



8

Processing and Preservation

Junior Farmer Field and Life School – Facilitator’s guide



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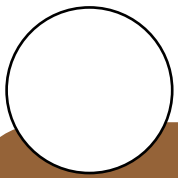
Module 8: Processing and Preservation

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Module 8: Processing and Preservation

INTRODUCTION

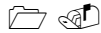
In this module the concept of processing and preservation will be explored from different angles. The module ends the agricultural cycle in JFFLS and the discussions about the processes of life. Food Security forms the first topic, in which different issues discussed during previous modules will be complemented and new ones will be introduced, in order to give a complete perspective of food in life. Food processing and livestock products will also be discussed as this can assist in making food available throughout the year to close the seasonal gap and fluctuations in availability of certain nutrients during different times of the year. Various recipes for crop and livestock related products are also introduced so that participants can try these out in the JFFLS setting before implementing them in their homes.

The skills that are developed through planning and implementation of processing and preservation will also aim to strengthen participants' entrepreneur skills. Thereby assisting in developing economic empowerment, something that is very important for the prevention of risk factors among young people such as HIV and gender based violence or risky coming strategies such as transactional sex.

The module contains sample exercises for each of the learning activities, plus a number of sample energizers and cultural activities that can be used to keep the participants engaged and reinforce their learning. The provided activities should serve as samples to be modified and applied as appropriate. The important thing is that all main building blocks of a typical JFFLS session are included in each learning session.

By the end of this module participants should:

- Be able to explain what food security is;
- Understand how to plan food availability over the year so as to close the seasonal food gap;
- Gain knowledge on how to select and store seeds;
- Understand the importance of food processing and preservation.



OBJECTIVES

A TYPICAL JFFLS SESSION (3-4 HOURS):

-  **ENERGIZER AND FUN** (30 MIN)
-  **IN THE LEARNING FIELD** (45 MIN)
-  **AGRICULTURAL TOPIC** (45 MIN)
-  **MAKING THE LINK WITH LIFE** (30 MIN)
-  **CULTURAL ACTIVITIES (ART, DRAMA, SONG)** (30 MIN)
-  **ASSESSING PROGRESS**
-  **CLOSING ENERGIZER**



Exercises

➤ GETTING STARTED WITH “ENERGIZERS”

Some sample energizers that will also help to “break the ice” and make participants feel comfortable while at the same time introduce the module focus are provided below.

Energizer: Fruit salad

OBJECTIVE:

To get the group active and awake, especially good after lunch or to break a long passive session.

TIME:

10 minutes

MATERIALS:

Chairs arranged in a circle; one fewer than total number of participants and trainers. If there are enough chairs then these could be set up ahead of time in another space, such as an adjoining room. If not, then ask participants to bring their chairs with them.

STEPS:

1. Decide on the number of groups that are needed, as this will determine the number of fruits selected. Set up a closed circle of chairs, one fewer than the number of people who will join the exercise.
2. Ask participants to sit in the chairs. The trainer begins the game by standing in the middle. Explain that this is an energizing exercise, which will require their (very!) active participation.
3. Let the participants name as many fruits as you need sub-groups, for example four fruits, if you need to form four sub-groups. Ask one person to choose a fruit, their neighbour another fruit, the next neighbor another, and so on until the desired number of sub-groups is reached. The next person in the circle takes the first fruit, the next the second, and so on until everyone including the trainer has a fruit name (such as mango, papaya, lemon, pineapple, banana etc.).
4. If necessary, you can then write the fruits on a large sheet of paper or on the board, especially if there are more than five fruits to remember.
5. Before you start, ask all the oranges to put up their hands, then the melons etc. This will just remind everyone once again of their fruit.
6. The person in the middle calls out the name of one fruit. All those participants who are that fruit must change chairs - no exceptions! The person in the middle will also try to get a seat, and should succeed as they have only half the distance to travel.
7. One person will be left in the middle who then repeats the process by calling out another fruit. When “fruit salad” is called out, then everyone must change chairs.

Energizer: Drawing entrepreneurship

OBJECTIVE:

To get sub-groups motivated by involving them immediately in an easy task.

TIME:

1 hour in order to create a common understanding about the concept

MATERIALS:

Pen and paper.

STEPS:

1. Divide the groups into sub-groups of 4-7 participants.
2. Ask each group to construct a picture of the concept “entrepreneurship”. If the term is not clear to all let some participants explain their interpretation of the term.
3. The sub-groups are given 30 minutes to discuss and draw, after which a spokesperson presents their diagram. Alternatively, put up the diagrams in an exhibition and encourage everyone to walk around before the discussion.
4. Conclude by asking the participants the following questions:
 - What elements were common to all groups?
 - What elements were only represented in one group?
 - Why did these similarities and differences happen?
 - What disciplinary biases are apparent in the diagrams?
 - How do you think a villager might represent the same concept and what assumptions about him/her are you making?



FOOD SECURITY AND GOOD NUTRITION ALL YEAR AROUND

This topic aim to create an understanding of what food security is and how we can avoid risks in attaining a good nutrition throughout the whole year.

☞ exercise 1

INTRODUCTION TO FOOD SECURITY

OBJECTIVES:

- To understand the meaning of food security;
- To reflect on how availability of food in quantity and quality varies around the year.

TIME:

2 hours and 15 minutes

MATERIALS:

Flipchart and markers for 4-5 groups, + 100 seeds/beans/stones for each group.

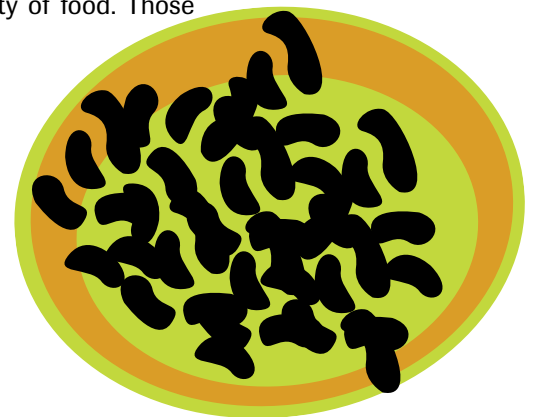
STEPS:

Part 1. Brainstorming

1. Ask the participants: What do you need for living? (Food and water, cloths, shelter, friends, family, education, etc.)
2. Tell them that food is one of the basic needs for our survival.
3. Ask them to discuss: What are we eating and where do we find the food we need?
4. Conclude by summarising the term "Food Security".

Part 2. 100 seeds exercise

5. Explain that you are going to perform an exercise, called "100 seeds", in order to understand better what Food security is.
6. Split the participants in groups of 5-8 people and give to each group 100 seeds (or stones).
7. Explain that the 100 seeds represent all the available food during the year for a certain unit (i.e. community in general, group of orphan and vulnerable children participating in the JFFLS).
8. Define the kind of food to which we are referring: if only that produced by the group/community, if besides to that we can add food purchased, the school feeding, or others.
9. Each group should present a calendar with 12 columns, representing the 12 months of the year (this can be done in a flipchart paper and also on the floor). Ask the participants to distribute the 100 seeds by the months according to the availability of food. Those months with a lot of food will keep more seeds and those with less food, less seeds (see the example in the table below). In this way we could visualise the food availability during the year.



Jan	Feb	Mar	April	March	Jun	Jul	August	Sept	Oct	Nov	Dec
o	ooo ooo	ooo oooo	ooo oooo oooo	oooo oooo oooo oooo oo	oooo oooo oooo oooo o	oooo oooo oooo	oooo oooo	ooo	ooo	ooo	oo
1	6	7	11	22	21	13	8	3	3	3	2

10. Ask the participants in groups of 3 people to think 10 min. about:
 - The different reasons for lack of food during the year.
 - The different measures we could take in order to overcome these problems.
11. In plenary, make two columns on a flipchart: Reasons for the lack of food/Measures to overcome these problems.
12. Ask the small groups to discuss, present their conclusions and prepare a list of all the contributions.
13. Explain that now we can think all together about what we need in order to plan our food security for the next year.
14. Summarise the discussions in order to explain again what Food security is.

🔄 facilitators' notes 1

FOOD SECURITY

What is Food Security?

- Having enough food, nutrient, adequate and safe during the whole year in a way that allows everybody to have an active and healthy life.
- The Food security also implies the capacity to look for adequate and nutritive food, through incomes, productions or informal trading.

So, food security includes two components:

- **Food availability:** adequate food supply in terms of quantity, quality and variety in a stable and regular way.
- **Access to food:** the capacity of acquiring food, though buying or trading products, including land ownership and other productive resources.

To evaluate the food security situation in the community, one should observe different aspects, such as:

- **Food production:** implies the access to fertile land, clean water, labour, seeds, knowledge, healthy environment, and also to collect data on the produced quantity for self-consumption, trading or both.

- **Use of food:** instead of the healthy aspect (people have to eat well and in a varied way in order to maintain their energy and health) it is necessary also to look at the quantity of products that have been sold, traded, stored or consumed.

- **Food conservation:** communities need areas to store food in order to let them last for long periods of heat or drought. If rats would eat half of the food, it means that they will suffer hunger. It is necessary to have enough food for 3 to 4 months, in order to cover the hunger period and guarantee the food security in most communities.

- **Food transport and distributions to the market:** if bringing food to the market is not possible, and if people are not able to access the market, their food security will be compromised. Also if an unequal food distribution is done, a part of the community will benefit from it and another one will suffer.



- **Money, savings and credit:**

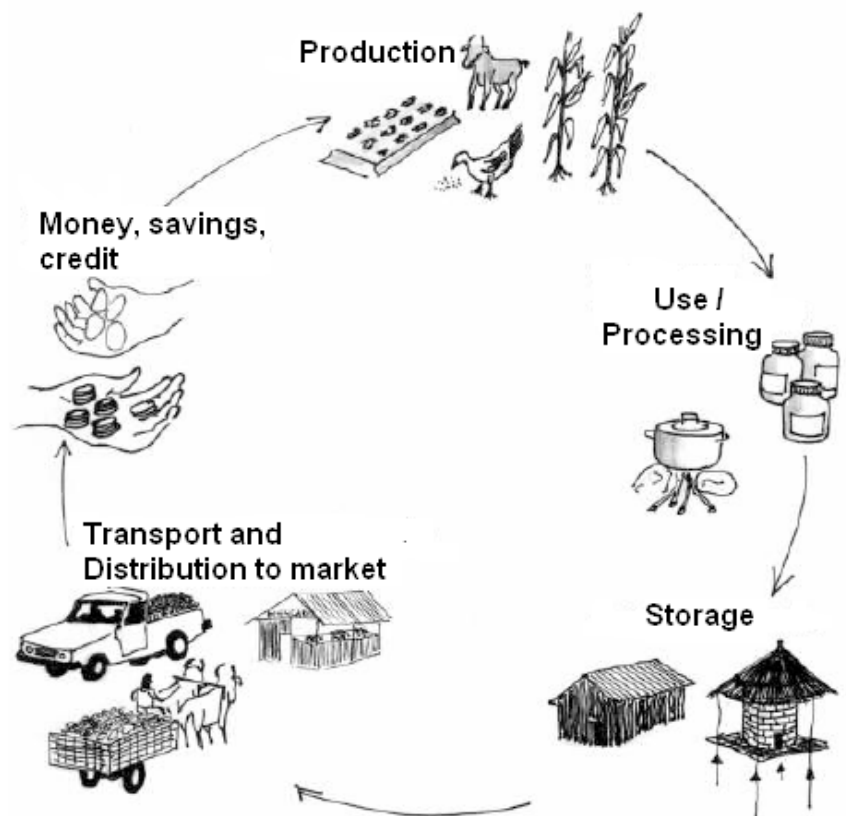
for communities and households depending on money for buying food, a fundamental aspect of the food security depends on the availability of enough money or easy access to credit to buy food. Even if a household doesn't depend only on money to buy food, it needs some agricultural incomes to ensure the food security (to buy seeds and other agricultural inputs, to pay medical costs, labour, maintaining small size animals, education costs, etc.).

- **Some causes for the lack of food in "starving periods"**

- Weak knowledge in agricultural techniques and in conservation methods, bad management and planning of agricultural residues.
- Lack of seeds, weak harvest, lack of fertile land.
- Irregular rains.
- Low crop diversification and other agricultural sectors.
- Low labour to produce enough food, lack of time due to illness or involvement in other activities.
- Low diversification of income sources (i.e.: a household depending only from agriculture).

- **Some measures to mitigate problems of food shortage**

- Learning improved production techniques (i.e.: improved seeds, etc.).
- Diversifying crops and other agricultural sectors.
- Improving or introducing small species of livestock.
- Add types of crops, including vegetables, fruit and nuts trees with different harvesting periods, drought resistant crops, etc.
- Learning improved methods of Conservation Agriculture.
- Building improved granaries and driers.
- Good use of Integrated Pest Management (IPM).
- Improved soil conservation and fertilisation methods.
- Improved water conservation methods.
- Adding or improving the food agro-processing for consumption and market. Looking for market opportunities with crops that can generate income, such as: pine apple and cashew.
- Diversifying the income sources, i.e.: developing a small business, participating in an producers' association or performing some seasonal works.
- Participating in savings and credit schemes.
- Performing community activities (i.e.: community granaries).



☞ exercise 2

PLANNING FOR FOOD SECURITY

OBJECTIVE:

To reflect on reasons for seasonal food gaps and how to avoid this.

TIME:

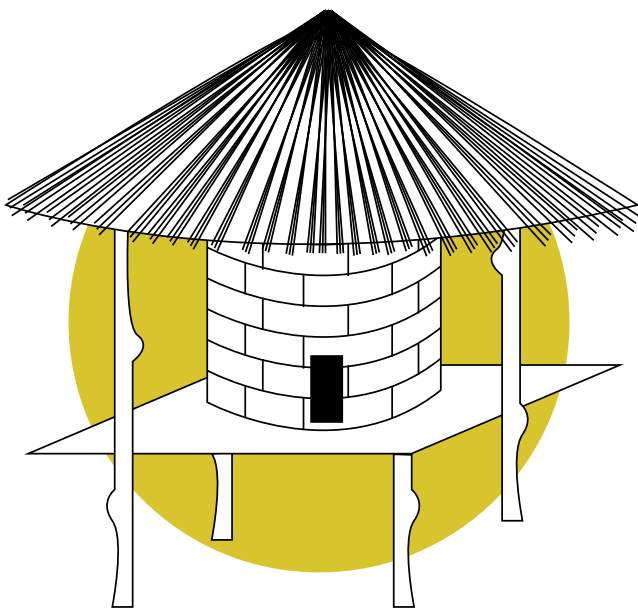
1 hour

MATERIALS:

Flipchart and markers.

STEPS:

1. Refer to the exercise on food security above.
2. Split the participants in groups and ask each group to discuss and write down why we have plenty of food in some months and why we have the lack of food in others.
3. Let each group discuss how this situation can be addressed in order to have food available throughout the year.
4. Have each group present their findings in plenary.
5. If the following strategies were not mentioned bring them up for discussion: A) Storage/ Conservation, B) Selling, C) Saving, D) Other, such as crop diversification.
6. Summarise the discussion and the presented outputs.





SEED SELECTION AND GRAIN STORAGE

In this section participants will learn about how to select which seeds to keep for planting the next season and how to best store seed and grain.

🔄 exercise 1

SEED SELECTION AND STORAGE

OBJECTIVE:

To reflect on what one should consider when selecting seeds for planting.

TIME:

1 hour

MATERIALS:

Paper and markers, agricultural tools.

STEPS:

1. In plenary discuss the reasons around why people keep and conserve seeds.
2. Introduce the topic of seeds selection and storage for the next year and explain some key points.
3. Move with the participants to a field planted with a grain crop, for example maize, and discuss the following issues:
 - What should one think about when selecting seeds?
 - In this field which seeds would you select for keeping and why?
 - How and when should you select the seeds?
4. Back in the learning site divide the participants in groups of 4-5 persons and ask the groups to discuss and write down/draw their ideas related to:
 - What storage methods people use to protect grains, edible crops, beans and seeds against pests?
5. Have each group present their findings in plenary.
6. Summarize the presented methods and introduce other missing ones.

🔄 facilitators' notes 1

GRANARY STORAGE

Steps in the storage of products and seeds in the granary

1. Cleaning

- Clean well the containers, bags and the granary.
- If necessary, **smoke the granary** in order to help in disinfecting or sterilising the area.

2. Select seeds

Select those plant seeds:

- That were not attacked by pests;
- That show a good harvest;
- That are well adapted to the local environment;
- That will have similar characteristics over the next generation (i.e.: assuring that they didn't have pollination with other existing similar crops around the field, given that these can acquire undesirable characteristics over the following



generation);

- That are not hybrids (they should have had an “open pollination” in order to produce good seeds.

3. Processing seeds for preservation

- Pulp fruits with wet seeds (i.e.: tomato, egg-plant, cucumber, pumpkin, etc.):
 - Select very ripe fruits of healthy plants.
 - Take out the seeds and place them in fruit juice in a clean container. Cover well the lid. Let it rest for 4 to 7 days. The mixture will start to ferment lightly.
 - Mix lightly the container with the fermented juice and put the content in a bucket.
 - Add clean water. The good seeds will sink to the bottom and the bad ones will float.
 - Carefully take out the water and the bad seeds in order to keep only the good seeds.
 - Wash the selected seeds (with clean water!) and put them to dry on a cloth to the top of a wire structure situated in an elevated and shade place for 2-4 days.
- Pulp or dried fruits with dried seeds (i.e.: chilli, paprika, bean, cabbage, lettuce, onion, etc.)
 - Fresh fruits: put all the fruits in a dry cloth.
 - All the fruits: put the dried fruit in a bag and mash them until they release the seeds.
 - Divide the seeds and put them in a bag or on matting and let them dry for 2 to 3 days.
 - Sieve the seeds and take out the cockle.



4. Preservation of products and seed in the granary

Seed storage:

- Keep the dried seeds in a pot or bottle that doesn't allow air entering and put it in a fresh and dry place. Label the container, indicating the type of plant and the date of harvest.
- In order to keep the seeds fresh, mix them with cold ash from the stove (about 0.5 kg of ash for 1 kg of seeds). Sometimes, put the seeds in the sun in order to keep them in a low level of humidity.

5. Protect grains, seed and any product from pests.

- 6. Preservation period:** Preferably sow the seeds after having kept them for 3-6 months. Do not keep seeds for more than 2 years, given that they will not germinate.



🔄 exercise 2

UNDERSTANDING GRAIN STORAGE METHODS

OBJECTIVE:

For participants to familiarise themselves with different methods used for seed storage.

TIME:

1 hour

MATERIALS:

Flip chart, marker pens, masking tape.

STEPS:

1. Divide the participants into 4 groups.
2. Give each group a flip chart and marker pens.
3. Brainstorm in plenary different seed storage methods, and define four very different methods that are allocated one to each group.
4. Ask them to describe and list down the advantaged and disadvantages of each method on the flip charts.
5. Allow them to present in the plenary.
6. Summarize the learning session.

🔄 facilitators' notes 1

GRANARY PEST PROTECTION

Protection Measures against pest

1. Using layers of sand alternated with grains

The idea is to fill the empty spaces between the stored grains in a given container (for beans, corns, etc.), removing in this way the air spaces and eventually, avoiding the development of insects.

How to do: start and end with sand layers. Pay attention to not leave grains out of the sand. Later you will need to sieve the grains in order to separate them from the sand.

2. Mixing wood ashes with grains

The ash forms a protecting layer against the insects. When the insect enters in contact with the ash, it will cause the insect's skin dehydration and eventually its death.

How to do: for each 100 kg of cleaned and dried grains (leguminous and cereals) add about 10 kg of sieved ash. Keep in raffia bags, wooden boxes or another kind of available container.

3. Keeping in Chilli or *Margoza* powder

Chilli and *Margoza* prevents the development of different pests.

How to do: Pour a fine layer of chilli in a container (mashed until it becomes very well minced). Cover the layer of chilli with another layer of dried and clean grains. Alternate the layers, ending with the last layer of chilli. Keep in raffia bags, wooden boxes or other kind of available container.

4. Protect the ears (Corn) with eucalyptus, tobacco or *lantana camara* leaves

The eucalyptus *citrodurus*, tobacco, or *lantana camara* leaves, repel plum curculios in the granary.

How to do: cover the bottom of the granary with a layer of leaves. Alternate layers of ear with leaves. Ending the last layer with leaves.

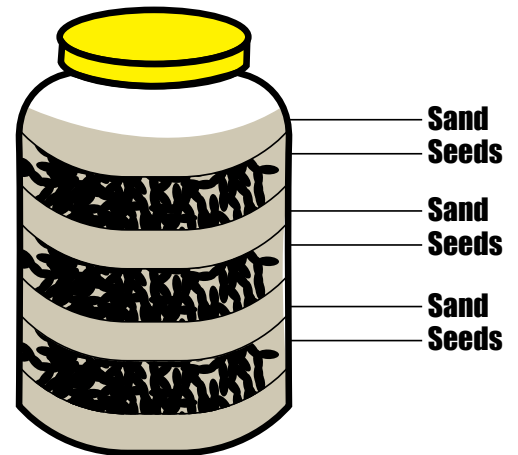
Note: Renew tobacco leaves every 6 months; eucalyptus leaves every 90 days.

5. Keep with flowers/repelling leaves

How to do: Plant *chrysanthemum* flowers or *catharanthus* or other plant with repelling leaves (such as: *Tagetes minuta* of *Myrtaceae* family and *Datura stramonium* of *Solanaceae* family) around the granary in order to make escape the insects because of the bad smell exhaled from the repelling plants.

6. Grain preservation through smoking

How to do: Prepare a low but long burning fire under the granary to get the smoke to impregnate the stored seeds and grain.





FOOD PROCESSING AND PRESERVATION

Food processing and preservation is a set of physical, chemical and biological processes that are performed to prolong the shelf life of foods and at the same time retain the features that determine their quality, like colour, texture, flavor and especially nutritional value. Food preservation is achieved by destroying enzymes and micro organisms using heat (blanching, pasteurization), or preventing their action by: removal of water, or increasing acidity or using low temperatures

🔄 exercise 1

FOOD PROCESSING AND PRESERVATION

OBJECTIVE:

To understand the importance and how to do food processing for food security and a good nutrition during the whole year.

TIME:

45 minutes + practice time (2 hours and a quarter)

MATERIALS:

Flipchart, markers, ingredients and tools to conserve and cook the food.

STEPS:

1. In plenary brainstorm with the participants to review the contents of Food Security. Guide questions:
 - What can we do at home in order to plan and enhance food security? I.e. How can we increase the availability of food during the whole year and diversify our food intake?
 - What is the interest and the importance of food processing?
 - Which are the different processing methods? (Fill a list, adding the list already in key points to the facilitator).
2. Divide the participants into 3-4 groups and ask each group to choose 3 methods.
3. Ask each group to explain and write down the methods chosen and, if possible, give an example.
4. Each group should present one method to the plenary for further discussion (each group for a different method).
5. The Facilitator should explain with easy words the methods that have not been chosen. Ask: which methods are possible in your community?
6. Practice with the participant how to process and preserve some selected recipes.



🔄 facilitators' notes 1

FOOD PROCESSING AND PRESERVATION

Why process the food?

- The family food security depends on the regular supply of diversified and adequate food in terms of quantity and quality during the whole year.
- The production of the majority of food is on a seasonal basis (practiced in certain period of the year). For this reason, we have to think on how to increase the food availability of this period.
- Food can rot (going off) in different ways: by internal reactions between its components, by the reaction of the components with water and air or through enzymatic and toxic effects, due to the development of micro organisms and to the presence of chemical elements.

So: Food proceeding is done for:

- Slowing down the rotting process interfering into the physical and chemical reactions, reducing the development of unwelcome micro-organisms;

- Increasing the food flavour;
- Making the food more attractive for the consumer;
- Facilitating its commercialisation.

In summary:

The food processing allows increasing the food availability beyond the area and the period of production, guaranteeing its supply and increasing the food security at National and Household level.

Main methods of food processing

- Cooking
- Preserved food
- Oiling
- Adding chemical preservatives
- Sterilising
- Freezing
- Drying
- Salting
- Fermenting
- Germinating



Freezing

This reduces the temperature of the food so that micro-organisms cannot grow, yet some may still survive. Enzyme activity is too slowed but not stopped during freezing.

Drying

Drying removes most of the moisture from the foods thus micro-organisms cannot grow and enzyme action is slowed down. Dried foods should be stored in airtight containers to prevent moisture from rehydrating the products and allowing microbial growth.

Canning

It is the process in which foods are placed in jars or cans and heated to a temperature that destroys micro-organisms and inactivates enzymes. Air is driven from the jars during heating, and as it cools, a vacuum seal is formed. The vacuum seal prevents other microorganisms from decontaminating the food within the jar or can.

Main steps in food processing

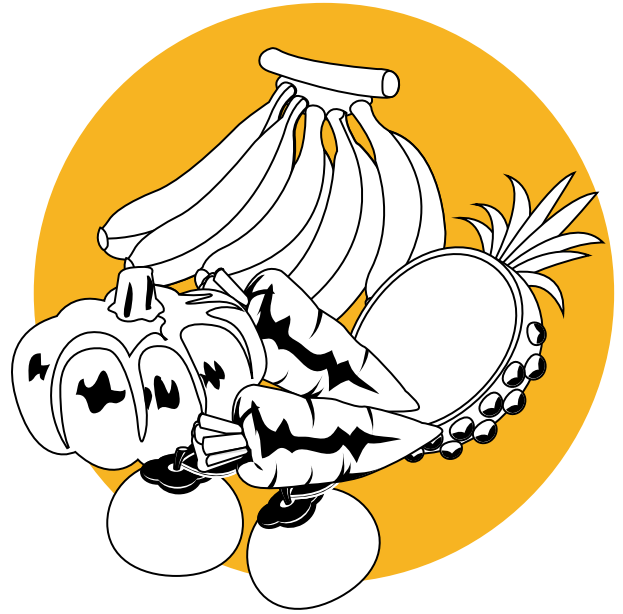
1. Choose only good quality and fresh vegetables and fruits. Fruits shouldn't be green, but they shouldn't either have reached complete ripening.
2. Wash well the products in order to remove the dust.
3. Wash carefully the hands and sterilise all the tools you are going to use, such as: tablecloth, cooking pots, recipients, etc.

🔄 facilitators' notes 2

STERILISATION OF POTS/BOTTLES

How to sterilise pots/bottles

1. Wash the recipients (also taps and corks) with soap and water. Dry well with running water.
2. Put the clean recipients into a cooking pot coated with a cloth or wooden grid.
3. Put some water into the cooking pot, filling until the half of its capacity. Close the lid and let it boil for 15 minutes.
4. While the water is boiling, put inside the cooking pot the tabs and corks of the recipients that will be used in order to keep the conserves. Let them boil for 5 minutes.
5. Take out the taps and corks from the cooking pot in which they have boiled, using a clean wooden spoon.
6. Put the pots turned upside down on a clean cloth, out of air currents in order to avoid that the recipients break (due to the thermo shock). The pots shouldn't be dried with a cloth, but naturally.
7. Do not touch with your hands inside the pots/bottles, taps or corks.
8. Put the label on the pots/bottles (type of preserves, date of production, used ingredients, etc.).



🔄 facilitators' notes 3

PRESERVATION METHODS

Preservation by chemical action

Acids, salts and sugars are the prime food preservatives. The acids found in fruits help in preservation of jams, juices and marmalades.

Preservation by the addition of sugar

Sugar is generally added in the processing of jams, jellies and sweets. A concentration of 65% sugar preserves the food by drawing out water from the food and preventing micro-organisms from growing. The fruit must be boiled, after which the sugar is added in variable amounts, depending on the kind of fruit and the product being prepared. The mixture must then continue to boil until it reaches a high level of soluble solids, 65-70% which allows for its preservation. The addition of sugar combines with certain fruit substances to produce a gel-like consistency, which characterizes the texture of jams and jellies. To achieve this, appropriate acidity levels and sugar content, together with pectin, form a proper gel. Individual characteristics of the fruit products depends on type of fruit used, preparation method, proportions of the various ingredients in the mixture and the cooking method.

Preservation by adding salt

Pickled vegetables and fruits are fermented products. The particular fruits or vegetables used depend on availability and include red/white cabbage, cucumbers, onions, garlic, cauliflower, tomatoes, under ripe mangoes, grapes, peaches and pears. The growth and fermentation of vegetables by more than one species of lactic-acid bacteria are influenced by especially salt concentration and

temperature. The wrong temperature and/or salt concentration can produce the wrong bacterial population resulting in soft and hollow pickles with off-flavours. In fermentation salt plays a role in sorting the micro-organisms permitted to grow on the basis of salt tolerance.

facilitators' notes 4

PROCESSING ROOTS AND TUBERS

Processing roots and tubers

The common roots and tubers in most countries are sweet potatoes and cassava. These are:

- Easy to grow, adoptable to various agro-ecological zones and are good security crops.
- High source of carbohydrates, fibre, calcium, phosphorous and potassium, but low in proteins and fat, and in fat soluble vitamins (A, D, E, and K). They are rich with vitamin C-which reduces during cooking. Varieties like orange fleshed sweet potato varieties are rich in beta-carotenes (precursor of vitamin A).

Value addition for raw/fresh roots and tubers should be done right from planting to marketing. The stages in the value chain at which value can be added are as below:

- Variety selection
- Planting methodology
- Management
- Method of harvesting
- Sorting/washing
- Grading
- Packaging
- Transportation to market
- Marketing

Sweet potato processing

Traditional methods of processing sweet potato in most countries have been limited to washing, peeling and boiling. In some communities, the roots are washed, peeled, cut into small pieces and lemon or tamarind juice added, then dried in the sun and milled together with sorghum into flour that is used in making porridge.

Some farmers make chips, sun dry, store and later reconstitute by adding water then cook by boiling. Others dry the grated product, mill and then add to other flours to make composite flours.

Improved processing methods have been developed to help overcome some of the problems associated with traditional method, in order to produce sweet potato flour with improved odour, colour and nutritional qualities.

Steps of processing dried chips and flour

1. Selection of raw materials-select only healthy roots.
2. Cleaning, peeling, and trimming: remove any soil using a clean knife and trim any damaged part.
3. Washing: using a large saucepan of water wash the roots thoroughly.
4. Slicing/chipping: the roots are pre-dried in a clean place to remove the surface water, and then chipped manually or mechanically into pieces about 5 mm thick.

5. Soaking: soak the slices in clean water twice the weight of slices for 90 minutes. The water should be enough to cover all the slices.
6. Drying: sun dry the slices on a raised tray for approximately 4-6 hours if weather conditions are suitable or in a conventional dryer using firewood or charcoal as fuel.
7. Sorting: sort the dried chips for uniformity before packaging or further processing.
8. Grinding: mill the dried chips into flour.
9. Packing and storage: pack the flour in polythene bags or other suitable containers with well fitting lids.
10. Sweet potato can store in clean sisal, polypropylene sacks or polythene bags.
11. Store in a cool dry well ventilated place.
12. Packages should be labeled to trace origin of the root and the chief processor.

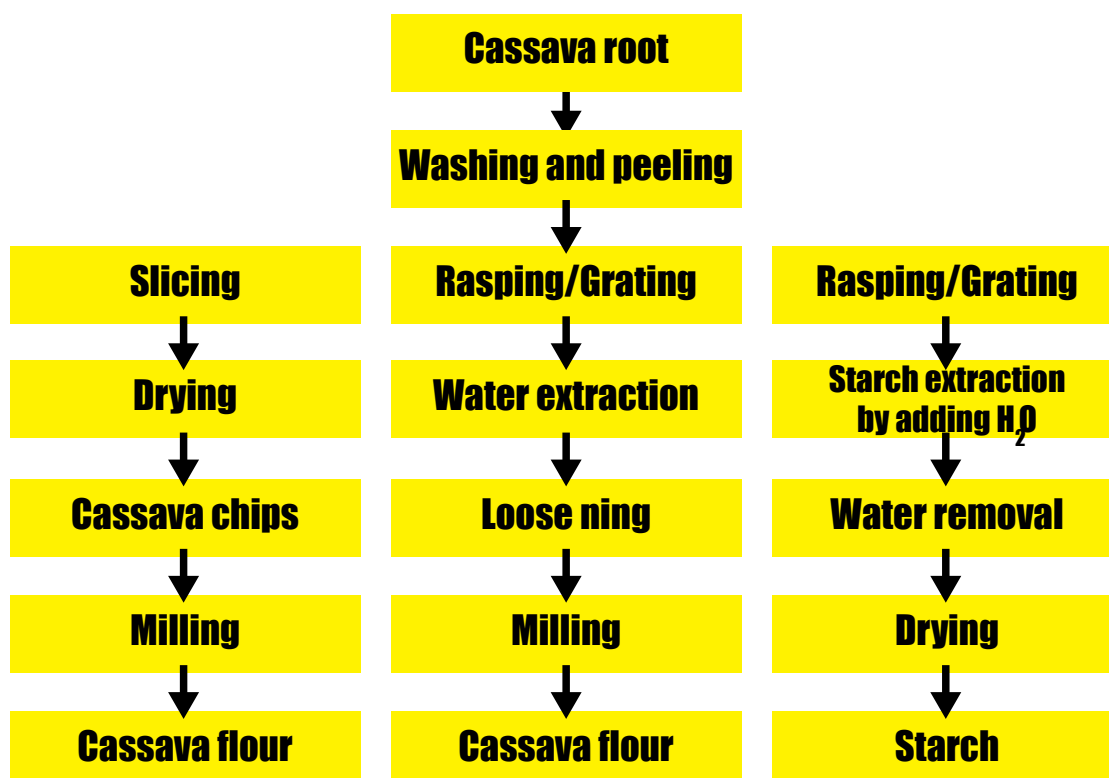
Cassava processing

The traditional processing of cassava is labour intensive and time consuming and produces low quality and quantities of materials. The common method of preparing cassava is boiling, roasting, stewing, or frying. It can also be peeled, washed, grated, dried and milled to obtain cassava flour.

Cassava toxicity and detoxification

Some varieties of cassava include substances that are toxic to humans when the cassava is consumed raw. When a small amount of the toxic (hydrogen cyanide) is consumed over a long period (chronic toxicity) the individual develops goiter, cretinism, mental retardation and neurological disorders. Peeled tubers can be detoxified by grating followed by sun or oven drying at temperatures less than 700c. Detoxification can also be achieved by fermenting grated pulp.

WAY OF PROCESSING CASSAVA



facilitators' notes 5

PROCESSING FRUIT AND VEGETABLES

Preservation by reduction of water content

Drying of fruits and vegetables

Drying is one of man's oldest method of food preservation. It is also the most widely used method of food preservation. Drying of foods yields highly concentrated material nutritionally. Dehydration which means removal of water is presently done by drying by artificially produced heat under carefully controlled conditions of temperature, humidity, and air flow. The drying rate depends on temperature, humidity and speed of air, type of drier and size of food pieces with fruits and vegetables generally drying at 38–60 c. The drying process is critical in that air temperature and circulation must be monitored to avoid microorganism growth and spoilage. Dried products are easy to store and have long shelf life, reduced weight and bulk for transport and distribution costs, and provide raw materials for further processing. However there are risks such as loss of quality in drying products, contamination is high and case hardening may occur. The removal of moisture prevents the growth and reproduction of micro-organisms causing decay and minimises many of the moisture mediated deterioration reactions:

- It brings about substantial reduction in weight and volume minimizing packing, storage and transportation costs.
- Dehydration involves the application of heat to vaporize water and some means of removing the water.
- Drying which employs high temperatures for short times does less damage to food than drying processes employing lower temperatures for longer times.

Blanching

Blanching is the process of heating vegetables sufficiently to inactivate enzymes. Enzymes are the biological catalysts that facilitate chemical reactions in living tissue. If certain enzymes are not inactivated, they will cause colour and flavour to deteriorate during drying and storage. Blanched vegetables, when dried, will have better flavour and color than unblanched ones. Blanching - exposing fruit and vegetable to hot or boiling water or steam - as a pre-treatment before drying has the following advantages:

- It helps clean the material and reduce the amount of micro-organisms present on the surface.
- It preserves the natural colour in the dried products; for example, the carotenoid (orange and yellow) pigments dissolve in small intracellular oil drops during blanching and in this way they are protected from oxidative breakdown during drying.
- It shortens the soaking and/or cooking time during reconstitution.
- When the blanching time is completed cool the product immediately to prevent over blanching.
- As a rule fruit is not blanched due to damage from heat sogginess, and juice loss.
- You may blanch with hot water or with steam.

Water blanching usually results in more leaching of vegetable solids, but it takes less time than steam blanching under kitchen conditions.

With water: Use only enough water to cover the product. Bring the salty water (at a ratio of 5 liters water to 50g/5 table spoons salt) to a boil and gradually stir in the vegetable. Re-use the same water for additional lots when blanching the same vegetable, adding new water as necessary. Keep the lid on the kettle while blanching.

Sun and solar drying

Drying practices

- A large quantity of same maturity raw material should be used.
- Remove damaged parts, wash in clean water, trim and cut into 3-7 mm sizes (use same thicknesses).
- Bananas, tomatoes and other vegetables or fruit are sliced with stainless-steel knives or similar equipments.
- As a general rule: plums, grapes, etc. are dried as whole fruits without cutting/slicing.
- To prevent bananas, apples etc. slices from going brown they must be kept under water until drying can be started.
- The main problems for sun drying are dust, rain and cloudy weather.

Preservation by concentration with sugar, acid and salt

Sugar preservation

70% sucrose in solution will stop growth of all micro-organisms in foods. Fruits can be preserved in sugar in form of jams, jellies, marmalades, juices, squash or whole fruits. A concentration of 60% sugar can preserve fruits for as long as one year.

Preservation with salt

Salt levels of about 18% to 25% in solution generally will prevent all growth of micro-organisms in foods.

Preservation with acid (Vinegar)

Fruits and vegetables can be preserved in vinegar and sugar, and then stored in glass containers. Fruits and vegetables stored in vinegar can keep for as long as two years or more and also improves in flavor e.g. chutney, pickles and sauces. Removal of water by concentration also increases the level of food acids in solution (particularly significant in concentrated fruit juices).

facilitators' notes 6

FRUIT AND VEGETABLE RECIPES

Selected recipes

- **Dried leafy vegetables**
 1. Prepare blanching solution and bring to boil.
 2. Select and wash the vegetables in cold water.
 3. Chop the vegetables and blanch for 3 minutes.
 4. Drain the vegetables well.
 5. Dip in cold water (same time as blanched) to avoid further cooking.
 6. Spread the blanched vegetables on drying trays in thin layers.
 7. Load the dryer and keep turning till crisp dry.
 8. Remove from the dryer.
 9. Pack the dried vegetables in clean and moisture proof containers.

10. Remove as much air as possible from the container and seal well.
11. Label the package with the name of the product, date of processing and expiry, method of pretreatment and source.
12. Store in cool, dry, dark place.

● **Dried Mango Slices**

INGREDIENTS:

Mangoes, lemons, water.

METHOD:

1. Select and weigh hard ripe fresh mangoes.
2. Wash the fruits thoroughly in clean water.
3. Peel the mangoes and slice into uniform slices.
4. Prepare lemon juice: water solution (1:20).
5. Then arrange the sliced fruits on drying trays in single layer and sprinkle with lemon juice.
6. Load the trays in the dryer (the dryer should face the sun).
7. Shift the trays in the dryer and occasionally turn the slices until dry.
8. Unload the dryer.
9. Sort and pack the dried slices in moisture proof containers.
10. Store in cool, dry, dark places.

Note: 15 kg fresh mangoes give 1 kg dried.

● **Pawpaw Jam**

INGREDIENTS:

- 3 cups pawpaw pulp
- 3 cups sugar
- 0.5 cup lemon juice

METHOD:

1. Wash ripe pawpaw, cut into halves and scoop the seeds.
2. Scoop flesh and pound to make a pulp.
3. Wash the lemons and squeeze out the juice.
4. Measure the ingredients and boil under moderate heat stirring continuously until thick.
5. Test for setting (See below).
6. Pour the jam into clean hot sterilized jars.
7. Cover and seal immediately.
8. Process the packed jars.

Jam setting Tests:

1. Flake test. Using the stirring spoon, scoop some jam from the boiling mixture then raise it about

one foot (30 cm) above the pan and out of reach of the steam. Hold the spoon horizontally for a few seconds then pour the jam from the spoon. If the jam falls in clear drops, it is set. If it runs on a continuous flow, it needs to be cooked a little longer and tested again

2. Cold plate test: Pour a little amount of the jam onto a cold plate and wait to cool. When cold, press the jam with a finger, if it forms wrinkles and a skin forms on top then the jam is ready.

During this testing, the rest of the jam should be removed from the fire to avoid overcooking.

● **Tomato Sauce**

INGREDIENTS:

- 2 kg ripe tomatoes
- 0.25 cup sugar
- 1 teaspoon salt
- A pinch cayenne pepper
- 2 cups vinegar
- 0.5 teaspoon ground ginger
- 0.5 teaspoon ground mace
- 0.5 teaspoon paprika

METHOD:

1. Clean and cut tomatoes.
2. Cook till soft and then pass through a sieve.
3. Put into a pan and add all the other ingredients mixing well.
4. Bring to boil and reduce heat to simmer in an open pan until the consistency is that of a thick cream.
5. Pour into hot bottles and process for 30 minutes and seal.

● **Passion fruit squash**

INGREDIENTS:

Passion fruits, lemon juice, sugar.

METHOD

1. Wash the fruits and cut into halves.
2. Scoop out the flesh with pips.
3. For each cup of flesh and pips, add 0.5 cup water.
4. Sieve the mixture to get juice. Add two tablespoons of lemon juice.
5. For every 2 cups of fruit juice add one cup of sugar.
6. Heat the mixture slowly until the sugar is dissolved. Do not boil.
7. Pour the hot juice into a clean hot bottle, cover and process.



LIVESTOCK PRODUCTS

Livestock products like milk, meat and eggs tend to be consumed by rural households in small amounts and some of the production is sold or given out in the raw form. In the local shops we find products that have been made by transforming the raw products (milk, honey, meat etc.) to better, tastier and more durable products. These new products are sold for better prices.

🔄 exercise 1

PROCESSING LIVESTOCK PRODUCTS

Some animal parts or by-products can be made into unique items such as for example key holders from cow horns etc.

OBJECTIVE:

Participants will recognize the range of products that can be made when an animal is slaughtered.

TIME:

1 hour

MATERIALS:

Flip chart, marker pens, masking tape.

STEPS:

1. Participants will make a drawing one the common livestock species in the village.
2. Participants then label all the animal's body parts (head, tails etc).
3. Ask the participants to present the drawing with labels to the whole group.
4. Each label will be re-written on a small piece of paper. The papers will be folded and placed in a basket.
5. The basket will be passed round for the teams to randomly pick a label of an animal part that can be transformed into a unique product that can be sold at an agricultural trade fair.
6. The group then make drawings of all the products they can create.

🔄 facilitators' notes 1

MAKING MILK PRODUCTS

Making cheese

What is cheese?

Cheese is the solid part of milk, also known as curd, obtained by separating it from the liquid part (known as whey) by a chemical reaction. Curd is separated from the whey by adding an acid, bacteria culture and/or starter (rennet). Cheese can be described according to its texture as hard, semi-hard or soft or it can be described according to extent of maturing as fresh or ripened.

MATERIALS:

To make cheese you need:

- Good quality milk: with a low bacteria content, from healthy cows: do not use milk from cows with mastitis or other diseases or milk which could contain antibiotics. Also do not use colostrums (milk from animals that have calves that are only 2 days old).
- Clean equipment: make sure you clean and sterilize your milking utensils and rinse you utensils thoroughly in clean water.

To make cheese follow these steps:

1. Use fresh whole milk. Reduce the fat content by allowing the milk to stand for about one hour,

and then skim off the top layer.

2. Heat the milk to about 85° C to destroy most of the bacteria present and also to increase yield through the precipitation of the whey protein.
3. Dilute lemon juice with an equal quantity of clean water so that the lemon can be distributed uniformly. Add about 30 ml (about 3 tablespoons) of lemon juice per litre of milk. Stir the milk while carefully adding the lemon juice. The curd precipitates almost immediately.
4. Continue stirring for about 3 minutes after adding the lemon juice.
5. Allow the curd to settle for 15 minutes. Separate the curds from the whey by draining through a sieve or a cloth (use a cotton cloth folded twice).
6. While draining the whey, stir the curd to prevent excess matting (coagulation).
7. Add salt to the curd at the rate of about 4g (about a level tea spoon) per 100 ml of curd and mix thoroughly. The amount of salt may be varied to cater for different consumer tastes and preferences.
8. Transfer the curd to a mould lined with cheese cloth. The mould may be cylindrical or square shaped and may be made from metal, plastic or wood.

Making fermented milk (Mala)

What is Mala?

This is milk that has undergone the fermentation process due to introduction of a specific bacterium either from a commercial culture or by adding a small amount from a previous batch of fermented milk. The process described below is based on a traditional process.

How to do it and materials

The process for making fermented milk is:

1. Use good quality milk, i.e. free from antibiotics and preservatives, not adulterated.
2. If making sweetened cultured milk, add sugar at the rate of 20 to 25 kg per 500 litres (40 to 50 g per 1 litre).
3. Heat the milk to 92 to 95°C for 3 to 5 minutes or 85° C for 30 minutes or just bring to the boil.
4. Cool to 22 to 25° C (warm room temperature).
5. Inoculate with a commercial fermented milk culture or mix with a small amount of fermented milk.
6. Incubate at 22 - 25° C (warm room temperate) for 16 to 18 hours.
7. Cool to 20° C (just cool to the touch) in 30 minutes.
8. In case of flavoured cultured milk, add flavour and colour.
9. Stir until smooth.
10. Pack at 20° C.
11. Refrigerate for 10 to 12 hours to help recover thickness lost during stirring.
12. Distribute for consumption and/or sale.

Making yoghurt

What is yoghurt?

Yoghurt is a form of fermented milk whereby fermentation is achieved through the introduction of

specific “friendly” bacteria into milk under very carefully controlled temperature and environmental conditions. The source of bacteria can be a small amount of plain live yoghurt bought from the shop or one may obtain a commercial starter culture.

How to do it and materials needed

The process for making yoghurt is:

1. Use about 5 litres of good quality milk, i.e. free from antibiotics and preservatives, not adulterated.
2. Bring the milk to 85° C over a stove and keep it there for two minutes (or just boil for two minutes) to kill any undesirable micro organisms.
3. Pour the milk into a tall, sterile (rinsed with boiling water) container and allow to cool to 43° C (just warm to touch with the back of the hand).
4. Take about half a cup of plain yoghurt (bought from the shop) and warm it slightly, i.e. to the same temperature as the milk.
5. Mix the warmed yoghurt with the milk and cover tightly.
6. Put the mixture in a constantly warm place (e.g. food basket) at 43° C (just warm to the touch) and leave it for six hours.
7. Remove and leave it for about 30 minutes to cool to room temperature.
8. Add flavour and colour if required while stirring gently.
9. Pack into sterile containers.
10. Store in the fridge for 10 to 12 hours.
11. Distribute for consumption and/or sale.



CULTURAL ACTIVITIES

The following activities will help the participants to reflect on what they have done or learned by a creative outlet for expressing it such as singing, drawing, poetry, drama, Of course, you can also use cultural activities of your own choice or you may want to ask the participants if they have any activities of their own that they enjoy!

ACTIVITY 1. The need to control effects of micro-organisms

TIME:

30 minutes

STEPS:

1. Mark out a large circle on the ground. It should be wide enough for someone to run round it in about 3 minutes.
2. Mark out a smaller circle at the centre of the larger circle, a fort. (It represents the milk, meat that must be protected from decomposing agents).
3. Find the middle of this second circle and mark a spot for placing the ball (it represents the micro-organisms that have secretly attacked our foods stuff).
4. The participants are divided into two teams that will compete.
5. Each team will identify a person who is good at hitting balls hard and also running round the large circle fast to win points for their team.
6. Team A starts by hitting the ball and competing with the runner from Team B round the large circle. Other members of Team A run to find the ball to give it to their runner when s/ he completes running round the big circle. They will also try to secure access to the centre. Team A player must successfully place the ball back at the centre to finish the race. Team B members must try to prevent access to the fort (inner circle).
7. The roles are changed and Team B will choose a runner to run around the big cycle competing with Team A runner. Other members of Team B will look for the ball and try to keep an access to the circle (fort) while Team A protect the middle circle so that the opponents do not return the ball in case they get it before a Team B member gets it.
8. Participants are asked to draw a link between the game and the following critical factors in preserving foodstuff.
9. The facilitator gives a list of the aspects in the second column (key aspects in preserving and processing products) in an incorrect order. Ask sub groups to draw arrows that link the step in the game to the correct interpretation.

The game	The key aspects of preservation and processing foods
The ball	Micro-organism to be removed, destroyed from the product
Hitting the ball	Removing micro-organisms
Running round the big circle	Tough conditions that destroy the micro-organism such as heating
Guarding the inner circle	Preserving factors used (salt, oils, sugar, vinegar, friendly micro-organisms)
Sending a team to search for the ball	Removing all possible micro-organisms



ASSESSING PROGRESS

Pair-wise interviews among JFFLS participants¹

This exercise allows participants to assess each others management practices and adoption of improved practices at their households and thus provides for informal evaluation of JFFLS impact. Participants are stimulated to reflect upon reasons and constraints for adoption both in their own context and among their fellow farmers.

OBJECTIVES:

- To evaluate management practices on individual JFFLS members' farms;
- To share experiences among participants;
- To think about constraints and opportunities in relation to applying the knowledge gained in the FFS on individual farms.

TIME:

1 hour during the 1st session and 2 hours during the 2nd session

Note: This exercise should be applied towards the end of the JFFLS cycle.

MATERIALS:

Large sheets of paper and coloured pens

STEPS:

During the 1st session:

1. Inform the participants that they will be visiting each others' farms to conduct farm interviews. Half of the group will be visiting another member and the other half will host a visit on their farms.
2. Ask the participants to split in small groups and develop a checklist of issues and questions to explore during the farm visit. The questions should relate to the impact of FFS on household and farm level, and on the use of the knowledge gained through FFS, including adoption of practices. In particular the questions should cover issues such as food security situation, efforts to ensure enough high quality food, storage of seed and grain and experiences with processing of products.
3. Randomly, divide the participants in two groups and tell one group that they will be the ones conducting interviews, and the other group will be the ones hosting the farm visit. Thereafter, pair each of the persons in the "interviewers" group up with a person from the "farm visit host" group. Take into consideration the distance between participants when finalizing the pairs.

¹ Adapted from Discovery-based Learning on Land and Water Management: Practical Guide for Farmer Field Schools (FAO and IIRR, 2006).

4. Tell all that during the coming week they have to arrange in their pair for the farm visit and interview to take place, and that during the following session the interviewer will report the findings of the visits. The information gathered during the interview should be documented in a record book.

During the 2nd session

1. Ask each “interviewer” to summarise the finding of the farm visit interview, and especially explain in what way their fellow FFS member appears to have made use of the knowledge gained in the FFS, and any constraints and/or opportunities related to the uptake of practices.
2. In plenary discuss the results of the exercise. Some suggested questions for processing discussion:
 - Does there appear to be a trend among group members in relation to which practices are adopted or not?
 - What are the key factors affecting the transfer of knowledge gained in the FFS to the individual farms?
 - How did the “farm visit hosts” perceive the exercise - did the interview exercise make them think of issues they had not previously thought of?
 - How can the transfer of knowledge from the FFS to the household/farm level be improved and/or quickened?



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