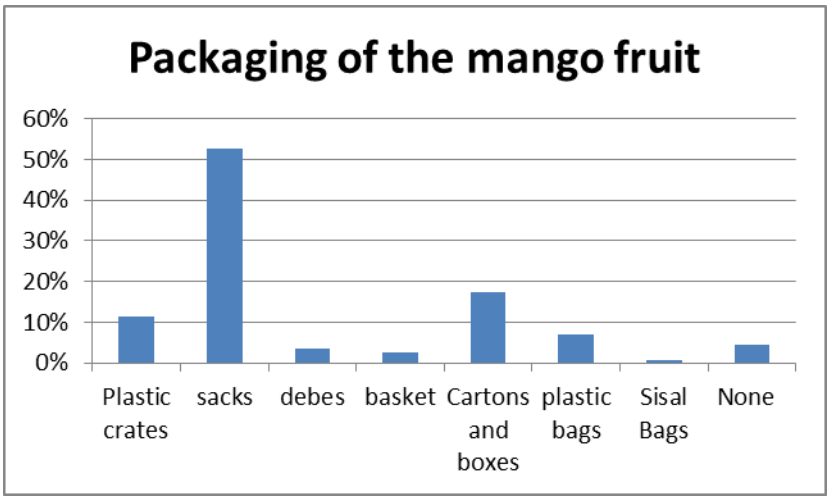


Fig 19: Packaging of the mango fruits

Over 70% of interviewed farmers keep no records for their farm inputs and outputs. In Overall, record keeping is only observed by about 10% of the interviewed farmers.

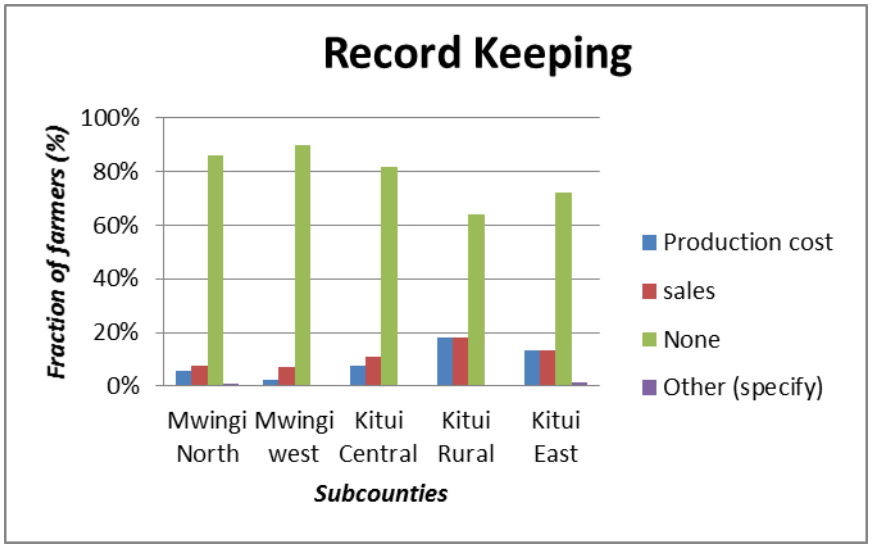


Fig 20: Record Keeping

1.5. Mango Farmer Groups

Only 36% of the interviewed farmers belonged to a farmer group, with 95% of these groups being registered with the Ministry of Co-operatives of the Kitui County Government and are women farmer groups. 64% of the interviewed farmers do not belong any group. The main reasons that were cited included; poor incentives, unawareness of farmer group existence and corruption in the groups as the major reasons.

The farmers belonging to registered groups cited the benefits of belonging to their groups as: Provision of soft farming loans (32%), seedlings (13%), pesticides (5%) and training on best mango farming methods (34%).

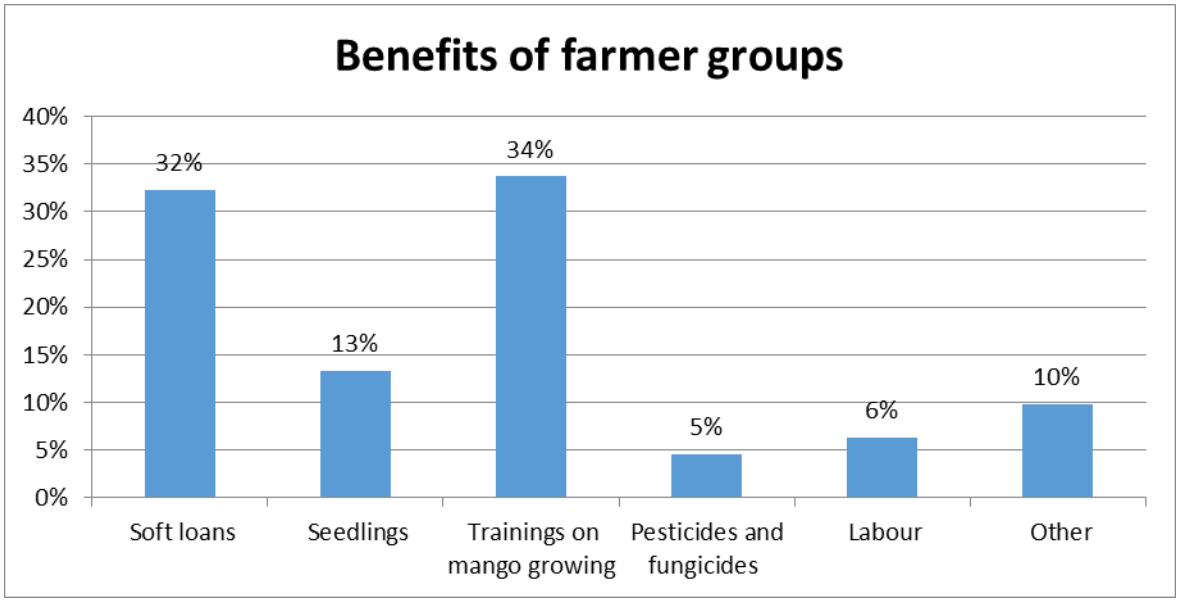


Fig 21: Benefits of farmer groups

1.5.1. Challenges faced by farmer groups

The main challenges faced by the farmer groups are lack of capacity for proper marketing and lack of technical support and knowledge in the value addition technologies. Other challenges that were noted include poor governance among the group officials.

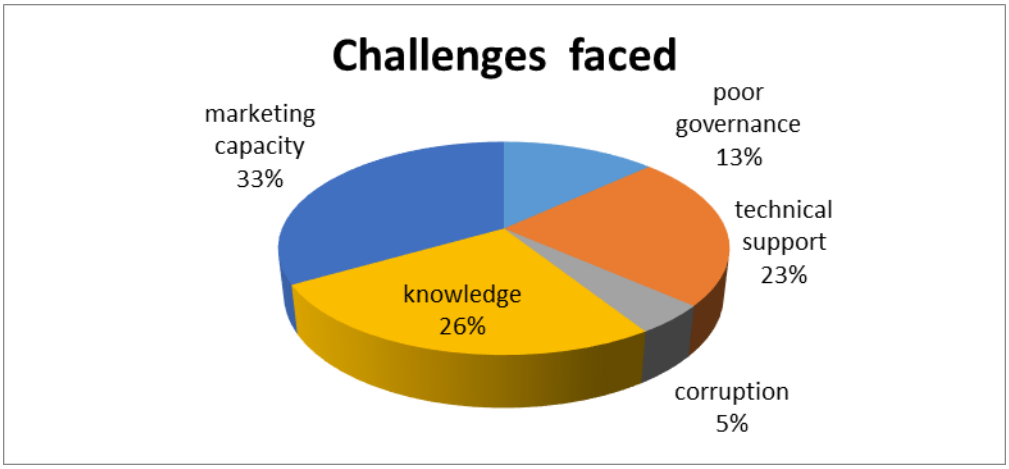


Fig 22: Challenges faced by farmer groups

1.6. Capacity of the respondents

Most of the interviewed farmers (80%) had received no training. 23% of the farmers however had received training on mango production and harvesting while by 10% with training on post-harvest handling and record keeping. 6% of the respondents have received training on marketing and financial management.

It is also noted that the farmers have undergone little to no training on processing, value addition and nutritional value of the mangoes. Most of these trainings were reported to have been carried out by; the Ministry of Agriculture, Kenya Forestry Research Institute, local NGOs including the Kitui Development Center, RISE Center and International NGOs including Japan International Cooperation Agency (JICA), The Red Cross. Corporates reported as having been involved in some of the trainings include Syngenta ltd., Amiran Kenya ltd. and Bayer ltd.

TRAINING	SUB-COUNTY					TOTAL
	Mwingi North	Mwingi West	Kitui Central	Kitui Rural	Kitui East	
Mango production and harvesting	7%	2%	3%	4%	8%	23%
Post-harvest handling and Record keeping	3%	0%	3%	1%	3%	10%
Processing	0%	0%	0%	0%	0%	1%
Value addition	0%	0%	0%	0%	1%	1%
Nutritional value of mango	0%	0%	0%	0%	0%	1%

Marketing and financial management	2%	0%	2%	0%	2%	6%
Leadership	1%	0%	0%	0%	1%	2%
None	22%	34%	12%	6%	6%	80%
Other	0%	1%	0%	0%	0%	1%
Total	**28%**	**36%**	**16%**	**8%**	**12%**	**100%**

Table 10: Capacity of mango farmers

ANNEX 3 **KEY INFORMANT GROUP DISCUSSION GUIDE**

Topic	Detailed questions
Production	
What specific functions do small producers perform?	Please explain to me how the mango business works. Where do they grow the mangoes? How do they grow them?
What sort of business relationships do small producers have? What information, advice or other support and services flow through those relationships? How? Why?	What types of inputs do you need to produce these crops? Who do you buy that from (for each input)? Where? How often? How much does it cost? Do you pay it all up front or do you sometimes get it on credit? Do seed and fertilizer suppliers give you any advice or information when you buy inputs from them? How does that help you? Does he help you with anything else in your business?
What are the primary production zones? Which type is most produced?	What are the primary mango-producing areas within Kitui county?
Are there extension services to help farmers in the production of mangoes? What have you done to ensure quality, quantity production?	Does the local trader/government give any advice or information for your business decisions? Does s/he help you in your business in any other ways? How? Why?
How easy/ difficult is it for farmers to access these services?	When you need advice or help for your enterprise, who do you ask? What help do they provide? Why? How?
Do the mango producers know who to contact for these services?	Which office? Where? Individual/ team? Has this been communicated? How?
Processing, Value addition	
How do business relationships in the mango value chain work?	What sort of relationships exists between producer's and mango buyers? What information, advice or other support and services flow through those relationships? How? Why?
What are value chain enterprises' key business constraints?	What are the mango value chain enterprise's constraints to reaching a specific market opportunity? Which constraints do the value chain enterprises consider most severe? Which do they consider the most important to overcome?
What is the capacity of current support product / service providers(Cooperatives, associations, informal groups)	What is the ownership structure of each support product/service provider? How does the structure influence their business/institution? What is each support product/service provider's strengths and weaknesses vis-à-vis meeting the needs of the value chain enterprises?
Marketing	
What are the primary markets?	To whom do you sell your products? In what form do you sell your mangoes? Do you get paid right away or do you offer credit? Why? How has this evolved?
Market Power	How is the price determined? By international prices? By one or both of the participants
Location of the Transaction	Where does the transaction occur? Who is responsible for product transportation costs?
Type of Transaction	How is payment made? How does the transaction occur? Who is responsible for quality assessment
Product Characteristics	What are the product characteristics which are considered during purchase?
What are viable market opportunities?	Do FGD participants see a market opportunity from which they think they could earn more? If so, what? Have they tried to reach this market? If so, how and what were the results? If not, why not?

What constraints do mango enterprises face and what solutions have been tried?	What problems do the FGD participants face? How have they tried to solve these problems and what have been the results? How do culture, accepted business practices, gender roles and government regulations affect the FGD participants? For those that affect them negatively, have they tried to address them? If so, how and what were the results?
	What issues do you encounter in reaching buyers or sellers? How do you communicate with each other? What interrupts or slows down your operations? What factors lead to efficient and easy transactions? What would an efficient transaction look like?
What are viable sustainable solutions to identified constraints	What ideas do the FGD participants have for solving particular problems in the mango enterprise? What external support would be required to make those solutions happen? Which enterprises and other stakeholders would be involved?
Are mango enterprises interested in a particular solution to an identified problem	Are the FGD participants interested in a particular solution (described by the moderator) to a common constraint? If not, why not? If so, what would the participants be willing to pay or contribute?
What project support would be needed to make the solution happen?	What external support would it take to make that solution happen? What resources are available in the value chain to support the solution? What resources would need to come from outside the value chain
Expected mango Sector Trends Over the Next 2 Years	What is prediction over the next 2 years for sales volumes, primary production zones, and improvements (if any) in quality?
What mechanisms need to be put in place?	What types of mechanisms or systems would be needed for the changes to be permanent? What does each member of the value chain need to do? How will the success of the intervention be measured and information shared?
Do you think the proposed intervention (of mango powder) will be accepted and adopted by value chain enterprises? Is so, how? If not, why not?	To what extent do you think SEs and other value chain enterprises will willingly participate in the intervention? Why? What reasons do you think enterprises will give for not participating in the Action Research?
In your opinion will the intervention have the desired results (vis a vis relationships, transactions, impact on target SEs, etc.)?	Will the intervention support and/or encourage positive interaction amongst value chain enterprises? How?
What evidence is there that this intervention may / may not be scalable?	Are there other enterprises that want to be involved as a result of seeing the Action Research? How many? Is the intervention appropriate to the circumstances of a large number of targets SEs?
What are the difficulties with the intervention? Can the design be adjusted to overcome the flaws?	How can the activities be changed to increase participation, improve efficiency or generate greater impact?
What are the potential risks associated with the intervention? How can they be mitigated?	What are enterprises' concerns about participating in the Action Research? How are these concerns addressed?

ANNEX 4 **RESULTS FROM THE KEY INFORMANT GROUP DISCUSSIONS**

FOCUS GROUP DISCUSSION WORKSHOP REPORT HELD IN KITUI 2/12/14

Objectives of the key informant group discussions:

iv. To establish or validate the indicator targets earlier identified.

v. To gather data that will inform the actual situation of the project intervention areas during the commencement of project.

KEY INFORMANT DISCUSSION

TOPIC	COMMENTS	OBSERVATION AND RECOMMENDATION
PRODUCTION		
What specific functions do small producers perform?	Residents grow mangoes in their farms. The most practiced techniques are top working in Mwingi west and grafting in Kitui Central East and rural.	The most embraced technique is the top working as the farmers can have more than 3 types of mangoes in one tree and also it is cheap and any tree can be top worked.
What sort of business relationships do small producers have? What information, advice or other support and services flow through those relationships? How? Why?	Inputs: the seedlings are readily available and most of the farmers exchange freely amongst themselves. Some buy scions. Farmers do not use fertilizers in their land but manure. Though many take time to grow as others dry up	Farmers can be helped with seeds that are of quality and disease resistance.
What are the primary production zones? Which type is most produced?	Chamulia, Nzambani, Mbitini and Zombe in Kitui East rural and Cental. In Mwingi North .Kakuyu, Kise and Katse. Mwingi west: Nzeluni Ikoluni Nzauni location and Migwani.	Most mango producers are in Kitui rural East and Central and has number of farmers growing grafted mangoes. Mwingi North and West have mango farming concentrated along the river beds and most are the indigenous with few farmers now embracing the farming of the grafted ones.
Are there extension services to help farmers in the production of mangoes? What have you done to ensure quality, quantity production?	Extension officers are present but they mainly focus on the animal farming, each location has extension services accessible in radius of 6 km.	There is still a huge gap in accessibility of extension officers. Most farmers are unaware of their existence. This problem can be solved by approaching the ministry of agriculture in the county government.
How easy/ difficult is it for farmers to access these services?	Farmers access the services in the locations or in the county offices.	
Do the mango producers know who to contact for these services?	Very few farmers know about the services of extension officers.	
PROCESSING VALUE ADDITION		
What are value chain enterprises' key	Lack of training on handling of mangoes.	Most of the farmers have never been trained on effective farming

business constraints?	Competition between brokers and cooperatives. Lack of good governance structures. Poor market prices.	methods. This has contributed to their losses. Training of the mango farmers and creating market linkages will bridge the gap.
What is the capacity of current support product / service providers(Cooperatives, associations, informal groups)	The capacity of many support group is low in handling of the mangoes that are produced, there are 2 cooperatives that are operational and few NGOs that process in small scale	Capacity building can be done.
MARKETING		
What are the primary markets?	Mainly are brokers and agents.	The market is controlled by mainly the brokers who buy mangoes at such a low price. They buy the mangoes in the farm so the farmer has no opportunity of meeting different potential buyers. Increasing market accessibility will increase the value of mangoes
Market Power	Brokers and agents determine the price of the mangoes hence exploiting the farmers.	
Location of the Transaction	Transaction of mangoes takes places mainly in the farm for most of the farmers others take their products to the market.	
Type of Transaction	Brokers pay cash immediately after harvest quality.	
Product Characteristics	The brokers mainly focus on the grafted mangoes. The indigenous has no market hence they are the one that spoil most.	
What are viable market opportunities?	Selling of the pulp and target of large local market to food and juice processors like Delmonte and others. International markets for export of fruit, juice and powder.	Farmers strongly believe that their products have value but the problem is access of market.
What constraints do mango enterprises face and what solutions have been tried?	Lack of technology to preserve mangoes, lack of market, poor market prices, poor governance structures in their groups and cooperatives. Lack of information on different Diseases affection their mangoes. Lack of transport is a factor as well.	Provide training to the farmers and creating market linkages will boost the production and increase profit for the farmers. Putting in place good governance structures will as well improve the capacity of farmer group's cooperatives and CBOS.
What are viable sustainable solutions to identified constraints	Formation and strengthen of CBOs, mango farmer groups and Cooperatives .Organize modes of transport. Provide revolving/seed fund.	
Are mango enterprises interested in a particular solution to an identified problem	Elimination of the middle men and identification of market	
What project support would be needed to make the solution happen?	Formation of CBOs and cooperatives with good governance, processing plants can be set up	
Expected mango Sector Trends Over the Next 2 Years	High rate of seedling plantation and surplus mango supply.	There will be increase in mango production if this project is established and successful Hence there should be mechanism put in place to avoid wastage
What mechanisms need to be put in place?	Capacity building of the farmers, good governance structures.	Formation of cooperatives will eliminate middlemen Good governance also will improve the curb most of the obvious problems.eg mismanagement of resources.
Do you think the proposed intervention (of mango powder) will be accepted and adopted by value chain enterprises? Is so, how? If not, why not?	Yes. famers will support the project as any value addition well be to their advantage and they have suffered losses for long however the brokers will be the major competitor .who according to Phillip will come up with strategies to still control the Kitui mangoes .	
What are the difficulties with the intervention? Can the design be adjusted to overcome the flaws?	Ownership of the plant by a few i.e. if the plant is set in individuals' group land after the exit of NETFUND. High mango turnover that the machines may not be able to handle.	Agreements should be clear on the ownership and operation after exit and the type of community that will take over.

ANNEX 5 **HOUSEHOLD DATA COLLECTION QUESTIONNAIRE**

Enhancing Climate Resilience and Nutrition Uptake through the Fortification of Corn Flour with Locally produced high nutrition value Crops

BASELINE SURVEY QUESTIONNAIRE 2014

For official use:

Note for interviewer/supervisors:

Please introduce yourself and the objective of the survey properly and openly to your respondent before you start questioning. Establish a good relationship with your respondent. This survey is expected to contribute to *enhancing climate resilience and improving livelihoods of the drylands communities in Kitui County through value addition of mango products.*

- All answers to the questions in the questionnaire should be true and sincere.
- All answers to each question will be analyzed.
- All information provided by the respondent will be treated with strict confidentiality.

Instructions for filling the online data collection tool:

SECTION A: GENERAL INFORMATION ABOUT THE RESPONDENTS

Name of the Research Assistant: Name of Supervisor:

1.1. What is your age?

18 – 28 years	
29 – 39 years	
40 – 50 years	
51 and above	

1.2. What is your main occupation?

Farmer	
Trader	
Teacher	
Artisan	
Student	
Other	

1.3. If you ticked ‘other’ please explain

1.4. What is your current employment status?

Employed	
Self-employed	
Unemployed	

1.5. What is your level of education?

None	
Primary school	
Secondary school	
College	
University	
Other	

1.6. What is your main source of income?

Farming	
Business/ self-employment	
Employment	
Other	

1.7. If 'other' please explain _____

1.8. Much do you earn in a month?

1.9. How much of the money that you earn is spent on?

Item	Amount spent
Food	
School fees	
Clothing	
Hospital	
Investment or savings	
Other expenditure (in lumpsum)	

1.10. Please explain the different form of expenditures you have stated in the previous question?_____

SECTION B: PRODUCTION OF MANGO FRUIT

2.0. What variety of mangoes do you grow in your shamba?

Ngowe	Sabine
Baribo	Pafin
Batawi	Maya
Apple	Kensington
Kent	Gesine

Keitt	Nimrod
Tommy Atkins	Dodo
Van Dyke	Other (Please Specify)
Haden	
Sensation	
Sabre	

2.1. What is your reason for growing these varieties? (mark appropriately)

Disease tolerant	Big sized fruit
Sweet pulp	Good Market price
Attractive Colour	Regular bearer
Pleasant flavour	Off season bearer
	Other

2.2. What mango growing methods do you use?

Grafting

Traditional

Other (Specify) _____

2.3. What mango pre-harvest care techniques do you use?

- Spraying
- Pruning
- Other (Specify) _____

2.4. What is your main reason for growing mangoes?

- Get income
- Timber/firewood
- Landscaping
- food
- Other_____

2.5. Where do you grow your mangoes?

- Own land
- Leased land
- Government land
- Community land
- Family land
- Other (Specify) _____

2.6. What is the average size of land under farming?

Acreage	Tick
Below 1	
1-3	
3-6	
6-10	
More than 10	

2.7. What percentage of this land is under mango?

- Less than 25%
- 25%
- 50%
- 75%
- 100%

2.8. In which month(s) of the year do you harvest your mangoes?

2.9. About how many mango trees do you have on this land?

2.10. Of these how many trees are productive?

2.11. On average about how many mangoes do you harvest per season?

	2011	2012	2013
Sacks			
Debes			
Pieces			

Other (specify)			

2.12. What was your average production cost?

Item	Cost
Seedlings	
Land preparation	
Planting	
Fertilizers/pesticides	
Pruning	
Harvesting	
Other (specify)	
Total	

2.13. Have you experienced poor harvest before?

Yes ☐ No ☐

2.14. What is the reason for poor harvest? Please circle as appropriate

- Land not good
- Weather-long periods of drought
- Poor quality of seeds
- Diseases
- Poor soils
- Lack of fertilizers
- Lack of training on management
- Animals destroy
- Lack of care
- Other (specify)_____

2.15. What challenges do you experience in mango farming? (Mark appropriately)

• Limited access to good quality planting materials	
• Lack of capital to purchase inputs	

• Poor infrastructure such as irrigation etc.	
• Pest and disease problems	
• Poor orchard management	
• Postharvest losses	
• Limited returns from mango production	
• Other (Please Specify)	

2.16. Please specify the location that there is the highest concentration of mangoes?

SECTION C: STORAGE AND PRESERVATION

3.0. How soon after maturity do you harvest your mangoes?

- 1 week,
- 2 weeks,
- 1 month
- Others (Please specify)

3.1. Please give reason for your answer above

3.2. What harvesting techniques do you use?

Pick fruit by hand	
Clip them off with a long stalk	
Climbing the tree	
Shaking the tree	
Waited for mango to fall	
Other (Explain)	

3.3. Where do you store your mangoes after harvest?

• Store	
• In the house	

• Warehouse	
• Barn	
• Other (Please Specify)	

3.4. How long do you store you mangoes after harvest?

1 week	
2 weeks	
3 weeks	
Other	

3.5. What preservation techniques do you use?

Refrigeration	
Drying	
Adding of preservatives	
None	
Other (Please Specify)	

3.6. What is the average amount of mangoes that gets spoilt per season?

	2011	2012	2013
Sacks			
Debes			
Pieces			
Other (specify)			

SECTION D: MARKETING OF MANGOES

4.1 Do you sell your mangoes?

YES	
NO	

If the answer is NO please explain

_____

4.2 Who are your main buyers?

Buyer	Quantity (sold in the last season)
Agents for other local market	
Local market	
Super market	
Fruit groceries	
Agents for Export	
Other (specify)	

4.4 In what form do you sell your mangoes?

- Fruit
- Juice
- Powder
- Other (Specify)_____

4.5 How do you package your mangoes or mango products for sale?

Plastic crates	
sacks	
debes	
basket	
Cartons and boxes	
plastic bags	
Sisal Bags	
Other (please specify	

4.6 What was your average sales of mangoes and mango products in terms of sacks, debes and pieces in the following years?

SEASON	2011	2012	2013
Sacks			
Debes			
Pieces			
Other (specify)			

4.7 What was your average profit/loss for the season?

Profit/loss	2011	2012	2013

4.8 What was the reason for the losses if any?

4.9 How do you utilize the proceeds from the mango sales?

4.10 Do you keep records of the following?

a) Production cost
b) Sales
c) Other (specify)_____

SECTION E: FARMER GROUPS

5.1 Are you a member of any group/organisation that deals with production and marketing of mango fruits?

YES	
NO	

If NO why? _____

5.2 If yes, what is the name of your organisation/group?

5.3 Is the group registered?

YES	
NO	

If NO why? _____

5.4 What is the average number of members in your group?

5.5 On average how many women and men are in the group?

MALE	
FEMALE	

5.6 How does your group help you in the production and marketing of mangoes?

- Soft loans
- Seedlings
- Trainings on mango growing
- Pesticides and fungicides
- Labour
- Other (Specify)_____

5.7 What are some of the challenges that your group faces?

governance	
technical	
corruption	
knowledge	
capacity	

5.8 Do you know of any other groups involved in mango production and marketing?

Name	location/ contact

5.9 If yes (Please give name location and contact.)

5.10 Are you aware of any other players clarify

Yes ☐ No ☐

5.11 If yes please give details of their name location and contact

e.g. (private companies, farmers, brokers) involved in the production and marketing of mangoes (apart from the groups mentioned above)

Name	(location/ contact)

SECTION F: MANGO PROCESSING TECHNOLOGIES

6.1 Do you process your mangoes?

YES	
NO	

6.2 How do you process your mangoes?

PROCESS	METHOD
Peeling	Manual/ machinery/ none
Pulping	
Drying	
Milling	
Powdering	
Branding	
Packaging	
Other (specify)	

6.3 Do you use any technologies to add value to your mangoes?

YES	
NO	

6.4 Please tick the processing products that you use technology

Mango product	Technology used
Juice	
Powder	
Leather	
Jam	
Other (specify)	

6.5 please explain technology used to do what you have ticked in the previous question?

6.6 Are you aware of any other technology for adding value to the mango fruit in your area?

YES	
NO	

6.7 If yes, (specify)

Mango product	Technology used
Juice	
Powder	
Leather	
Jam	
Other (specify)	

6.8 Would you support establishment of a mango processing unit in your area?

YES	
NO	

If NO please explain_____

_

6.9 Where would you recommend that such a plant be set up?

Location	Tick	Name	Location
Renowned mango farmer			

Chief's place			
Church			
Local NGO (Give name)			
Community land			
Other (specify)			

SECTION G: CAPACITY OF RESPONDENT

7.1 Have you ever been trained on the following? Please circle as appropriate.

TRAINING (tick as appropriate)	SPECIFY	BY WHOM
Production of mango		
Harvesting		
Post-harvest handling		
Processing		
Value addition		
Nutritional value of mango		
Marketing		
Financial management		
Leadership		
Record keeping		
Other (specify)		

SECTION F

8.1 Any other information you might to share?

GPS points/coordinates: _____

Respondents Signature: _____

Name of Supervisor_____

Date: _____

ANNEX 6 **IDENTIFICATION OF WOMEN MANGO FARMER GROUPS**

NATIONAL ENVIRONMENT TRUST FUND

Geomaps Centre, Matumbato Road, Upperhill

P.O. Box 19324

Nairobi Kenya

Nairobi Kenya 020 236 9563/4

PRELIMINARY FIELD SURVEY REPORT TO IDENTIFY FARMER GROUPS FOR THE IGAD PROJECT IN KITUI COUNTY

PROJECT NAME: ***Enhancing Climate Resilience and Nutrition Uptake through the Fortification of Corn Flour with Locally produced high nutrition value Crops***

1.0. INTRODUCTION

This report is based on field survey that was carried out in various Kitui sub counties with the objective of familiarizing with the project intervention area and identifying various mango farmer groups, community based organizations and individuals involved in the mango value chain exploitation.

Most farmer groups in Kitui county work under different organizations in the community. Below are the briefs of these organizations that bring mango farmer groups together and train them on income generating activities.

1.1. BRIEF PROFILE OF KITUI DEVELOPMENT CENTER (KDC)

Kitui Development Center (KDC) was registered in December 32001 as a local Non- Profit making organization under the NGO coordination act of 1990 to work in Kitui district. Kitui Development Centre (KDC) is a capacity-building organization involved in rural development activities geared towards poverty reduction in eastern Kenya. It plays a significant role in the socio-economic development since its services target and benefits the poor in vulnerable communities. It helps the community to help themselves and is involved in rural development activities which are geared towards poverty reduction in the district. The organization plays a significant role in the socio-economic development of the project area since its services targets and benefits the poor and vulnerable communities.

VISION

To see a self-reliant, determined community with organized and sustainable institutions that are able to negotiate, mobilize local and external resources and utilize them effectively for improved livelihoods.

MISSION:

To bring together the marginalized to analyze and share experiences in order to find environmentally friendly solution to the problems, mobilize and utilize resources for improved living standards without discrimination.

GOAL:

To improve standards of living through reduction of hunger, diseases and poverty by utilizing appropriate knowledge, skills and abilities among communities in Kenya.

KEY OBJECTIVES:

vi. To facilitate communities to come up with viable social structures which promote sustainable community development.

vii. To strengthen the capacity of rural communities in Kenya to meet their basic needs.

viii. To promote good governance and peace building in Kenya

KDC PROJECTS

KDC has several projects that are running concurrently. The center initiates projects that are self-sustaining and it uses participatory methodology to identify the pressing needs, develop a home grown practical solution, and identify existing opportunities. The ideas that emerge at the community are translated into projects:

i. Kithambangii water project: This is Under the Orphans and Vulnerable Children project, KDC in collaboration of the Wikililye community drilled one borehole, 10 subsurface dams within a radius of 8 km with 8 water distribution kiosks. The project also distributes water to 43 households within the Wikililye sub location.

ii. Seed bulking: the project aims at improving the wealth and food security among small holder farmers through small holder production.

iii. Mango value chain addition project: the project aims at improving the livelihoods of small scale women farmers through mango value chain addition through juice extraction. The objective is to increase mango production through utilizing appropriate technologies, knowledge and skills

iv. Poultry project: the objective of this project is to increase poultry production and productivity by adopting commercially focused management techniques and community organization.

v. Child labor: the project implements an integrated program which seeks to address the root cause of child labor.

vi. Drought mitigation: this project aims at addressing food security while reducing high prices by local traders within Self Help Group promotion sites.

MANGO FARMER GROUPS SUPPORTED KDC.

NO.	NAME OF THE GROUP IN KAMALE AREA	MEMBERSHIP	CONTACT PERSON	PHONE NUMBER
1	TEI	21	TINA KASYIMA	0716503618
2	ITAMBYA	21		
3	MUIKIO	21		
4	MUMO	21		
5	MWIKI	21		
6	UTHASYO	21		
7	WINYIVYO	21		
8	KAMUTANDA	21		

NO.	NAME OF THE GROUP IN KYANIKA AREA	MEMBERSHIP	CONTACT PERSON	PHONE NUMBER
1	UMIISYO	23	PENINAH MWANGANGI	0722251829
2	SEMBASEMBA	23		
3	NEW GENERATION	21		
4	MATITHINI	21		
5	KYENI	24		
6	KATETHYA	21		
7	KYANIKA ADULT	24		
8	BE E KEEPING	20		
NO.	NAME OF THE GROUP IN NGENGI AREA	MEMBERSHIP	CONTACT PERSON	PHONE NUMBER
1	NGENGI FARMERS	20	REGINAH MITAO	0711942381
2	MUMBUNI	25	MUSANGI	0728343864
3	UKILYO	25	KATHINI MASAMBA	0713380560

NO.	NAME OF THE GROUP IN WIKILILYE AREA	MEMBERSHIP	CONTACT PERSON	PHONE NUMBER
1.	NGENDA KILUKUYA	21	ELIUD KIMATIA	0726440436
2.	WIKILILYE SHG	21	MWIKALI MUMO	0724498573
3.	KATHUKINI A	20	MWIKALI MUMO	0724498573
4.	MEKO MUSYAO	21	MWIKALI MUMO	0724498573
5.	MUMO WIKILILYE	20	MWIKALI MUMO	0724498573
6.	WAEMWA TIWA	23	PAUL NZIOKI	0722964296

7.	YOANI	21	MWIKALI MUMO	0724498573
8.	UMIISYO WA AKA	20	LUCIA MAKAU	0720984311
9.	KATEIKO	25	PATRICIA MUENI	0714757995
10.	SYAISYA WONE	23	MWIKALI MUMO	0724498573
11.	KANINI KASEO	24	RUTH MAILU	0724019794
12.	MULANGO	20	ALICE MUSYOKA	0720743026
13.	KITHAMBANGII	21	MWIKALI MUMO	0724498573
14.	KA MUSYI B	20	MWIKALI MUMO	0724498573
15.	NENGYA	23	MUSEE KIMANZI	0716015526
16.	MUUNGANO	22	MWIKALI MUMO	0724498573
17.	MUTETHYA	21	NGINA KIMANZI	0721539019
18.	WIKWATYO	22	KASYOKA MALOMBE	0707220564
19.	KIKWATU	21	KATINDI MUSYOKA	0717041391
20.	WUUMISYE WOMEN GROUP	23	MWIKALI MUMO	0724498573
21.	UTHASYO	24	MWIKALI MUMO	0724498573
22.	WIKILILYE MARKET	25	MWIKALI MUMO	0729655772
23.	YUMBISYE	21	ROSE TITUS	0711914779
24.	KATILIKU	21	MWIKALI MUMO	0724498573

TOTAL FARMERS = 826

NB.

Groups from Kamale are informal and coordinated by the community facilitator Tinah Kasima

Groups from Kyanika network are coordinated by Penninah Mwangangi

Most groups at Wikililye are coordinated by Mwikali Mumo their community facilitator. The other groups are coordinated by their chairpersons

2.0. BRIEF PROFILE OF RISE KENYA

Regional Institute for Social Enterprise (RISE-Kenya) is a local NGO duly registered with the National NGO Coordination Board. It is located at Bazaar Market, in Migwani, Migwani District of Kitui County, about 190 km from Nairobi, and 20 km to the south of Mwingi town. Operating within Kitui County, the NGO works with existing community structures of 25 CBOs bringing together 100 SHGs, and a cumulative membership of 12,412 of which, 85% are women/Youth.

To achieve their vision and mission, RISE collaborates with other networks (locally and internationally), development actors, institutions, GOK line ministries to integrate social enterprise components in all the community projects for sustainable development as well as

mainstreaming HIV/AIDS , gender ,environment and people with disability on all thematic areas.

RISE-Kenya funds its initiatives/programs through fundraising from donors, community contributions, well-wishers and through incomes from social enterprise initiatives

Overall Goal: To work grassroots communities in Kitui County in particular and other parts of the Country in general, in developing their capacity so as to enable them to sustainably fight their own poverty, famine, HIV/AIDs, environmental degradation, climate change and low standards of education through public advocacy, applied training Social business models.

Vision: A Socially and Economically Empowered Community.

Mission: To assist local communities develop their capacity, to be able to sustainably fight their own poverty, famine, HIV/AIDs, low school transition and effects of climate change, through new and innovative social enterprise development models, impact entrepreneurship, Knowledge diffusion and legal skills .

Main objectives

i. Social Enterprise Development and Training: Skills (knowledge) diffusion and training to communities on Sustainable Social Enterprise Development, through Community Based Organizations (CBOs) Self Help Groups
ii. Environmental Conservation and Mitigation against Climate Change.
iii. Community Educations, Health and Knowledge Diffusion

Rise-Kenya has various programs ranging from:

i. Juice processing from Mangoes,
ii. Social enterprise activities (Weaving, aloe Vera processing, leather work, Poultry climate change
iii. Knowledge diffusion /capacity building
iv. HIV/ AIDS
v. Human rights awareness and campaign
vi. Key Thematic Areas the Rise Kenya should focus on during the selected Strategic Plan Period.

RISE STRATEGIC PLAN

To achieve the objectives, current vision and mission as well as a very in-depth situational analysis, rise plans to focus on the following areas.

i. Enhance Grassroots Community Mobilization, Organization and Capacity Development through Social Business, Applied Training and Knowledge Diffusion:
    - Work with established CBOs, SHGs and other organized Community Development actors to identify potential ToTs, and CRPs for further capacity development.
    - Scale up the capacity development operations of the organization to other Counties in the Country.
ii. Climate Change and Poverty Reduction Focused Projects and Programmes.

- Initiate, support and profile all the existing social enterprise initiatives, while expanding the same to new areas.
- Make applied learning in climate change and poverty an integral part on the organizations, on-going initiatives.

iii. Economic, Environmental and Social Rights:

- Scale up lobbying and advocacy initiatives as they relate to economic, environmental and social rights on mining extractives (coal, limestone, iron ore and any other minerals found=d in the County.
- Enhance capacity development / knowledge diffusion to grassroots community leaders and duty bearers on issues relating to mining extractives in Kitui County.

iv. 4 Youth and Women Empowerment:

- Enhance support and profiling of research and development (R&D) initiatives, mainly focusing on youth and women empowerment.
- Enhance knowledge diffusion/ indigenous knowledge (in aloe Vera and sisal weaving) particularly amongst the semi-literate youth and women.
- Enhance Value Chain mapping, analysis and support in all youth and women led initiatives with the highest potential for commercialization.

v. Partnerships, Networks and Collaborations:

- Continuously enhance all the current networks, partnerships and collaborations.
- Initiate, support and profile an applied skills enhancement training programme for grassroots community leaders.

FARMER GROUPS

No.	Group name	Members	Contact person.	Contact number	location
1.	Mepa	52	Anita Kiara	0725979526	Nzauni
2.	Kaiveti	53	Musyoka	0729927826	
3.	Itoloni Mbunga	56	Phillip Mbuvi	0711836831	Itoloni
4.	Musyi wa syana	48	Muinde	0716611386	

3.0. FARM AFRICA

Farm Africa was established in response to the famine in Ethiopia In 1985 by Sir Michael Wood and David Campbell, who shared a vision of a prosperous rural Africa.

In 1987, Farm Africa started work with nomadic pastoralists in the remote north of Kenya, expanding to Ethiopia a year later. Farm Africa believes that Africa has the power to feed itself and that its smallholders hold the key to lasting rural prosperity. They work directly with farmers to help them unleash their potential to feed Africa's people.

Eighty per cent of rural African people depend on small family plots for their livelihood. Most farmers have less than one hectare of land and struggle to grow enough food to survive. Farm Africa brings in simple but effective technologies, such as:

i. small-scale irrigation schemes
ii. seeds for drought-tolerant crops
iii. Disease-resistant native crops.

Farm Africa prove that good farming, backed by strong marketing of produce, is a lasting way out of poverty for millions of rural Africans.
In programs around eastern Africa, smallholders are helped to:

i. adapt to the changing climate
ii. practice sustainable agriculture
iii. Manage natural resources effectively.
iv. Mango Farming project.
v. Farm Africa pioneer techniques that boost harvests, reduce poverty, sustain natural resources and help end Africa's need for aid.

Kitui in eastern Kenya is more densely populated with mango trees than anywhere else in the country. But farmers have found it difficult to make a profit from the local mangoes, which are small and poor quality.

The trees fruit at the same time of year, leaving farmers with little option but to sell all their mangoes at market at the same time, resulting in lower prices and wastage – with many unsold mangoes left to rot.

Funded by innovative *Maendeleo* Agricultural Enterprise Fund, this project is working with 800 hard-working women farmers by:

i. providing better-quality mango stocks that ripen and fruit at different times of year
ii. encouraging farmers to form associations so they can sell collectively and receive higher prices at market
iii. investing in a mango juice plant
iv. Establishing links with fruit-processing companies.

Farm Africa ambition is that by the end of the project the women farmers will be earning enough to afford medical care and school costs, and build savings so they can invest in their families' long-term futures.

Other activities include

i. Climate-resilient farming
ii. Connecting barley farmers with business
iii. Connecting cassava farmers with business
iv. Farming opportunities for young people
v. Maize farming
vi. Cassava farming
vii. Passion fruit production and marketing
viii. Pineapple farming
ix. Rural women's economic empowerment

FARMER GROUPS

	LOCATION	NAME OF FARMER GROUP	CONTACT PERSON	PHONE NO.	COMMENTS
KITUI	TUNGUTU	WIKWATYO	ANN KASILIA	0711893899	
		KATITIKA	HELLEN BERNARD	0723494614	
		KYAMWANGEI	MARY SAFARI	0721930514	
	KYANGWITHYA	KITUI HORTICULTURAL	GEORGE NZOU	0722689618	Covers large area of Kitui Central District
		KAVETA FFS	KIEMA NDOLO	0720425536	
	MATINYANI	KITUI ORCHARD	J M MUMO	0721311091	Covers large area of Matinyani District
	NZANGWA	KABUKWA			
	NZANGWA	MAZINGIRA	HELLEN	0723494614	

4.0. CHULUNI HORTICULTURAL ENTERPRISE

ChulunI Horticultural Enterprise was established in 2009 and is the fastest growing producer of fruits juice and Jam that are free from synthetic process; it is an organization that has over the last four years embraced the need to improve value of horticultural fruits through processing and preservation. The project is tailored to improve livelihoods through food security, better health, environment poverty alleviation wealth creation and lastly, provide information on the trends in horticultural trade.

Mission.

x. To be a dependable version for motivating growth of commercially oriented horticultural farming based on value addition.

xi. Transform pre- harvest to opportunities through value chain

The projects social mission is based on development and empowerment of both members and farmers through entrepreneurship.

Objectives.

xii. 1. To create employment opportunities and realize our general vision based on positive change to the community through trans-formation of traditional agriculture to commercial agriculture.

xiii. 2. Provide opportunity for safe consumption of mangoes all the year round.

xiv. 3. Transform pre harvest challenges to opportunities.

xv. 4. To shape future of fruits and create value for society help farmers achieve food security, economic well-being and development.

PROJECT POTENTIAL

xvi. Create employment opportunities for people in rural areas in order to reduce exodus of young people (youth) to major towns and cities.

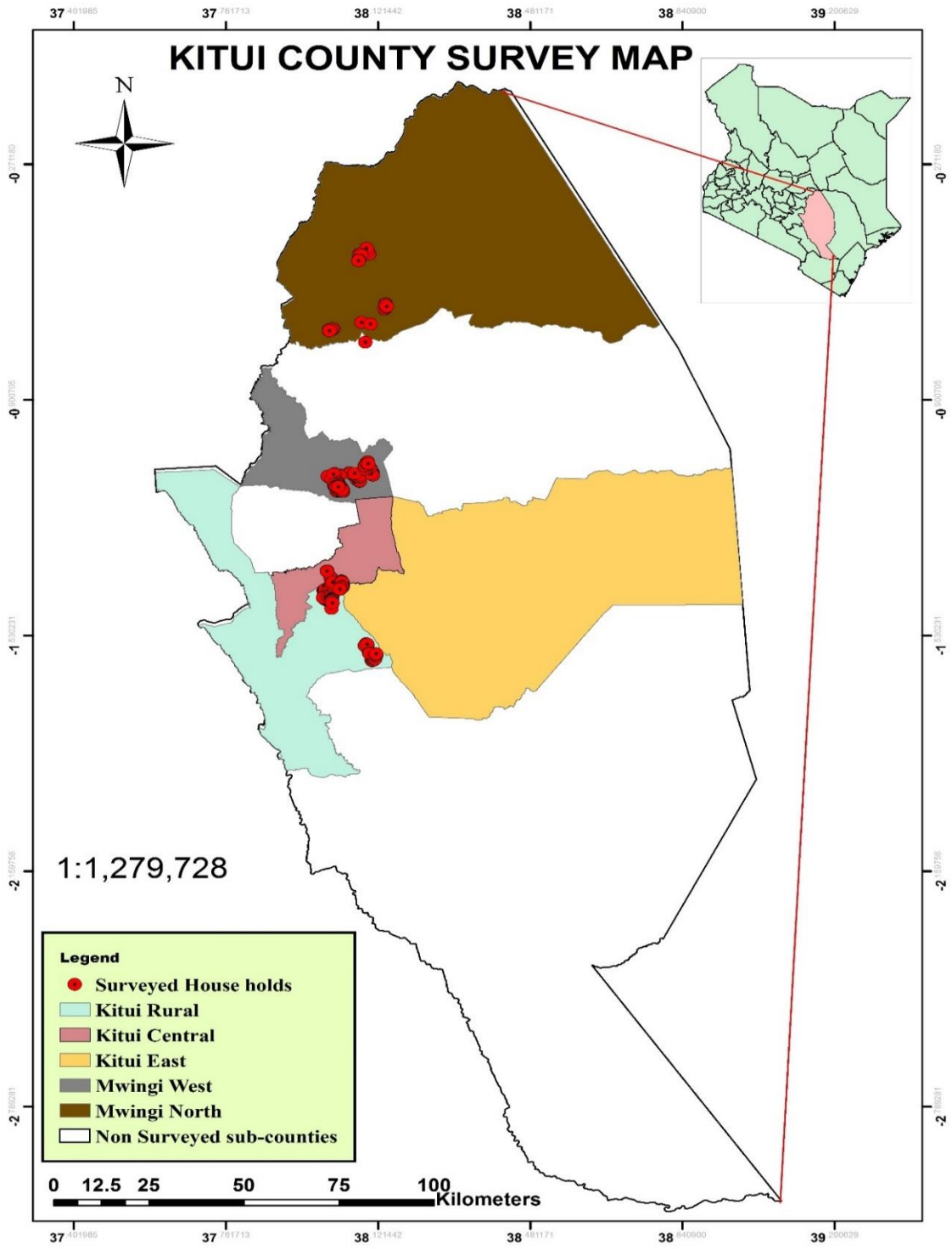
xvii. Reduce levels of malnutrition through improved foodstuff.

xviii. Contribute to the county, government’s efforts to foster industrial development through integration of Jua kali sector in the county's economic manifold and enterprise development Sustainable market for horticultural products.

xix. To create a unique process of turning fruits to a product that can serve the health needs of the community and further the knowledge of those dedicated to caring.

xx. Sustainable market for horticultural products.

ANNEX 7 **PROJECT BASELINE SURVEY MAP**



ANNEX 8 **LIST OF PARTICIPANTS FOR THE KEY INFORMANTS DISCUSSIONS**

NETFUND

Leading the way to a greener future

FOCUS GROUP DISCUSION ATTENDANCE LIST

SNO	NAME	ORGANISATION	ID NO.	CONTACT	SIGNATURE
1	BENEDICT SIMBA	MIN. OF INDUSTRIALIZATION	1631102	0720311530	
2.	HOPE SILA	Min. Trade, Industry Int & Co-op	29678942	0716480060	
3.	PHILOMENAH MUKATA	ZOMBE WOMEN M.C.S.L	0273439	0727563761	
4	RUTH SAMUEL	MUKY-ORDAP NGO	3197581	0724930174	
5. 4.	EVELYN M. MUTIO	FARMER – KITHAMA MUTHAVI	16015674	0722823814	
6. 5	PHILIP MWANGANGI	RISE KENYA	10074442	0716705915	
7. 6.	Shivo Edwin	Green Africa Foundation	24115158	0725604065	
8. 7	ELIAS K. WAKI	KITUI COUNTY MULTI PROCESSORS	13098601	0721485615	
9. 8	NELSON K. MUSYOKA	COUNTY MINISTRY TOL & KI	0272387	0722649179	
10. 9	Chelsi Andrew	NETFUND	24821306 / 0259131327	0728231771	
11. 10	Stella Karwitha	NETFUND	27535253	0729625749	
12. 11	ERIC MUGAMBI	NETFUND	21938485	0724918689	
13. 12	Francis Kea	County Govt - Kitui	7867268	0720703462	
14. 13	Robert Ngiga	County Min. of Trade, Industry & Co-op	10265556	0722389220	
15. 14	Chrisline Onandi	NETFUND	22850458	0721993204	
16	Joseph Mutunga	C.H.F.D.	0012507	0727348245	
17	Janet S. Mumo	K.D.C	3326017	0722229238	
18	Sweeny Ogeto	NETFUND	23870557	0721269970	

ANNEX 9 **OPEN TENDER ADVERTISEMENT FOR PILOT PLANT EQUIPMENT**

NETFUND

TENDER NOTICE

The National Environment Trust Fund (NETFUND) invites interested and eligible suppliers to tender for the following:-

TENDER REFERENCE	TENDER DESCRIPTION	ELIGIBILITY
NETFUND/T/03/2014/2015	Supply and delivery of hammer mills	Open to all registered bidders
NETFUND/T/04/2014/2015	Supply and delivery of disk mills	Open to all registered bidders
NETFUND/T/05/2014/2015	Supply and delivery of ribbon mixers	Open to all registered bidders
NETFUND/T/06/2014/2015	Supply and delivery of packing troughs	Youth, women and persons with disability
NETFUND/T/07/2014/2015	Supply and delivery of grading racks	Youth, women and persons with disability
NETFUND/T/08/2014/2015	Supply and delivery of washing troughs	Youth, women and persons with disability
NETFUND/T/09/2014/2015	Supply and delivery of plastic crates	Youth, women and persons with disability
NETFUND/T/10/2014/2015	Supply and delivery of peeling table with overhead shelf and under shelf	Youth, women and persons with disability
NETFUND/T/11/2014/2015	Supply and delivery of electronic weighing scale	Open to all registered bidders
NETFUND/T/12/2014/2015	Supply and delivery of sealer machines	Open to all registered bidders
NETFUND/T/13/2014/2015	Supply and delivery of portable platform scale	Open to all registered bidders

The tender documents with further detailed information may be obtained from NETFUND offices; Procurement Office, Located at Geomap Center 7th floor Upper Hill, Matumbato road Nairobi, during normal working hours upon payment of a non-refundable fee of **Kenya shilling one thousand only (Kshs. 1,000)** per set per tender category in cash.

Completed tender documents are to be enclosed in plain sealed envelopes, marked with tender number and name and deposited in the Tender Box at NETFUND office reception area addressed to:

The Chief Executive Officer
National Environment Trust Fund
PO. Box 19324-00202
Nairobi

so as to be received on or before **22nd January, 2015** at **12.00 noon.**

Tenders will be opened immediately thereafter in the presence of the candidates representatives who choose to attend at NETFUND Wing B small conference room at 12.00 noon.

Chief Executive Officer
NETFUND

NETFUND

NATIONAL ENVIRONMENT TRUST FUND (NETFUND)

OPEN NATIONAL TENDER

TENDER REF. NO:	**NETFUND/T/01/2014/2015**
TENDER NAME:	**SUPPLY, INSTALLATION AND COMMISSIONING OF MANGO FRUIT DRIERS**
TENDER REF. NO:	**NETFUND/T/02/2014/2015**
TENDER NAME:	**SUPPLY, INSTALLATION AND COMMISSIONING OF SOLAR AIR DRIERS**

The National Environment Trust Fund (NETFUND) invite sealed tenders from eligible candidates for supply, installation and commissioning of mango fruit driers and solar air driers in Kitui County

A complete set of tender documents will be obtained by interested candidates at NETFUND offices; Procurement Office, Located at Geomap Center 7th floor Upper Hill, Matumbato road Nairobi, during normal working hours upon payment of a non-refundable fee of Kenya shilling one thousand only (Ksh 1,000) in cash.

Bidders are advised that evaluation will be done as per requirements in the tender documents. Failure to comply with the tender requirements will lead to automatic disqualification.

Completed tender documents are to be enclosed in plain sealed envelopes, marked with tender number and name and deposited in the Tender Box at NETFUND office reception area addressed to

The Chief Executive Officer
National Environment Trust Fund
P O Box 19324-00202
Nairobi

so as to be received on or before **22nd January 2015 at 11.00 AM**

Tenders will be opened immediately thereafter in the presence of the candidates representatives who choose to attend at NETFUND Wing B small conference room at 11.00 AM

Chief Executive Officer
NETFUND

ANNEX 10 **INCEPTION WORKSHOP REPORT**

INTRODUCTION

The Projects manager from National Environment Trust Fund (NETFUND), opened the workshop and welcomed the implementing partners to the project inception meeting. NETFUND has partnered with Green Africa Foundation (GAF), Kitui Development Centre (KDC), Rise Kenya and MUKI ORDAP to implement the 'Enhancing Climate Resilience and Nutrition Uptake through the Fortification of Corn Flour with Locally produced high nutrition value Crops 'project. The project is funded by the Intergovernmental Authority on Development (IGAD).

The participants were invited to introduce themselves and the organizations that they represent. List of participants is as attached Annexed 1.1 below

PURPOSE OF INCEPTION WORKSHOP

The purpose of the inception workshop was to familiarize the partners with each other, their roles in the implementation of the project, their deliverables and the Partner's Agreement Documents.

The agenda for the meeting was tabled as; overview of the project goals, specific objectives, outputs and expected outcomes, Project Agreement Document, Project Monitoring and implementation framework and selection criteria for plant operations and maintenance team. Each item was explained in more detail under each respective agenda item.

EXPECTED DELIVERABLES

The projects Manager highlighted the expected deliverables for the inception meeting as;

Partners understanding of the overall description of the project

Change in the project implementation structure including setting up the processing plant first in Kitui Development Centre (KDC)

Discussion of project activities in the work plan

Selection criteria for operations and maintenance team

Partner requirements before installation

Project implementation strategy and time lines for activities

Partner roles and responsibilities in the implementation of the project.

PARTNER' ROLES AND RESPONSIBILITIES

National Environment Trust Fund (NETFUND)

NETFUND will be responsible for:

Procurement and installation of the mango drying and powdering line equipment

Training of a plant operations and maintenance team -

Overall oversight and management of all the activities

Monitoring and evaluation of all project activities.

Maintenance of the mango powdering line equipment until the project handover time.

NETFUND shall facilitate the purchase, sales and marketing of the mango and the final mango products through the Green Africa Foundation who are the project implementing partner.

Implementing partners (KDC, Muky and RISE)

The implementing partners shall be responsible for:

Holding the mango processing plant in trust for the community

Provide the necessary amenities and facilities for the installation of the mango powdering equipment.

Provide storage space for the raw materials and or finished products and any other project item.

Oversee proper handling and maintenance of all equipment and materials affiliated to the project.

Mobilize and coordinate the mango farmer groups registered under their care as the sole suppliers of the raw mangoes and maize to the plant.

Ensure quality control in the whole production line.

Assist in the identification of individuals from the community as per the set criteria to be trained as the plant operations and maintenance team.

Oversee operations and maintenance of the plant as well.

Provide monthly operational costs as well as production and financial reports accompanied by the necessary receipts.

Oversee the purchase, sales, marketing and product promotion of the final products.

Shall open a dedicated project bank account where all the project proceeds will be banked and payments made from.

PROJECT MANAGEMENT

Advisory Committee

To ensure proper management of the project, the participants discussed and agreed that an advisory committee be constituted as follows;

2 representatives (1 from NETFUND and 1 from Green Africa Foundation)

2 representatives from the community (as per set selection criteria)

1 representative from implementing partners (KDC,MUKY,RISE)

1 Representative from Kitui County Executive Committee (Ministry to delegate representative at local level (sub-counties)

Project administration costs

Participants wanted a clarification from NETFUND on whether the budget has project administration allocation. However, it was noted that the only cost that has been factored in is the contingency cost. Implementing partners will cover the administration costs.

Timesheets

With respect to monitoring and evaluation of the project, it was agreed that NETFUND shares with the implementing partners the timesheets templates for project implementation staff.

Bank Account opening

The Projects manager advised the implementing partners to open new bank accounts specifically for the IGAD project. This will enhance credibility in financial processes.

TORS for Green Africa Foundation

Other implementing partners felt that the role of Green Africa Foundation was not clear in the Agreement document and therefore requested that NETFUND shares with them the Terms of Reference for Green Africa Foundation.

NETFUND was also requested to share the schematic diagrams of the mango processing equipment to enable them develop their facilities adequately.

Certifications;

Participants identified and discussed some of the certifications that are necessary for the implementation of the project. These certifications include; NEMA, KEBS, TRADE, HEALTH, HALAL.

TECHNICAL AND FINANCIAL REPORTING

The M & E Assistant took participants through the technical and financial reporting templates. The following items was discussed in detail by the participants,

Introduction (brief description of the project objectives and planned activities)

Project outputs (Achievements and impacts, number of stakeholders, number of women whose livelihoods have been impacted)

Challenges (Internal and external challenges that might impede project implementation

Financial reports (Documentation; receipts, payment vouchers and invoices)

SELECTION CRITERIA FOR OPERATIONS AND MAINTENANCE TEAM

Participants discussed the need to develop selection criteria for operations and maintenance team as such the following terms of reference were agreed upon:

6 persons (2 plant operators per plant); 3 technical support staff- (payments of these operations and maintenance team should be based on % of time worked)

Experience in machine operations

Diploma in analytical chemistry/ food technologist and allied course/ food science

1 year experience in food handling

SELECTION CRITERIA FOR COMMUNITY MEMBERS

The participant's discussed on the criteria for selecting the 2 community members to be involved in the project management and the following was agreed;

Must be a mango farmer

Must be a mango Supplier (to the plant)

Must be an active group member

PARTNER'S CONTRIBUTION IN THE PROJECT

Processing facility (implementing partners)

Security –co-shared role (insurance for equipment and personnel- NETFUND and physical security-implementing partners)

Utilities -Water and Electricity (implementing partners)

WAY FORWARD

The participants all agreed on the following timelines

Share draft agreement for consensus by 15th, June, 2015

Signing of the agreement by NETFUND by 17th June, 2015

Signing of the agreement by partners by 19June, 2015

Bank a/c opening by partners to be confirmed by 23rd June 2015

Installation- from 22nd -27th June 2015

Seconding of Operations and Maintenance personnel 24th June, 2015

Operations and Maintenance training 29th & 30th June 2015

CLOSURE OF THE MEETING

After satisfactory deliberations, the meeting ended at 5.00 p.m.

ANNEX 10.1 List of Participants

NETFUND

IGAD PROJECT INCEPTION MEETING HELD IN KITUI ON 12TH JUNE 2015

Attendance Sign in Sheet

No.	NAME	ORGANIZATION	PHONE No.	EMAIL	SIGNATURE
1	WARUGURU MBUTHIA	NETFUND	0721 943192	wmbuthia@netfund.go.ke	[illegible]
2	SHARON MUHIA [illegible]	KDC	0722266308	kidc@nbnet.co.ke	[illegible]
3	Christine Ombedi [illegible]	NETfund	0721 993204	combedi@netfund.go.ke [illegible]	[illegible]
4	Chisti [illegible] Andrew	NETFUND	0728231271 [illegible]	[illegible]@netfund.go.ke	[illegible]
5	RUTH SAMUEL	MUKY-ORDAP	0724930174	ruthsamuel206@gmail.com	[illegible]
6	MBONDO FREDRICK	Green Africa Foundation	0712267806	mbondo@greenafricafoundation.org	[illegible]
7	Naomi K Muthengi	MUKY	0729728854		[illegible]
8	AGGLINAH M KITAVI	RISE-KENYA	0725558013	[illegible]@Gmail	[illegible]
9	Philip Mwangasi [illegible]	RISE KENYA	0716705915	philipm@risekenya	[illegible]
10	DAVID K. MUTHOKA	KDC CHAIRMAN	0733761232	kidc@nbnet.co.ke	[illegible]
11	Janet Mumo	KDC-P.Coordinator	0722229238 [illegible]	janetsyombua@gmail.com	[illegible]
12	MICHAEL MUSEMBI	NETFUND	0722399875	Musembi@netfund.go.ke	[illegible]
13					
14					
15					
16					
17					
18					

ANNEX 11 **REPORT ON INSTALLATION AND LAUNCH OF PILOT PLANTS**

Kitui Development Centre (KDC) is a local Non-Governmental Organization registered in Kenya under the NGO Coordination Act of 1990 in 2001 to work in the former Eastern Province and located in Kitui County. Kitui Development Centre registered Kitui Enterprise Promotion Company (KEP) Company as a business enterprise entity under the companies Act to carry out the business aspect of the organization. In this regard, KDC was launching KEP to carry business of manufacturing of non-alcoholic beverages of all descriptions.

Women in Kitui County are most often the managers of local on-ground natural resources as their income is highly dependent on these resources especially through farming and small scale business. Agriculture is the main economic activity in Kitui and with its arid and semi-arid ecological zones, climate impacts are threatening the viability of small-scale farmers and agro-pastoralists, the majority of whom are women.

This initiative aimed at piloting a new approach to mango value addition by drying the mangoes and converting it to mango powder. This means that worries about spoilages will be avoided completely as the mango powder can be preserved and used over a long period of time. The powder is rich in iron, vitamin A and E and helps combat acidity and improves digestion. The advantage of mango powder is that it can be used in many different ways including direct consumption. The powder can be mixed with other kinds of flour. In this sense it contributes to reinforcing food security in the arid and semi-arid lands and enhancing the nutrition value of the local staple food, which is mainly based on corn flour.

The project anchored on community participation and capacity building. The community, particularly mango farmer groups are involved in the project implementation throughout the project duration and this helps create a sense of ownership of the initiative. The capacities of

the women who form a major percentage of the mango farmers are also enhanced to enable them to progress the project even after the funding period.

NETFUND was invited as it is one of the project implementing partners from an IGAD funded mango powder processing project perspective. The pilot project aimed at improving income and alleviating poverty among households in Kitui by adding value to the mango fruit. The launch was a social marketing day where the participants including women groups from Kitui County had time to taste the products and give comments before the products are launched into the market. The Kitui community had also an opportunity to meet the partners of the project who included:

Farm Africa

ACT

NETFUND

Representatives from the Project Partners introducing themselves during a function at KDC

The Mango processing plant was officially opened by the Governor of Kitui County Dr. Julius Malombe on 30th November, 2015.

Governor of Kitui County Dr Julius Malombe cutting the ribbon to open the KDC plant

HE Dr Julius Malombe signing the guest book

The Chief Executive Officer of Kitui Development Centre Ms. Janet Mumo took the Governor and his delegation through the plant explaining the various sections of the plant. She introduced the various engineers and staff that run the plant. She noted that through NETFUND, they were able to set up a whole wing of the plant to facilitate the production of mango powder.

HE Dr Julius Malombe inspecting the KDC plant equipment

The Chief Executive Officer of KDC Janet Mumo introduced some beneficiaries of the project who had testimonies of how the project had improved their livelihoods and also reduced the impacts of post-harvest loss. One of the beneficiaries noted that due to the plant, she was able to get an income of Kes. 45,000 and this was able to sustain the farm and herself until the next harvest season.

Beneficiaries of the project

The event was also graced by the Minister of Industrialization James Mwinzi, Kitui County who had shown full support for the project and emphasized on how the project was important in the socio-economic development of Kitui County. He emphasized on the need to do a market analysis and open up the county to the outside market.

He noted that with sufficient marketing and branding, the products would be able to reach greater heights. He also said that the enterprise should now also look into infiltrating the

local markets through the supermarkets and other retail stores. In doing this, he noted the need to introduce barcodes to the products thus making them competitive in the markets.

The CEO also noted the presence of the other two projects identified in Kitui County namely; Migwani and Chuso and how they are in the process of setting up the plants. The representatives from the other projects noted the milestones that KDC had achieved through the partnerships created and were enthusiastic that through these, they would also be able to open up their areas and promote poverty alleviation. The representatives specifically noted the full involvement of NETFUND in the setting up of the projects by provision of the machinery for the powder production process.

The NETFUND representative addressed the launch and expressed NETFUND's appreciation in the KDC launch and noted the achievements in terms of the mango powder technology introduced and disseminated to the farmers' groups, capacity building of women groups on mango powder processing and marketing, the awareness on mango powder products and nutritional value created in Kitui County and lastly the improved value chain management for mango fruits that KDC has created.

NETFUND representative addressing the KDC Launch participants

He reiterated that the current ongoing projects in Kitui County identified are progressing with the infrastructural development and installation of the plants' equipment will be undertaken on the 16th November, 2015. He noted the widespread community support in the projects and the sense of ownership.

The CEO of KDC took the podium and thanked all the participants for the success of the project.

KDC CEO Ms. Janet Mumo addressing the event participants

She noted that there are 20,000 indigenous and 50,504 mango trees of improved variety respectively yielding 2,474 tons per year in Kitui County. She also noted that almost all the mangoes produced in Kitui district mature same time around November to mid-March resulting to oversupply and thus reducing value of fruit. Due to the harvest season she noted that there tends to be a lot of post harvesting loses of ripe fruits falling and spoilage of harvested fruits when they do not get to markets in time, going into several tens of bags per farmer. This thus reduces the market price to up to Kes 5 for local mangoes and Kes 10 per piece for the improved during harvesting period. Through the various partnerships, KDC was able to have an organized marketing of the mangoes and reduce the dependency on brokers who buy an extended bag of mangoes at Kes 200 per bag for local mangoes.

Ms Janet reiterated that mango fruits are rich in vitamins and minerals and that it was found to protect against colon, breast, leukemia and prostate cancers. She also noted that the health benefits of the mango fruit are an excellent source of Vitamin-A, vitamin-B6, Vitamin-C, Vitamin-E and potassium.

To facilitate the product launch into the market, the CEO emphasized that laboratory tests have been done by Kenya industrial research and development institute (KIRDI) for the ready to drink mango juice and was found to have high calorific value.

The CEO also brought forth that for sustainability of the project, KDC facilitated the registration of Kitui Enterprise Promotion Company (KEP) to carry business of manufacturing of non-alcoholic beverages of all descriptions and improve the socio-economic livelihoods of Kitui County.

The Chief Guest of honor was His Excellency the Governor Kitui County DR. Julius Makau Malombe. The Governor expressed his gratitude to the partners who have invested in KDC and have thus contributed to empowerment of the residents of Kitui. He noted that the climatic conditions of Kitui are actually a blessing if prudently exploited. He expressed a passionate desire to improve the livelihoods of the entire Kitui County which has been lagging behind.

ANNEX 12 **CERTIFICATE OF INCORPORATION**

No. CPR/2012/85060

CERTIFICATE OF INCORPORATION

I hereby CERTIFY, that -

KITUI ENTERPRISE PROMOTION COMPANY LIMITED

is this day Incorporated under the Companies Act (Cap. 486) and that the Company is **LIMITED**.

GIVEN under my hand at Nairobi this **15 th** day of **November** Two Thousand and **Twelve**

Registrar Of Companies

ANNEX 13 **SECURITY CONTRACTUAL AGREEMENT**

KYUSO FRUIT PROCESSING PLANT COMPANY LTD (KFPPco.Ltd)

P.O box 71-90400 Mwingi.

Email: kfppcompany@gmail.com

TEL: +254724930174, +254723353201, +254723818548, +254726580464

KFPPCo. Ltd

Our Fruits our wealth

This employment contract (this 'contract') is made effective as from 1/11/2015 to 1/04/2016(6.months) between KFPCO.LTD and MUTHUI KITONGA of KIMU. Location, KYUSO District KITUI County.

ID/Pass. no. 3752584 PIN no. N/A

MUTHUI KITONGA is engaged in the business of WATCHMAN six months and will primarily perform the job duties in the KFPCO.LTD coverage area.

MUTHUI KITONGA desires to have the service of security officer

MUTHUI KITONGA .is willing to be employed by KFPCO.LTD therefore the parties agree as follows;

Employment

KFPCO.LTD shall employ MUTHUI KITONGA as a security officer shall provide the stated services (attached).

He/she accepts and agrees to such employment, and agrees to be subject to the general supervision, advice and direction of the Board of Directors (BOD).

2. Best efforts of employee

MUTHUI KITONGA agrees to perform faithfully, industriously and to the best of his/her ability, experience and talents, all of the duties that may be required by the express and implicit terms of this contract, to the reasonable satisfaction of KFPCO.LTD, such duties shall be provided as such per the needs or opportunities that KFPCO.LTD may require from time to time.

Ownership of social media contacts

Any social media contacts, including 'followers' or 'friends' that are acquired through accounts (including, but not limited to e-mail, addresses, blogs, twitter, Facebook or other social media networks) used or created on behalf of KFPCO.LTD are the property of the organization.

Compensation of employee.

As compensation for services provided by MUTHUI KITONGA under this contract, KFPCO.LTD will pay monthly salary of Kes 7,000 payable in accordance with KFPCO.LTD's usual payroll procedures. Upon termination of this contract, payment under this paragraph shall cease; provided, however, that MUTHUI KITONGA shall be entitled to payments for

periods or partial that occurred prior to the date of termination. No notice of termination will be given for the contract clearly explains.

All the KFPCO.LTD staff should read and adhere to these codes which are clearly defined in the KFPCO.LTD Human Resource manual.

6.0 Staff relations.

6.1.1 Staffs are expected to respect all rules and regulations of the organization.

6.1.2 Staffs are required to carry out all dealings with people with mutual respect.

6.1.3 Staffs are required to ensure that correct information regarding KFPCO.LTD, policies and operations is communicated.

6.1.4 Staff should not verbally or any other ways express their individual preference candidate and political parties while working or representing KFPCO.LTD.

6.1.5 Staff wishing to contest for political post either at municipal, county councils, parliamentary and presidential should tender their resignation from date of inter-party nominations.

6.1.6 Staff should not display political party messages on KFPCO.LTD vehicle or assets. KFPCO.LTD staff must make our non-partisan role clearly to the government, political parties and the public.

6.1.7 Staff should not misuse KFPCO.LTD's property for personal gain.

6.1.8 The working days shall be from Monday to Friday from 8.00am-4.30pm.

6.2 Disciplinary offences.

6.2.0 Offences shall be grouped as follows:

6.2.1 Misdemeanor

The following offences among others shall be considered as misdemeanors and will result in penalties ranging from verbal to written warnings.

Late arrival or early departure from work without approval of supervisor.

Idling or loitering during working hours.

Avoiding work by malingering or feigning illness.

Failure to account cash advances within the required period.

6.2.2 Misconduct

The following offences among others shall be considered as misconduct and shall result to penalties ranging from written warnings to termination of appointment or dismissal.

Repeated commitment of misdemeanors.

Absence from work without permission for three consecutive days.

Dereliction/gross neglect of duty by willfully neglecting, refusing or careless performing of work.

Use of abusive language or behavior including sexual harassment which is insulting to the organization, staff and community.

Misuse of telephones, supplies and other KFPCO.LTD properties.

Failure or refusal to obey a lawfully and properly issued instructions.

Misuse of KFPCO.LTD vehicles by overloading, driving without valid driver's license, driving KFPCO.LTD motor vehicle or riding motor bike while under influence of alcohol or permitting unauthorized persons to drive KFPCO.LTD vehicles, over speeding and negligent driving.

Gross incompetence in carrying out one's duty.

Awarding of tender/contracts to parties that one has interest in or is bound to gain financially.

Use of time and resources for non-KFPCO.LTD work.

Publishing or speaking or releasing inaccurate information about the organization.

Unauthorized disclosure of any confidential or classified information.

Pecuniary embarrassment or involvement in financial scandal that is likely to lead to bankruptcy.

Repeated failure to submit private mileage, return on time, pay for private phone bills and photocopies.

Desertion of duty.

Being intoxicated while on duty.

Willful damage of KFPCO.LTD property.

Carrying fare paying passengers.

Physical violence against staff and community members.

Abuse of authority.

6.2.3 GROSS MISCONDUCT

The following offences will be considered as gross misconduct and will be punishable by summary dismissal:-

(a) Soliciting, giving or accepting bribes or favors in any form.

(b) Misappropriation or theft of KFPCO.LTD funds or obtaining money fraudulently.

(c) Proven fraud or dishonesty.

(d) If convicted over criminal offence.

6.3.0 DISCIPLINARY PROCEDURE AND PENALTIES

6.3.1 Staff will receive a verbal warning in the event of 1st misdemeanor.

6.3.2 A repeated misdemeanor shall constitute misconduct and result in penalty for committing misconduct.

6.3.3 Penalties for misconduct shall depend on the magnitude of the offence.

They will involve:-Written warnings.

-Supervision.

-Termination.

-Dismissal.

Penalties for committing gross misconduct will be summary dismissal.

6.3.4 The MD will give written warning with copies to the B.O.D if the offence does not subject the staff has to dismiss from the Company, however, repeated receipt of written warnings shall subject a staff to dismissal.

6.3.5 In an event where a member of staff has committed misconduct, the M.D or B.O.D may institute an inquiry. In such case the employee may be suspended and issued with penalty applicable to such offence. A reply to such letter would be expected within three days failure to which the intended action may be taken without further reference to the staff concerned. This action will be taken by the MD with a copy to B.O.D.

6.3.6 Suspension period will create room for the investigation and will not exceed 30 days. No salary will be payable at this period. All cases not finalized within this period will be forwarded to B.O.D.

6.3.7 Letter of termination or summary dismissal will be issued by B.O.D

6.4. O GRIEVANCES

6.4.1 This policy addresses situations where staff are aggrieved or discontented with work related issues, disciplinary measures or issues that may adversely affect their performance.

6.4.2 Before a formal grievance begins, staff members are encouraged to discuss the issues with their immediate managers. The managers are expected to have an open discussion with their staff in an attempt to reduce grievances.

6.4.3 Any aggrieved staff member can bring their cases direct to the attention of the Managing Director (MD) or the B.O.D in cases where it may be difficult to go through the immediate manager such as sexual harassment.

6.4.5 ALLOWANCES

Out of office allowances will be paid for work exceeding 5 hours out of office and no allowances for duties within Kamuwongo Location which is the office area.

Rates will be paid as per ranks and area of work

Transport when staff is on duty will be catered for by the COMPANY.

All field reports must be submitted immediately and failure to which no field work approval to the relevant staff.

NB/Incase a staff decides to resign he/she should give one month notice, he/she MUST do official handing over to the managing director of both reports and requirements as per the duties assigned. Failure to which will result to salary pending and no payments will be done to him/her before deliverance of all the required reports.

CONTRACT AWARDED BY

JOHN M. KANGANGI

DIRECTOR.

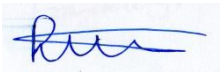
JAPHETH M. MUSANGI

DIRECTOR

BETH K. SYENGO

DIRECTOR.

SIGN ON BEHALF OF THE DIRECTORS.



RUTH M. SAMUEL

DIRECTOR

DATE: 01.NOV 2015

CONTRACT AWARDED TO

SIGN 

NAME: MUTHUI KITONGA

DATE: 01. NOV 2015

ANNEX 14 **PRODUCT TEST CERTIFICATE**

KIRDI
Your Industrial Technology Partner...

KENYA VISION 2030

Ref: **Date:**

LABORATORY REPORT

Material: Dried Mango Powder

Laboratory No... 958/15/16 **Analysis Date...** 03/12/2015

Date Received... 06/11/2015 **Sampled by:** Sender

Received from: National Environment Trust Fund

CONTROLLED DOCUMENT

RESULTS OF ANALYSIS

LAB. NO.		958/15/16
Senders Ref:		
Parameter:		
Calorific value	(Kcal/g)	6.41
Vitamin C (Ascorbic acid)	(Mg/g)	0.220
Moisture	%(m/m)	9.98
Acidity (Acetic acid)	(gm)	0.066
Sugars	%(m/m)	1.30
Fibre	%(m/m)	2.6
Yeast & Moulds		Less than $1.0x10^1$ colonies
E.coli	MPN/100ml	0
Coliforms	MPN/100ml	0

National Environment Trust Fund
P O Box 19324 - 00200
NAIROBI

- The results apply to the sample received
- The signed copy of this report is kept by LSC for at least two years
- LSC takes no responsibility for electronically transferred version of this report

E O Oguna
FOR: DIRECTOR

DOC.NO: LSC-FDS-003	Restricted	REV. NO. 01	Effective date: 18/8/2008	Retention Period .....

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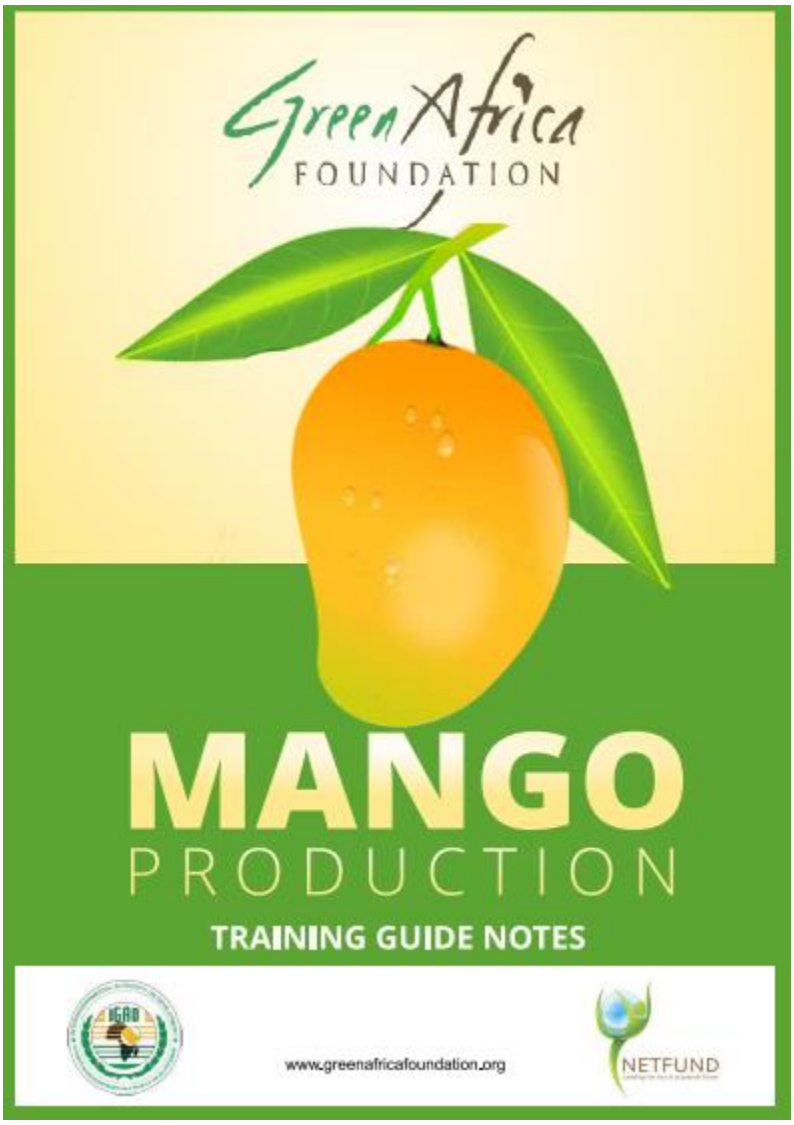
ANNEX 15 **MANGO TRAINING BOOKLET**



ANNEX 16 **DUE DILLIGENCE TOOL**

Due diligence questionnaire

Getting to Know You

THE QUESTIONNAIRE – PARTNER INFORMATION

This section is intended to gather relevant information of getting to know you prior to signing the MoU or a contract with NETFUND. Please ensure that the information is truthful.

NB: All the information received below shall be treated in strict confidence and shall not be disclosed to any 3rd party other than as may be required by law.

Legal set up	
Organization Name:	
Principal Address	
Website	
Name	
Telephone	
Email	
Type/Form of organization	
Registration number (Attach copy of Certificate of Registration)	

Date established	
Is your organization regulated by any Government body?	
What is the tax status of the organization?	
How did you hear/learn about NETFUND and the proposed project?	
Alignment of interest/Policy compatibility	
Outline the proposed partnership work. (Include project objectives and expected outcomes)	
State your organization's vision, mission and strategic objectives.	
Indicate how the proposed partnership activity will aid your organization in achieving its vision and mission	
What are your organization's geographical areas of operation	
List your organization's Focus/Sector/Thematic area(s) of	

operation	
Technical capacity	
Attach your organizational structure	
How many employees does your organization have?	
Attach a brief profile of management level personnel. Include the profile of the persons who will be directly responsible in the implementation of the proposed partnership activities.	
Kindly give your approximate revenue amount for the last 3 years	
How do you maintain records of financial transactions?	
Track record/Implementation history	
Give a brief of the main projects handled by your organization. Include total project budget for each.	

For the projects listed included above, demonstrate impact created on the beneficiaries. (Tell stories of the impact created)	
Were the projects detailed above completed on time and within budget? If not, give reasons	
Kindly list the challenges and lessons learnt in the past project implementations	
Have you partnered with another organization in the past? If so, give the name	

Leadership and Governance	
Does your organization have a Board? If so, how many members? How often does the Board meet?	
Kindly attach a brief profile of the members of the Board.	
Have the organization ever been audited? If so, when was the last audit carried out?	

Declaration:

I ___ confirm that the information given above is correct to the best of my knowledge.

Signed & Stamp: ____

Date:

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Training Manual on Production of Dehydrated Mango Products

1.0 INTRODUCTION

The **mango** is a fleshy stone fruit belonging to the genus *Mangifera,* consisting of numerous tropical fruiting trees in the flowering plant family *Anacardiaceae*. Dried mango is the highest value mango product. It also generates temporary local employment at the production facility (where more women are involved in labour).The mango is native to the Indian subcontinent from where it spread all over the tropical and subtropical regions of the world. Its fruit is distributed essentially worldwide. It is one of the most cultivated fruits of the tropical world. The **common mango** or **Indian mango** – is the only mango tree commonly cultivated.

The ripe fruit varies in size and color. Cultivars are variously yellow, orange, red or green, and carry a single flat, oblong pit that can be fibrous or hairy on the surface, and which does not separate easily from the pulp. Ripe, unpeeled fruit gives off a distinctive resinous, sweet smell. Taste of mango fruit could be described as combination of a nectarine, a pineapple and an orange. The mango is generally sweet, although the taste and texture of the flesh varies across cultivars, some having a soft, pulpy texture similar to an overripe plum, while the flesh of others is firmer, like a cantaloupe or avocado, or may have a fibrous texture.

The mango is generally sweet, although the taste and texture of the flesh varies across cultivars, some having a soft, pulpy texture similar to an overripe plum, while the flesh of others is firmer, like a cantaloupe or avocado, or may have a fibrous texture. For consumption of unripe, pickled or cooked fruit, the mango skin may be consumed comfortably, but has potential to cause contact dermatitis of the lips, gingiva or tongue in susceptible people (see above). Under-ripe mangoes can be ripened by placing them in brown paper bags. They will then keep in a plastic bag in the refrigerator for about four or five days. In ripe fruits which are commonly eaten fresh, the skin may be thicker and bitter tasting, so is typically not eaten.

Mangoes are used in preserves (dried and powdered unripe mango) and pickles, including a spicy mustard-oil pickle and alcohol. These bars are similar to dried guava fruit bars available in some countries. Dried strips of sweet, ripe mango are also popular. Mangoes may be used to make juices, mango nectar, and as a flavoring and

major ingredient in ice cream and sorbetes. Mango is used to make juices, smoothies, ice cream, fruit bars, raspados, aguas frescas, pies and sweet chili sauce, or mixed with chamoy, a sweet and spicy chili paste. It is popular on a stick dipped in hot chili powder and salt or as a main ingredient in fresh fruit combinations. Pieces of mango can be mashed and used as a topping on ice cream or blended with milk and ice as milkshakes.

Processing and drying can be an alternative to the marketing of fresh products as this facilitates transport and extends the storage period. Moreover dried mangoes can be a valuable factor in the supply of micronutrients for the population as they have a considerable content of vitamins.

1.1 Nutritional information and health benefits of Mangoes

Mango contains a variety of phytochemicals and nutrients. The fruit pulp is high in prebiotic dietary fiber, vitamin C, diverse polyphenols and provitamin A carotenoids. In mango fruit pulp, the antioxidant vitamins A and C, Vitamin B6 (pyridoxine), folate, other B vitamins and essential nutrients, such as potassium, copper and amino acids, are present. Mango peel and pulp contain other phytonutrients, such as the pigment antioxidants – carotenoids and polyphenols – and omega-3 and -6 polyunsaturated fatty acids.

Mango peel contains pigments that may have antioxidant properties, including carotenoids, such as the provitamin A compound, beta-carotene, lutein and alpha-carotene, polyphenols such as quercetin, kaempferol, gallic acid, caffeic acid, catechins, tannins, and the unique mango xanthonoid, mangiferin, any of which may counteract free radicals in various disease processes as revealed in preliminary research. Phytochemical and nutrient content appears to vary across mango species. Up to 25 different carotenoids have been isolated from mango pulp, the densest of which was beta-carotene, which accounts for the yellow-orange pigmentation of most mango species. Peel and leaves also have significant polyphenol content, including xanthonoids, mangiferin and gallic acid. The mango triterpene, lupeol, is an effective inhibitor in laboratory models of prostate and skin cancers. An extract of mango branch

bark called Vimang, isolated by Cuban scientists, contains numerous polyphenols with antioxidant properties in vitro and on blood parameters of elderly humans.

2.0 DEHYDRATION OF MANGOES

Post-Harvest Losses of tropical fruits, including mangoes, amount up to 60%. One of the causes of these extremely high losses is the enormous quantity of fruits that have to be handled during the harvesting period. Processing and drying can be an alternative to the marketing of fresh products as this facilitates transport and extends the storage period. Moreover dried mangoes can be a valuable factor in the supply of micronutrients for the population as they have a considerable content of vitamins.

There are several options to dehydrate fresh mangoes of which the most important are **sun drying, solar drying** or the use of **mechanical tray driers**. As mechanical tray driers demand a considerable investment and need a reliable energy supply which in most production areas is not available it rather comes to the alternative between sun and solar drying. However, the traditionally sun dried fruits mostly don't respond to the requirements for a safe and physiologically valuable product and additionally can't be stored long enough to ensure an all-season marketing.

Reduction of the drying period will prevent oxidative and photo-induced decomposition processes of vitamins as well as enzymatic browning. That's why solar drying should be the method of choice. But even for solar drying there are a number of different technical solutions depending on the type of radiation, the character of air movement and the type of air duct. The best results can be obtained when using a solar dryer with forced convection in combination with a solar panel for the energy supply of the fan.

2.1 Solar drying

Principle

Sun radiation is absorbed in an air collector and/or by drying goods and is transformed in warmth

The warmth is used for the evaporation of the humidity enclosed in the goods

Classification

The classification and type of solar drying is based on the following factors

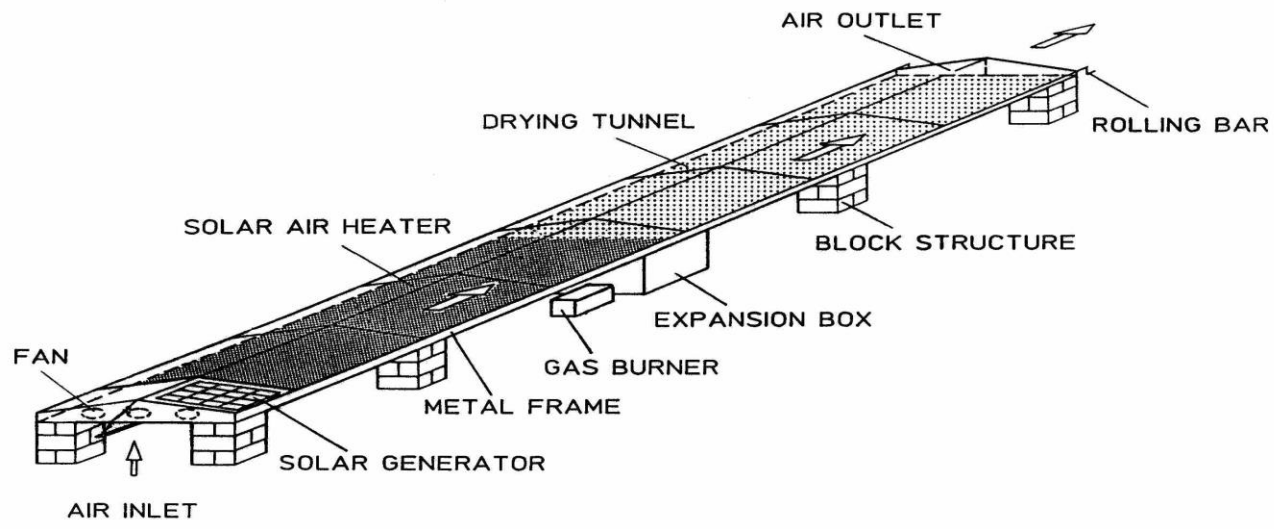
- Type of radiation
- Character of air movement
- Type of air duct

Benefits of solar tunnel dryer

- Drying of fruits, vegetables and spices
- Use in arid regions or humid regions during the dry period
- Use in farms bigger 1 ha and cooperatives
- Protection against weather and animals
- Even drying to a storable condition
- Energy independent use with solar panel and thermic warming of the air
- Quality of drying products achieves international standards
- Minimum mass losses
- Construction with locally available material is possible
- Amortisation time 1 to 5 years

2.2 Solar tunnel dryer with integrated air collector

- Air collector and dryer are constructed in line
- Expanded drying goods get overflowed
- Air collector and dryer are covered with transparent screen
- Airflow is generated by fan



Solar tunnel dryer for mangoes

Cabinet solar dryer

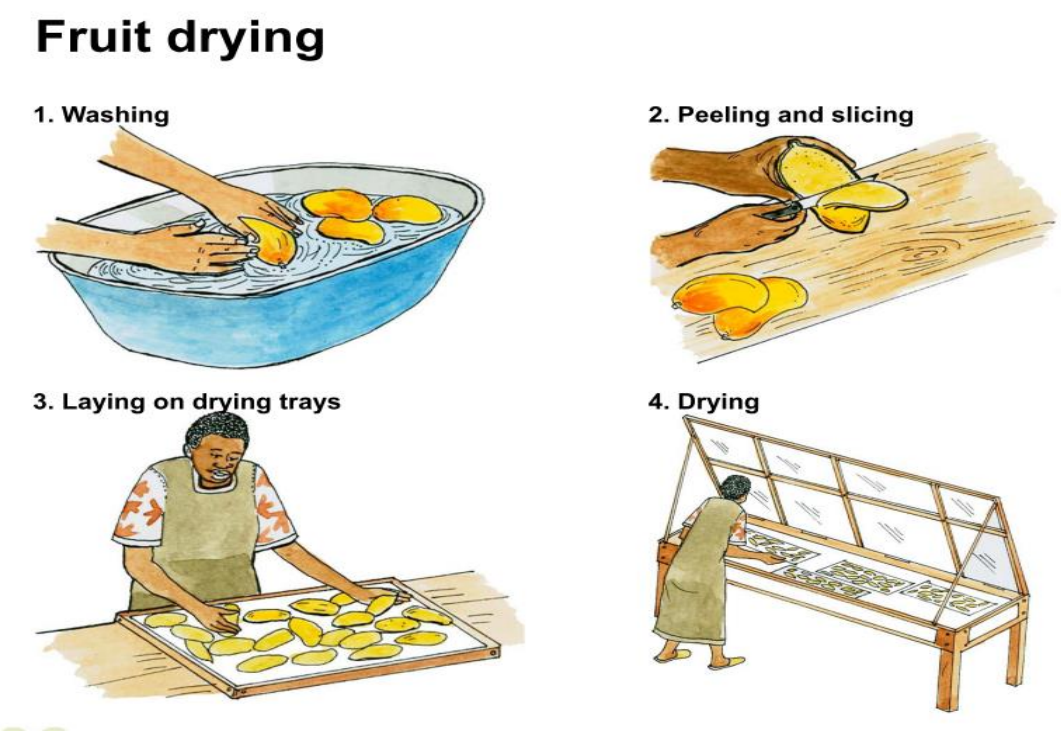
Dryer with solar heat collector

Green house solar dryer by QSM

3.0 PREPARATION OF MANGOES FOR DRYING

The choice of mangoes in the right stage of maturity is essential for the production of high quality dried fruits. Mangoes are climacteric which means that their ripening process continues after harvest and they are very sensitive to ethylene. The physiological alterations of the pulp have a big influence on the substances of content and the quality of fresh as well as of dried fruits. Therefore fruits should be harvested at an optimum stage of ripeness and be processed without any delay.

Ripe and faultless fruits must be prepared under most hygienic conditions for the dehydration process. To ensure this a stringent sorting should be followed by a careful washing. After this the mangoes have to be cut in slices of the same thickness to ensure an equable drying process.



Fruit drying at different stages

Mangoes have to be dried to a water content of around 16% to be storable. As they are hygroscopic it is important to prevent a re-humidification during storage due to high humidity in the surrounding atmosphere.

Dehydrated mango pieces

4.0 DRYING PROCESS

Mangoes have to be dried to a water content of around 16% to be storable. As they are hygroscopic it is important to prevent a re-humidification during storage due to high humidity in the surrounding atmosphere.

Reduction of the drying period will prevent oxidative and photo-induced decomposition processes of vitamins as well as enzymatic browning. Ripe mangoes are often cut into thin layers, desiccated, folded, and then cut.

The mangoes are washed, peeled and cut into 6-8 mm thick slices (1-2 centimetres thick and about 4 x 4 centimetres square) with a stainless steel knife. The pieces are then dried osmotically in 67 percent sugar syrup for four hours. The subsequent sulfur dioxide treatment should be a dip for two minutes in a 0.8% sulphur dioxide solution (15 kilograms sugar and 250 grams potassium metabisulfite in 10 litres water).To obtain

finished products with good quality and long storage life, the mango slices can also be soaked for 18 hours in a solution containing:

- Boiling water: 1 litre
- Sugar: up to 40 Brix (7-800 g)
- Potassium metabisulphite: 3 g / litre of water
- Lemon juice: 2 spoons/litre of water

The slices thus prepared are drained and placed on glycerine coated aluminium trays, which are placed in a sun-drier. The drying is completed when the product has a moisture content of 15%. The dried slices (150 g) are packed in cellophane bags, labelled and stored in a dry place.

5.0 SUMMARY AND PERSPECTIVES

I. In developing countries solar drying is a promising alternative to reduce mass losses and ameliorate product quality

II. Solar dryers with forced convection outmatch dryers with natural convection

III. Dehydration of mangoes can reduced risk of deterioration, obtain much higher performance and maintain quality and safety of produce at low cost.

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ANNEX 18 **INSTRUCTION MANUAL FOR THE DISK MILL**

DISK MILL MANUAL INSTRUCTION
Introduction

The FFC disk mill has multiple purposes. There are four types of FFC disk mill available. The sizes or specifications of the mills are different, but the mechanical structures are nearly the same. Giving consideration to the common cases, however, this manual mainly deals with Model FfC-45 disk mill.

This disk mill is designed compactly. It is small in light and weight, reliable in operation and easy in maintenance. It has a large range of service and it has a high quality in crushing. It has proven to provide the best service to the users.

This machine is most desirable in crushing various coarse grains such as corn, soya bean, sorghum, dried sweet potatoes and such like in to powder by one stroke.

Apart from the above-mentioned functions, it can also be used to crush fresh fruit, fresh sweet potato and soaked soya beans, which contain a great deal of moisture content, The crushing result is very good and has been praised by its users.

The machine is composed of the body and base. The body add valve form the crushing chamber, The main shaft, supported by a roller bearing passes through the bearing box of the body with a pulley on one end of the crushing chamber. On the rotator, there are many lines of steel teeth crisscrossing with the gear wheel fixed inside the valve. Around the rotator, screen is fixed. On the valve, there is an Inlet above which is the hopper. The outlet is beneath the body.

Caution about Operating Instructions

Please study these instructions carefully before attempting to operate the machine.

All operators must be familiar with the contents of the operating instructions.

Please observe all notes concerning your safety.

The disk mill was designed with the user's safety in mind; however inherent risks cannot be excluded. Follow the advice in these instructions to avoid risks to users.

These operating instructions do not constitute a complete technical description. They describe only the details required for safe operation and maintenance for usage under normal conditions.

Method of Operation

The material sample is comminuted in a dustproof grinding chamber containing two counteracting grinding disks with coarse teething on the inside. One of these disks is driven by a powerful, slow-running gear motor.

The material to be ground is loaded into the center of the motionless grinding disk through a closable hopper, emerging from the gap between the two disks after being comminuted by compression or shearing stress. The gap width determines the average grain size of the material; it can be adjusted and checked from outside.

In case of batch grinding, .the material is collected in a vessel which has a dustproof connection to the mill.

The enclosed construction prevents dust from escaping. In addition, a dust extraction unit can be connected. Swing up the housing for cleaning; this renders the grinding chamber freely accessible.

Drive motor

The drive motor is a 3-phase a.c. motor. Due to the strong reduction ratio of the drive the disk mill stops in a minimum of time after switching it off.

NB: ONLY A TRAINED SPECIALIST IS PERMITTED TO CHANGE THE DIRECTION OF ROTATION.

THE DEVICE CAN BE OPERATED ONLY AT A THREE-PHASE NETWORK.

Electric fuses

Material

Final Fineness

Operating Safety

Read the operating instructions carefully before use.

The instrument should only to be used for the purpose intended and not any other.

We recommend that a safety logbook should be kept in which all work (service, repairs etc.) carried out on the machine should be entered.

Use only original accessories and original spare parts. Failure to do so may call into question the performance of the instrument.

Do not use damaged accessories.

The operators must be familiar with the contents of the operating instructions.

Do not remove labels.

Protective devices must not be made unserviceable or removed.

Wear ear protectors if the noise level is higher than 81dB (A).

Wear eye shield!

Behavior at all times must be such as to strictly preclude any risk of accidents.

Applicable, ventilation must be provided or the instrument must be operated under an exhaust hood.

Do not run the disk mill unsupervised.

Operators

No one other than authorized persons should operate the instrument and it must be serviced and repaired by trained specialists.

No one suffering from medical problems or under the influence of medications, drugs, alcohol or overtiredness should be permitted to operate the instrument.

Protective equipment

Protective equipment must be used as intended and must not be rendered disabled or dismantled.

All protective devices should be regularly checked for completeness and to ensure that they are functioning correctly.

The disk mill has an extensive safety system which:

The feed hopper has a grid lock to prevent interference;

A protection switch monitors the grinding chamber during operation to make certain it is closed and prevents the disk mill from starting when it is open;

A second protection switch monitors the collecting vessel during operation to make

certain it is closed and prevents the disk mill from starting when it is open; and

The disk mill will not start if grinding chamber or collecting vessel is open.

Danger Points

Squeezing danger at the cover of the funnel.

Squeezing danger at the toggle of the grinding chamber

Electrical Safety

General

The disk mill is turned off and on by means of a motor protection switch matched to the mains voltage (as per nameplate).

On turning the switch to Start:

The disk mill starts up.

On turning the switch to Stop:

The mill will stop within seconds.

Grinding chamber can be opened.

Sample container can be taken.

Protection against Restarting

In case of line fault during the operation the under voltage release switches off.

The mill will stop within seconds.

- Grinding chamber can be opened.
- Sample container can be taken out.

The mill does not restart when the supply returns.

The mill is secured against restarting.

On turning the switch to Start, the motor is switched on and the mill takes up its function.

Optimum operating conditions

Use the instrument only inside.

The air must not contain any electrical conductive dust.

The ambient temperature must be between 5 and 40°C.

Electrical Connection

Before making the connection, compare the voltage and current values shown on the nameplate with the values of the mains supply to which the machine is to be connected.

Adapting the cutting mill to the available supply

Changing the required supply voltage from 230 to 400 volts and or changing the connecting cable may only be carried out by a trained electrician.

Before Switching On for the First Time

A set of grinding disks is already fitted to all disk mills supplied to the customer. The mill is therefore ready for operation once the electrical connection has been made.

Please check whether the grinding disks are fixed correctly.

GRINDING DISK MUSTN´T TOUCH THEMSELVES

INSTRUMENT IS ONLY TO BE OPERATED WITH ASSEMBLED AND FIXED GRINDING DISKS.

Material Feed

Turn the mill on before pouring material into the hopper.

Feed material into the hopper one at a time and then close the cover immediately afterwards.

Do not add any more material until the grinding noise has de- creased considerably.

The amount of material put into the hopper must be no more than will allow the cover to be closed during grinding.

Determine the maximum amount to add on the basis of the grind ability of the material.

Cleaning

To clean the grinding chamber, open the housing. Use a brush or a suction unit to clean. If necessary, you may also use a liquid cleaner (alcohol, naphtha), but watch for the beginning of rust development. Be very certain to dry out the cutting mill completely.

When using cleaning materials which are combustible or detrimental to health, it is imperative that you observe the pertinent safety regulations and, if necessary, clean the disk mill in a ventilated safety zone.

Maintenance

Disconnect mains connector before starting any work. Disconnect mains connector and secure instrument against being turned on again accidentally. When maintenance work is being performed, this should be indicated with a warning sign.

Changing the gear oil of the motor

The gearbox of the motor has already been filled with low- viscosity grease at the factory.

A screw-in filling plug in the gearbox makes it possible to check the level.

The grease must be changed after approx. 5,000 hours of operation. To do so, let the motor run for at least 1 hour (to warm the grease), drain the grease and then pour in new grease.

Exchanging the Grinding Disk

The grinding disks are subject to natural wear and will have to be exchanged after protracted use. If you discover while inspecting or cleaning that the disks are worn, there is no need to exchange them at once. Simply change the rotation direction of the driving motor: The crushing edges on the backside of the disks are brought into action now. However, you should order new replacement disks now if they are not already available.

Functional error	Possible cause	Corrective measure
Mill fails to start	No power	Insert plug
	Safety switch 1 open	Lock the grinding chamber correctly
	Safety switch 2 open	Slide product container correctly
Disk does not turn	Gap width 0	Set the gap width
Mill stops during operation	Motor	Allow mill to cool
	Overload	Allow mill to cool, clear of material, reduce material feed rate
	Motor protection switch actuated	
		Open and empty the grinding chamber
Poor milling result	Grinding disk worn-out	Change rotational direction or renew grinding disk.
Material escapes	Sealing soiled or faulty	Clean or replace the seals

Exchanging the Fixed Grinding Disk

Loosen the fastening bolts with a 30mm fork-wrench, before opening the grinding chamber. Then undo the fastening bolts completely - but hold the grinding disk securely with one hand in the process. Afterwards you can remove the grinding disk.

The new disk is installed by reversing the procedure above.

ANNEX 19 **OPERATIONS & MAINTENANCE MANUAL OF POWDERING EQUIPMENT**

GM 40 HAMMER MILL

Introduction

Milling techniques

There is a wide range of milling techniques used at various scales in the production of various types and qualities of maize meal. The smallest scales of production are associated with techniques used at the household level (e.g. use of mortar and pestle of querns) while the largest scales of production are generally achieved by roller mills. Intermediate scales of production are associated with techniques used in stone, plate and hammer mills. Given the focus of the memorandum on small-scale production, this chapter emphasizes these latter techniques and only briefly reviews the technology used by roller mills. Milling techniques used at the household level are not considered especially since an increasing number of rural women tend to use the services of custom or community mills in order to be able to devote more time to more productive activities.

PRE-TREATMENT OF MAIZE FOR MILLING

In general, untreated shelled and dried maize grain is simply ground into a meal or flour for the preparation of traditional products. However, some traditional maize products require that the shelled grain be subjected to various pre-treatment processes prior to grinding.

REVIEW OF MAIZE MILLING TECHNOLOGIES

There are two main milling technologies: one in which the grain is directly ground without any pre-processing and one in which the grain undergoes a number of pre-processing stages prior to milling. The

former milling technology yields whole meal which contains both the bran and the germ,

while the latter one yields a large range of products including partly or fully emerged meals called bolted and super-sifted meals respectively. The production of whole meal is carried out in three types of mills: plate, stone and hammer mills. The output of these mills ranges from 25kg per hour for plate mills to over 10,000kg per hour for some large scale hammer mills. Plate, stone and hammer mills may use various sources including water-power, diesel and electricity. Some plate mills may use animal or wind power at relatively low outputs. The whole meal produced by these mills may be further sieved for the removal of large pieces of bran and germ. The mills may be equipped with grain cleaning equipment and attached to sieving devices. Water-powered mills are mostly custom mills while the other mechanically powered mills may be either custom or merchant mills, depending on the location and scale of production. The use of plate, stone or hammer mills is usually governed by local preferences, the intended scale of production and the type of output. Plate mills are extensively used in parts of West Africa (e.g. Ghana, Nigeria, Cameroon and Sierra Leone), whilst hammer mills are more common in east Africa (e.g. Tanzania, Kenya, Malawi). Stone mills for the dry grinding of maize prevail in Central and South America, the Indian subcontinent, north America and the Middle East. Hammer mills are predominantly used for the production of ground animal feed in places such as West Africa, Indonesia and Central America.

GM 40 Hammer Mill manual

The GM 40 is a large capacity, robust, durable all-purpose mill capable of dealing with fodder roughage and grain of all types. It incorporates new as well as well-proven features thus giving more appeal to a greater range of users.

The GM40's capacity of the mill will vary with the below listed parameters.

1) Size of screen fitted

2) Driving HP available,

3) Material being milled and

4) Moisture content of the material.

Under normal circumstances, the mill will produce in excess of 10 bags of maize flour per hour. The GM40 has long-life hardened hammers which are fixed to a massive 2" rotor shaft firmly secured and running between two heavy duty self-centering plumber block bearings which eliminate vibration. It also has a huge blower of special design, producing a massive air stream which will draw all the ground meal and leave the screen clear, and carry the meal 40ft and more. The height of the cyclone is adjustable by use of extra pipes. The mill's convenient feeding chute is large and fitted with swinging baffle plates for operator safety. The extra-large cyclone is matched to the mill to guarantee clean, economical, trouble-free milling. Every mill leaving the factory is test-run, and carries a guarantee.

MILL SPECIFICATIONS

Speed of mill rotor	2000 to 2600
Drive	Electric Motor belt driven
Power	40-100HP
Requirement	
Rotor Shaft Size	1.5" Diameter, with keyway
Bearings	Heavy-duty 1.5" sealed flange.
Screen	Interchangeable and wide selection.
Grinding Plate Area	300 Sq. In
Hammers	24 pcs, fixed, Hardened Steel
Bagging	Single spout cyclone

INSTALLATION.

The Hammer mill comes with a base and the shock reducing pads.

Make sure the surface is flat and the mill is balanced hence no need of anchorage.

The electric power is 3Phase (Provide an isolator before connecting to the mill circuit).

The cyclone provided has connection pipes and stand.

OPERATION OF THE MILL

In the operation of the hammer mill, one should follow the following steps;

Set the container/ bag to collect the flour.

The mill is provided with star –delta starter.

Start the mill and leave to stabilize (from star to delta).

Load the material to be milled from the hoper continuously.

Run the mill for a short time after the last feed to clean the sieve of any material.

For maximum performance a hammer mill must operate with the correct tip speed, have sufficient screen area for the applied

horsepower, the proper hammer pattern, and hammers in the correct position in relation to the screen.

Tip Speed:

Use higher tip speeds for fine grinding with small hole screens (8/64” or less). High tip speeds will be more efficient for producing finer grinds, and permit the hammers to do more of the work, minimizing wear on the screens. Use lower tip speeds for producing coarser, more uniform grinds.

Screen Area:

For most applications a hammer mill should have at least 14 in 2 of screen area per horsepower. Too little screen area makes a hammer mill inefficient and can cause significant heating of the material being ground. When using very fine screens (less than 5/64”) it may be necessary to have more than 14 In2 of screen area per horsepower since the screen has less true open area.

Hammer Pattern

The number and arrangement of hammers in the hammer mill is called the hammer pattern. For most large diameter hammer mills using hammers that are over 10” long, a ratio of 2.5 – 3.5 HP per hammer is fine when using screens larger than 8/64”.

For smaller screens it may be necessary to increase the number of hammers used in the hammer pattern to prevent rocking of the hammers on the hammer pins. To produce finer grinds, heavier hammer patterns should be used.

Hammer Position

The clearance between the hammer tip and screen has a minor influence on hammer mill performance in most cases. Setting the hammer tip near the screen can be beneficial with making fine grinds on fibrous or other tough to grind materials like meat and bone meal. For most grinding applications, a coarse hammer pattern with the hammers further from the screen will provide the greatest capacity and efficiency.

Hammer mill Maintenance Basics

There are three basic areas of hammer mill maintenance:

Routine replacement items such as screen, hammers, and pins

Regular long term maintenance items such as flow directors regrind chamber, and bearings

Long term maintenance items such as screen carriage, wear liners, and couplings

Maintenance vs. Operating Costs

The energy cost to operate a hammer mill is typically 5 to 10 times more expensive per ton than maintenance parts.

Regular replacement of the screens and hammers will ensure that the hammer mill continues to produce the highest quality products at the lowest cost per ton. Using high quality parts that process more tons before replacement will maintain peak hammer mill performance and actually lower the total operating cost.

Replacement of parts

Screens

These should be replaced whenever the hammer mill capacity decreases or product quality begins to deteriorate. A drop of 15-20% in capacity is a good indicator that the screens should be replaced. Replacement screens should have an equal percentage of open area as new screens and the screen hole stagger should correct. Low cost screens will often have less open area (more space between the holes) and can reduce hammer mill capacity by 20-40%.

Hammers

They should be replaced whenever the wear extends about 25% along the width of the hammer. In addition to loss in capacity and efficiency, excessive wear can lead to severe imbalance in a set of hammers causing extreme hammer mill vibrations. Single holed flared hard faced hammers are preferred for most tasks in animal feed and oil seed operations. “Cheap” hammers will often have inconsistent heat treatment and little or no hard facing to protect the working surfaces. Consequently the hammers will wear out unevenly (more vibration) and require more frequent replacement, reducing the efficiency and increasing the cost of operating the hammer mill.

Hammer pins

These should be replaced whenever changing the hammers to prevent wear from becoming excessive and causing a pin failure. If a hammer pin must be reused, it should be rotated end for end to make sure the hammers are located in a new spot on the hammer pin.

Excessive wear of the hammer holes or grooving of the pins generally indicates an inconsistent feed (surges that cause the hammers to rock on the pins) or the need for a heavier hammer pattern. This is especially true on machines with lower tip speeds such as 38” diameter mills with 1,800 RPM motors. As hammer manufacturers improve the quality of the hard-faced edge treatments available, hammers last longer and exaggerate any problems with hammers rocking on the pins. In some cases it may be necessary to change the hammer pattern by adding more hammers to prevent excessive hammer pin hammer hole wear. Always consult with the hammer mill manufacturer when increasing the number of hammers in the pattern to avoid any danger of overloading the rotor plates.

Long Term Maintenance Items

Any component in the grinding chamber of a hammer mill is subject to wear, and should be designed for ease of replacement. Of course screens and hammers are the most obvious wear items, but other component should be checked on a regular basis as well.

At the top of most modern hammer mills is a flow director that guides material into the path of the moving hammers. Material circulating in the grinding chamber will constantly abrade the back side of the flow director eventually leading to the need for replacement. At the bottom of the hammer mill is a regrind chamber designed to interrupt the flow of materials within the hammer mill, directing them back into the path of the moving hammers.

This unit will also be subject to constant abrasion by the material being ground and will eventually need to be replaced. Depending on the material(s) being ground and the tons processed on a daily basis, the inlet flow director and regrind chamber may require replacement after 18 to 48 months. Failure to replace these worn out items in a timely fashion can lead to catastrophic failures within the hammer mill if the inlet flow director or regrind chamber fail and enter the path of the moving hammers.

Hammer mill bearings

These require good maintenance in order to provide long term trouble free service and lubrication is the key. Unless a bearing has a leaking seal, hammer mill bearings do not require frequent lubrication. In many cases, the grease fittings are removed from hammer mill bearings to prevent over

lubrication. If the bearing has too much grease, the friction within the bearing can cause excessive heating and can easily destroy a bearing. At least every 6 to 12 months the covers should be removed from the bearing and all of the old grease carefully cleaned out. The bearing should be repacked to 1/3 to ½ full with new grease, and the bearing monitored closely for the first 8-12 hours of operation after that. When a bearing must be replaced, the new bearing must be properly positioned on the rotor shaft to prevent thrust loads, and the clearances adjusted to the precise tolerances recommended by the manufacturer.

Long Term Maintenance Considerations

Other common long term maintenance items on the hammer mill are the screen carriages, wear liners, and the motor coupling. Over a long period of time, the screen carriage assembly that holds the screens in the hammer mill can be subject to wear and impact causing it to lose the proper form. This can be especially troublesome in hammer mills grinding fine fees for pet food or aquaculture applications since a small percentage of material leaking past the screens can create big problems with extrusion equipment. Factory fresh screen carriages can restore hammer mill performance by eliminating these small leaks.

The wear liners within the hammer mill form the interior surfaces of the grinding chamber, and provide a convenient sealing surface for the edges of the screens. Because these wear liners are constantly subject to wear and abrasion, they should be manufactured from abrasion resistant steel such as AR235 plate. This manganese steel material actually increases in hardness and wear resistance with use (work hardens). Mild steel does not offer the same level of protection and will require more frequent replacement. The sections at the top of the grinding chamber (primary destruction zone) should be designed so they may be easily replaced since they receive the greatest amount of impact and abrasion. Hammer mills in operation are a dynamic system and are constantly changing. Each time the hammer mill is started (and stopped with electronic motor brakes) the motor coupling is flexed and stressed. Add to this mechanical stress the hostile environment around the hammer mill and to no surprise the coupling elements will eventually fatigue and fail. One common source of hammer mill vibration is a motor coupling out of alignment, or with a badly fatigued flexible element. Periodically (at least ever 6-12 months) check the alignment of the motor coupling after first verifying the motor mounting bolts and the coupling bolts and bushing are properly tightened and the coupling elements are sound.

GRADING TROUGHS

Introduction

Grading is an important process for the mangoes as it helps to grade the fruits as per prevalent standards for easy marketing. There are sophisticated technologies for grading the fruits which can be done on basis of colour, size, degree of sweetness and firmness. These are the non-destructive methods in which sensors are used.

The qualifications of good mangoes for grading should be:

Whole, firm, sound and ripe in appearance

Clean practically of any foreign matter

Free of black necrotic stains or trails

Free of marked bruising

Free of abnormal external moisture

Free from damage caused by low or high temperature

Free of any foreign smell or taste

Free of damage caused by pests

Sufficiently developed and display satisfactory ripeness.

The grading troughs will grade the mangoes according to the qualities above by use of the sensors available in the troughs. The apparatus for grading mangoes includes a succession of specially made troughs through variously sized slots of which the trimmed mango stock drops according to size.

Operation

The grading apparatus is mounted on a base which in practice is suitably wheeled so as to run on the ground for ease of use. The number of the grading racks will depend on the levels of the grading i.e. the troughs will depend on the number of grades.

Cleaning

Use 1% ammonia solution but don't use bleach – it's too easy to make the solution too strong and difficult to rinse properly afterwards.
After washing, rinse in clean water and wipe the surface dry with a soft absorbent cloth.

The troughs will be 2000*650*860mm in size which will be metal made. The trough may be divided into two parts of varying sizes to divide the progressively varying widths for the separation of various sizes of articles delivered to the trough series.

Maintenance

Since the grading troughs are made of metal, proper care and maintenance should be considered. This is for the purposes to avoid any contamination of the fruits e.g. rust. The racks should always be:

completely dry inside

free from dirt

clean

odourless

The racks within should have the nails well fitted to avoid damage to the mangoes.

WASHING TROUGHS

Introduction

Washing or cleaning of fruits is an important practice. The Purpose of cleaning the fruits is to keep the fruit practically free from dust, dirt latex or any other foreign material. The washing can be done manually or can be mechanized to ease the work and to increase the speed of cleaning.

Washing machines should be able to clean the mangoes thoroughly because of any pesticides or insecticides that may have been used. They should be made of stainless material of size 2000by650by860 mm. The water trough should be made of material that does not rust e.g. plastic. This is to enhance easy cleaning and to avoid contamination of the mangoes. The trough

should have an outlet for discharge of the dirty water. The outlet should be of a considerable size whereby it will only allow the water to pass through and not the fruits i.e. should be small in size.

The outlet should have a kind of a sieve which will help trap the dirt washed from the fruits. The dirt will then be disposed of by use of the right means to avoid pollution of any kind on the environment. Regular checks should be carried out on the outlet to avoid blocking and bad odours.

The trough should also be made of heavy material to withstand the weight of the fruits during the washing. It should be fully welded and with rounded corners both internally and externally to ensure easy cleaning.

Cleaning

The water troughs should be cleaned using hot water to kill any germs and greater attention will be on the outlet. Clean hot water helps to keep off bad odours. The water troughs should be made of plastic so they should not be scrubbed but a clean soft cloth is used to avoid leaving grain marks on the trough which may harbour dirt and germs.

MAINTENANCE

Do not:

rub with steel wool (wire wool) or scraping with steel tools;

use scourers and cleaning cloths that have been used on ordinary steel;

rub plastic scourers across the grain of brushed surfaces and

use concentrated bleach or hydrochloric acid-based cleaning products

RIBBON MIXER INSTRUCTIONS MANUAL

INSTRUCTIONS ABOUT MANUAL

Please study these instructions carefully before attempting to operate the machine.

Please observe all notes concerning your safety.

The ribbon mixer was designed with the user's safety in mind; however inherent risks cannot be excluded. Follow the advice in these instructions to avoid risks to users.

These operating instructions do not constitute a complete technical description. They describe only the details required for safe operation and maintenance for usage under normal conditions.

RIBBON MIXER

INTRODUCTION

A ribbon blender's agitator typically has metal ribbons, often in a double helical design, surrounding a central bar that extends the length of the trough. The ribbons are angled and balanced in such a way as to continually move material within the container.

An industrial-strength machine, a ribbon blender is used to mix large amounts of material in many different industries. The blender gets its name from the thin, ribbon-shaped metal mixers that perform the blending.

Most ribbon blenders consist of an engine to power operation, a large trough to hold the material and a ribboned agitator that does the mixing.

The construction of the 50kg ribbon blender is out of stainless steel G304 for all the areas in contact with products. The weld joints are all continuous with one end bolted to allow dismantling, removal and servicing of the agitator.

Mixing of powders is a very common unit operation in many industries, including food processing. Oddly, it is rarely discussed in undergraduate engineering classes and is not a common subject of academic research. Nonetheless, it is at the heart of many food plants either to produce an end product, such as dry soup mix, or to make an intermediate material, such as a topical seasoning for snacks (Clark 2005a, 2007).

There are many choices for mixing equipment, including horizontal and vertical agitated chambers, tumbling vessels, and air agitated operations. Mixing can be continuous or batch, but delivering the components and delivering the final product are often more critical than the choice of mixing equipment.

Some of the key issues in solids mixing are as follows:

Material handling

Proper mix time

Mixer volume

Scheduling and surge

Segregation

Feeding especially in the case of continuous mixing

MATERIAL HANDLING

This refers to the delivery, scaling, and conveying of various components of a mixture, typically solids such as flour, sugar, salt, or other ingredients. Most formulas have major, minor, and micro ingredients, distinguished by their relative amounts in the formula. The dividing points are matters of judgment, but one approach is to say that amounts >10% are major, 1–10% minor, and <1% micro ingredients.

Micro ingredients, while occurring in relatively small amounts, are often critical to the functionality of the final mix, as they may be vital nutrients, leavening agents, colors, or flavors. Thus, their proper dispersion in the mix may be especially crucial.

Each category of ingredient may be delivered in a different way. For example, major ingredients are often delivered in bulk, unloaded pneumatically into bins, and delivered to a mixer by pressure or vacuum pneumatic lines.

NB: Pneumatic transfer refers to conveying solids in pipes or tubes by suspending the solid particles in moving air. Depending on the concentration of solids in air, the

transfer may be considered dense phase or dilute phase

MIX TIME

Mixing is a case where more is not necessarily better. There is usually an optimal mix time, which must be determined experimentally. The experiment is tedious because mixing is determined by measuring the standard deviation of some critical component. This requires taking multiple samples, at least ten (10), from various parts of the mixer at a succession of times. Often, mixing times are determined by using an easy-to-analyze component, such as salt, but care must be taken that the results apply to the material of most interest, since it may have different particle size and density than salt does. If mix time is determined on small-scale equipment, scale-up parameters can be established by using similar geometric ratios and keeping the Froude number constant.

NB: The Froude number is a dimensionless group equal to N2 D/g, where N is rotational speed, D is a characteristic dimension of the mixer such as diameter, and g is the acceleration due to gravity, all in consistent units.

The implication of this approach is that as a mixer of the same geometric ratio, such as length to diameter, gets larger (i.e., the diameter gets larger), the required rotational speed is reduced to keep the Froude number constant. The resulting mix time in a larger mixer might actually increase because the intention is to keep the number of turnovers Nt, where t is the mix time, constant (Valentas et al. 1991).

Rotation speed also matters and usually has an optimum value. At too low a speed, there is inadequate agitation; but at low speeds, avalanching flow can occur, which is efficient in mixing. At too high a speed, centrifugal force sends all the particles to the perimeter. The Froude number is the relevant scaling parameter:

$$Fr = N2D/g$$

Where

N is the rotation speed

D is the radius of the cylinder (or another characteristic dimension of the equipment)

Fr = 1 defines the beginning of the centrifuging, so values considerably less than 1 are needed for mixing

Once a process study has been performed, it is important to control mix times because excessive mixing can promote segregation. Furthermore, unless all subsequent steps are carefully designed, a uniform mix can become segregated just by falling through chutes or filling bins.

MIXER VOLUME

Most solids mixers have working volumes equal to 50% of their total volume. This means, for instance, that a ribbon or paddle blender should only be filled to just above its shaft. Other designs, such as tumblers and V-blenders, likewise must be only partially filled. This can be a source of friction between operators who want to maximize batch sizes and developers who understand the limitations of the equipment. If a mixer is overfilled, it is difficult for the solids to be moved by the agitator and mixing will be poor at best. Net production is actually improved by using equipment properly because mix times will be shorter and quality higher, resulting in less rework.

SCHEDULING AND SURGE

The simplest mixing process consists of loading directly into a mixer, mixing for the correct time, and then dumping directly into packages or processing further. This requires some elevation of the mixer to allow room for packaging or conveying

under the equipment. Often, there is a work platform on which bagged ingredients are placed and an operator manually loads the mixer. The mixer is idle during loading and unloading.

A modest improvement in cycle time is achieved by delivering some ingredients in bulk to a receiver and scale, but this requires more head room and additional equipment.

The next level of complexity adds a receiving bin, into which the components of a formula are loaded, manually through a bag dump station or pneumatically, while the previous batch is being mixed. The mixer is idle during unloading but is loaded quickly from the receiving bin once it is empty. The assumption is that successive batches of the same formula or of compatible formulas are being made. If cleaning is required between batches, then that time is added to the cycle.

FEEDING

Finally, if a proposed mixture must have widely disparate particles, such as croutons in a seasoning mix for stuffing, or the confection called bridge mix, it might be most practical to avoid conventional mixing altogether and just assemble the product in the package. This then becomes a feeding challenge instead of a mixing operation. Feeding is also the critical factor in continuous mixing.

In dry mixing, getting ingredients into the mixer and removing the mix in a timely manner can be as important as having the right mixer and mix time.

Provision of staging bins and surge bins can increase the productivity of a given mixer in a system, at the cost of additional equipment and space.

Most dry mixers are probably overfilled, so consistency can often be improved by reducing the batch size.

Optimum mix time is rarely determined for each formula. Rather it is usually arbitrarily chosen and is likely to be too long or too short. Determining mix time is tedious but worth doing.

Formulas can usually be modified to maximize the use of unit quantities of ingredients – whole boxes, drums, or bags.

Continuous mixing is a feeding problem, not a mixing problem.

Feeding solids has its own challenges, including measurement, flow control; wear from abrasion, and cleaning of complex equipment.

OPERATING INSTRUCTIONS

Carefully read all instructions before operating for the first time and keep the document safely for future reference.

AVOID LOAD STARTS (load the material then start the blender)

Remove and safely discard any packaging material and promotional labels before using for the first time.

Ensure the surface is level, clean and free of water and other substances. Vibration during operation may cause the surrounding environment to vibrate.

Handle the ribbon mixer and attachments with care – remember the blades and discs are razor-sharp and should NOT be operated by unqualified personnel.

Always make sure the mixer is completely assembled before operating to avoid damage to other equipment.

Ensure the OFF button has been pressed, and the ribbon mixer is switched off at the

power outlet and unplugged before inspecting the blades.

Always operate the ribbon mixer with the processing lid in position.

Do not push the materials into the chute with your hands or other equipment. Always use the provided equipment.

Keep hands and other equipment away from moving blade and discs.

Do not place hands in the processing bowl of the ribbon mixer unless the motor and processing blade has come to a complete stop. Ensure the OFF button has been pressed to switch the motor off and the mixer is switched off at the power outlet and the power circuit breaker is in off position before removing the lid from the processing bowl.

Do not use attachments other than those provided with the ribbon mixer.

Do not attempt to operate the ribbon mixer by any method other than those described in this manual.

Care should be taken when removing the powder from the processing bowl by ensuring the motor and processing blade have completely stopped.

INSTALLATION INSTRUCTIONS

Anchorage is recommended to prevent any shifting during action.

Install on a level ground to avoid deformation of the trough or agitator since the machine is moving at 54rpm

ANNEX 20 **BILL OF QUANTITIES**

BILLS OF QUANTITIES

FOR

CONSTRUCTION OF PROPOSED FRUIT PROCESSING PLANT

CLIENT
KITUI ENTERPRISE PROMOTION CO. LTD
P.O BOX
KITUI.

Prepared by:
Wilson K. Mwonga
Marlin Contractors
P.O Box 1124
KITUI.

INSIGHT GENERAL CONTRACTORS LTD.
P. O. Box 764 - 90200
KITUI
PIN No. P051349727 H

ANNEX 20.1 OTHER RESOURCES PROVIDED BY THE PARTNERS

KITUI DEVELOPMENT CENTRE (K.D.C)

P.O. Box 901- Tel: 044-22096/0208009693
Email: kidc@nbnet.co.ke
KITUI

PV No. 0606

Situated Along Kitui-Kibwezi Road Opposite Multipurpose Training Institute and next to Kitui Ginneries

KDC INTERNAL PAYMENT VOUCHER

TO: Davis & Shirtliff

Activity/Budget line Charged: Water treatment Equipment

CHQ NO: 0006

PARTICULARS	KSHS	CTS
Being payment for water treatment Equipment 80% down payment @ 1,141,275=	PAID. 913020=	
TOTAL	913020=	

AMOUNT IN WORDS: Nine hundred and thirteen thousand & twenty shillings only

Authority Signature for the Amount Given: Voucher Prepared By:

NAME OF RECIPIENT Edwin Mutuku ID NO 23221771 SIGN

DATE: 10/11/2014

REMARKS: Cheque/Cash - (Posted, Collected)

KITUI DEVELOPMENT CENTRE (K.D.C)

P.O. Box 901- Tel: 044-22096/0208009693
Email: kidc@nbnet.co.ke
KITUI

Situated Along Kitui-Kibwezi Road

Opposite Multipurpose Training Institute and next to Kitui Ginneries

KDC INTERNAL PAYMENT VOUCHER

TO: Julius Kitheka & Jonathan Joint

Activity/ Budget line Charged: KEP Plot Purchase

CHQ No.: 00046.

PARTICULARS	KSHS	CTS
Being Payment of Purchase of KEP Plot No. Nzambani/Kyanika/231		
Total Agreement Amount	600,000=	
TOTAL	600,000=	

AMOUNT IN WORDS: Six hundred thousand only

Authority Signature for the Amount Given:

Voucher Prepared By: Mr. Mungao

SIGNATURE OF RECEPIENT:

ID/NO:

DATE: 3/12/2012

REMARKS: Cheque/Cash - (Posted, Collected)

21052 Busto Arsizio - Varese - ITALY
Headquarters: C.so Sempione 212/2/a

BERTUZZI
FOOD PROCESSING

Phone: +39.0331.358.311
Main Fax: +39.0331.358.349
info@bertuzzi.it
www.bertuzzi.it

Customer
KITUI DEVELOPMENT CENTER,KITUI
P.O. BOX 901, 90200 Kilungya Street.
KITUI-KENYA
Tel.: +254 044 22096, +254 726161612
E-mail: kdc@mbnet.co.ke

PROFORMA INVOICE NO. PI-20-12-2012 — Busto Arsizio, 20 December 2012

COUNTRY OF ORIGIN: EU
H.S. CODE NO 84386000
Ref.: QUOTATION NO. MCN5644

DESCRIPTION OF THE GOODS:		
PULPER REFINER- CAP 300 Kg/h	PC	1
TOTAL EX OUR BUSTO ARSIZIO WORKSHOP	EURO	13.600,00
PACKAGING AND CIF MOMBASA PORT	EURO	2.150,00
GRAND TOTAL PRICE CIF MOMBASA PORT	EURO	15.750,00

TERMS OF PAYMENT:
- Euro 6.300,00 with the order as not reimbursable down payment.
- Euro 9.450,00. at notice goods ready for shipment by bank transfer.

DELIVERY TERMS/TIME:
Within January 2013 from the receipt of the down payment and provided that the payment due at notice of goods ready for shipment will be effected timely.

BANK: MONTE PASCHI DI SIENA
ADDRESS: VIA XX SETTEMBRE, 12 – 21052 BUSTO ARSIZIO (VA)
ACCOUNT: 000001194165
IBAN: IT 74 O 01030 22800 000001194165
BIC/SWIFT: PASCITMMBUS

"ESENTE IVA ART. 8 LETT A"

BERTUZZI FOOD PROCESSING SRL — KITUI DEVELOPMENT CENTER

KITUI DEVELOPMENT CENTRE (K.D.C)

P.O. Box 901- Tel: 044-22096/0208009693
Email: kidc@nbnet.co.ke
KITUI

Situated Along Kitui-Kibwezi Road.

Opposite Multipurpose Training Institute and next to Kitui Cemeteries.

KDC INTERNAL PAYMENT VOUCHER

TO D.K. Engineering Company Ltd

Activity/ Budget line Charged Purchase of Pasteurizer

CHQ No. 057

PARTICULARS	KSHS	CTS
Being Payment For Purchase of Pasteurizer For (Mango Project) to Refund. Total Price = Ksh 590,000= Advance payment 60% = Ksh 354,000	354,000=	
TOTAL Bal 40 upon delivery	354000=	

AMOUNT IN WORDS Three hundred and Fifty four thousand only

Authority Signature for the Amount Given:

Voucher Prepared By: Mr. Mwanzia

SIGNATURE OF RECEPIENT ..... ID/NO:.....

DATE: 27/1/2014

REMARKS: Cheque/Cash - (Posted, Collected)

ANNEX 21 **ADDENDUM TO GRANT AGREEMENT BETWEEN NETFUND AND IGAD**

I G A D

INTERGOVERNMENTAL AUTHORITY ON DEVELOPMENT — AUTORITÉ INTERGOUVERNEMENTALE POUR LE DEVELOPPEMENT

ADDENDUM TO GRANT AGREEMENT

BETWEEN

INTERGOVERNMENTAL AUTHORITY ON DEVELOPMENT

(IGAD)

AND

THE GOVERNMENT OF THE REPUBLIC OF KENYA

Page 1 of 2

ADDENDUM TO GRANT AGREEMENT

WHEREAS The Danish Government, through the Ministry of Foreign Affairs, (hereinafter referred to the "Donor") agrees to extend the duration of the agreement between the Donor and IGAD (referred to as "Prime Agreement")

WHEREAS consequently the Intergovernmental Authority for Development represented by IGAD Secretariat, Avenue Georges Clemenceau Djibouti of Republic, B.P. 2653, Djibouti; Tele: +253-21354050; Fax: +253 21353195 (hereinafter referred to the "Grant Awarding Agency" or "IGAD") and The Ministry of Water, Environment and Natural Resources, P. O. Box 30126, Tele: 254 20273583819 or 20 2710120, Nairobi, Kenya (hereinafter referred to as "the Grantee") agree to extend the period of performance expressed in Article 2 of the grant agreement (hereinafter referred to as "the Agreement") dated 30/06/2014.

WHEREAS, in accordance with the Parties and pursuant to clauses 15.1 and 15.2 of the Agreement, the Parties wish to modify provisions pertaining to the duration of the Agreement in order to finalize the activities undertaken, without changes in duties or responsibilities,

Now Therefore, the Parties agree that duration of the Agreement shall be extended up to the June 30, 2016

(1) All the consequent obligations of the Parties pursuant to clauses 2, clause 5, clause 14, and clause 18.3 shall be modified to be in accordance with the duration as extended by the present Addendum.

(2) In all other aspects the Agreement between IGAD and The Ministry of Water, Environment and Natural Resources shall remain in full force and effect and unaltered.

IN WITNESS WHEREOF, the Parties hereto agree to be legally bound by all terms and conditions contained herein.

Signed on behalf of IGAD	Signed on behalf of the Grantee
Amb(Eng). Mahboub M. Maalim Executive Secretary	Name: CATHERINE NDAGWA Title: CEO NETFUND
Date and Signature 03/11/2016	Date and signature 31/10/16

SECRETARIAT OF IGAD DJIBOUTI P.O. BOX: 2653 TEL: 35 40 52

NATIONAL ENVIRONMENT TRUST FUND P. O. Box 10934 – 00100 NAIROBI

Page 2 of 2

ANNEX 22 **FINANCIAL BREAKDOWN OF PARTNERS CONTRIBUTION**

KEPS CONTRIBUTION TOWARDS THE IGAD PROJECT

ITEM DESCRIPTION	Amount (Kes)	Amount (USD)
BILL OF QUANTITIES	2,781,740.00	31,290.66
JUICE SALES	87,835.00	988.02
LAND PURCHASE	600,000.00	6,749.16
PASTEURIZER	590,000.00	6,636.67
PULPER	1,105,650.00	12,437.01
COMMISSION FOR TRANSFER IN PULPER	1,500.00	16.87
PURCHASING RAW MATERIALS (MANGOES)	107,312.00	1,207.11
PURCHASING RAW MATERIALS (MANGOES)	75,000.00	843.64
SALARY 1 WORKER FOR 1 MONTH	40,000.00	449.94
SALARY 2ND WORKER FOR 1 MONTH	34,000.00	382.45
WATER TREATMENT EQUIPMENT	1,141,275.00	12,837.74
TOTAL AMOUNT	6,564,312.00	73,839.28

CONTRIBUTION BY RISE KENYA TO THE PROJECT

ITEM DESCRIPTION	Amount (Kes)	Amount (USD)
PURCHASE OF LAND	250,000	2,812.15
FACTORY BUILDING	850,000	9,561.30
SALARY 1 WORKER FOR 1 MONTH	40,000.00	449.94
SALARY 2ND WORKER FOR 1 MONTH	34,000.00	382.45
TOTAL AMOUNT	1,174,000.00	13,205.85

CONTRIBUTION BY RISE KENYA TO THE PROJECT

ITEM DESCRIPTION	Amount (Kes)	Amount (USD)
PURCHASE OF LAND	300,000.00	33,74.578
FACTORY BUILDING	1,350,000	15,185.6
SALARY 1 WORKER FOR 1 MONTH	40,000.00	449.94
SALARY 2ND WORKER FOR 1 MONTH	34,000.00	382.45
TOTAL AMOUNT	1,724,000.00	19,392.58

ANNEX 23 **PROVISIONAL PATENT FOR THE MANGO POWDERING TECHNOLOGY**

KE/UM/2015/00541

KENYA INDUSTRIAL PROPERTY INSTITUTE
PATENT REGISTRY
18 AUG 2015
P. O. Box 51648 - 00200, NAIROBI
TEL: 0702 002 020, 020 2386220

FORM IP 3
Regulation 12, 18

THE INDUSTRIAL PROPERTY ACT, 2001

The Managing Director,
Kenya Industrial Property Institute.

☐ REQUEST FOR A GRANT OF A PATENT
☒ REQUEST FOR REGISTRATION OF A UTILITY MODEL (please choose one).

The grant of a patent/registration of a Utility Model is requested by the undersigned on the basis of the present

☒ Provisional specification
☐ Final specification (Please choose one)

I	Applicant's or agent's reference (Please insert if available)				
II	Title of invention	**Hybrid biomass and electrical dryer for crisping**			
III	Applicant (First or only applicant) (see note 2)	National Environmental Trust Fund			
	Address	Geomaps Centre, 7th Floor, Matumbato Road, Upperhill, P. O. Box 19324, 00202 Nairobi;			
	Nationality (Country)	Kenya		Residence (Country)	Kenya
	Telephone number (if any) +254 202369563/4, +254 20 236 9563, +2540 202320484,	Facsimile number (if any)	E-mail address (if any) info@netfund.go.ke comondi@netfund.go.ke		
	Name of second applicant (if more than one)				
	Address				
	Nationality (Country)			Residence (Country)	Kenya
	Telephone number (if any)	Facsimile number (if any)	E-mail address (if any)		
IV	Inventor (see note 3)				

	(a) The applicant(s) is/are ☒ the sole ☐ joint inventor(s) or (b) ☒ A statement in Form IP 4 is furnished.		
V	Name and address of agent (if any) (see note 4)		
VI.	Address for service (see note 5)		
	Telephone number (if any)	Facsimile number (if any)	E-mail address (if any)
VII.	Declaration of priority (see note 6)		
VIII	It is suggested that Figure No……. of the drawing (if any) should accompany the abstract when published		

IX. Check list to be filled in by applicant or agent

(A) The application contains the following number of sheet(s)		(B) The application as filed is accompanied by:	
Item	**No of sheets**	**Item**	**(Tick)**
Request		Declaration claiming priority	
Description		Copy of earlier application	
Claim(s)		Form IP 4 (Statement justifying right to patent/utility model certificate)	
Drawing(s)		Form IP 39 (Appointment of agent)	
Abstract		Other document(s) (specify)	

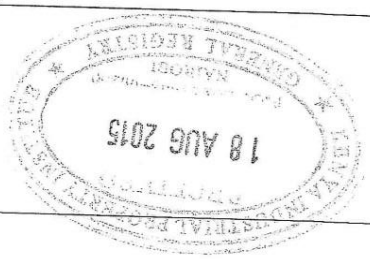
Dated at .18..... this .....Tuesday..... day of .....August....., 2015.....

Signature……

SUPPLEMENTAL SHEET

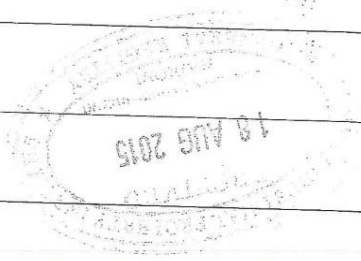
(To be used if the space provided above is not large enough to contain information to be furnished)

Additional Applicant(s)	
Additional Inventor(s)	
Additional Priority	
Other	



For official use only

Date of actual receipt of application under section 41(1) of the Act	
Date of receipt of correction under section 41(3) or 41(5) of the Act or drawings under section 41(4) of the Act	
Application number	
Filing date	



FORM IP 4
Regulation 12

THE INDUSTRIAL PROPERTY ACT, 2001

The Managing Director,
Kenya Industrial Property Institute.

STATEMENT JUSTIFYING APPLICANT'S RIGHT TO PATENT/ UTILITY MODEL CERTIFICATE

Name and address of applicant(s)	National Environmental Trust Fund
Name and address of agent (if any)	
Title of invention	**Hybrid biomass and electrical dryer for crisping**

I/We, the applicant(s) in respect of the above mentioned application for a patent/Utility model, declare as follows:

(i) I/We believe that person(s) below (and on supplementary sheet if necessary) is/are the inventor(s) of the invention in request of which the above-mentioned application is made.

Name of inventor	Address
Chrispine Omondi	Geomaps Centre, 7th Floor, Matumbato Road, Upperhill, P. O. Box 19324, 00202 Nairobi;

(ii) The derivation of my/our right to be granted a patent upon the said application is as follows-

The biomass drier has been developed through a concerted effort and research on the following components which I wish patented:

- The intergration of the Hybrid electrical and biomass drying method

(iii) I/We consent to the publication of the details contained herein to each of the inventors named above.

Dated at .18..... this .....Monday..... day of .....August....., 2015.....

Signature .....

ABSTRACT: not more than150 words

Abstract: *Summary of the invention. Includes description of the invention and should contain most of the technical words or expressions describing the invention. (Less than 150 words)*
The Hybrid biomass and electrical dryer for crisping. The dryer has a maximum load capacity of 0.25 tons and is fitted with both an electrical system and a biomass gasification system as the main sources of heat energy. The gasifier system is especially designed to combust agro-waste biomass and the waste products from the processing of the mangoes such as the mango stones as the main feedstock. The biomass gasifier unit thus serves as the main source of energy with the electrical component serving as a stand-by heating system in cases where biomass is unavailable. This dryer utilizes dry hot air as the main heat medium and is in cooperated with the heat exchangers and is thus able to achieve heating capacity of 90^0C. The unit is also fitted with a temperature control unit composed of a display unit, thermocouples and thermostat for desired heat control. The final desired fruit moisture content from the dryer is at 6.5% with drying times of 0.5 hours per batch

Technical Field statement and Background Art: *Specify the technical field to which the invention relates to.*

The invention relates generally to forced air dryers and, more particularly, pertains to solar energy-based drying of fruits, vegetables, and other food particles.

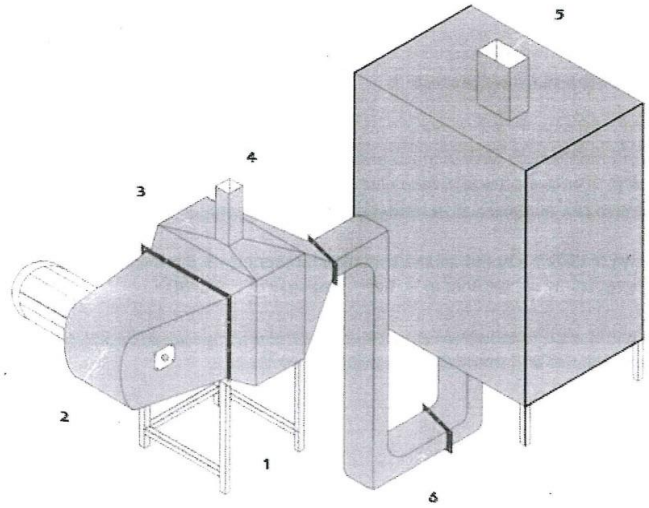
The benefits of evaporating moisture or dehydrating foods such as bananas, raisins, dates, papayas, apples, tomatoes, onions and the like are well known. Weight is reduced, making transportation and storage less expensive; food may be preserved in varying temperature environments for long periods without refrigeration and continue to provide a concentrated, pleasing flavor.

The development of dehydrating procedures includes traditional methods wherein food particles are laid out in the sun on trays for several days during which period they were exposed to dust and were frequently discolored by the sun's ultraviolet rays. The moisture content is reduced by evaporation from the initial value of 80% to the range of 15%-25%. Despite the concentrations in sweetness that accrued as a result of direct sun drying, objections arose to the products as a result of their darkened color and the dust and dirt they accumulated. Some consumers also discovered the caramelized quality of fruit sugars that are generated to a small extent in some products to be objectionable, and this caramelization was proven to be due to prolonged overheating in the sun.

Next, enclosed kilns have been developed which blow heated dry air at about 65° F. over and between the food particles laid out on a perforated kiln floor. Further drying compensation had to be considered when the food particles were dipped in chemical preservatives which increased their moisture content.

Another type of drying system is a continuous through circulation dryer having a natural gas burner which discharges its hot combustion into a mixture of recycled vapors from a drying bed and makeup air from the outside; the resulting hot gas and vapor mixture is drawn with a fan from a gas mixing plenum and blown into drying contact through a gas permeable bed of goods to be dried. The gas is withdrawn from drying contact and most of it is recycled for reheating while a portion is expended to the atmosphere as spent gas.

Notwithstanding these previous designs, it remains desirable to provide an improved drying system of a modified type from that known in the prior art which is effective to maintain a constant temperature range in a drying compartment to ensure even drying of food particles disposed therein. It is further desirable to provide a drying system which is solar energy-based yet contemplates the assistance of a backup fuel source for continuous 24 hour production. It is also desirable to provide a solar-based drying system which employs a collector device which permits maximum dehydrating heat flow to the food material to be dried.



BACK VIEW

Figure 2: Back View of the Hybrid biomass and electrical dryer for crisping

Components:

Front View

- 1- Door
- 2- Thermometer
- 3- Rack
- 4- Trays

Back View

- 1- Gasification Stove
- 2- Blower
- 3- Heat Exchanger
- 4- Exhaust Pipe
- 5- Chimney with a damper
- 6- Insulated Duct

ANNEX 24 **LIST OF PILOT PLANT EQUIPMENT**

LIST OF PILOT PLANT EQUIPMENT (TECHNICAL AND DESIGN SPECIFICATIONS)

No.	EQUIPMENT	QTY	TECHNICAL AND DESIGN SPECIFICATION
1.	Hybrid Electrical-Biomass Fruit Drier	1unit	a) Portable Horizontal type cabinet hybrid Biomass- Electrical system b) Electrical standby unit c) Detachable biomass gasification unit capable of combusting any form of biomass especially mango seeds and maize cobs d) Single phase power heaters e) Single phase electrical Blower f) Food grade stainless steel interior and perforated stainless steel trays g) Temperature control unit and digital display unit with thermometer and thermostat h) With maximum heating capacity of not less than 90 ^{0}C i) With an input load capacity of at least 0.25 ton per batch j) Dry-air as heat medium k) Copper tubes heat exchange system
2.	Solar Air Drier	3units	a) Drying capacity of 0.25 tons per batch b) Dimensions of 10,000*20,000*4,000mm (W,L,H) c) Mild steel framework d) Wooden trays with plastic sieves of 5mm pores e) With convection/ natural air draft f) UV stabilized poly ethylene sheets with direct transmittance of 83% & 68% diffuse radiation g) Corrugated black sheet floor heat absorber h) Rooftop air exit vent i) Side shutters/ air regulators j) Tray Load density of 5kg/ M^2 k) 22^0 roof inclination l) Must be rain, insect, dust and rodent proof m) Average temperature range of 40-65^{0}C n) Direct absorption of solar energy o) Fiber glass insect screening p) Side wall ventilation q) Final fruit moisture content of not less than 8.5%

3.	Disk-mill	3pcs	a) Production capacity of 100Kg per hour b) Made out of Food grade high carbon steel material c) Single phase power d) Mesh Dia 0.6mm e) Motor 0.5kW f) 3pc ratator Knuckle gears g) 3pc ratator oblate gears h) 150mm ratator outer Dia i) 9000rpm main shaft Rotational speed
4.	Hammer mill	3units	a) Suitable for maize, sorghum, millet and cassava b) Speed of mill rotor:- 3600 rpm c) Electric motor drive d) 10-20HP power e) 1.25" rotor shaft size f) 1.25" long life bearings g) 1/20" screen h) Interchangeable and wide selection of screens i) 24 pieces fixed and hardened steel hammers j) Single bagging k) With a detachable cyclone l) 6-7bags per hour production capacity
5.	Electronic weighing scale	3pcs	a) Table-top scale b) Capacity 6kg*0.001kg c) Readability 0.001 d) Weighing mode-Grams e) Stabilization time 1.5- 2 seconds f) Overload protection g) Auto Off (menu select) h) Power requirements- inbuilt battery with cut-off i) Battery back-up with Automatic Voltage Regulator j) Low battery indication k) Power consumption- 0.75- 1 Watt in average l) LCD display with backlight m) Calibrated with a calibration certificate from Weights and Measures
6.	Portable platform scale	3pcs	a) Capacity 250kg*100gm b) 400mm*625mm c) Portable d) Non electronic e) Calibrated with a calibration certificate from Weights and Measures

7.	Sealer	3pcs	a) Foot operated b) Single phase powered c) Sealing length 450mm / 13.77” d) Sealing width 2~5mm / 1/8 ~ 3/16 inch e) Input voltage AC 220/110V 50-60Hz f) Heating time 0-2.5 Sec g) Impulse power 1250 Watts h) Dimensions 550x520x880mm
8.	Ribbon Mixer	3pcs	a) Horizontal Mixer with stainless steel interior b) High carbon stainless steel ribboned mixing blades c) Single phase electrical powered d) Capacity 50Kg
9.	Packing trough	3pcs	a) Made out of stainless steel material b) 50kgs Capacity c) With filling hopper and under table for packing
10.	Grading racks	3pcs	a) Made out of mild steel with removable wooden boxes b) Dimensions 2000*650*860mm
11.	Washing trough	3pcs	a) Made out of stainless steel b) Size of 2000*650*860mm c) With stainless steel drain valve
12.	Plastic crates	30pcs	a) Standard size plastic crates b) Stackable and vented c) Fruit and vegetable crate d) Meshed e) Dimensions 600*400*170mm f) Any color
13.	Peeling table with overhead shelf and under shelf	3pcs	a) Made of stainless steel b) Size of the peeling table 2000x1000x900mm c) Over shelf size 1900x350mm. d) Under shelf size 1700*300mm

ANNEX 25 **LIST OF PARTICIPANTS FOR THE MARKET LINKAGES WORKSHOP**

Attendant Sheet

Private sector workshop in market linkage and product promotion

Venue__________ Date__________

No	Name	Gender F	Gender M	Organization	Email	Sign
1.	Elizabeth Muthui Mwali	✓		Chamber of Commerce		
2.	RUTH M SAMUEL	✓		MUKY – ORDAP	ruthsamuel206@gmail.com	
3.	Christopher Mutua		✓	Bestrock Sacco Ltd	chrissmutu[illegible]@gmail.com	
4.	MUGAI EUNICE KAMENE			GRITS INDUSTRIES (K) LTD	[illegible]	
5.	JAMES THEO MUMO		✓	GRITS INDUSTRIES (K) LTD	James-Kinengo@gmail.com	
6.	Esther Muthami	✓		ULTIMA MEGA LTD	estherm@ultimamega.co.ke	
7.	Ruth Kimeu	✓		Media – Athiani	[illegible]@gmail.com	
8.	Eunice Mutuku			Catholic Diocese		
9.	Monika Masinzi	✓		GAF		
10.	Philip Mutek		✓	Media Mbaitu fm	mutekphilip@gmail.com	
11.	JOYCE MORAA	✓		MEDIA COUNTY FM	jfmoraa@gmail.com	
12.	Vincent Mutua		✓	ACK – Diocese		
13.	BENEDICT N. JOHN		✓	CATHOLIC DIOCESE	ndutoj@yahoo	
14.	GRACE MUNYAO		✓	KEP		
	Janet Sammy			Chair member		

KICC, LC 13 Tel 254 20 248 769/248 846/214 705 Fax 248 768 P.O. Box 9164 - 00200 City Square, Nairobi, Kenya.
Email: info@greenafricafoundation.org www.greenafricafoundation.org

Attendant Sheet.

Private sector workshop in market linkage and product promotion

Venue________________ Date________________

No	Name	Gender F	Gender M	Organization	Email	Sign
1.	PHILIP MWANSANSI		✓	Kusi:komo	Phillip Ovicekaye [illegible]	
2.	Faith Mueni david	✓		Kiembeni Market	Faith M david	
3.	ELIZABETH Muthangye	✓		Kithimbuan Market	ELIZABETH	
4.	Brian M Mwangangi		✓	Syokimau Farm	Brian[illegible]@gmail.com	
5.	JACOB M. KASYULA		✓	TOURISM & NATURAL RESOURCES	[illegible]jacob 2014@yahoo.com	
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7.	Brenda Mwende	✓		Media - K24	mwendebrenda33@gmail	
8.	Charles Musyoka		✓	Media - People daily	[illegible]	
9.	Abel Mutuku		✓	Media - NTV	[illegible]@gmail	
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12.	CAROL MWENDE	✓		STAGE MARKET	mwende.c	
13.	MILTON O. OKADA		✓	Green Africa foundation	[illegible]@greenafricafoundation	
14	Kasembeli James			KEP	james.kasembeli@yahoo	

KICC, LG 13 Tel 254 20 248 769/248 846/214 705 Fax 248 768 P.O. Box 9164 - 00200 City Square, Nairobi, Kenya. Email: info@greenafricafoundation.org www.greenafricafoundation.org

ANNEX 26 **MEDIA RELEASE**

ENHANCING CLIMATE RESILIENCE AND NUTRITION UPTAKE THROUGH THE FORTIFICATION OF CORN FLOUR WITH LOCALLY PRODUCED HIGH NUTRITION VALUE CROPS (MANGO)

ANNEX 27 **TRAINING REPORT ON USE OF GREEN HOUSE SOLAR DRIERS**

QSM & ASSOCIATES LTD.

FOOD QUALITY & SAFETY AND VALUE ADDITION CONSULTANTS

FIRST FLOOR
TEMBO SACCO BUILDING
P.O. BOX 1957 THIKA-01000

CELL PHONE: +254716198418
+245733819168
E-MAIL: *qsmkenya@yahoo.com*

TRAINING OF MUKY ORDAP WOMEN GROUP AND RISE KENYA GROUP
BY QSM AND ASSOCIATES LTD. ON THE USE OF GREEN HOUSE SOLAR DRYER
ON FRIDAY 13TH JULY 2016

Trainers: Dr. John Wangoh and Mr. Munene Nyagah – QSM

Training Venues: Mwingi North Sub-county; Kyuso Location at Kamuwongo and Mwingi West Sub-county; Migwani Location at Bazar

THE TRAINING

Together the training was carried out on 7 technical personnel at Kamuwongo and 4 at Bazar, Migwani. The training was interactive and started with verbal description of the steps involved. The training used live specimens of mangoes and used the "Training Manual on Production of Dehydrated Mango Products" by QSM & Associates Ltd. The manual is attached

1. **PROCEDURE FOR DRYING OF MANGOES**
   - Select firm ripe fruits
   - Wash the fruits
   - Let the water drain
   - Peel each fruit
   - Slice off the pulp from the broad end and from the spines
   - Cut the fruit slices into either smaller slices (not more than 0.5cm) or dices of similar size – slices were used
   - Dip the cut pieces into 0.2% sodium metabisulfite solution (10 g/L water) for 5 minutes using either a basket or muslin cloth – prevents browning during drying and storage of dried slices and also controls fungal growth during storage of dried product.
   - Drain as the water as much as possible
   - Spread as monolayer in dryer
   - Allow to dry with occasional turning to about 10 - 15% moisture

- Package in moisture and light impermeable packages

TECHNICAL CHALLENGES OF THE GROUPS AND RECOMMENDATIONS

a) Moisture determination – The group needs simple equipment for quick moisture assessment during drying.

b) The RISE Kenya group were very conversant with dehydration of mangoes. They had been trained on the same by GTZ using a small size dryer. After discussion with them they did not require a demonstration. They were awaiting the mango season to begin drying.

Dryer at Muky Ordaa Group

Dryer at RISE Group

Participants being shown how to prepare mangoes for drying at Muky Ordap

Participants being shown how spread mangoes for drying at Muky Ordap