



**Participatory Ecological Land Use Management Association
Agro-processing and Value Addition Training Workshop Report**

Chester Hotel Nakuru
16th-18th March 2011

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Background

Participatory Ecological¹ Land Use Management Association, PELUM, has a mission to work towards sustainable local community empowerment, food security and prosperity by facilitating networking and advocacy. Based on this backdrop, food security takes centre stage in the associations' interweaved values of promoting seed security and the use of indigenous food programmes among small-scale farmers.

With many PELUM Kenyan farmers at community level, agricultural production has substantially improved. Even where production is low, there is a need to extend the storage of certain foods hence lengthen the shelf life when the foods are in their bounty season in order to prevent wastage due to excess production.

The legendary case of vegetables is a good example. Farmers continue selling vegetables at throw-away farm gate prices during the wet season causing shortages during the drier months when they are needed most.

It's therefore necessary for community group trainers to acquire skills and knowledge for diverse methods of food preservation, value addition and agro processing that is practical and possible at household level.

This training workshop will be an important step in strategising for Agribusiness² and Value Chain³ engagements in marketing agricultural produce, for group marketing as well as individual marketing.

Participants proposed a list of crops that they were interested in. Even though PELUM Kenya may not address all the proposed food crops due to the time limitation, participants are challenged to continue building skills with other crops once they go back to their respective areas of work.

¹**Ecological** - Ecology is the scientific study of the relation of living organisms with each other and their surroundings

²**Agribusiness** - In agriculture, agribusiness is a generic term for the various businesses involved in food production, including farming and contract farming, and retail sales.

³**Value Chain** - An industry value chain is a physical representation of the various processes that are involved in producing goods (and services), starting with raw materials and ending with the delivered product.

Day 1

1.0 Introduction



Participants listening to J. Cooney © PELUM Kenya

1.1 Welcome remarks

Maryleen Michieni who works with PELUM Kenya as the Programme Officer in Research and Information Management was the key coordinator of the 3 days workshop that started on the 16th of March 2011 at Chester Hotel in Nakuru County. Maryleen conducted the welcome remarks by encouraging members to be free and active as they participate and ask questions during the workshop.

1.2 Members Introduction and house keeping

Participants introduced themselves and conducted a participatory and voluntary housekeeping session, selecting their welfare representatives and time keeper as part of team building and participatory learning during successive sessions. The number of participants, occupation and organizational representation are appended in this report (See appendix I)

1.3 Keynote speech

The workshop was officially started at 8:45 am with devotion and prayers, followed by a keynote speech by Mr. Stanely Bii from the Catholic Diocese of Nakuru; Mr. Stanely is one of the PELUM Association founders.

Stanley underscored the main purpose of the workshop in his keynote speech indicating that;

It was important for farmers to be taught on preservation of various foods like Vegetable, Mangoes and Pumpkins especially when they are in their bounty season to avoid wastage.

Stanley continued to say that most farmers waste their harvests in excess and when the season is over, people starve to death due to food shortage. Through the workshop, farmers would be encouraged how to eat different types of foods especially edible insects, hence getting practical skills on methods of adding value and processing of various foods.

Stanley thanked the PELUM team for organizing the workshop which would inform the entire community on foods, value addition, nutritional value and how to get them locally.

2.0 Programme overview and objectives

2.1 Theme

While focusing on the main theme of Agro Processing⁴ and Value Addition⁵, the key objective of the workshop was to impact practical skills and capabilities in the methods of value addition and agro processing to participants on selected food and edible insects. The overall aim of the workshop was to increase food security through diversification of agricultural food products.

2.2 Objectives

The participants were expected to;

1. Gain a deeper understanding of the importance of food preservation and the methods that retains the nutritional value of the foods.
2. Discuss the Phytosanitary⁶ (hygiene standards) conditions requirements during agro processing and food handling.
3. Engage in practical sessions of value addition and agro processing of pulses and cereals, root crops, legumes, dairy, vegetables and edible insects.
4. Compare the market value of finished, labelled products in the food stores and the importance attached to the same foods (plants) at farm gates markets.

Maryleen facilitated the workshop objectives outline and discussed with participants their expectation based on the programme and expounded in brief the workshop objectives. At the end of the workshop;

2.2.1 They participants expected to learn;

1. How to preserve milk and vegetables in arid areas
2. Nutritional value of milk and meat for pastoralists
3. Preservation of cereals like millet and maize. Participants complained that maize weevils are very destructive; they expected to learn local ways of controlling these pests.
4. More about the value addition of cassava, sweet potatoes and how to market them.
5. Processing of mangoes, avocados and bananas.
6. The nutritional value of wild fruits.
7. Economic value of insects.
8. Application of hygiene standards when handling foods.
9. Approaches to employ when teaching community members on the on the importance of edible insects like grasshoppers and others.

⁴**Agro Processing**- turning primary agricultural products into other commodities for market

⁵**Value Addition** - Refers to "extra" features of an item, product or service that go beyond the standard expectations and provide something "more" while adding little or nothing to its cost. ⁶**Phytosanitary**- These are regulations that restrict the importation and marketing of certain plant species, or products of these plants, so as to prevent the introduction or spread of plant pests or pathogens.

10. Alternative equipments or local techniques to use in rural areas when processing different foods.
11. Food preparation traditionally and locally.
12. About nutritional needs of the community.

3.0 About PELUM Kenya

Maryleen introduced PELUM Kenya, stated the objectives of the association, its aim, values and mission. She elaborated the core functions of PELUM Kenya and its role in advocating and supporting small scale farmers' initiatives all over Africa and the world at large.

3.1 What is PELUM Association?

Participatory Ecological Land Use Management, PELUM, Association is a network of Civil Society Organizations / NGOs working with small-scale farmers in East, Central and Southern Africa. The Association membership has grown from 25 pioneer members from 1995 to over 210 members in 2009. PELUM- Kenya is the Kenyan country chapter of the PELUM Association and currently has a membership of 37 member organizations.

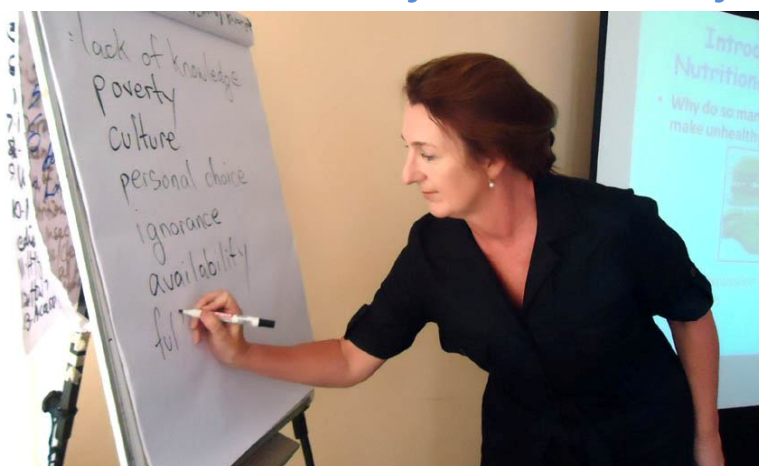
3.2 What does PELUM Association do?

With focus on this workshop, PELUM;

1. Promotes participatory ecological land use and management practices in the East, Central and Southern region.
2. Increases the visibility of the small-scale farmers.
3. Promotes the use of indigenous food Programme

A. SESSION 1

4.0 Introduction to Healthy Nutritional Dietary Guidelines



Jill Cooney Facilitating Healthy Dietary Session ©PELUM Kenya

The session was facilitated by Jill Cooney; Jill is an Applied Nutritionist working with Real Impact, an NGO based in Thika town.

Jill started by asking the participants why people within the society make wrong food choices; Participants underscored; poverty, ignorance,

Availability of the particular type of food, hunger needs, income level, and lack of knowledge, cultural/social attachment, education and family dynamics as some of the factors contributing to poor choice of food consumed.

Participants were then engaged in an exercise to show the quantity of a particular type of food consumed over a certain period of time.

4.1 Exercise 1

Participants were to write on a piece of paper, what they had consumed in the last 2 days and categorize in food groups i.e. Proteins, Carbohydrates vitamins and check where they concentrated most.

4.2 Plenary session;

The members discussed some of the benefits of taking nutritional food in a balanced diet.

1. Increased lifespan.
2. Improved immunity to fight against diseases
3. Good health
4. Increased energy level.

4.3 Exercise 2

Participants were asked to write all the methods of preserving foods.

They named drying, smoking, salting and refrigeration as the main methods.

4.4 Exercise 3:

Discussion on causes of food poisoning

Explain the presence of micro- organisms/ bacteria in the body

- Due to poor hygiene i.e. improper handling of food during preparation.
- Keeping food for too long until it spoils

Results; Diarrhoea, Vomiting, Hallucinations, Coma, Death

Explanation on how one can get ⁷bacteria from improper food handling

Prevention measures and Personal hygiene

4.5 Plenary Sessions;

Participants wanted to know why pastoralists' communities consume raw meat and milk but are still very healthy. Jill explained that the art of mixing herbs in milk and meat cleanses their body systems, though this eating habit was not considered healthy. She cautioned that they should take a balanced diet or otherwise they will shorten their life expectancy.

Participants inquired if the amount of food consumption between an office worker and field worker matters. Jill reiterated that it was common sense that anyone who does a lot of work in the field should take a lot of food especially a lot of carbohydrates as compared to those seated in the office. Their body requires sufficient energy unlike the office person.

Jill challenged the participants to research online about the amount of calories⁸ consumed by household by measuring the amount of calories by grams to determine consumption rates per meal as an effort to living healthy.

⁷**Bacteria** - A large domain of single-celled, prokaryote microorganisms. ⁸**Calories** - is a pre-SI metric unit of energy. ⁹**Ugali** - is an East African dish of maize flour (cornmeal) cooked with water to a porridge- or dough-like consistency.

Participants asked the difference between raw and cooked salt. It was discussed that sodium level is equal whether cooked or raw otherwise more herbs or natural spices can be used like the *dania* and *hoho*, Ginger since they reduce the urge of taking too much salt.

4.6 Lessons learnt

The participants learnt that too much salt can cause high blood pressure, it can dehydrate the body. The community should be taught on food intake i.e.

- a. When to take and who should take a large and small amount of food.
- b. One can take a balanced diet in an affordable sense. For example, one can get a plate of chips, soft drink, chicken at KSh 200 (2.5 \$) even though it's not a balance diet. This was compared to serving a plate of beans, vegetables and flour *ugali* ⁹ at Ksh 70 (1 \$)

B. SESSION 2

5.0 Nutritional Value of Milk and Fruits



Ms Tabitha Tene demonstrates how to prepare cheese © PELUM-Kenya

This session was facilitated by Ms Tabitha Tene, Tabitha is a free lance trainer on value addition and cancelling, she consults with RODI Kenya based in Thika Town.

5.1 Sources of milk

Participants were asked to name common sources of milk; Cow, Goat, Donkeys, camel, sheep, Breast, soya were listed. Tabitha prioritised cow milk for discussions and training.

5.2 Importance of milk in the body

1. Adds calcium which makes body strong
2. Adds iron but in a little quantity

5.2 Milk products

1. Mala (sour milk)¹⁰
2. Yoghurt¹¹
3. Butter
4. Ghee

Before preparing any product from milk especially yoghurt one needs to confirm and be sure that the milk is free from the following

1. Mastitis¹²
2. Colostrums¹³
3. High acidity (Not slightly sour before pasteurization)
4. Impure milk (milk that has been diluted with water)

How to test milk for;

	Test	Observations	Testing Procedure
1	Mastitis & Acidity	The milk produces bad Odour (smell).	<ol style="list-style-type: none"> 1. Get ethanol¹⁴ at 72% 2. Syringe the milk up to 5cc level. 3. Put in a glass 4. Syringe Ethanol up to 5cc level as well. 5. Mix and shake well 6. If the milk goes bad then the milk has either mastitis or High level of acidity and vice versa.
2	Colostrums	Milk colour is yellow	
3	Impure milk	Milk diluted with water is visually light in mass weight.	Mercury lactometer test Procedures <ol style="list-style-type: none"> 1. Put milk in a jar 2. Dip in the lactometer 3. If the red mark floats at the level of milk then the milk is ok if it floats at a different level then the milk has water in it.

5.3 Plenary Sessions

Participants shared other methods used locally to determine impure milk.

	Method / Test	Procedure
1	Matchstick Test (Traditional Way)	<ol style="list-style-type: none"> 1. Put a small portion of milk in a small cup 2. Dip in a matchstick get it out and try to light (if it lights then the milk is pure if it doesn't then the milk has been added water. <p>This was tried out practically and the results were positive</p>

2	Ground test	Pour little milk on the ground and if it dissolves quickly then the milk is diluted with water and vice versa.
3	Glass test	Pour milk in one glass, dip an empty glass in it. If the milk is diluted with water then it will separate the water.

During the preparation of the milk products, the facilitator also gave a theoretical procedure of making Milkshakes and Ice creams.

5.4 To prepare milkshakes¹⁵;

- Mix avocado and milk at your preferred amount then whisk thoroughly.
- Add ice cream into the mixture then whisk again.
- Add flavours and sugar successively then continue whisking.
- Chill

5.5 To prepare Ice cream;

Procedure 1

- You get cream from cooled milk
- Don't over process the cream like that of butter
- Add icing sugar and other flavours and whisk thoroughly
- Pack well then refrigerate to preserve.

Procedure 2

- Mix milk with Egg-York to your desirable amount then whisk thoroughly.
- Add icing sugar and continue to whisk
- Add preferred flavours then pack and chill to preserve.

Participants also learnt that milk from cows differs; other cows produce milk that is too fatty others have low fats but both can be used to make milk products.

5.6 Yoghurt preparation

5.6.1 Practical sessions

Ingredients used

- Culture¹⁶ ¼ tea spoonful.
- 10.5 table spoons of sugar, 2 drops of strawberry flavour, A pinch of food colour.
- Four Litres of Milk

5.6.2 Equipment used

- Thermometer
- Wooden spoon
- Sufuria

¹⁰Mala - sour milk, ¹¹Yoghurt - is a dairy product produced by bacterial fermentation of milk. ¹²Mastitis-means that the breast is inflamed, and there is swelling, redness, tenderness and pain, ¹³Colostrums- is a form of milk produced by the mammary glands of mammals in late pregnancy. ¹⁴Ethanol-is a volatile, flammable, colourless liquid, ¹⁵Milkshakes-is a sweet, cold beverage made from milk, ice cream and flavourings such as fruit syrup or chocolate sauce, ¹⁶Culture- The bacteria used to make yoghurt.

Ms. Tabitha demonstrates how to measure temperature ©PELUM-Kenya

5.6.3 Production of yoghurt has two procedures

1. The Mother culture method
 2. The yoghurt culture method
- The mother culture method was used during the session

Procedure 1

1. Participants tested the milk to confirm purity level.
2. They pasteurized¹⁷ the milk at 85°C for 15-20 minutes. As it boiled, they stirred the milk with a cooking stick to ensure it boiled thoroughly (The process is homogenization¹⁸)
3. They then let the milk cool to 40°C - 45 °C. Tabitha added that for those who had no thermometers could alternatively use their hands to test if it was cool enough. (The process was demonstrated)
4. After it had cooled the cream was removed
5. Mother culture was inoculated¹⁹ at the rate of 2%
6. The mixture was put in a container, covered with a towel then wrapped in a paper bag to maintain the temperature for 5 hrs.
7. After 5 hours they added the straw berry flavours, sugar and food colour then mixed it and refrigerated to cool for preservation purposes.



Procedure 2

This procedure was theoretical due to shortage of time.

1. Boil your preferred amount of milk.
2. Add sugar as it boils and stir
3. Add flavour and food colour as the milk continues boiling.
4. Let the mixture to cool at 40°C - 45 °C.
5. Inoculate 2% of culture in the mixture and keep it in controlled incubation for 5 hours.
6. Sieve then cool.

5.7 Plenary Sessions

During the session, Tabitha encouraged participants without refrigerating systems to could cool the yoghurt mixture by dipping it in a bucket full of cold water. She also added that since the mother culture was too expensive, alternatively before adding the flavours, one can take a few litres of the mixture, deepfreeze it and reuse in the next preparation of yoghurt. (¼ full Glass is enough for 5 litres of milk).

¹⁷**pasteurized** - is a process of heating a food, usually liquid, to a specific temperature for a definite length of time, and then cooling it immediately, ¹⁸**homogenization** - is a mechanical treatment of the fat globules in milk brought about by passing milk under high pressure through a tiny orifice. ¹⁹**inoculation** - Is to inject a serum or a vaccine in order to create immunity

The participants realized that using method 1 was economical because through the procedure one can extract culture for future use. They also learnt that in the 1st procedure, one can extract cream which can be used to produce butter and even Ghee.

Tabitha also clarified that when packing yoghurt, aluminium containers were preferred but warned participants not to use aluminium containers to boil milk.



It was also noted that procedure 2 was not quite reliable because during the process no cream can be extracted. The mixture cannot be preserved for long because sugar was mixed while boiling.

She reminded the participants that the nutritional value of yoghurt was very high compared to **mala**.

Mala can be made traditionally by using lemon or just keeping the milk for long to ferment or by using culture. She continued to explain that traditional mala was very nutritious than the mala made using cultures.

A participant later inquired what could make the whole of the process fail i.e. what can hinder the production of quality yoghurt. The facilitator demonstrated the following reasons;

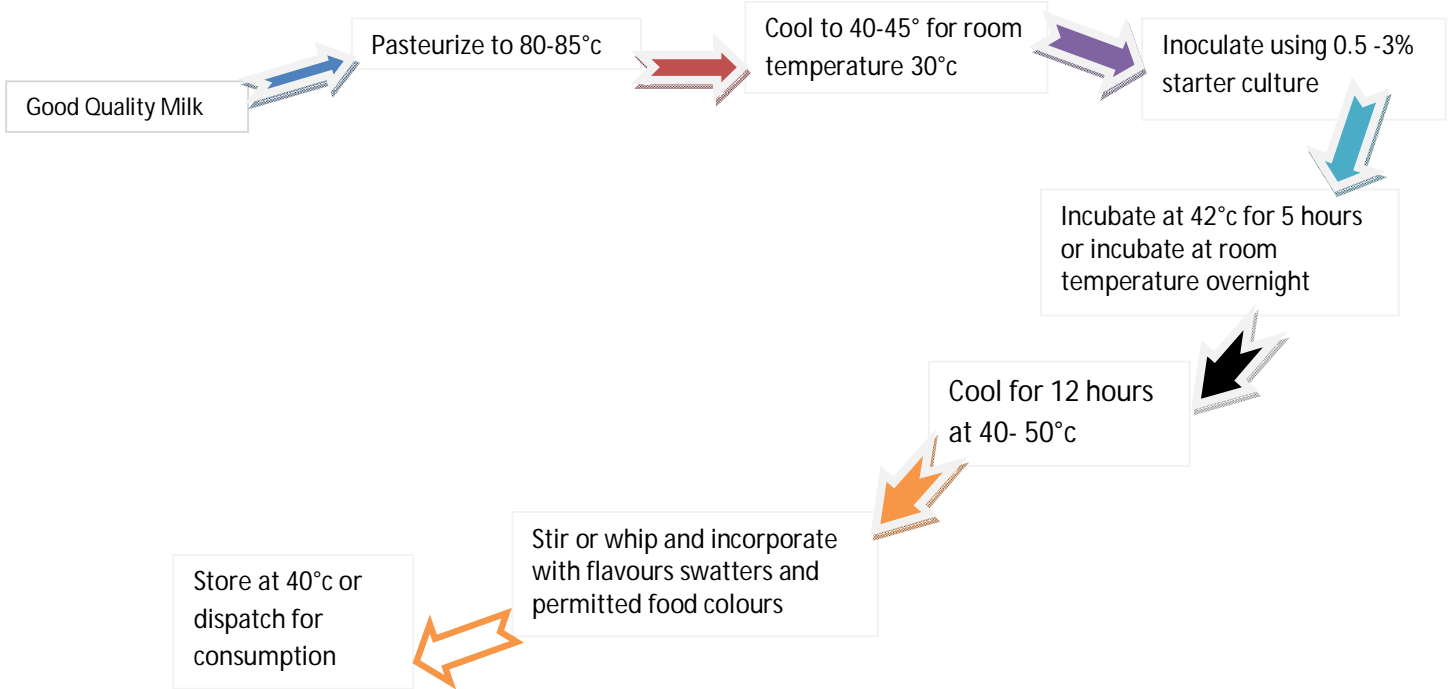
1. Doing inoculation when the temperature is too high
2. Use of metal spoons to stir the mixture
3. Interfering with the mixture after inoculation.

The participants also asked the effect of using too much culture; Tabitha explained that too much culture can turn the yoghurt to be too acidic hence not good for human consumption.



Facilitator adding Culture to preparing yoghurt as participants participate in the session ©PELUM-Kenya

5.8 Flow chart for yoghurt manufacturer



Common market costing for Yoghurt		KSH	USD \$
1	Food colour	30	0.4
2	Flavours	60	0.8
3	Milk 5litres	200	2.5
4	Culture	4	0.1
5	Sugar	25	0.3
6	Charcoal	40	0.5
7	Labour	200	2.5
8	Colour	1	-
	TOTAL	473	7.1

Based on the breakdown on the table above, a 5 Litres mixture of yoghurt costs Ksh 100 (1.3 \$) per litre

Participants concluded that it was economical to make a lot of yoghurt using the same labour and time to increase profit margins. The facilitator added that the Preparation procedure took only 1 hour hence no time is wasted.

5.9 Nutritional values of yoghurt milk.

Yoghurt helps in digestion process.

A Participant added that yoghurt was not good for children of less than one year, because it made them uncomfortable. He further explained that a child at that age, already has enough bacteria in the stomach to aid digestion hence the bacteria levels in yoghurt may collide with the naturally produced bacteria in the baby's stomach. He advised mothers to only breastfeed babies of that age because the bacterium only digests the mother's milk.

5.10 Butter preparation

This was a practical session, where participants were involved in the production process.

1. After the milk used for yoghurt production cooled, cream was extracted from it.
2. The cream was put in a bowl then stirred thoroughly until milk was separated from the fatty layer.
3. Water was poured in the mixture (to wash the mixture), the process was done repeatedly until the separate water was very clear.
4. A pinch of salt was added in the washed mixture and butter was ready. (Why was the salt necessary)

Tabitha explained that if one wanted to make more butter, collect enough cream which must be refrigerated because if it's not well preserved, it survived for 3-4 days. She added that butter must be refrigerated well to keep it fresh.

5.10.1 Uses of butter; smeared on bread to add flavour

5.11 Ghee preparation

1. When butter was ready, a portion of it was taken extracted.
2. The portion was put in a *Sufuria* and was left to boil in moderate heat temperatures until all impurities were settled out.
3. It was then left to cool then ghee was drained into a clean container then preserved.

NB Impurities were kept to be used in prepared vegetables to add flavour.

5.11.1 Uses of ghee

Used to prepare vegetables and chapattis

DAY 2:

Recap of day1

Maryleen facilitating the recap session



Maryleen asked participants to draw a mind map some of the lessons they learnt the previous day.

Participants remembered that butter is the mother of ghee and it was easy to make butter and ghee using cream and that yoghurt was the mother of all.

They also learnt alternate ways of checking the milk temperature without using a thermometer

before employing the two methods of processing milk yogurt. Yoghurt was healthy for digestion since it compensates the bacteria we may lack in the body.

As they underscored Hygiene standards during handling of milk products, participants recalled that milk should be put in a clear container when storing to monitor contamination. Participants reiterated the Importance of Sour milk i.e. highly nutritious and good when fermented raw. Other than that, it was interesting to recall that, in the absence of a lactometer one can use a lit matchstick to test if milk is diluted with water or to ascertain its purity before use.

They also learnt the importance of reducing starch intake due to excess sugar in the body to live longer. That one needs to have a balanced diet based on availability. The daily requirement of starch for an adult was approximately 300g.

During the production of yoghurt, it was important to remember that it was economical to use a certain amount of processed yoghurt that is free from preservatives and flavours as culture.

Participants also learnt that red meat takes 7 days to be completely digested out from our system. Milk with colostrums should not be used to make yoghurt. That one can spend less and still have a balanced diet based on nutritional value. Participants also learnt diverse methods of preserving different foods

C. SESSION 1

6.0 Nutritional value of different fruits

Participants preparing fruits and processing fruit juice during a practical session ©PELUM-Kenya



This session was facilitated by Tabitha Tene. She opened the session by selecting Mango, Pawpaw, passion, avocados, pineapple and carrots as the types of fruits she proffered to use during the training since they were common and locally available.

Tabitha highlighted the importance of each fruit in the human body system.

6.1 Table showing fruit nutrients and their nutritional value

Fruit	Nutrients	Nutritional value
Pawpaw	Vitamin A	Good for eyesight
	Vitamin B	Good for nervous system
	Vitamin C	Good for immune system
		<p>Other benefits in the body</p> <ul style="list-style-type: none"> • Its seeds help in prevention of worms when chewed. • The white sap from the raw pawpaw cleans dirty wounds • Papaine enzyme in pawpaw aids digestion • Pawpaw is also used to tenderize meat. • When you pound pawpaw leaves one generates soap
Passion	Vitamin C	Prevents scurvy
		<p>Other benefits in the body</p> <ul style="list-style-type: none"> • Boil passion leaves in water for 10 minutes (Handful of leaves and 1litre of water) cures sleeping sickness.
Avocado		<ul style="list-style-type: none"> • Good for people suffering from malnutrition • Produces oil that is good for skin care • Can be used to prepare milkshakes
Pineapples	Vitamin C	Prevents scurvy
		<p>Other benefits in the body</p> <ul style="list-style-type: none"> • Has bromeline enzyme which prevents inflammation. • 500g of unripe pineapple mixed with 0.7 litres of water then boiled together, the syrup produced cures amenorrhoea (absence of menstrual flow) • Raw boiled pineapples can prevent fever. • pineapples supports the immune system
Mango		<ul style="list-style-type: none"> • Helps during constipation • Tender mango leaves when boiled cures sore throats. • Chewed tender leaves helps in inflammation of gum cavity.
Carrots	Vitamin C	Prevents scurvy
		<p>Other benefits in the body</p> <ul style="list-style-type: none"> • Stabilizes the stomach functions • Good for eyesight, diarrhoea and constipation • Reduces level of bad cholesterol in the body • Slightly effective against hookworms, irregular menstruation and Prostatitis

Later, participants were divided into different groups for practical session where participant learnt to prepare fruit juice using different

6.2 A summary of participant's facilitation of fruit juice preparation

NO	Group facilitator	Juice prepared
1	Group I The presentation was done by Ambros Muthiani	<p>Pawpaw juice preparation process</p> <ol style="list-style-type: none"> The group washed the pawpaw first Bisected into two They then removed the seeds, scooped the pulp and smashed it. Water, Lemon and sugar was added into the mixture and mixed thoroughly. The juice was then packed in clean containers. <p>The group members later realized the benefit of using honey instead of sugar for its medicinal value.</p>
2	Group II Presentation was done by Fatuma Hamisi	<p>Passion juice preparation process</p> <ol style="list-style-type: none"> The passions were first washed Cut into two and the pulp was scooped into a clean container. Water was added mixed and then sieved No sugar was added because the juice was to be left natural. <p>NB: The ratio of passion pulp to the water was 1:2 respectively</p>
3	Group III	<p>Avocado juice preparation process</p> <ol style="list-style-type: none"> Participants washed the avocado fruit. It was cut into two and the seed removed. The pulp was removed; lemon was added, mashed and then sieved. The juice was packed in containers.
4	Group IV Presentation was done by Ferdinand	<p>Pineapples juice preparation process</p> <ol style="list-style-type: none"> 3 pineapples were washed and peeled They were then chopped into small pieces. The pulp was put into a bucket then mashed. It was then sieved and packed. <p>No water and sugar was added.</p>
5	Group V Presentation was done by Ann Nashipae	<p>Carrots juice preparation process</p> <ol style="list-style-type: none"> The carrots were washed; grated then mixed with water at a ratio of 1:1 It was then blended and mixed with lemon then finally sieved and packed.
6	Group VI Presentation was done by Max Galwal.	<p>Mango juice preparation process</p> <ol style="list-style-type: none"> The mango fruit was washed peeled and cut into small pieces. The pieces were mixed with water then blended at a ratio of 1:1 until all the pulp was all smashed. Lemon was added into the mixture then sieved and packed.



Participants preparing fruits and processing fruit juice in a practical session ©PELUM-Kenya

7.0 Root crops and Pulses

The facilitator discussed on the nutritional value attached to Sweet potatoes, Cassava and Arrowroots that are classified as root crops, as she demonstrated to the participants.

The participants learnt that;

7.1 Sweet potatoes;

When processed well, can produce sweet potato juice and that it's leaves can be cooked as vegetables.

7.2 Cassava;

This type of root crop can be used to produce crisps and that it's leaves, in particular those with few sections, could be used as vegetables. (after plucking the less leaves species are dried under the sun for 30 minutes and 2hours for the many leaves species respectively) Cassava can also be grinded to produce nutritious flour while mixed with millet and sorghum. Plain cassava flour can also be used to make cakes *mandazi* and even *chapati*.

7.3 Arrow roots

Just as Cassava, Arrow roots are also good for making crisps. Participants shared some of their experiences on the nutritional value of Arrow roots, how it should be harvested, preserved and used to produce other products.

They first confirmed that cassava had cyanide (cyanide is a naturally produced poison that protects cassava during growth until they matured). Different types of cassavas have cyanide in different quantities. Participants learnt that, if cassava was harvested before maturity, it produced a lot of poison that could be harmful to the human body. Therefore, it was important to note that the more the cassava matured the lesser cyanide it produced. Participants learnt how to identify a poisonous cassava before cooking. Poisonous leaves had a visible brown string on the edge and sometimes in the middle.

The process of harvesting cassava was put into consideration, i.e. if one harvested the cassava vigorously, the cyanide would be activated (cassava will be very bitter) and can be poisonous to the body. It was concluded that when harvesting cassava all the procedures MUST be done with care.

One participant added that current factories encourage farmers to produce more cassava for baking bread instead of wheat which was noted to be too expensive. They promised to encourage farmers in their communities to plant plenty of cassava.

How is cassava planted?

1. Cutting the cassava stem to at least 6 nodes
2. Dig a hole and lay the stem by burying it (this is done if the rains are far, so as to prevent it from drying)or alternatively if the rains are near members were encouraged to plant the stem at an angle of 45° protruding from the hole, since it grew faster at that time.

It was concluded that farmers needed to be too cautious when planting cassava because of its poisonous nature.

It was also important to know the Varieties of cassava before planting.

Day 3:

D. Session 1

8.0 Introduction to Edible Insects



Mr. John Kinyuru facilitating on the Edible insects session

This session was facilitated by Mr. John Kinyuru. Mr. Kinyuru is a Scientist and Lecturer in the Department of Food Sciences at Jomo Kenyatta University of Agriculture and Technology, JKUAT.

He started by introducing the JKUAT, outlined of what the department of the food sciences taught and introduced the researchers of edible insects and other traditional foods in the University. Before the session began, John asked the participants to share their expectations of the topics he was facilitating:

They expected to learn;

- a) Nutritional value of insects especially grasshoppers and how to tame grasshoppers
- b) The importance of eating insects.
- c) How they can locally produce insects in high mass
- d) Preservation and processing of insects.

He continued by saying that the world inventory of activities has realized that there is no more Land to produce enough food and insects will at the end be available for food in many parts of the country.

Many people in dry lands suffer from severe malnutrition and yet insects are available for enough nutrition, he informed the participants to encourage community members to utilise

edible insects for food, clarifying that insects lived longer than plants. John gave an example of insects that were available locally i.e.

- ↳ Nyoso From Luo land (a fatty insect good in proteins)
- ↳ Duck beetle
- ↳ Sene sene(Grasshopper) - From Luo community
- ↳ Shiswa (Termites) from the Luhya community
- ↳ Queen termite that is a good source of proteins

He further demonstrated that the soldiers (male termites), were not supposed to be eaten and the eggs as well. He gave an example of the Mahwetere from Luhya community which was a good class of edible termites. Sometimes it depended on taboos and culture from different communities, Luyhas considered termites that are harvested in the month of August to be good for consumption.

Participants learnt that termites were a source of livelihood as John gave an example of a mother in Kakamega namely Monica. Monica sells termites throughout the seasons and earns a living from them. She currently sells a *gorogoro* (2kg tin) costs ksh1000 (12.5 \$)

E. Session 2

9.0 Nutritional value of Termites and Grasshoppers

During his second session, John explained that flies found around the Lake areas, especially those from Luo land in Kenya, were good food while mentioning Crickets to be good in generating proteins.

John shared a video presentation featuring an Asian native, collecting Grasshoppers for and processing them for consumption. The documentary emphasised the importance of these insects as a delicacy in that the community.

After the video presentation, the following concerns were raised and shared by the participants with the facilitator.

Eating insects should not be considered uncivilized act. John urged the participants to teach people from other areas of the country on the importance of eating these insects. He reminded them that even though communities think that eating insects is a taboo, the workshop sessions educated them to change this mentality by first eating the insects themselves as part of the orientation.

The Bukusu ethnic group of the Luhya community in Kenya, need to be taught ways of harvesting termites throughout the year. He further clarified that since 2006, promotions are underway with partners and stakeholders to educate people in the larger communities.

Participants added that since it's not in the culture of some communities to eat termites, producers in the food industry should start mixing harvested termites with other products to change their perceptions over the consumption of termites.

Local strategies in marketing traditional foods should be developed; design fliers for presentation and capacity build the community with proper researched information to improve their livelihood.

The facilitator added that, there is a substitute of zinc mineral in termites commonly found in *Sukuma*, Amaranths and Millet.

9.1 Plenary session

Participants inquired if termites were prone to any diseases but the facilitator said there were no reports on the matter. However he added that, when taking food that is rich in Zinc, he encouraged them to mix with sources rich in Vitamin C to enhance the absorption of zinc and iron. (Source of vitamins in lemon)

John noted that in areas growing sugarcane, had plenty of termites, but since they destroy sugarcane, farmers are forced to use pesticides to eliminate termites. Due to this the community loses the edible termite's species due to ignorance.

Participants deliberated on this issue and concluded that, pesticides manufacturers need to be advised to introduce replants to be sprayed in sugarcane plantations, hence, prevent termites from invading the place but maintain the ecosystem between the termites and sugarcane.

9.2 Value addition of termites

The facilitator demonstrated that dried termites, if mixed with wheat flour can produce nutritious buns cakes and biscuits (5% termites plus flour). John added that, the flour mixture was very good for biscuits because when anything with less gluten is added the dough raised.

Processed Mushroom, mixed with termite produces a nice starter soup and Termites also produce oil good for food preparation.

9.3 Uses of Termite oil how to harvest termites

In his last presentation on Agro processing, John delegated participants in various groups for practical sessions on preparing, Tomato and Mango jam, preparing Sweet potato leaves and *Mandazi* (Cookies), Soya milk and balls, Pumpkin *Chapati* and Rabbit meat using termite oil.

9.4 Participant's presentations on various food processing & value addition

Group	Ingredients	Processing method
Group I Tomato jam preparation	The members used 3 cups of finely chopped tomatoes. 2.3 cups of sugar, And 3 lemons.	Tomato jam preparation: <ul style="list-style-type: none"> Members washed the tomatoes and put in warm water for a few minutes to loosen the cover skin The skin was removed and tomatoes were cut into small pieces. A few lemons were washed, grated and squeezed off their juice.

		<ul style="list-style-type: none"> • The lemon mixture was added in the tomatoes then grinded and cooked for 10 minutes in gentle heat. • 2.3 cups of sugar was added while stirring the solution to dissolve. • Cooking heat was increased for the mixture to boil up to a certain temperature. • The mixture was left to cool for some time then scum layer was removed then the tomato jam was poured in clean containers.
Group II Sweet potato Mandazi	a) 2 Cups of mashed sweet potato b) 2 Cups wheat flour c) 4 Tablespoons - sugar d) 3 Table spoons- sugar e) 3 Table spoons of baking powder f) 1 Cup of water g) Cooking Oil	Sweet potato Mandazi preparation <ul style="list-style-type: none"> • Members mixed the ingredients to form dough. • They then rolled the dough on a surface and cut into small shapes and deep-fried it.
Group III Mango jam	<ul style="list-style-type: none"> • 6 Mangoes • 3 Cups sugar • 1/2 Cup of water lemon 	Mango jam preparation <ul style="list-style-type: none"> • Members washed 6 Mangoes, peeled and cut into small pieces. • 3 Cups of sugar and 1/2 of water was mixed • They grated the lemon and squeezed juice from it • The juice was poured in a <i>sufuria</i> and boiled under gentle heat until it was soft, • They added sugar and stirred to dissolved • Members cooked again for ten minutes then left the mixture to cool, removed scum and poured in containers.
Group IV Sweet potato leaves	<ul style="list-style-type: none"> • Onions • Tomatoes • Table Salt • Cooking Oil • Sweet Potatoes leaves 	Sweet potato leaves <ul style="list-style-type: none"> • Members washed the Sweet potato leaves and cut them into small sizes. • They peeled onions, chopped and fried them with oil until they turned golden brown. • Washed and chopped tomatoes were added into the onions. • Salt was added and the mixture left to cook for some time. • They finally added the Sweet potato leaves, cooked for 5 minutes then served hot with the Pumpkin Chapati.
Group V Soya milk and balls	Soya	Soya milk preparation. <ul style="list-style-type: none"> • Group members boiled water and sprinkled soya in it at a ratio of 5:1 respectively. The solution boiled for 30 minutes. • After boiling, they drained water and again the soya was put in hot water.

		<ul style="list-style-type: none"> • They drained the water then put back again in cold water again. • The soya beans were gently rubbed to remove the outer cover(Husk) <p>The soya was then put in a blender mixed with water at a ratio of 1:1 and blended thoroughly. The mixture was sieved until the liquid was free from residues.</p> <p>Soya balls preparation</p> <ul style="list-style-type: none"> • After sieving, the remnants were mixed with flour, <i>dhania</i>, onions and spices were added for taste. • The mixture was compacted and squeezed until ready. • Mixture was cut into small balls and deep fried until they were evenly brown.
Group VI Pumpkin chapati	<ul style="list-style-type: none"> • Pumpkin • Table Salt 	<p>Pumpkin chapatti preparation</p> <ul style="list-style-type: none"> • The pumpkin was washed, peeled and cut into small pieces • It cooked until it was ready and all the water drained. • The pumpkin was smashed and mixed with wheat flour and water to make dough • The dough was cut into sizable balls and was rolled. • Later it was pan fried and the chapatis were ready.
All Participants Rabbit meat	Slaughtered Rabbit meat	<p>Rabbit meat processing</p> <p>The meat was divided into 2, i.e. Rabbit for roasting and for frying.</p> <ul style="list-style-type: none"> • The meat was cut into small pieces. • Boiled for some minutes until all the water drained completely. • Onions were fried until turned to golden brown then tomatoes were added. • The boiled meat was added in the mixture, and then salt was added and cooked until ready. • The other section was roasted on the <i>Jiko</i> with a wire mesh over very low heat for it to cook evenly, • Then cut into small pieces, salt sprinkled QS and served. <p>The Rabbit skin was processed for preservation.</p> <p>These steps were followed; The skin was spread on the table; salt was sprinkled on the bloody part, scrubbed until all the blood was over.</p> <p>Uses of rabbit skin</p> <ul style="list-style-type: none"> ♣ Making shoes ♣ Braziers ♣ Ladies tops

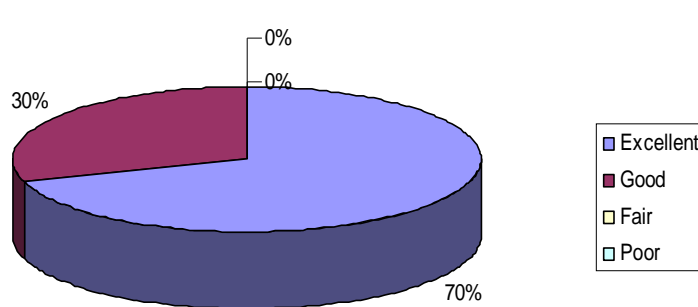
Participants display final processed food based on their acquired skills ©PELUM-Kenya



10.0 Workshop Evaluation and recommendations

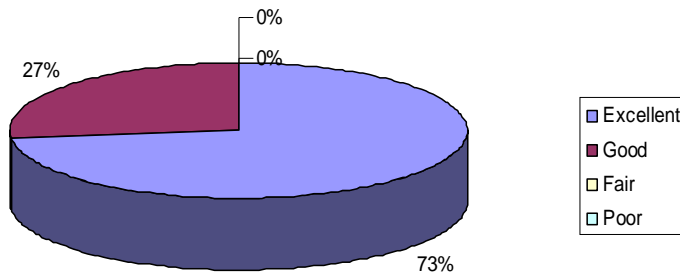
The following pie-chart analysis, underscores participant's views about the 3 days training workshop held in Nakuru's Chester Hotel.

10.1 Workshop Content Chart



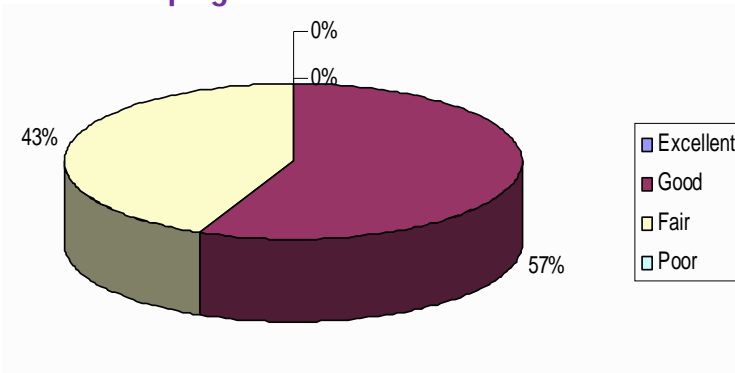
- 70% of Members said the workshop was excellent
- 30% said it was good and the rest of the categories were rated 0%

10.2 Workshop Facilitation Chart



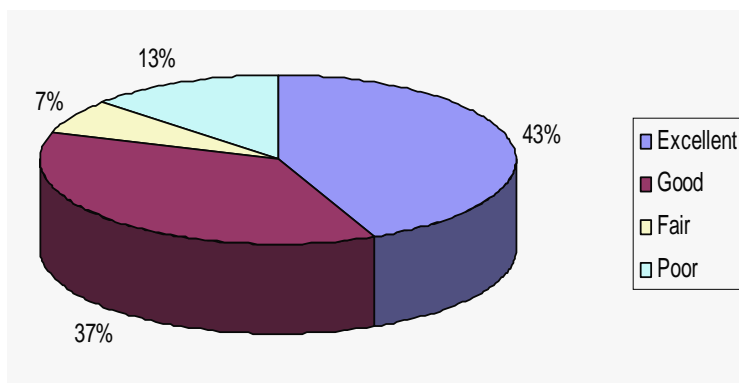
- 73% of the participants said the facilitation was excellent.
- 27% said it was good other categories were rated 0%

10.3 Time keeping Chart



- 57% of the participants said time keeping was good
- 43% said it was fair other categories were rated 0%

10.4 Workshop Prior information



- 43% of the participants said that the prior information package (information about the workshop before the commencement date) was Excellent
- 37% said it was good
- 13% said it was fair
- 2% said it was poor.

10.5 Other general comments about the workshop;



Participants thanked PELUM for organising the workshop, even though they requested to do it in a different venue next time. The group also confirmed that the workshop built their soft and hard skills in linking food processing technology to value addition for their farm products. They promised the facilitators that they would implement what was learnt as part of their action points.

Due to time limit, they unanimously suggested for any future workshop of that nature, to be planned for one week since the 3 days spent were very few. They also recalled that due to time limitation and lack of adequate preparation on learning aids like; packaging and labelling of processed foods, was a major setback during their participation.

They credited the organizers since the workshop was very educative and very relevant to Agro Processing and Value Addition while praising how the facilitators did their work, despite the fact that they downgraded the learning environment.

There was professional interaction throughout the workshop, between the facilitators and participants, as underscored in their views while promising to support PELUM in fundraising to increase such activities.

Appendix I ... Delegates contacts

Participatory Ecological Land Use Management Association (PELUM-Kenya)

Agro Processing and Value Addition Workshop, PELUM-Kenya

Dates: 16th – 18th March, 2011 at Chester Hotel, Nakuru

Participants' Contacts

No	Name	Organization and Position	Contacts		
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Appendix 2 ... More about the facilitators

Tabitha Tene Ngunjiri

Tabitha Tene Ngunjiri is a qualified and experienced Appropriate Technology trainer in Value Addition and Agro-processing working with the youth, women groups. Tabitha has also extensively interacted during training of the in-mates in Kenyan prisons and Institutional field extension staff to impart knowledge and skills for the trainers. He has over 20 years' experience.

Qualifications and Professionalism

She is a professional teacher with advanced certification in Value addition and appropriate technology among other credentials from certified institutions

Engagements

Consultant and Facilitator working with youth groups, women groups, staff of development agencies and prisons, inmates etc in Value addition while incorporating most of the skills above in the trainings

John N. Kinyuru,

John is a Lecturer at the Department of Food Science & Technology in Jomo Kenyatta University of Agriculture and Technology, JKUAT. He has research interests in Agro-processing and value addition for food & nutrition security especially in development of foods for children and other vulnerable groups.

Credentials:

John is currently a PhD fellow in Food Science & Nutrition at JKUAT, Kenya & the University of Copenhagen, Denmark. Other qualifications include B.Sc in Food Science & post harvest Technology and M.Sc in Food Science & Technology all from JKUAT, Kenya.

Jill Cooney

Jill Cooney is an Applied Nutritionist working with Real Impact, an NGO based in Thika town, Kichozi Farm as an Applied Nutrition Director