FACILITATORS' FIELD GUIDE FOR FARMER FIELD SCHOOLS ON LOCAL FOOD PLANTS FOR NUTRITION

Module:
Managing local food plants

SD = HS Sowing Diversity = Harvesting Security

Donor: Sida

Sverige

Partners: Oxfam Novib, CTDT-Zimbabwe, CTDT-Zambia, PELUM, ESAFF, Li-Bird, NAFRI, ASOCUCH, FOVIDA, FSN

OXFAM · Community Technology Development Trust · PELUM Association · ESAFF · LI-BIRD · NAFRI · ASOCUCH · FOVIDA - Fomento de la Vida - · 农民种子网络 Farmers' Seed Network (China)

FACILITATOR'S FIELD GUIDE FOR FARMER FIELD SCHOOLS ON LOCAL FOOD PLANTS FOR NUTRITION

Module: Managing local food plants

This module is written by Gisella Cruz-Garcia, Elena Nera, Hilton Mbozi, Bert Visser and Jorge Chavez-Tafur.

This work is part of the Sowing Diversity = Harvesting Security program (www.sdhsprogram.org) Phase II (2019-2022). Funding for the program is provided by the Swedish International

Development Cooperation Agency (Sida).

Citation: Oxfam Novib. 2021. Facilitators' Field Guide for Farmer Field Schools on Local Food Plants for Nutrition. Module: FFS-level evaluation. The Hague: Oxfam Novib.

Contact: Gisella Cruz-Garcia, Lead Local Food Plants for Nutrition, SD=HS Program, **gisella.cruzgarcia@oxfamnovib.nl**.

All illustrations by Irene Cécile (**www.irenececile.com**) 2022.

Structure of the module

OXFAM Novib

Introduction

This module has been designed to help facilitators of Farmer Field School (FFS) on nutrition and local food plants to implement activities that help farmers to improve the management of local food plants.

Each FFS will choose which activity or activities it will implement based on their own selected research objectives. The objectives are defined at the end of the diagnostic phase of the FFS, taking into account the preferences of women, men and youth.

The implementation phase can start as soon as the curriculum for the FFS cycle has been agreed by the participants. It is important that the FFS facilitators ensure that the materials required are available on time, and that they organize the logistics (e.g. infrastructure, field site), coordinate with experts and local institutions, and ensure that the budget will suffice for the implementation of all activities.

This document presents guidelines for sowing local food plants, harvesting wild plants, seed storage and germination, and vegetative propagation. FFS facilitators and farmers, however, are encouraged to implement any other activities that they find useful not described in this module. The guidelines in this module are not written in stone. They can be regarded as suggestions and examples, rather than as a recipe or blueprint that needs to be followed in a fixed order.

This document summarizes the information on FFS activities presented in chapter 7 of the Field Guide. The preceding FFS diagnostic phase has been summarized in the Online Course on nutrition and local food plants.

Other illustrated modules for the FFS on nutrition and local food plants are: Diagnostic Phase, Improving Nutrition, FFS End-of-cycle Evaluation, and Special Topics.

Checklist for facilitators: key points of attention

Preparation:

- Has the FFS completed the diagnostic phase?
- Do all FFS members agree with the research objectives and activities?
- When is the best time for the FFS group to ask support from external collaborators (e.g. extension services, agricultural departments, nutritionists, health practitioners)?

Source of seeds or planting materials (if applicable):

- Where and when can the FFS get seeds of the local food plants selected for the activity?
- How many seeds in total do the FFS members need?
- Who will be responsible for obtaining the seeds?

Site selection and/or infrastructure (if applicable):

- Is the chosen site easily accessible for community members, including women and elderly?

Evaluation:

- How will you evaluate progress?
- When will the FFS organize the Farmer Field Day?

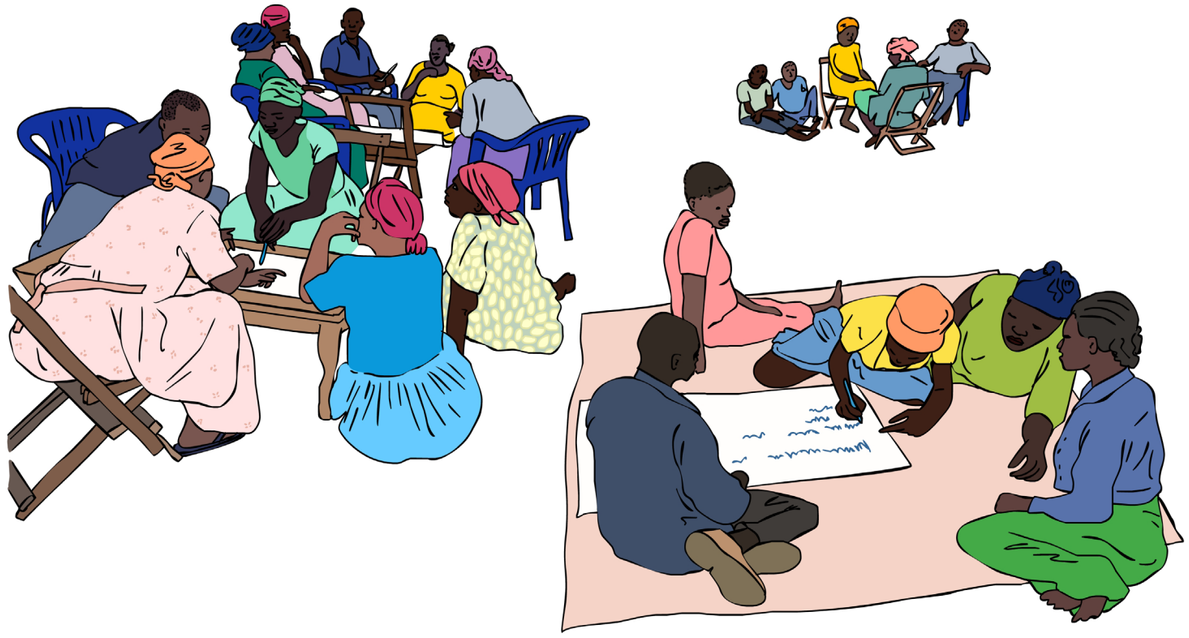
OXFAM Novib

Gender: women and men in the FFS

For the activities undertaken in a farmer field school to be successful, the selected package has to respond to the needs of all participants – women, men, youth. If not everybody feels their interests are included, people will stop coming to the weekly sessions very quickly. This is why the research objectives must address the preferences of all participants.

It is also important to organize the FFS in such a way that women and men can take part equally in the activities, that the workload is fairly shared, that everybody's views and opinions are included, and that decisions are taken by all. Even if this is not the case in regular community life, it can be strategic and influential to address unfair or unproductive relationships between men and women within the FFS. For example, by ensuring that both men and women take leadership positions in the plenary group and the sub-groups.

Choose meeting times that suit all participants and that interfere as little as possible with other family or household duties (childcare, cooking, market times).



Sowing local food plants

Objectives:

To promote effective sowing practices, so that local food plants can be sexually propagated (i.e. by seed) in home gardens and fields in an efficient manner.

Types of suitable local food plants:

Species in which sexual propagation is the best option and for which seeds are readily available.

Location for the activity:

Indoor locations serving as plant nurseries, with appropriate conditions of light, moisture, and temperature. Outdoor locations for growing out plantlets.

Materials required:

Water, pots, trays, paper towels, mulch, growing media (soil, moss).

Stakeholders involved:

Household members taking care of home gardens and fields should specifically be targeted for these sessions, so that they can then apply the knowledge gained.

Description:

Before the first session:

1. Collect information on the regular germination rates and common sowing practices for the selected species, and, if applicable, on the type of seed dormancy and treatments practiced to break it.

First session:

2. Opening questions: Write down the answers to each question in Form A, under 'pre-activity questions'.
3. Discuss with the participants (plenary): possible factors influencing germination rates, specific requirements of the selected species.
4. Discuss with the participants which methods they know and use in general for sowing, and for which type of seeds these different methods are more suitable. Also discuss if they would like to explore alternative methods.
5. Select one or more sowing methods which are suitable for the food plants of the session after having discussed their advantages and disadvantages.

Session 2 onwards:

6. Explain the selected method(s) step by step.
7. Test the method(s) in sub-groups:
   a. Over the following few weeks, compare the germination rate among the methods and in relation to direct sowing (if possible).
   b. Draw conclusions on which methods are most effective and feasible.

Final session (can be done as soon as plants are firmly established, does not have to wait until end of growing season):

8. During this meeting, FFS participants will reflect on what has (and has not) been accomplished during the FFS experiment and why. Write down the results of the group reflection in Form A, under 'activity evaluation'.
9. Based on the lessons learned, plan which activities they would like to conduct as a next experiment to complement or continue the work, or return to the results of the diagnosis exercises to set new objectives involving other topics.

Background:

Seed germination is influenced by light, water and oxygen, and temperature.

- Light: pioneer species (producing very small seeds) require high light for germination and need to be sown on the soil surface; whereas shade-tolerant species (trees and shrubs with medium-big seeds, herbaceous plants with small seeds) germinate in darkness and need to be buried.
- Water and oxygen: seeds should be kept moderately moist, allowing for a good water-oxygen balance.
- Temperature: seeds may require cold, intermediate, or warm temperatures, or alternating cold and warm temperatures in order to germinate (the latter particularly common in dormant seeds).

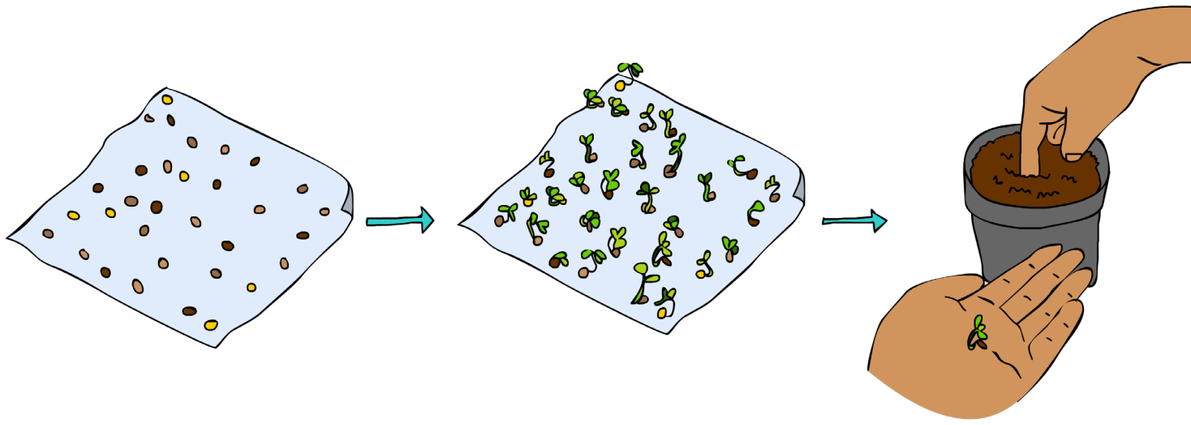
Different sowing methods can be applied, once seed dormancy (if occurring) has been broken. The choice of the most appropriate one depends on the seed characteristics.

- **Broadcasting:** seeds are thrown directly over the field or home garden. Only advisable for species for which seeds are available in abundance and that germinate easily and effectively.

- **Direct sowing** in hole: with a single seed (for rare seeds or seeds with a high germination rate) or multiple seeds per pot or hole (lower germination rate). Seeds are located centrally in a hole in the soil, with an orientation that allows for optimal growth. Depending on their light requirements, they are covered with a layer of mulch. Multiple-seed sowing is the most common practice, in which several seeds (2-5) are placed in the same container so that at least one or a few of them will germinate. The seeds should be separated to ensure good root development. As soon as multiple seeds start germinating in the same container, they should be separated. This moment is also an opportunity to select the healthiest and strongest plants.

- **Sowing germinating seeds:** after breaking dormancy, seeds are left to germinate between wet paper towels, and they are sown in containers once their rooting system has emerged. This is a labor-intensive method and it requires skills for proper planting.

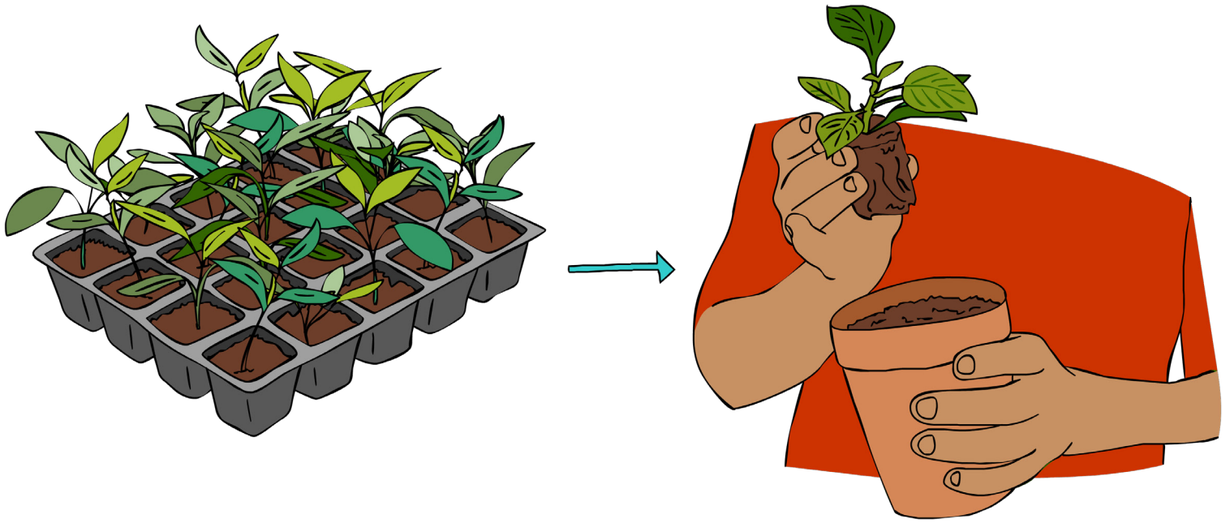
Furthermore, pathogens can easily affect the seeds since they are all germinating in the same bag. However, it is a very efficient method as it ensures that only viable seeds are planted, and it allows to observe the germination process and to identify factors affecting it.

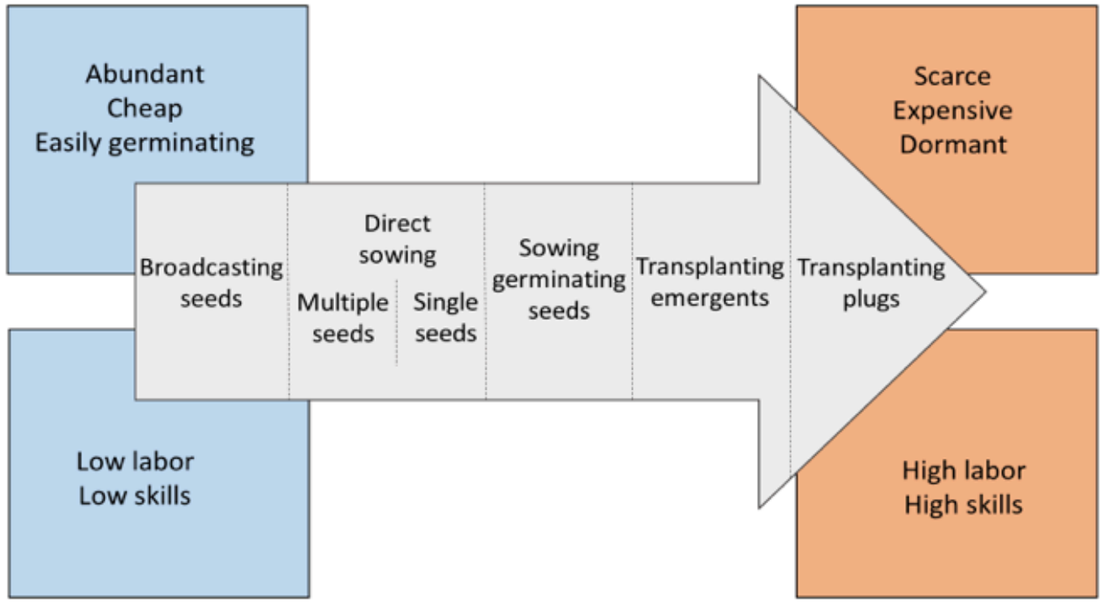


- **Transplanting seedlings:** seeds are sown in a shallow layer of growing medium, and once they have fully germinated the seedlings are transplanted into a container or on the seed bed - hence the sprout is more developed than in the previous method, in which only the root has emerged after the seeds were sown. The seedlings are gently extracted from the tray, taking along some of the surrounding medium, and inserted in a container in which a small hole in the soil has already been prepared. Correct root orientation is essential for the plant growth, and in some cases

root pruning can be practiced before planting. This method is not suitable for species with taproots, whereas it can be used for plants with fibrous rooting systems, with small or fragile seeds, and with seeds having complex dormancy traits.

- **Transplanting plugs:** seeds germinate in trays in individual cells, and the transplanting is carried out only once the seedlings are well established (plugs). The transplanting needs to take place once the roots are firm enough to prevent damage during transportation. This method is the most labor-intensive and it requires skills, but it is also the most efficient one. However, it is not always successful, thus it is recommended to do small trials before it is applied on a larger scale.





Please note:

Although the use of mulch is always recommended in these guidelines, the recommendation does not apply to seeds requiring light to germinate. In general, the specific requirements of a particular seed need to be considered when applying all of the above-mentioned methods, hence gathering information before the sessions on germination of seed of the selected species is essential.

Harvesting wild food plants in the wild

Objectives:

To promote the consumption of wild food plants while ensuring that sustainable harvesting practices are adopted, allowing for species conservation in the wild.

Types of suitable local food plants:

Wild plants and mushrooms, which can be difficult to harvest due to poor knowledge on maturity, or which are declining in abundance due to an excessive harvesting pressure.

Location for the activity:

The practical sessions should take place where the selected plants are located.

Materials required:

Pruning shears/knives and white plastic bags for harvesting. Pens, pencils, and paper for plenary discussions and for constructing a harvesting calendar.

External advisors involved:

Local expert with knowledge on wild species and ecosystems in the community neighborhood.

Description:

First FFS session:

1. Opening questions: Write down the answers to each question in Form B, under 'pre-activity questions'.
2. Explain and discuss the advantages of consuming wild plants: they are free to harvest and often rich in nutrients, they are adapted to

the environment, and their sustainable use can go hand in hand with preserving natural ecosystems and with maintaining plant genetic diversity.

Second FFS session onwards:

3. In **plenary**:
   a. Discuss the concept of sustainable harvesting, in relation with plant parts, plant types, growth rates, reproductive systems.
   b. Explain how to recognize readiness for harvesting and how to distinguish the species from similar non-edible species.
   c. Discuss how to avoid post-harvesting losses.
   d. If relevant, discuss which edible mushrooms may be available and sustainable mushroom harvesting.
4. In **sub-groups**, develop a calendar for the harvesting of wild species in the community area.
5. Organize a wild food plant harvesting expedition to practice the knowledge acquired during the FFS discussions. An expert from inside or outside the community may be invited to the expedition in order to help answer additional questions that may arise.

Final session:

6. During this meeting, FFS participants will reflect on what has (and has not) been accomplished during the FFS cycle and why. Write down the results of the reflection in Form B, under 'activity evaluation'.
7. Based on the lessons learned, plan which activities they would like to conduct in the next period to complement or continue the work, or return to the results of the diagnosis exercises to set new objectives.

Background:

Here are a few points that may be of interest during the sessions:

- Unripe plants may have lower nutritional content and be more difficult to digest, so it is important to harvest at the right plant stage. Exceptions are species that can ripen after harvesting, for which early harvesting can reduce losses, and species of which the vegetative parts are consumed. It is often possible to see whether a certain species it at maturity:
  - In cereals and legumes, the grains and pods will be dry.
  - Roots and tubers must have reached the desired size.
  - Most fruits change color at reaching their maximum size.
- Rare or threatened species should not be harvested in the wild but rather cultivated in home gardens, to avoid depletion of natural stocks.
- Harvesting from plants with different growth rates, reproductive systems, and life forms, or harvesting different types or parts of plants, may have different implications in terms of overharvesting risks.

	Annual / Biannual	Perennial	Shrub / Tree
Wood	–	–	Medium
Bark	–	Medium	Medium
Root	High	High	Medium
Leaf	Medium	low	low
Flower	Medium	low	low
Fruit and seed	High	low	low

Susceptibility to overharvesting depending on the plants' life form and the harvested part (modified from Schippmann et al., 2006).

- In the case of mushrooms, as the fruiting bodies are harvested, this does not usually cause damage. However, practices that favor the dispersal of spores should be adopted.
- Harvesting and transportation should take place at the coolest time of the day. Before transportation, eliminate damaged produce and avoid keeping ripe and unripe fruits together. As soon as possible, the produce should be stored in clean containers, located in cool and dry areas with ventilation, protected from sunlight and from rodents and insects.

Seed storage

Objectives:

To allow for the preservation of seeds for the following growing season(s), avoiding seed loss and maintaining seed germination capacity (viability); to contribute to species conservation.

Types of suitable local food plants:

Species in which propagation using seed is the major and best option and for which seed collection is feasible.

Location for the activity:

If possible, close to storage areas and/or community seed banks.

Materials required:

Materials for demonstrating seed storage techniques: e.g. trays for drying, materials for simple storage structures (e.g. wood, mud).

Stakeholders involved:

Household or community members responsible for seed storage should especially be involved.

Description:

First FFS session:

1. Opening questions: Write down the answers to each question in Form C, under 'pre-activity questions'.
2. In relation to the food plants selected for this topic, discuss the importance of seed storage and different ways to do it.

Second FFS session onwards:

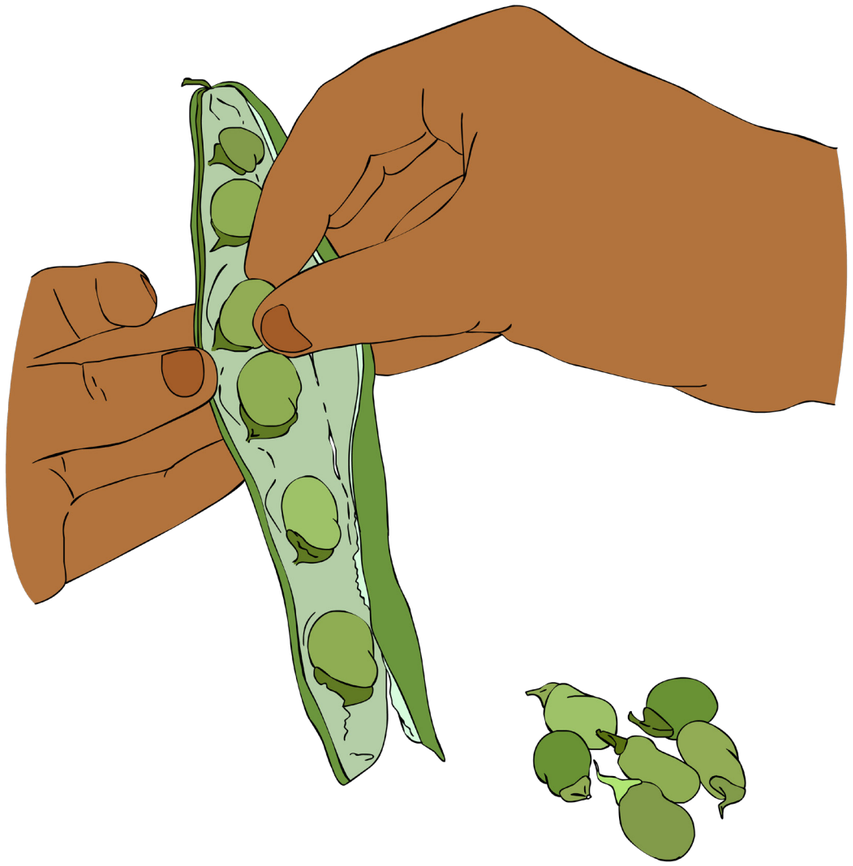
3. **In plenary**:
    a. Discuss what storage systems would be appropriate for which local food plant seeds, and the pros and cons of each system.
    b. Address the importance of seed maturity and quality, the effect of physical and physiological factors on seed preservation, the impact of pests and disease and their control.
4. **In subgroups**: try out seed handling practices and build different types of structures or improve existing ones.
5. Visit existing local storage facilities (and if possible, community seed banks), discussing their qualities and possible improvements.

Final session:

6. During this meeting, FFS participants will reflect on what has (and has not) been accomplished during the FFS cycle and why. Write down the results of the reflection in Form C, under 'activity evaluation'.
7. Based on the lessons learned, plan which activities they would like to conduct in the next cycle to complement or continue the work, or return to the results of the diagnosis exercises to set new objectives.

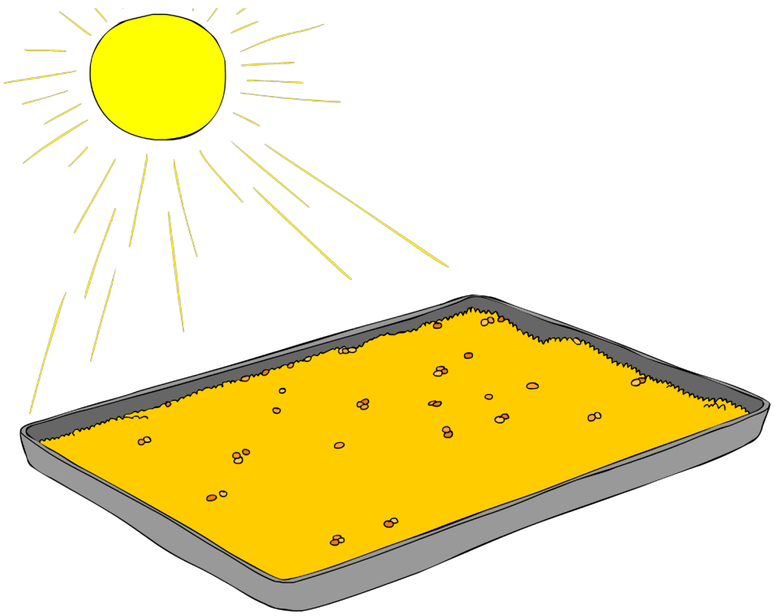
Background:

- Important seed-related factors:
  - Seeds should be harvested at maturity.
  - High seed quality allows for a longer storage life; it depends on environmental conditions such as soil quality and nutrient availability during plant growth.
  - Harvesting under wet conditions favors fungal contamination.
  - Different types of seeds (e.g. starchy vs oily) deteriorate more or less easily.
- Pre-storage handling practices are the basis for good seed storage. General steps:
  - Mature seeds are collected/extracted and transported to the storage site. For seeds in fresh fruits, seeds are only extracted right before storage.



  - Impurities such as leaves or insects are removed immediately.

  - Seeds (or in some cases, whole plants before extraction) are spread on trays and dried. They can be placed under the sun or under cover in open air and stirred regularly, although UV-light might negatively affect germination rates. For some plants, drying can be carried out before extracting seeds, by drying the whole plant.



- Husks or shells are often removed manually or mechanically.

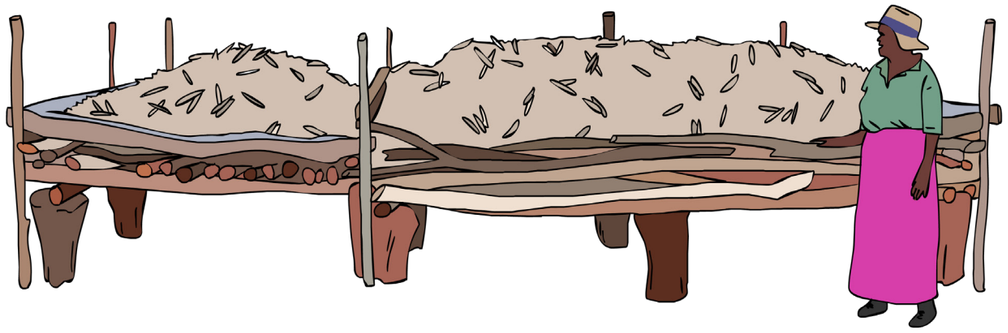
- During storage: high temperature, high seed moisture content, and high humidity negatively affect the seed germination capacity and facilitate the proliferation of fungi and insects. Most damage to seeds is caused by fungi and bacteria, causing major viability loss. Insects, rodents, and birds can eat the seeds or affect storage structures.
    - Microorganism and insect control: before storage, control seed quality, wash and dry the seeds shortly after extraction. During storage: ventilate, regularly monitor the presence of insects and fungi, and maintain high hygiene around the storage site (removing vegetation or rubbish, keeping livestock away, timely cleaning empty storage containers).
    - Rodent control: check for signs of a rodent infestation (feces, nests, footprints, fragments of grains and damaged

materials). To prevent rodent entrance: place metal plates at the base of doors; use cement to cover walls and floors and to fill holes; place the storage above ground level; avoid water stagnation; practice good hygiene and sanitation.

- Bird control: wire nets at windows and ventilation entries can prevent bird entrance in storage rooms.

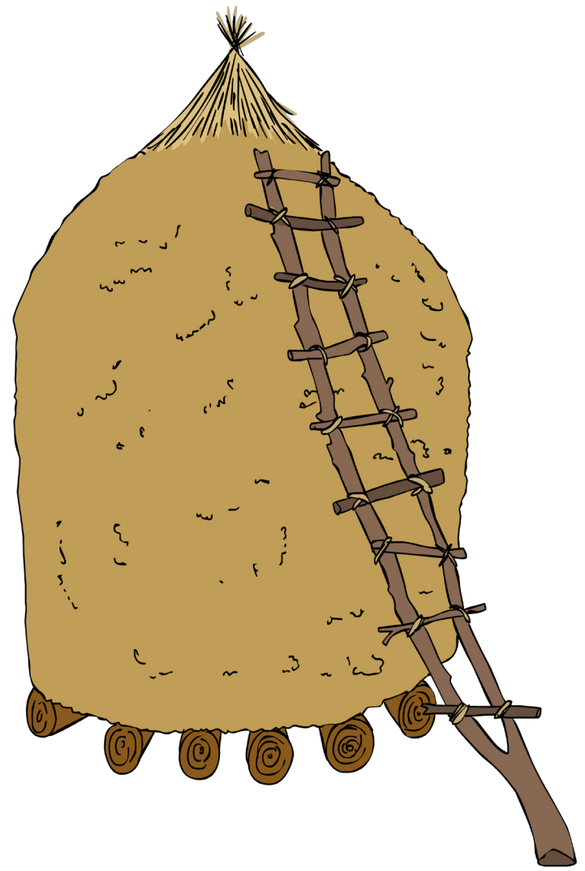
- Storage structures should be out of the sunlight and have low humidity and good air circulation. Main categories of structures:
    - Open storages: only suitable for short-term drying of recently harvested seeds with high moisture content. Open air sites allow for quick drying, preventing mold proliferation, and they enable seed maturation. They usually consist of wooden elevated structures, to protect from termite invasion; however, they expose the seeds to birds and insects, as well as possibly rain or excessive sunlight. As a specific form of open storage, cobs or panicles can be hung from the roofs

or over fire places, which allows for drying and protects from insects simultaneously.



- Semi-open storages: with porous walls, elevated on stones or poles to protect the seeds from rodents. They provide better protection from sun and rain while still enabling some ventilation, but they do not protect from insects, that may transfer micro-organisms.

- Closed storages: hermetic (airtight) containers made with materials such as cement, clay or mud, in combination with wood, straw, etc. They provide good insulation, so they allow to keep stable temperatures and humidity, but can only be used for seeds that can be dried until very low moisture contents before storage and that tolerate medium to high temperatures prevalent in some closed storage facilities.



Small amounts of seeds can be preserved in jars and pots sealed with candle wax or rubber rings, which allow to keep the seeds safe from rodents at low temperatures and moisture level.

Seed germination

Objectives:

To improve farmers' understanding of seed dormancy and to promote successful treatments for activating germination, so that farmers can plant and cultivate local food plants exhibiting seed dormancy.

Types of suitable local food plants:

Species in which sexual propagation is the best option, for which seed collection is feasible, showing strong dormancy.

Location for the activity:

Field or home gardens, covered spaces serving as plant nurseries.

Materials required:

Water, pots, materials for labelling the pots. Depending on the treatments: boxes, sand, sandpaper; access to fire or heating; hydrogen peroxide, citric acid; absorbing paper.

Stakeholders involved:

Household members who take care of the home gardens and the fields should especially be involved.

Description:

Before the first session:

1. Collect information on seed dormancy for the selected species and on treatments to break it from the literature and from community members holding traditional knowledge.

First session:

2. Opening questions: Write down the answers to each question in Form D, under 'pre-activity questions'.
3. In plenary:
    a. Explore the different types of seeds (recalcitrant, intermediate, orthodox) and on how to identify them.
    b. Discuss what causes seed dormancy, and what type of dormancy the selected species have.
    c. Address why certain activation methods may be better than others for these species.

Session 2 onwards:

4. In subgroups, test the method(s): seed lots of a certain species undergo different treatments and they are planted in differently labeled pots, including a control group without dormancy treatment. Over the following few weeks, observe the germination rate of each pot and compare among the different treatments and with the control group to draw conclusions on the most effective and feasible methods. Look at the number of seeds germinating but also at the quality of the seedling.

Final session:

5. During this meeting, FFS participants will reflect on what has (and has not) been accomplished during the FFS cycle and why. Write down the results of the reflection in Form D, under 'activity evaluation'.
6. Based on the lessons learned, plan which activities they would like to conduct in the next cycle to complement or continue the work, or return to the results of the diagnosis exercises to set new objectives.

Background:

Seeds can be classified as recalcitrant, intermediate, and orthodox:

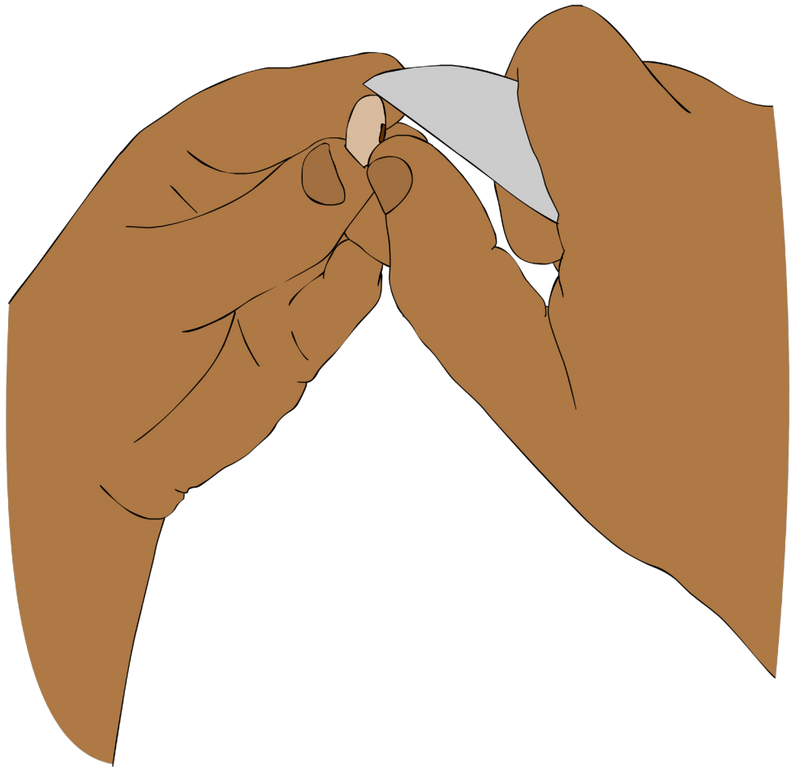
- Recalcitrant seeds germinate soon after dispersal, and they cannot be dried without losing their viability.
- Intermediate seeds can germinate soon, but they can also tolerate drying.
- Orthodox seeds can be dried without losing viability, and they may require treatment to break dormancy. The appropriate treatment depends on the type of dormancy:
  - External dormancy:
    - » Physical dormancy: due to hard and thick seed coats, which become permeable over years.
    - » Physical and physiological dormancy: same as above, but the seed coat becomes permeable after exposure to certain temperatures.
    - » Chemical dormancy: the fruits containing the seeds are rich in germination inhibitors.
    - » Mechanical dormancy: the fruits have hard and woody walls that constrain seed germination.
  - Internal seed dormancy:
    - » At dispersal, the seed needs to ripen before germination is possible.
    - » Specific environmental conditions activate the germination process.
    - » A combination of warm and cold conditions over a long time is required.

Non-dormant seeds can be directly planted, dormant seeds require some treatment before germination. Treatment may include:

- **Cleaning**: to prevent microbial growth, seeds should be soaked for 24 to 48 hours.
- **Scarification**: disruption of the seed coat allowing for oxygen and water to enter, required for all types of external dormancy.

OXFAM Novib

- **Mechanical**: manually (for big seeds) or by placing seeds in a box and gently rubbing them with sand or sandpaper (for small seeds).



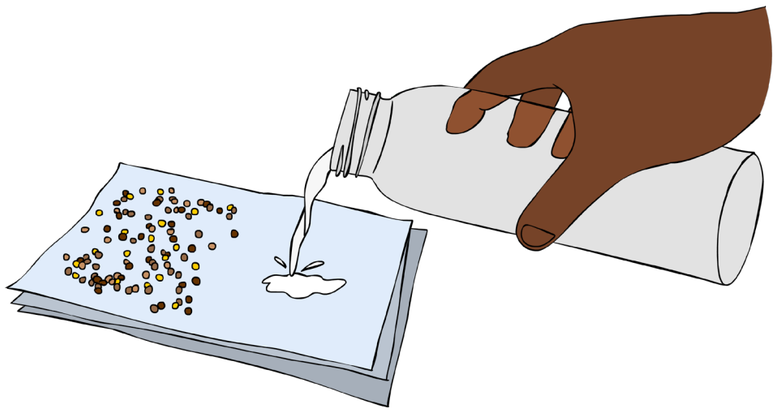
- **Heat**: seeds are exposed to high temperatures for a certain amount of time, either in hot or boiling water or in an oven. In wet heat scarification, seeds are added to boiling water for a few seconds (depending on the thickness of their coat) and then quickly transferred to cold water. In dry heat scarification, seeds are put in an oven until the coat cracks (temperature and time depend on the seed, close monitoring is necessary to avoid damage and loss of viability).
- **Chemical**: for species with very thick coats, acids can be used as a treatment. Please note that some acids are potentially

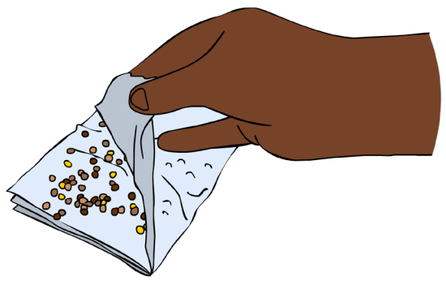
dangerous if correct procedures are not adopted; citric acid is safe and relatively easily available, but it requires long soaking times. The needed time is species-dependent. The seeds should be easy to cut but still firm after sufficient soaking.

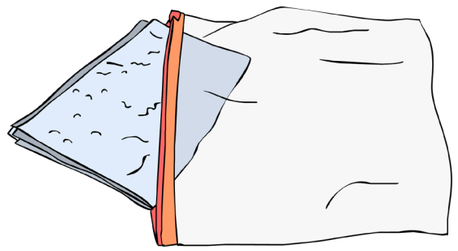
- **Soaking**: for one to several days, after undergoing cleaning and scarification (when applicable). Seeds can be soaked in running water or in stagnant water that needs to be changed regularly (at least twice per day). Seeds should be soaked until further soaking does not increase their weight.

- **Smoking**: seeds with internal dormancy should undergo smoking to stimulate germination. Seeds are distributed on trays and located in tents in which smoke is introduced through pipes. It is essential to determine the right timing , as excessive exposure can result in seed mortality.
- **Warm, moist treatments**: seeds with internal dormancy are kept in moist moss or sawdust at temperatures between 22 and 30˚C.

- **Stratification**: for seeds from high-elevation areas and with internal dormancy. Seeds are placed between sheets of wet (not waterlogged) absorbing paper and put in plastic bags until germination







Treatments for external and internal seed dormancy

	Cleaning	Scarification	Soaking	Smoking	Warm, moist treatments	Stratification
External seed dormancy	X	X	X	-	-	-
Internal seed dormancy	X	X	X	X	X	Seeds from high-elevation areas

Vegetative propagation

Objectives:

To increase farmers' knowledge on vegetative propagation of local food plants in home gardens and fields.

Types of suitable local food plants:

Species with easy root formation, strong seed dormancy, or rare occurrence.

Location for the activity:

Collect samples where the selected plants grow. Planting: covered locations serving as plant nurseries/greenhouses, or home gardens and fields.

Materials required:

Pruning shears and knives, white plastic bags, labels and pens, spray bottles with water. For plant parts containing roots only shears and knives suffice. For planting: containers, soil are needed.

Stakeholders involved:

Household members taking care of the home gardens and the fields, and keeping knowledge about the plants to be collected, should especially be involved.

Description:

Before the first session:

1. Collect information for the selected species on the type of cuttings to be used, their size, and other specific requirements facilitating vegetative propagation.

First session:

2. Opening questions: Write down the answers to each question in Form E, under 'pre-activity questions'..
3. In plenary:
    a. Discuss for which species vegetative propagation is preferable, also in relation to seed dormancy.
    b. Talk about which methods are known to the participants and their advantages and disadvantages.
    c. Highlight how to collect cuttings respecting and utilizing the genetic diversity of species populations (see "Harvesting wild food plants").

Session 2 onwards:

    d. Explain the selected methods step by step.
    e. Test the methods in subgroups:
        - Different methods may be tested for the same species.
        - Over the following few weeks, observe and compare when rooting occurs in each method and draw

conclusions on which methods are most effective and feasible.

Final session:

f. During this meeting, FFS participants will reflect on what has (and has not) been accomplished during the FFS cycle and why. Write down the results of the reflection in Form E, under 'activity evaluation'.
g. Based on the lessons learned, plan which activities they would like to conduct in the next cycle to complement or continue the work, or return to the results of the diagnosis exercises to set new objectives.

Background:

Vegetative propagation can be the most effective method for species with strong seed dormancy or containing few viable or no seeds. It allows to produce a large amount of uniform plants from one single mother plant in a short time, maintaining the same characteristics. Plants obtained through vegetative propagation are clones, i.e. genetically identical. Vegetative propagation cannot be used for selection of best plants.

The most common method is to use cuttings from stems and roots:

- The optimal size for stem cuttings depends on the species, but it is usually between 10 and 20 cm, removing leaves from the lower half. Stems continue growing in the same direction in which they would on the plant, which is important for rooting. To distinguish the two parts, cut straight at the bottom and with an angle at the top.
- Roots cuttings are small segments containing dormant buds, that can develop into a new plant. If the root cutting is planted vertically, polarity needs to be taken into account, in the same way as for the stem cuttings.

Several factors determine whether and how rooting may be promoted:

- Different species have different capacities to form roots, and they may require specific factors for rooting:
  - For some species the cuttings need to be collected in a certain time of the year. As a general rule, rooting happens more easily when cuttings are collected from the plant right before or after flowering.
  - The necessary size of the cuttings depends on the species and plant part, and some plants have precise requirements.
  - Cuttings should be collected from healthy plants. For stem cuttings, they should not be collected from flowering shoots, and leaves or buds need to be present.

Cutting preparation and handling cuttings influences rooting:

- Cuttings should be taken from right above a node (top) until right below a node where rooting is likely to occur (bottom). Leave some

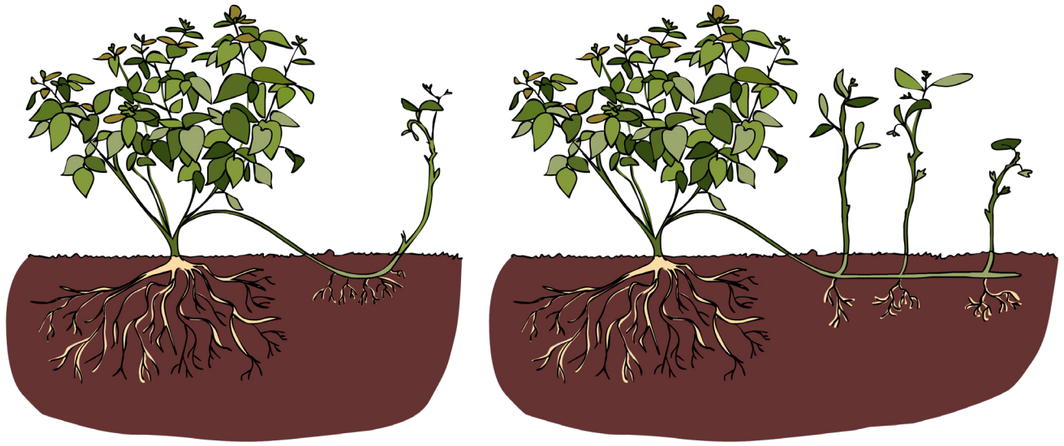
leaves or buds on the cutting to allow for photosynthesis during rooting.

- Cuttings should be collected from healthy plants, using sharp knives and shears, and disinfecting the cuts with a solution of bleach and water.
- Storage between cutting and planting should be kept to a minimum (i.e. maximum one day). Cuttings should be collected in fresh and cloudy days or early mornings, and they should be protected from the sun during transport and storage. They should be put in white

plastic bags (not transparent nor with heat-absorbing colors), labeled with origin and date.

If there is an objective to produce seeds over the long term, make sure to collect cuttings from both the male and the female plant.

Other methods for vegetative propagation:



- In layering, adventitious roots are allowed to grow directly on the plant stem before cutting. Two common methods are shown in the image below.

Some species have specialized structures that can be used for vegetative propagation, e.g. tubers, rhizomes, corms, stolons. These can be collected, in some cases cut in pieces, and replanted.

For more information

Sowing local food plants

- Tara Luna, Kim M. Wilkinson, and R. Kasten Dumroese (2014). Seed germination and sowing options. In *Tropical Nursery Manual: A guide to starting and operating a nursery for native and traditional plants. Agriculture Handbook 732* (pp. 163-183). Washington, DC: U.S. Department of Agriculture, Forest Service. Available at : https://www.fs.fed.us/rm/pubs_series/wo/wo_ah732/wo_ah732_163_183.pdf

Harvesting wild food plants in the wild

- Boa, E. R. (2004). 3 Management: wild edible fungi, trees, forest users. From *Wild edible fungi: a global overview of their use and importance to people* (No. 17). FAO . Available at : http://www.fao.org/3/y5489e/y5489e07.htm#P865_101496
- Schippmann, U. W. E., Leaman, D., & Cunningham, A. B. (2006). A comparison of cultivation and wild collection of medicinal and aromatic plants under sustainability aspects. *Frontis*, 75-95. Available at : https://library.wur.nl/ojs/index.php/frontis/article/view/1225
- FAO Zimbabwe (2015). Healthy harvest. A training manual for community workers in growing, preparing and processing nutritious food (pp. 70-75). Second edition. ISBN 978-0-7974-6229-8.

Seed storage

- Parimala, K., Subramanian, K., Kannan, K. M., & Vijayalakhsmi, K. (2013). Seed Storage Techniques-A Primer. *December 2013*. Available at : http://www.ciks.org/downloads/seeds/3.%20Seed%20Storage%20Techniques%20-%20A%20Primer.pdf
- Hong, T. D., & Ellis, R. H. (1996). *A protocol to determine seed storage behaviour* (No. 1). Bioversity International. Available at : https://cropgenebank.sgrp.cgiar.org/images/file/learning_space/technicalbulletin1.pdf
- FAO (2014). Appropriate Seed and Grain Storage Systems for Small-scale Farmers: Key Practices for DRR Implementers. ISBN 978-92-5-108334-5. Available at: http://www.fao.org/3/a-i3769e.pdf

Seed germination

- Tara Luna, Kim M. Wilkinson, and R. Kasten Dumroese (2014). Seed germination and sowing options. In *Tropical Nursery Manual: A guide to starting and operating a nursery for native and traditional plants. Agriculture Handbook 732* (pp. 163-183). Washington, DC: U.S. Department of Agriculture, Forest Service. Available at : https://www.fs.fed.us/rm/pubs_series/wo/wo_ah732/wo_ah732_163_183.pdf
- PROTA (Plant Resources of Tropical Africa) and PROSEA (Plant Resources of South East Asia) databases, available at: https://www.prota4u.org/

Vegetative propagation

- Tara Luna, 2009. Vegetative propagation. In: *Dumroese, R. Kasten; Luna, Tara; Landis, Thomas D., editors. Nursery manual for native plants: A guide for tribal nurseries - Volume 1: Nursery management*. Agriculture Handbook 730. Washington, D.C.: U.S. Department of Agriculture, Forest Service. p. 153-175. Available at: https://www.fs.fed.us/rm/pubs_other/wo_AgricHandbook730/wo_AgricHandbook727_153_175.pdf

a program by

OXFAM
Novib