

SEEDS AND PROPAGATION

8. SEEDS AND PROPAGATION

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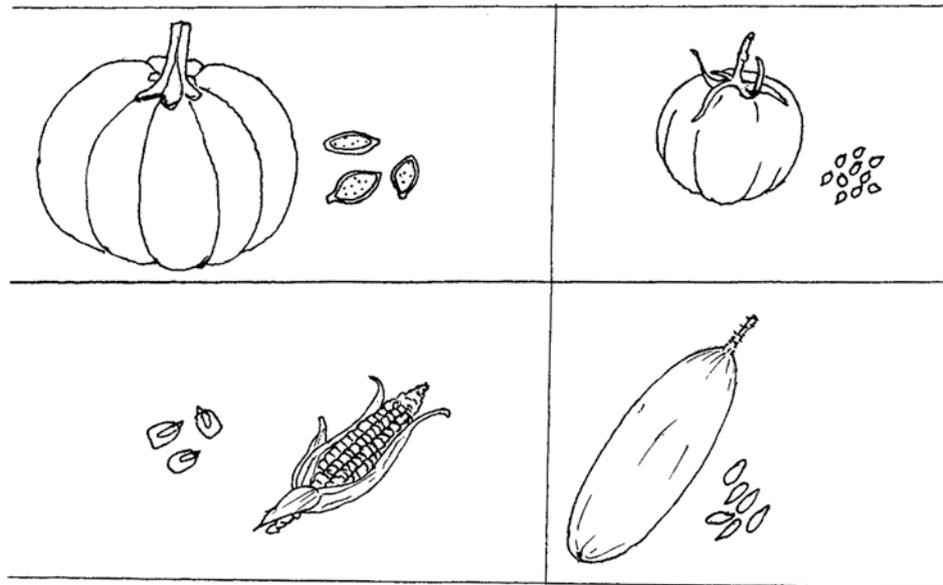
Saving and using local seeds is one of the most important methods for strengthening agriculture, increasing the variety of plants, and achieving food sovereignty.

WHY SAVE SEEDS?

- Everyone can collect and save seeds: it is cheap and easy to do.
- Saving and exchanging local seeds will increase the amount and variety of food that is grown.
- Local non-hybrid seeds generally have a higher nutritional content.
- Seeds are valuable and can be exchanged for other seeds or sold through a community seed bank.
- When good techniques are used for selecting and saving good seeds, the plant quality naturally improves each year.
- If there are no local seeds available, families and farmers have to buy seeds and are reliant on companies rather than on themselves. This decreases community resilience.
- A well-stocked seed bank containing proven local varieties is one of the best protections a community can have against the uncertainties brought by climate change.

Local seeds have adapted to local conditions.

This means that they are used to the climate and the soil where they grow. Each year that seeds are collected and planted, the plants become more adapted and stronger. If someone from Timor-Leste goes to live in England, or someone from Costa Rica goes to live in Kenya, it will take them many years to adapt to the climate, people, language, food, and culture! It is the same for seeds and plants. **The plants that grow the healthiest and strongest are the plants from which seeds must be saved.**



Every country has a large range of fruit, vegetables, grains, and other crops. These plants can be given local names to make trading and identification easier. New varieties of plants can also be grown to add to the range of different plants in your community, e.g. okra, kale. Sometimes introducing a new type of grain, fruit or vegetable can increase the yield of a crop, e.g. a new type of pumpkin.

To improve production, first consider the soil quality, amount of nutrients, water and sunlight. These are usually the most important factors. Then think about the type of seeds.



PLANT RELATIONS:

It is important to understand the classification of plants as it is then easier to understand the following information on pollination, cross-pollination, non-hybrids and hybrids, and creating new plant varieties.

Plants are divided into different groups using the following system, with the tomato and pumpkin shown as examples:

Order	Botanical name – Tomato	Botanical name – Pumpkin	General description
Kingdom	Plantae	Plantae	Plants
Subkingdom	Tracheobionta	Tracheobionta	Vascular plants
Superdivision	Spermatophyta	Spermatophyta	Seed plants
Division	Magnoliophyta	Magnoliophyta	Flowering plants
Class	Magnoliopsida	Magnoliopsida	Dicots
Subclass	Asteridae	Dilleniidae	
Order	Solanales	Violales	
Family	Solanaceae – nightshade family	Cucurbitaceae – Gourd family	
Genus	Solanum L.	Cucurbita L.	
Species	Solanum lycopersicum L. – garden tomato	Cucurbita mixta Pang. – pumpkin	



Solanaceae family



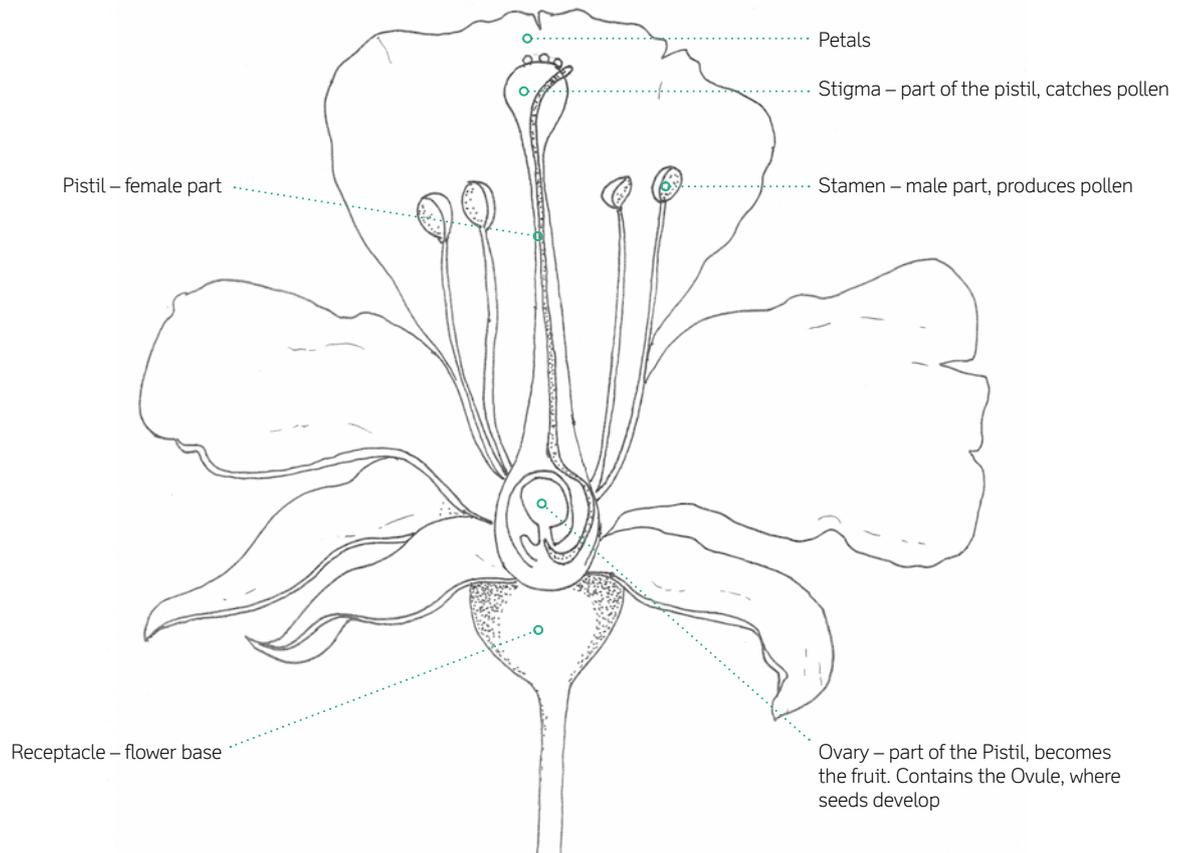
Cucurbitaceae family

Most plants you can grow vary at the family, genus, and species levels. Using the above examples, the Solanaceae family contains tomatoes, potatoes, eggplants, chilies, capsicums and tobacco. The Cucurbitaceae family contains cucumbers, pumpkins, gourds, squash, and zucchini. Generally seeds are produced from one species or from crossing two different species from the same genus. In nature two different genera sometimes but rarely cross to form a new plant.

POLLINATION:

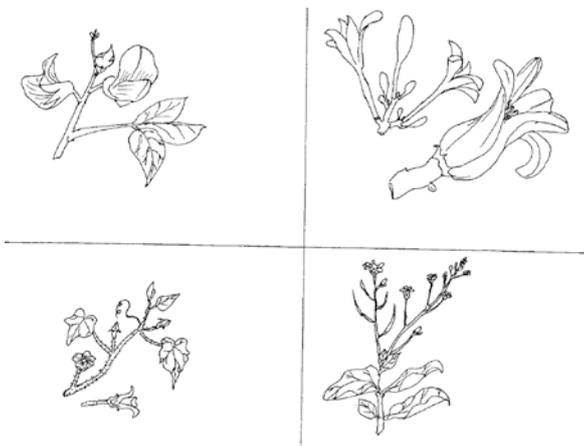
Pollination is the process a plant uses to make fruit and seeds.

During pollination, pollen from the male part of the plant fertilises the female part of the plant. These pollinating parts are usually found in the flower. Once the female part of the plant has been pollinated, the plant will produce fruit and/or seeds.



Different plants use different pollination techniques to produce seeds.

1. Beans, lettuces, tomatoes, cabbages, and chilies are examples of plants that have the female and male parts in the same flower.
2. Pumpkins, melons, cucumbers, and corn are examples of plants that have separate female and male flowers on the same plant. These plants all require insects, the wind or humans to pollinate by hand to reproduce.
3. Some papaya varieties have separate female and male plants and, therefore, require more than one plant to pollinate.



SMART IDEA:

More insects in the garden lead to better pollination rates, which lead to more and better quality seeds. Flowers, food, and water attract insects. If you have healthy soil and a large variety of trees and plants, you will have plenty of insects to pollinate your plants. A pond or ponds will also help.

CROSS-POLLINATION:

Cross-pollination is the transfer of pollen from the male part of a flower of one plant to the female part of a flower of another plant. It occurs naturally or it can be done by humans. Cross-pollination mostly occurs at the species level, depending on the plant family, and sometimes at the genus level.

Cross-pollination of different types of plants occurs when two different but closely related varieties pollinate each other, e.g. two different types of green-leaf vegetables, or two different types of corn, or a pumpkin plant and a squash plant. If this occurs, the resulting seeds might be good, sometimes they will be weaker than the parent plants or they may not grow at all, especially if two different genres cross. Therefore, it is best to try to prevent cross-pollination of different plant species from occurring unless you want to cross-pollinate.

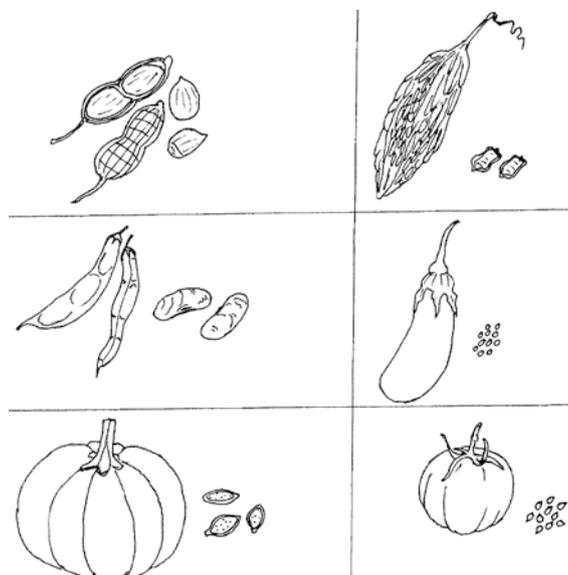
Some techniques to reduce the chances of different types of plants cross-pollinating are:

- Grow one type of each plant at a time, e.g. one type of corn or one type of pumpkin or squash or one type of eggplant.
- Plants such as green-leaf vegetables, lettuces and cabbage flower and set seed at the end of their life. Have only one type of green-leaf vegetable or one type of lettuce or one type of cabbage set flowers and seeds at a time.
- If different types of a plant are far apart from each other, and many other plants are grown in between, the chances of cross-pollination are reduced. Beans, tomatoes and plants that have closed pollination where the flower pollinates without opening require a 10m distance to be safe, plants that use insects and wind for pollination require a lot further. Bees can travel up to 5km!

Hand pollination: pumpkins, melons, luffas, gourds, chokos, and cucumbers can be pollinated by hand.

If these vegetables are pollinated naturally, they can cross-pollinate with other types of the same vegetable. They cannot cross-pollinate with other vegetables, e.g. only pumpkin-pumpkin, luffa-luffa, etc.

Hand pollination allows you to choose the exact type of seeds you want to collect.



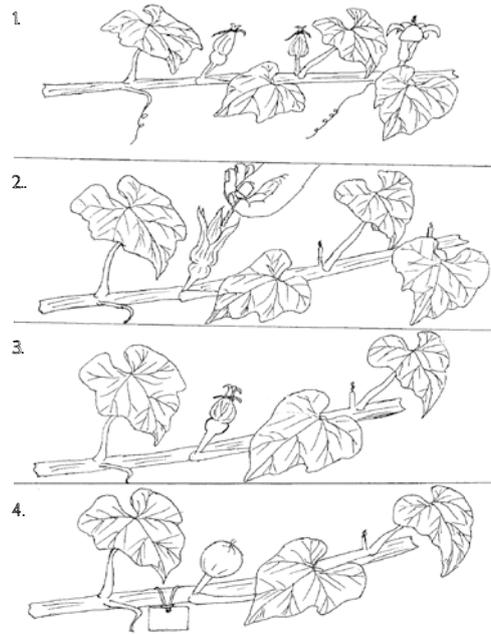
SMART IDEA:

- Repeat the process on other female flowers using male flowers from different plants of the same type, e.g. from different pumpkin plants that all produce the same type of pumpkin. This helps to keep seed quality and diversity.
- Use this method to cross pollinate different varieties to create a new variety. E.g. a new type of cucumber. This sometimes works and sometimes doesn't, so don't rely on these seeds to be your main crop.

METHOD:

These plants have male and female flowers. (The female flowers have small fruit below the flower.)

1. In the late afternoon, choose a male and a female flower that are just about to open. Tie them closed so that insects cannot enter.
2. Early the next morning open the flowers. Carefully pick the male flower, pull off the petals and rub the pollen-covered middle (stamen) inside the female flower.
3. Retie the female flower.
4. When the fruit starts forming, loosely tie a piece of string or material around the base of the fruit so you can find that fruit later to save it for seed.



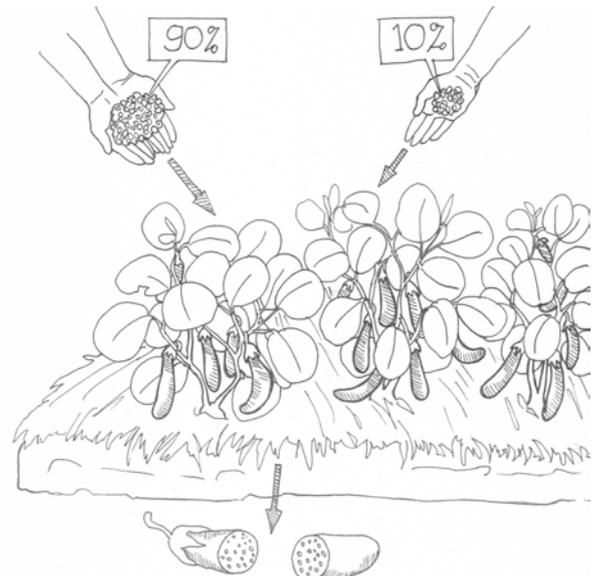
KEEP YOUR SEED STOCK STRONG

It is good to refresh your seed stock every few years. To do this you need to cross your existing seed stock with seed stock from somewhere else. This helps to keep your seed stock healthy and productivity high.

Grow plants from your seeds together with plants from the new seed stock. A mix of 90% of your seeds with 10% of the new seeds will ensure that your seeds are the strongest but that cross-pollination also occurs.

Always select high quality seeds with which to cross-pollinate:

- Cross your existing variety with seeds from the same species but from a different farmer or area. Seeds from an area with a similar climate are good.
- You can cross-pollinate with seeds that you buy but make sure that you know that the seeds give good results for your land and your climate before you use them.



Introducing fresh seed stock (10%) to keep quality high

SMART IDEA:

Grow a test crop first to find out if the new seeds grow and produce well. A simple test is to grow three small areas of a new type of vegetable in garden beds of 3m x 1m each. Each test site should be in a different area but using the same techniques. If the crop grows well, it can be grown in large plots the next year. This idea helps to increase the variety of crops grown, but it does not waste a lot of time, work and money if the crop does not grow well.



Vegetables test plot with labels

NON-HYBRID SEEDS

Non-hybrid seeds are produced when plants are natural pollinated. This can happen through open pollination, which occurs naturally through insects, the wind, birds, etc., or closed pollination where the flower pollinates without opening, e.g. beans and peanuts. Non-hybrid seeds are sometimes called heirloom or open pollinated seeds, and some varieties have been around for centuries.

Non-hybrid seeds can be saved each year. Plants, such as tomatoes and beans, can be relied upon to produce seeds that grow like the parent because of the way the seeds are produced. Plants, such as lettuces and corn, can easily cross-pollinate because of the way pollination occurs. It means the results can vary unless pollination is carefully controlled, and only one species is allowed to flower and seed at a time. Seed stock quality can be improved each year if good seed saving techniques are used.

All traditional varieties of vegetable, grains, and fruit seeds are non-hybrid.

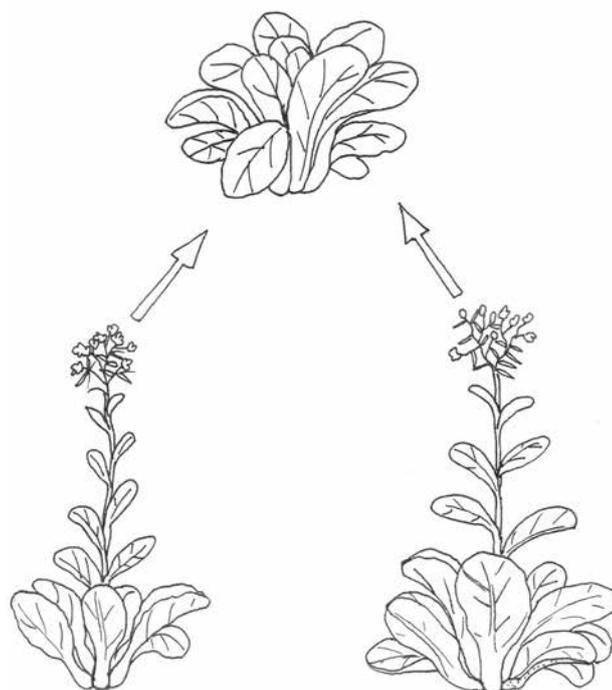


Healthy plant tagged for saving seed

HYBRID SEEDS

Hybrid seeds are created when two different plant varieties are crossed during pollination to create a new variety. This can happen accidentally if two varieties of the same species or genus are flowering at the same time and cross-pollinate, but it mostly happens when a farmer or seed business is looking to create a new seed. Hybrid seeds also come from open and closed pollination plants.

Hybrid seeds bought in a packet will produce similar plants and can usually be used for seed saving. However, the seeds from those hybrids can vary in their characteristics and the results from the next crop are unknown. Hybrids seeds will not be used to the local conditions and may suffer problems as a result. You can ensure resilience and the quality of seeds that are saved from hybrids over a few generations by using good seed saving techniques explained in this chapter.



Cross pollinating two different varieties to create a hybrid

F1 Hybrids: any packet with “F1” on it is a hybrid that cannot be used for saving seeds. This is because of how the seeds are produced. Seeds collected from F1 hybrid will not be the same as the plant: they will be either one of the weaker parent plants or they won’t grow at all. Avoid F1 hybrids for seed saving and for creating local seed stock.

From a farmer’s perspective, local seeds are resilient, dependable, and free. Local seed quality can be improved using simple techniques. Hybrids can give good results but cost money every year. Hybrid seeds, especially F1, are more likely to be attacked by pests and disease, which costs time and money.

Businesses want to sell lots of seeds, and they often also sell pesticides and herbicides. It is important for farmers to see the results before they believe what businesses say, and especially to understand the long term effects of chemicals on soil quality and production.

With natural cross pollination, hybrids, and even with F1 hybrids, natural laws are followed by farmers, scientists and business who work only with plants from the same families to create new seeds.



Example of F1 hybrid seed packet



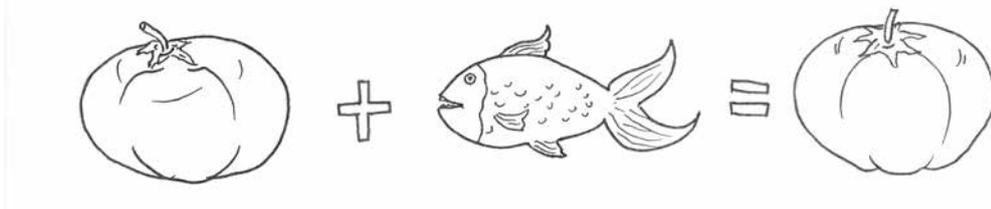
GM seed pack

GENETICALLY MODIFIED (GM) SEEDS

We strongly recommend NOT using GM seeds. They are a new form of hybrid where the seeds are modified genetically in a laboratory. GM seeds break all natural laws, as new seeds have genetics from not only other plant families but from animals too!

Scientists also change the genetics within the seeds. Most GM seeds have been changed by the seed manufacturers so that they only grow once, and any new seeds that come from them will never grow. They call it the terminator gene.

It can produce good yields in the short term, but the costs are high and over time farmers become locked into using GM seeds and the chemicals that go with them. Also, the yields usually decline year by year.



M tomato

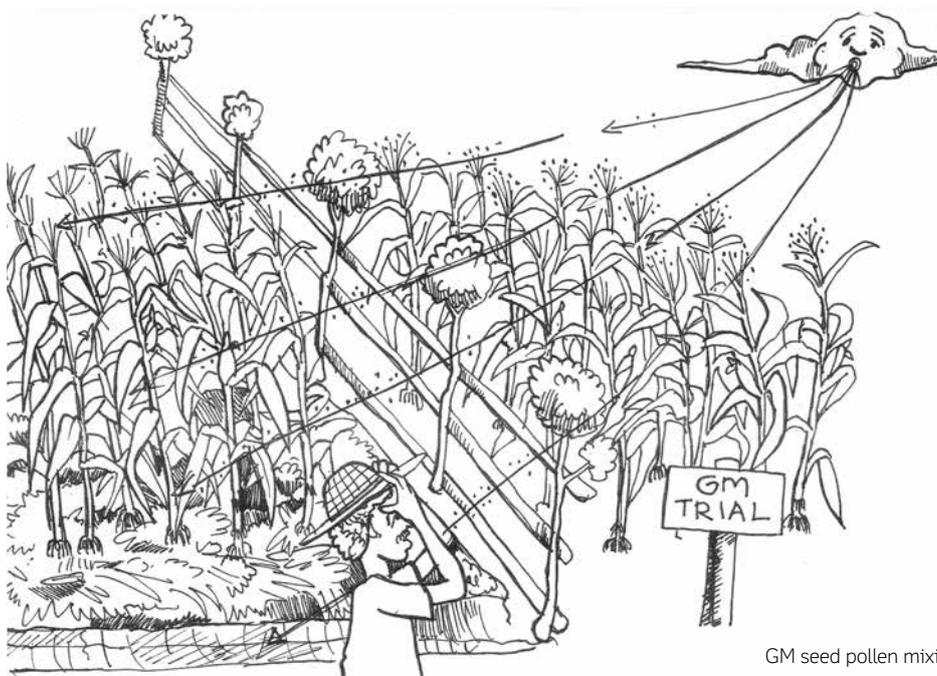
THERE ARE OTHER PROBLEMS TOO:

- Because the seeds have been modified, the company which makes them can own them because they are no longer made by nature. This means that you have to buy the seeds every year. If you save their seeds and use them, the company can take you to court for using their property. We think it is wrong for companies to own the rights to seeds because it takes away a basic human right to be able to own your seeds and control your own food supply. We advocate food sovereignty for all people.

- GM seeds do not grow well using organic farming techniques. The seeds are sold in a package with chemical fertilisers, pesticides, and herbicides and farmers need to use these to obtain good yields. This is expensive: farmers and their families are under great stress from financial debt caused by buying the seed package. The associated chemicals damage the soil, the water, the insects, and the environment and farmers become dependent on them to obtain a yield, which creates more damage until the soil is unusable, the water polluted, and the environment is heavily degraded.
- Farmers are exposed to toxic chemicals, especially because it is often hard to understand the instructions, leading to overuse. This can lead to many health problems, not just for the farmers but for their children too.
- GM seeds are, by necessity, grown as monoculture crops. This leads to less diversity, more pest problems, and higher pesticide use.

COMMUNITY AND NATIONAL PERSPECTIVE:

- Tell your neighbours not to use GM seeds! Once a farmer uses them, the land around is degraded and the GM seeds can cross-pollinate with other crops.
- Tell your government not to allow trials. Often tropical countries do not have strong laws protecting their natural genetic resources. It can also be easier for companies to influence poor countries and trial GM seeds in these countries to research results. Whether the trials work or not, cross-pollination can occur, impacting local seed stock.



GM seed pollen mixing with local variety of corn

LOCAL SEED CALENDARS

Making local seed calendars will help you and your community to know when different seeds are ready for harvest.

There will sometimes be differences in actual seed harvesting time due to climatic variations from year to year, but a calendar is still very useful and it is a great way to record local gardening knowledge. Calendars are especially handy for recording times for native seed collection. It is good to divide the calendar into vegetables, fruits, and natives. Sometimes links to knowledge of local environmental patterns can also be made, e.g. the seed of a particular native tree might be ready at the same time as seasonal insects, such as dragon flies, appear. This is more accurate than a fixed calendar because both events will vary with the climatic differences, and they will happen at the same time as each other even if the time it happens varies slightly from year to year.

HOW TO SAVE SEEDS

Saving your own seeds and storing them correctly will provide you with free good quality seeds that you can use for many seasons.

STEP 1: Healthy strong plants

To produce quality seeds, the first step is to grow healthy strong plants.

Healthy soil, compost, and mulch are the best way to produce healthy plants. Read the Soil Chapter (CH 5).



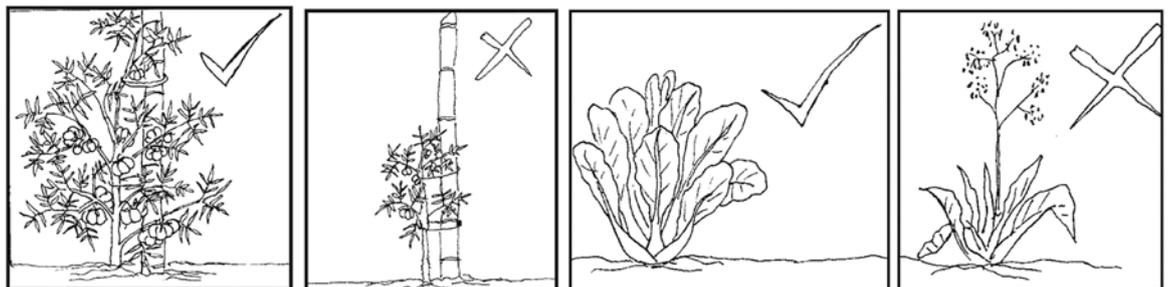
Compost methods

STEP 2: Choose the best plants

Always pick the BEST plants to collect the seeds from.

The best and healthiest plants:

- Produce healthy and tasty fruit or leaves
- Are disease free and naturally resistant to pests
- Are able to withstand extremes, e.g. able to cope with very dry or very hot conditions or still grow well in poor soil
- Are slow to go to seed. For green-leaf vegetables, lettuces, and similar vegetables collect seeds from the plants that are the LAST to produce flowers and seeds, not from the first.



Choosing the best plants for collecting seed

Select seeds from many plants to ensure a strong, healthy and diverse seed stock for the future. If you are growing trees, e.g. teak, select seeds from many different teak trees. It is the same for all vegetables, fruit, grains, and other plants.

When you collect seeds you pass on the characteristics of the plant to the next crop. If you choose healthy plants you pass on good quality characteristics; if you choose unhealthy plants you pass on bad characteristics.



Choosing the best plants for collecting seed

STEP 3: How to collect the seeds

- Label the plants that you want to collect seeds from so that they will not be harvested for food.
- Wait until the vegetable/fruit/grain is ripe before picking. This means leaving the vegetable/fruit/grain until it is passed the edible stage. Young edible fruit has young seeds that are not ready to germinate.
- The best time to pick the seeds is mid-morning on a dry and sunny day.
- In the wet season if the rain is continuous, you can pick the fruit, seeds or preferably the whole plant, and hang it up next to a fire. Even a small amount of moisture makes the seeds rot.



Collecting seed from labelled plants

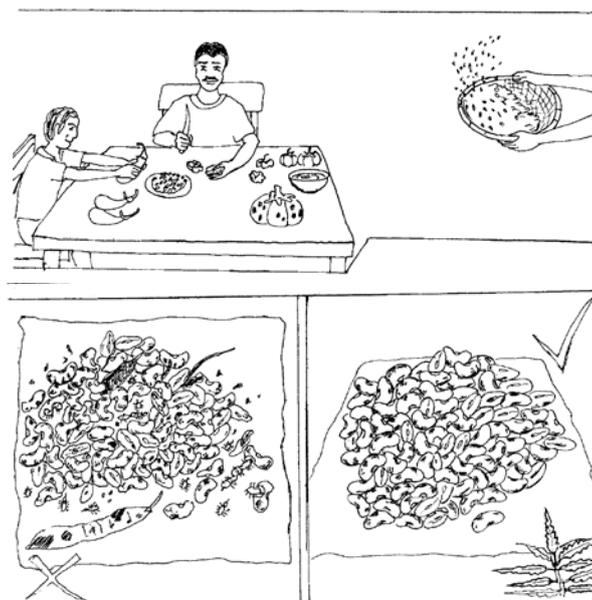
Plants	When to pick seeds	How to pick the seeds
Tomato, Eggplant	When they are ripe on the plant, slightly soft but not rotten. Pick from the early fruit to encourage early fruiting plants.	Hand pick the best fruit from the best plants.
Cucumber, Melons, Zucchini	Pick them about one month after you would pick for eating. (The seeds need to mature.)	Choose the best fruit from the best plants to leave for ripening.
Capsicum, Chili	When they are ripe on the plant (red).	Hand pick the best fruit from the best plants.
Lettuce, Green-leaf vegetables	Wait until the seedpods are brown and dry but not yet open.	Cover the seed heads with a bag then break main stem so no seeds will drop during collection.
Beans, Corn, Sunflowers	Leave them to dry on the plant in the dry season, pick them when ripe in the wet season and dry them near a fire.	Hand pick when the seeds are ready.

SMART IDEA:

Always pick more seeds than you need for the next season. This helps to prevent shortages due to insect or animal damage or the seeds rotting, and allows for replanting if some of the crop does not grow. Extra seeds can also be exchanged or sold through a community seed bank.

STEP 4: Cleaning the seeds

- Seeds that have a dry pod/shell or husk are removed and separated by hand. Small seeds and pods can be placed in a bag, gently rolled and crushed to separate the seeds. Any leftover plant materials need to be separated from the seeds by winnowing or by hand. Sometimes it is easier to dry the seeds in their pods first and clean them afterwards.
- Seeds from eggplants, pumpkins and similar vegetables need to be scraped out and placed in a bowl of water. The seeds must be cleaned well and rinsed so that all the flesh is removed from the seeds. Then place the seeds out to dry.
- Tomato and cucumber seeds should be “fermented” to remove some diseases. First remove the seeds and some flesh from the ripe fruit. Mix the seeds and flesh with some water and leave them in a bowl for a few days. Foam will form on the surface showing that fermentation has happened. Then rinse the seeds well with water to clean them. All the remaining fruit flesh must be removed. Spread the seeds onto hard plastic, wood or metal, and put them in the shade to dry.



Cleaning seeds from vegetables

STEP 5: Drying the seeds

This is a very important part of the seed saving process. If the seeds are not properly dried, they will rot when they are stored.

Seeds can be dried in whichever way you find best, but it is necessary to follow some practical guidelines for the best results.

- Spread the seeds out and air them. Shallow bowls, woven trays, old paper, and wire mesh can be used or large seeds can be put in woven bags and hung up to dry. The more air circulating the better. Turning them once or twice a day will allow all the seeds to dry.
- Protect the seeds from animals, especially mice and rats.
- Protect seeds from the wind, especially small seeds.
- Small seeds generally need one week to dry and large seeds one to two weeks to dry properly.
- Start the drying process in the shade or inside and continue for two days. You can place the seeds in the sun for half of each day: this will help to kill insects and their eggs. Bring the seeds back inside each night. In the wet season it helps to dry the seeds near a fire.



The bite test

Use the bite test to know if seeds are dry or not. Bite firmly on a seed. If the seed is hard and you leave no marks on the seed, they are ready for storage. If you leave teeth marks on the seed, they need more drying time.

STEP 6: Storing the seeds

After the seeds are dry they need to be stored well.

When seeds are stored correctly, many more seeds will grow next season. In a tropical climate seeds will rot quickly if they are not stored well. When in storage seeds need to be protected from:

- **Air** – it reduces the lifetime of the seeds.
- **Moisture** – it makes the seeds rot.
- **Heat** – it reduces the number of seeds that will grow next season.
- **Animals** – they damage or destroy seeds.
- **Insects and insect eggs** – they eat and damage seeds. If insect eggs are laid inside the container they hatch and the young insects will eat the seeds.
- **Light** – it damages the seeds and reduces the number of seeds that will grow next season.

To prevent these problems, first make sure that the seeds are well dried and clean. Then, on a dry and sunny day if possible, place the seeds in a container that will stop air from entering.

To reduce moisture problems you can cover the bottom of the container with wood-fire ash (not hot!), milk powder or very dry grain. These will absorb extra moisture.

METHODS TO REDUCE INSECT PROBLEMS

THESE METHODS ARE NOT FOR SEEDS THAT ARE FOR EATING.

Wood-fire ash: Coat the seeds lightly in wood-fire ash and put some ash at the top and bottom of the container. DO NOT use ash from rubbish fires because it will contain chemical and toxic residues.



Neem: Put 1cm of dried neem leaves underneath and on top of the seeds. Bay leaves or guava leaves will also help.

Tobacco: Only use old, dry tobacco leaves. Place about 1cm underneath and on top of the seeds.

Gliricidia: Put about 1cm of dry Gliricidia leaves underneath and on top of the seeds.

Custard apple (Annona squamosa): Dry the seeds, and crush them to a powder. Add 2 tablespoons of the powder per large container of seeds and mix. Be careful as it can cause minor skin irritation.



Cold: In places where it gets very cold at night, put the seed containers outside each night for a week. Bring them inside again each morning. This will kill weevils (small white grubs/worms).

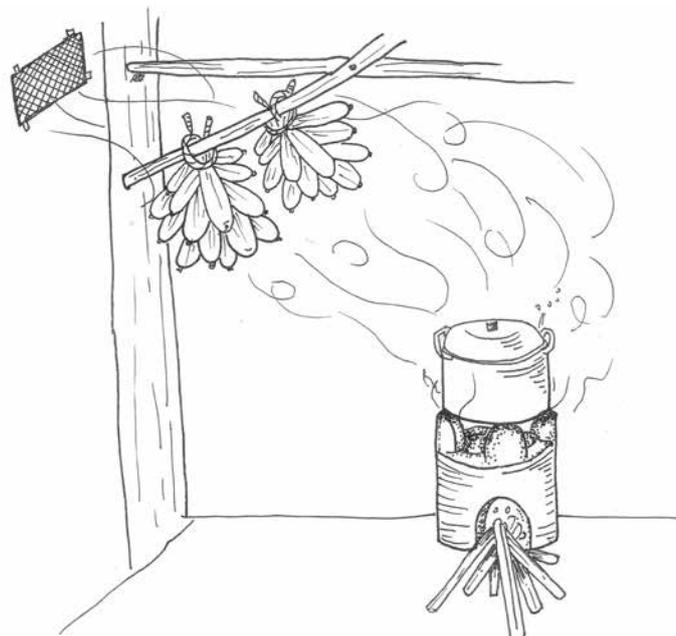
Ash and tobacco will help protect your seed

Salt: A small amount of salt mixed with the seeds controls some insects.

Smoke: Smoke is a preservative and a pest repellent. You can hang corn, seed pods and even whole plants above a fire as it helps to protect them from pests.

Oil: Large seeds can be coated with coconut oil to kill insect eggs. Put a small amount of oil in a large container, add the seeds, close the lid, and shake until the seeds are coated with oil. Small seeds, like lettuce and eggplant, cannot be treated in this way because the oil will damage them.

Larger seeds will generally last longer than smaller seeds.



CONTAINERS FOR SEED STORAGE

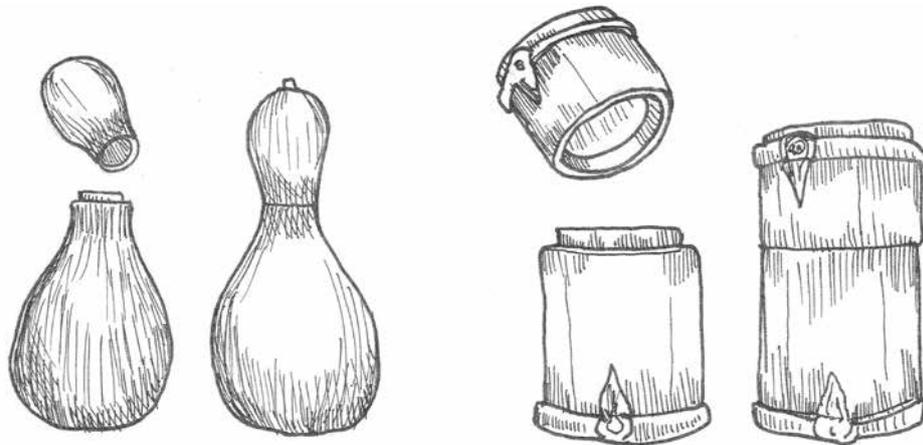
Tin cans and glass jars with good lids are very good to use. Water bottles and oil bottles are also good but be careful of rats and mice eating through the plastic.

Glass and plastic bottle containers need to be put in a box to stop direct light from damaging the seeds. Anything that is dry and sealable can be used as a container. Plastic bags can be used only if nothing else is available, but they need to be put into a container that stops animals.

One large sealed container stores many small bags of seeds. Store the containers in the coolest, driest and darkest place you can find. Protect them from animals.

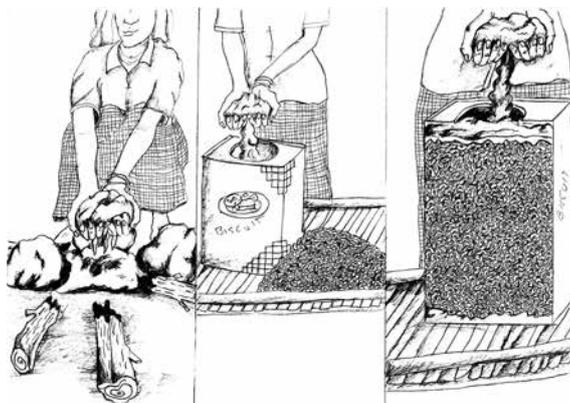
Bamboo and gourds can be made into storage containers. Important: bamboo that is correctly harvested and borer resistant is best (read in Bamboo (CH 13) for details). You can also coat the bamboo in tree resin, coconut oil or wax and then dry it in the sun. This makes the container last much longer. They make great containers but can be affected by mould in the wet season. Clean the bamboo inside with vinegar before it using to reduce mould potential.

Check the stored seeds occasionally to make sure there are no problems.



For larger amounts of seeds, biscuit tins, oil containers, and large plastic containers are excellent. Metal drums are also good but are expensive. Grain/Bean Storage Silos, often made by local blacksmiths, are excellent and can be used for large amounts of corn, beans or rice.

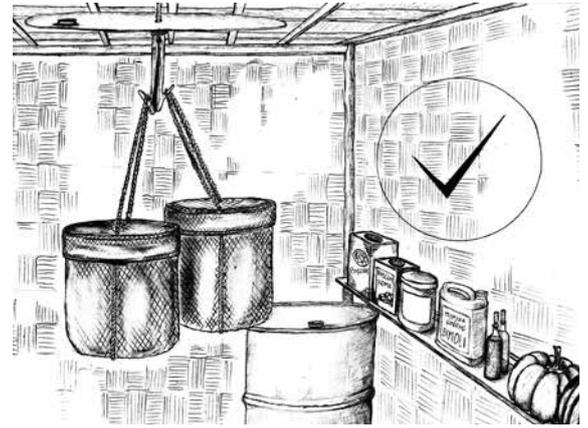
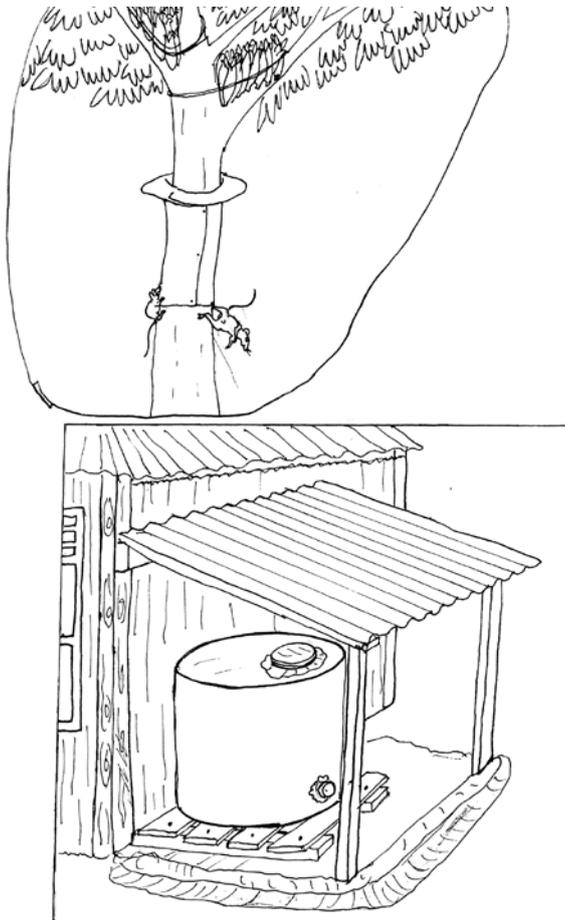
Traditional corn storage is a good example of easy, simple, and effective storage from season to season, but it is not good for long-term storage. A tin plate approximately 1m long wrapped around the tree trunk will help stop rats and mice. Fold over the top of the tin. Storage containers will reduce the number of seeds eaten by animals.



Using ash for seed storage in containers



Protecting stored seed from animals



Protecting stored seed from animals

FRUIT TREE SEEDS STORAGE

Most fruit trees in tropical regions have seeds that don't last a long time. It is best to clean and dry the seed and plant immediately, because the germination rate of the seeds reduces quickly after 2 weeks.

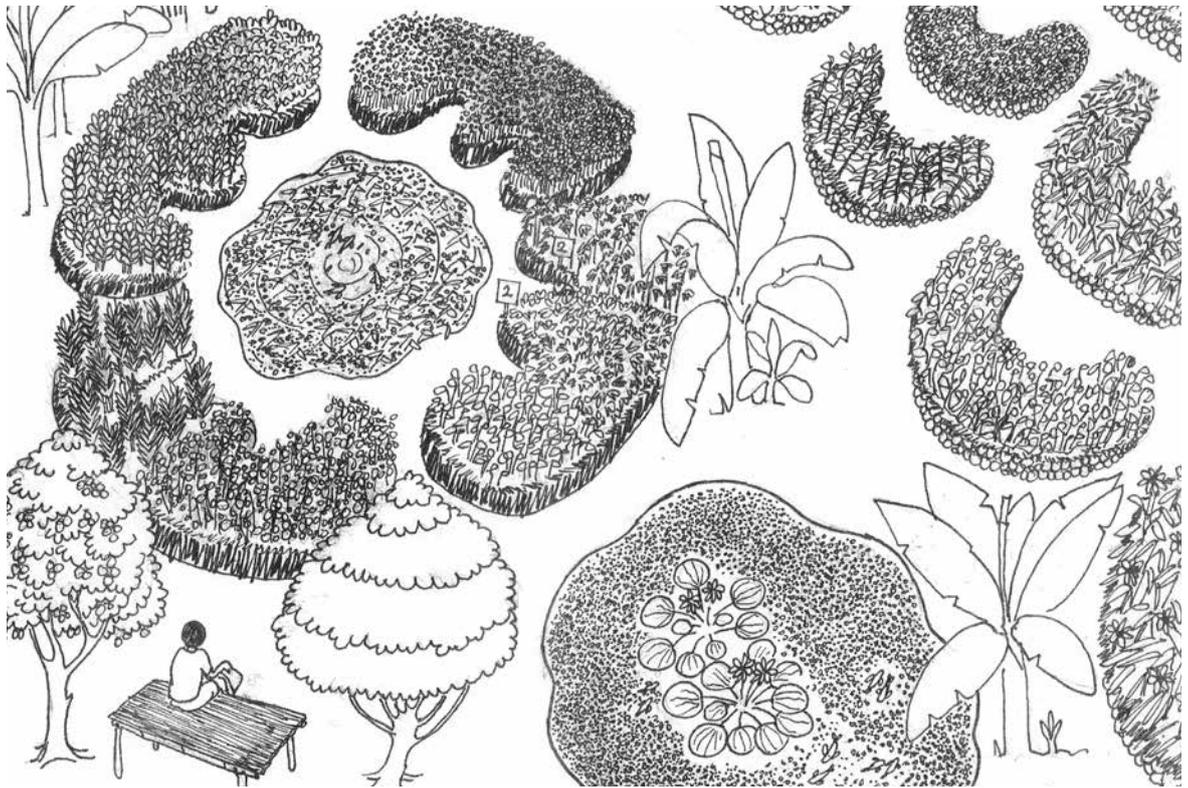
PLANTING MATERIAL STORAGE

Cassava, yams, sweet potato, and taro form a vital part of the food crop in many tropical communities. Arrowroot, lotus, bulrushes, water chestnuts, and Jerusalem artichoke are also eaten a lot. It is the same with spices, such as ginger, galangal, and turmeric.

The best way to store the supply for the next season's crop is to leave it in the ground and use it when you need to. It is important to have high quality tasty stock to use, and grow them so that they cannot cross-pollinate unless you want them to.

If you need to store some roots out of the ground, put them in an animal-proof container that has air holes that are too small for rats and mice to get through. The air holes are essential to let air through and stop the roots from rotting. A fine layer of wood/bamboo fire ash helps to stop insects, mice, and rats from eating the roots.

There are also many important leaf crops that do not produce seeds or are much easier to grow from propagation. Have a variety of high quality plants to take new stock from, e.g. sweet leaf (*Sauropus androgynus*), some types of water spinach, watercress, tree spinach, gotu kola, Brazilian spinach, and mint.



Garden for supplying planting materials

STEP 7: Using the seed and plant material

Now that you have lots of high quality seeds and plant material, you can use them!

Plant some of each variety of saved seeds every season or year, and save the seeds so you have a continuous supply of fresh seeds. Always save some for next year's crop, and keep extra in case of extreme weather or crop failure.

The rest can be exchanged or sold. Good quality local seeds are a valuable commodity. Read in the "Community seed and plant group" section for more ideas on selling and exchanging seeds.

When you exchange or buy new seeds or plant materials, make sure you know the history: where they come from, what micro-climate they grew in, old the seeds are. Seeds or plant materials from very different microclimates can lead to poor production or failure to grow.



If you keep following these steps, you will always have seed and plant material stock and you are improving its quality every year. If you form a community seed and plant group, you will have access to more plant varieties, and have better seed and plant security.

PLANT PROPAGATION TECHNIQUES

Many plants are grown from propagation of plant material not seeds, especially in the tropics. For all propagation techniques (cutting root stock, marcotting, grafting and collecting young seedlings) propagate from the healthiest, most productive and disease/pest resistant stock you can find! Propagation will pass on the characteristics of the parent plant, so choose wisely.

TREE PROPAGATION

There are many trees and plants in tropical regions that are easily propagated. Sometimes different plants require slightly different methods, but the following techniques cover the basic methods for good results.

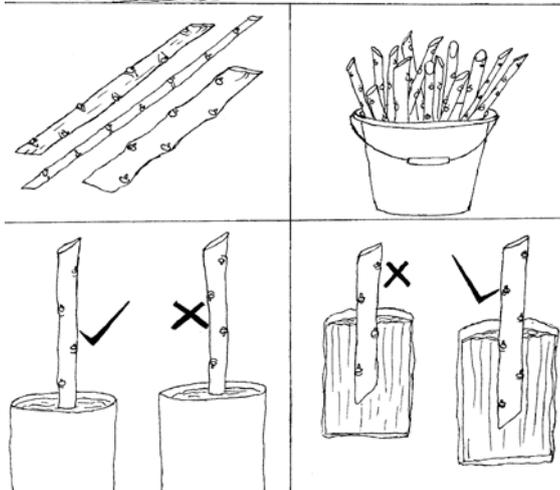
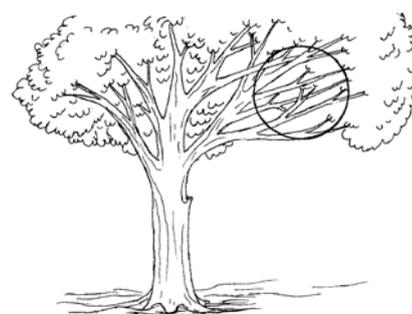
CUTTING PROPAGATION

STEP 1: Select the appropriate branches for propagating. The best age of propagating branches is one or two years old. The wood needs to be hard and brown, but not tough and old. For cassava, tree spinach, and other vegetables, the age will be much less, but use stems that are hard rather than green and soft.

STEP 2: Cut the ends of the sticks with a sharp knife or secateurs (hand pruners) to make a clean end. Have at least six growing buds on each stick. The growing buds are where the new roots and new leaves will grow from. Cut off ALL the leaves. Cut the TOP of the stick on an angle so that water does not sit on top and cause fungus and disease problems. The growing buds face upwards and will always be above the place where the leaf was.

STEP 3: Put the sticks in a bucket of water until ready to plant.

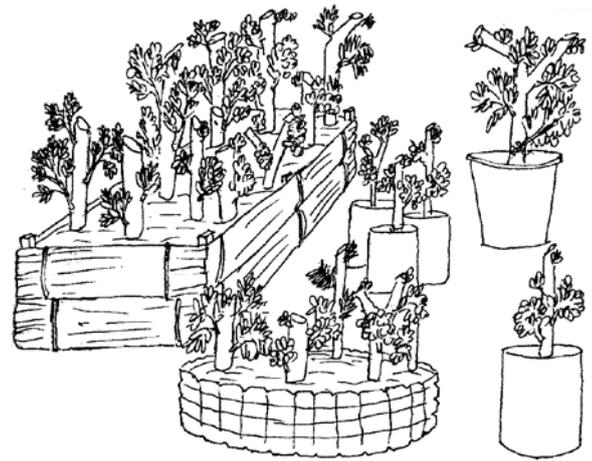
STEP 4: To improve the success rate of your propagation, dip the bottom of each stick in a natural root growth promoter before planting, e.g. honey, aloe vera, grated potato, or a mix of these together. This is not essential but it helps, especially in the dry season. Many communities will have their own root growth promoter, or you can have a special bucket of water containing a stick of a plant which grows roots in water quickly and easily. Once that plant has grown roots, the water will contain natural root growth promoter that new sticks can be dipped in before planting.



STEP 5: Prepare the planting area. This can be plant boxes or containers in a garden plot or an area of ground. If planting in a nursery, prepare and use the “Cuttings for propagation potting mix” in the Potting mix section of the Nursery Chapter (CH 8).

STEP 6: Plant the sticks. Make sure that the growing buds face upwards. Make sure that there are three growing buds in the potting mix, and three above the potting mix.

STEP 7: Water them every day until the new leaves are growing, then water twice a week. If you are planting out directly into the ground, water the cuttings every day if there is no rain and provide shade until the new leaves are established.



The best time to propagate is at the beginning of the wet season.

MARCOTTING - NEW TREES FROM BRANCHES

Growing trees from a tree branch by creating new root systems is a common practice in many tropical countries.

It is a good method to use because it creates new trees that would take two or three years to grow from seeds. It is most useful for citrus trees but works for many other trees as well. A benefit is that you know how well the tree will produce and a highly productive mother tree will produce highly productive new trees. Be careful because trees grown from marcotting won't grow a main tap root and therefore are more likely to blow over in very strong winds.

STEP 1: Choose a strong, productive and disease/ pest resistant tree to make the marcott. This is very important because the tree that you grow will have the same characteristics as the tree on which you make the marcott.

STEP 2: Choose the branch—about 2cm thick—that you want to use with good healthy growth and where the marcott is mostly in the shade. Cut off about 10cm (the length of the middle finger) of the outside layer of bark from the branch.

STEP 3: Cover the cut branch with good quality wet soil (mixed 50/50 with shredded coconut husk if possible) and a little manure, wrapped in two plastic bags. Tie both ends and the middle as well if needed. The two plastic bags help the soil to stay cool.

STEP 4: Keep the soil wet and check it regularly, while being careful not to disturb the soil. Leave it for three months.



STEP 5: When there are a lot of roots growing you can cut the branch below the marcott. Use a saw if you can because a machete will disturb the roots.

STEP 6: Plant the new tree straight away. Carefully remove the wrapping. Put the roots in water until it is planted. Remove about 1/3 of the branches and leaves. Plant it into a pot and place it in a nursery. Keep it in the nursery until new growth commences. When the new tree is established, put it out in the sun to harden. (Read the hardening plants before planting section later in Nurseries CH 9) After hardening it can be planted out. (Look in Trees Chapter (CH 12) for some tree planting techniques.)

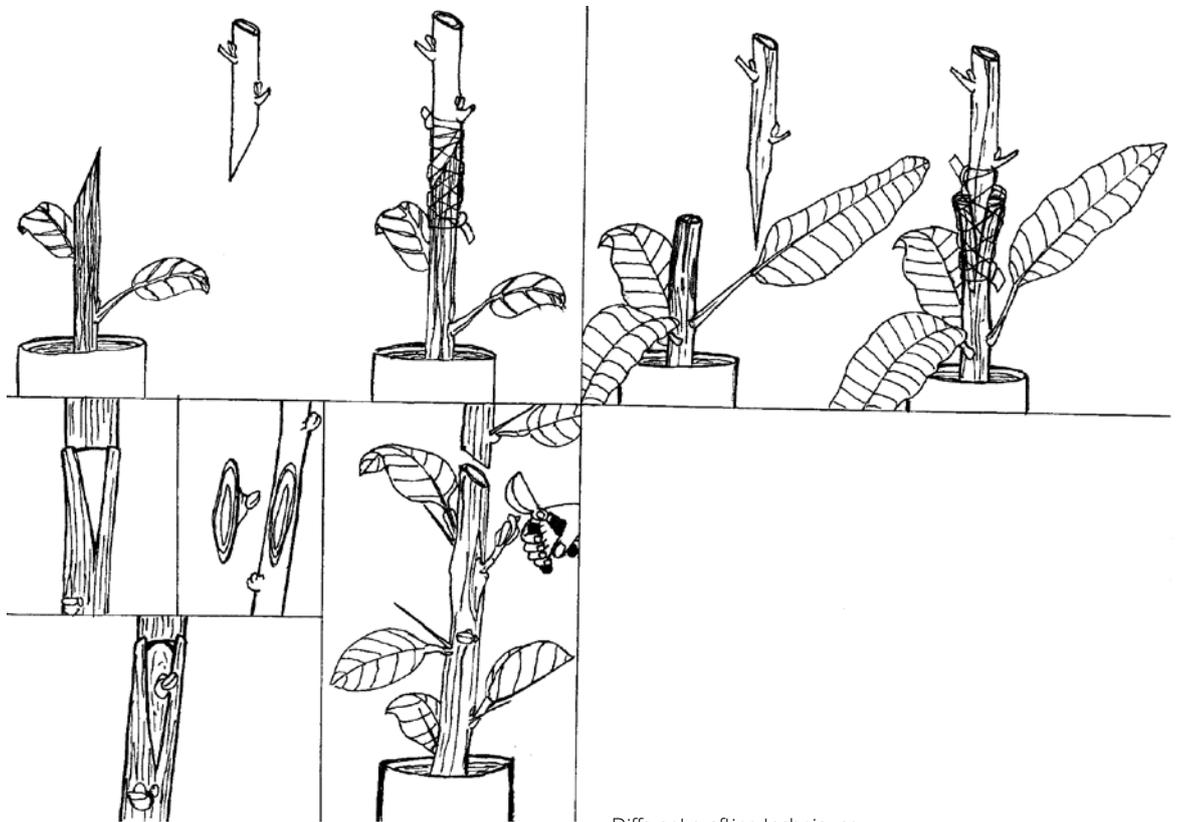
GRAFTING

Grafting is a technique used for fruit and nut trees to improve the quality and productivity of the fruit tree and reduce the time from planting to fruiting. It is a difficult technique that requires practice.

A simple explanation is that a branch from a healthy, good quality fruit tree is “grafted” – attached – to the stem of a small fruit tree (about two years old) of the same type, e.g. mango onto mango, orange onto orange. The branch is stock from highly productive trees with good tasting fruit. The tree it is attached to needs to be strong, tough and disease resistant with good roots.

A full explanation is too long to put in this manual. If you are interested in learning more you can read the references listed at the end of the book, and ask the government agriculture department or local fruit tree experts for more information.

Grafting is a good technique but not essential for producing good quality, highly productive fruit trees. Soil improvement, water storage, organic fertiliser, mulching, and good maintenance are the most important factors for good production. Grafting increases the quality and quantity of fruit and nut production, but only if the other factors are also addressed.



Different grafting techniques

ROOT PROPAGATION

For any plants that are propagated by root cuttings, the following steps will improve the results.

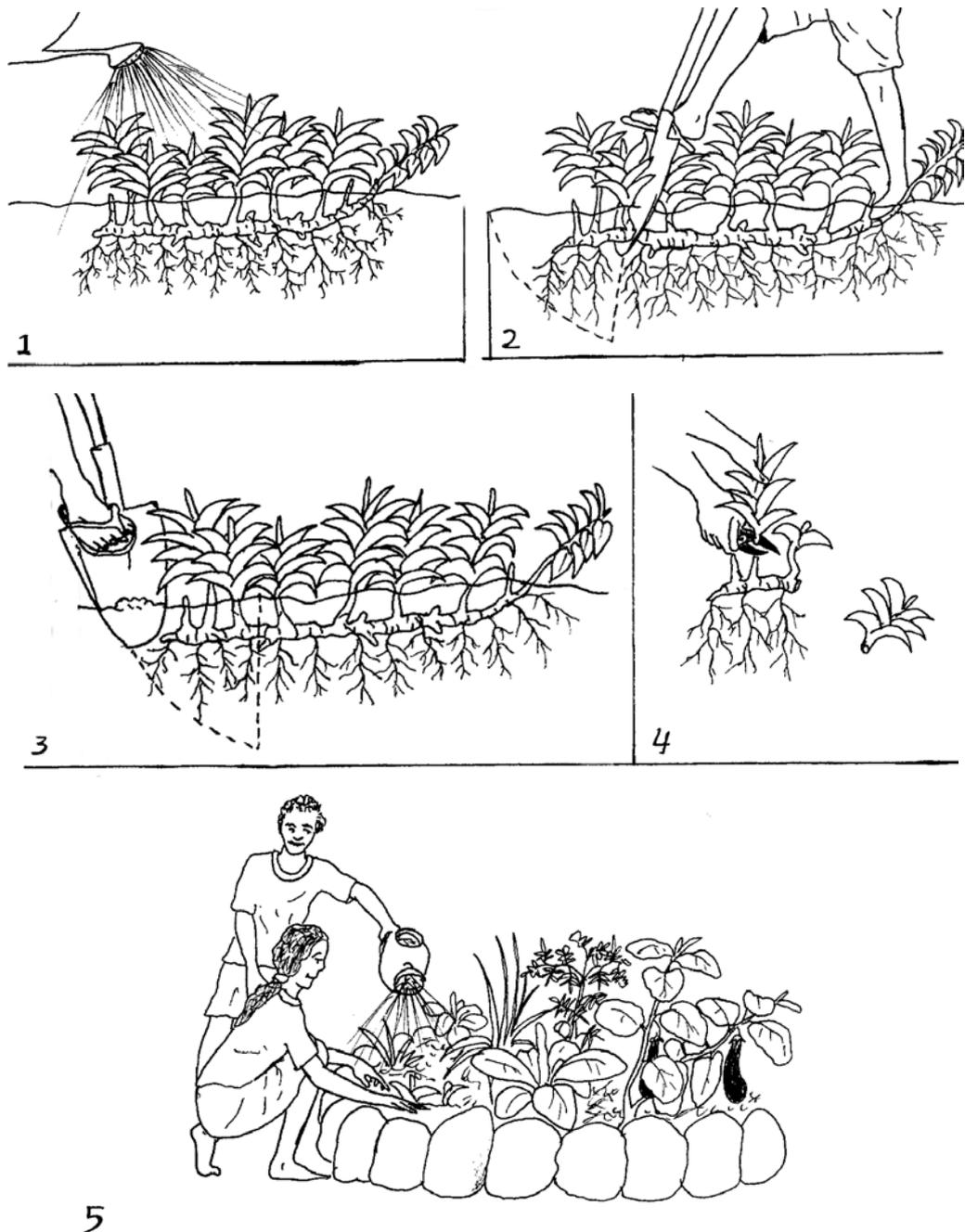
STEP 1: Water the plant very well.

STEP 2: Dig into the soil: first straight down through the plant to cut and separate the section of roots that you want to take and; second from the side, digging under the plant and giving room so as not to cut through the root system.

STEP 3: Remove the section, lifting from the side and being VERY careful not to damage the roots.

STEP 4: Cut off most of the shoots, leaving only one or two new shoots, especially if a lot of roots are damaged.

STEP 5: Replant it carefully into the ground or into a container and water it well.



COLLECTING YOUNG SEEDLINGS

Sometimes the easiest method for growing trees, and even for some vegetables and flowers, is to collect the young seedlings. Young seedling trees can- often be found under large parent trees.

Choose from a strong and healthy parent tree, and collect only the BEST seedlings for replanting; do not collect all of them or the easiest to access. This will help to ensure good quality plants with high production in the future.

Take the seedlings as small as possible – about 5–10cm tall is best. This reduces the stress and root damage caused by removing them. If the seedlings are bigger than 20cm, prune them back to two or three leaves high.

Water the seedlings first or collect the seedlings after rain to reduce root damage and stress. Be very careful and dig them up: DO NOT just pull them out.

Collect a bucket of soil from where you collect the seedlings because it has the right soil micro-organisms for those plants. Add it to the potting mix that you make for the seedlings.

Replant the seedlings into pots, and place them in a shaded area for a week. Then put them in the nursery and treat them the same as the other tree seedlings.

If it is the beginning of the wet season and you want to plant them directly in the ground, give them shade for one week after planting.

For vegetable and flower seedlings, use the same technique, but plant them straight into the ground and give them shade for three days.

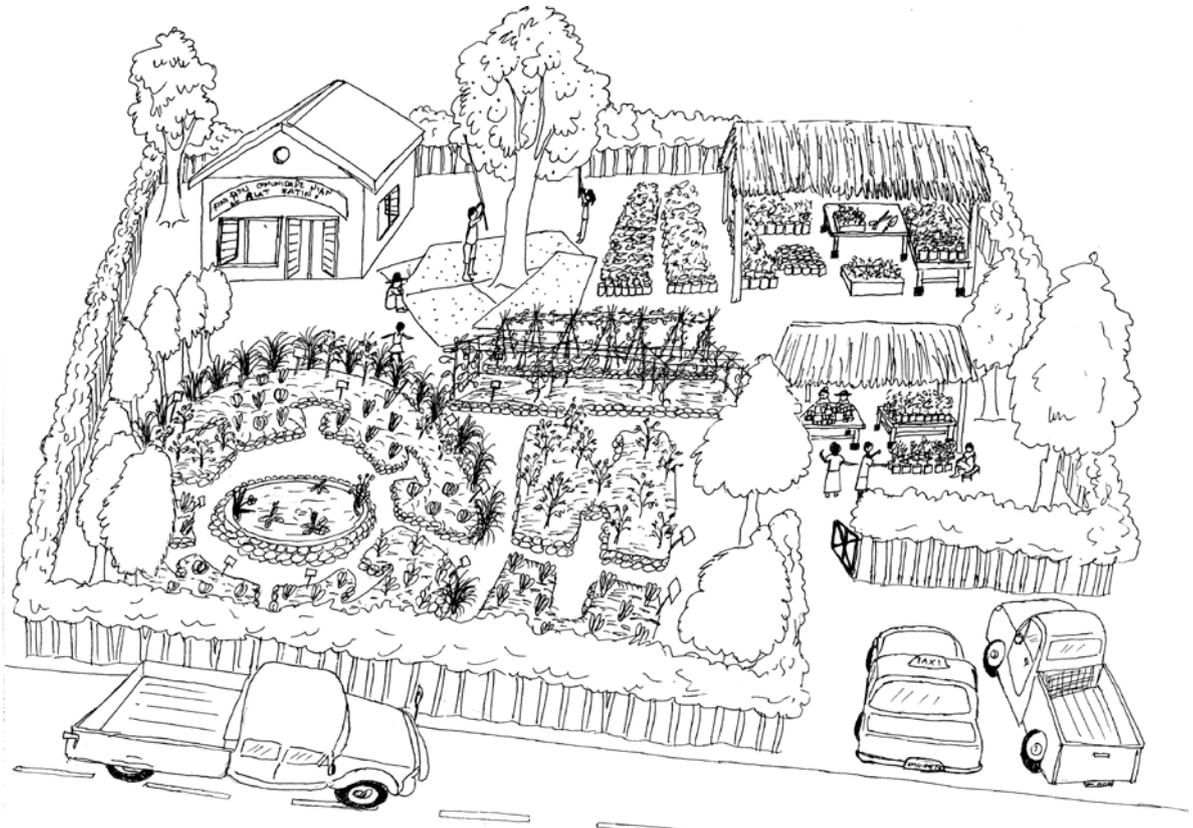


COMMUNITY SEED AND PLANT GROUP

A community seed saving and plant group is an excellent way to share excess seeds and increase the variety of seeds and plants available to everyone in the community. Community seed saving and plant groups also buy, sell or trade with other areas to bring in new plant varieties.

Plants, such as bamboo, bananas, yams, arrowroot, sweet potatoes, potatoes, cassava, taro, lotus, Jerusalem artichokes, sweet leaf, gotu kola, Brazilian spinach, tree spinach, water cress, water spinach and many more, provide planting material for new plants and crops.

A community seed saving and plant group is like starting a bank for seeds and planting material. The group collects and stores the best seeds and planting material, which are saved for growing, exchanging or selling in the future. The whole process of choosing, collecting, drying, storing, and distributing seeds is a lot easier as a community group. A garden can be set up to grow high quality plants for distributing plant materials. It also speeds up the process of improving seed and plant quality and, therefore, improves crops. Look in the Cooperatives chapter (CH 16) for ideas on how to set up a community group. There are many functions that a community seed saving and plant group can provide.



Community seed garden, storage room, nursery and shop

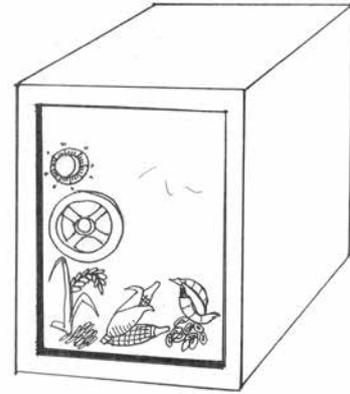
1. SEED AND PLANT EXCHANGE

It can start as a way for people to bring in their extra seed or plant material and exchange it with other people who have something different. This increases the variety of plants that people can grow.

2. SEED AND PLANT BANK

SEED BANK

A seed bank is a special seed supply that is stored in case of emergencies, such as crop failure, floods, drought or large storms. It is not part of your seed exchange or regular seed supply. It must be replenished with fresh seed stock each year and must hold a good selection of each of the staple crops in your community. Store as much as your community group can spare.



PLANT BANK

Plant material is taken from living plant stock. Therefore a garden is needed to grow the material for the bank. Choose high quality material and a few varieties of each plant, but plant them far enough apart so they cannot cross-pollinate. Make sure that there is always plant stock for members, especially for emergencies.



3. SEED AND PLANT SELECTION

Collect the seeds from the healthiest, most disease resistant crops in the community. Choosing two or three crops is best. Only 5–10 % of the crop needs to be left for seeds. The families that grow the crops from which seeds are collected can be compensated by selling to or trading the seeds with the group. The trading could include labour, time, etc.

As well as improving the seed stock for the group, it is important to find out why the crop grew well, e.g. good soil, pest predators, amount of water or sun, terracing, etc. The same selection techniques are used to improve planting material quality as well.

4. SEED COLLECTING AND DRYING

Seed collecting and drying is much easier and quicker when working with a community group. This is especially for collecting tree and plant seeds and propagation material from community land, native vegetation or forests.

5. SEED DRYING ROOM

A seed drying room provides a space for drying large amounts of seeds, especially in the wet season. It protects seeds from the rain and animals. Good ventilation is very important to protect seeds from too much moisture.

6. SEED STORAGE

A community hall or allocated house can be used for seed storage. Seed storage is quicker and easier when done by many people at once. Buying or collecting storage containers for large amounts of seeds is much easier and cheaper when bought by a community group. Seed storage silos are an excellent example and designed to prevent pest and insect damage. Large plastic containers and biscuit tins are also good for most types of small seeds.

7. SEED AND PLANT SUPPLY

All seed and plant supplies must be used wisely. The seeds should be distributed evenly among group members so that each member has enough for their own land. This includes community land. If the amounts vary a lot, other exchanges could be worked out. It is always good to keep enough seeds for one more crop, in case of problems. The plant material supply will not usually be enough for all the land, but it is a source of good stock for members and can be kept for emergencies. All members who receive seeds and plants need to provide something to the group as well. This could be producing the seeds, working at the plant bank, labour, manure, compost, land, storage containers, etc. If there are still seeds and plants remaining after distribution, they can be used for trading and selling.

8. SEED AND PLANT MATERIAL GARDEN

A community garden just for producing seeds and plant materials benefits the whole community, providing good quality seeds and plants for people to grow. It also makes it easier to reduce unwanted cross-pollination and to pick from the best plants.



9. SEED AND PLANTING MATERIAL LIST

A list of plants, seeds, and planting materials helps to show people in the group what is available to grow. It also provides a list for people in other communities and groups of what is available for buying or trading.

Important information that is included:

- A. Name: local name, national language name, botanical name (if possible).
- B. Plant description: how it is used.
- C. Plant size and shape.
- D. Time to fruiting: how long after planting the seed does the plant produce fruit or leaves?
- E. Amount produced by each plant: large, medium or small.
- F. Eating quality: is the variety of plant considered good to eat?
- G. Does the plant have other uses, e.g. medicine, building material?
- H. Insect and disease resistance.

If there are two or more types of the same plant (e.g. tomato) then write these separately as different plants with different names, e.g. round red tomato and bell shaped yellow tomato. This is because the different types will have different yields, different disease and insect resistance, and different time for fruiting, and even different eating quality.

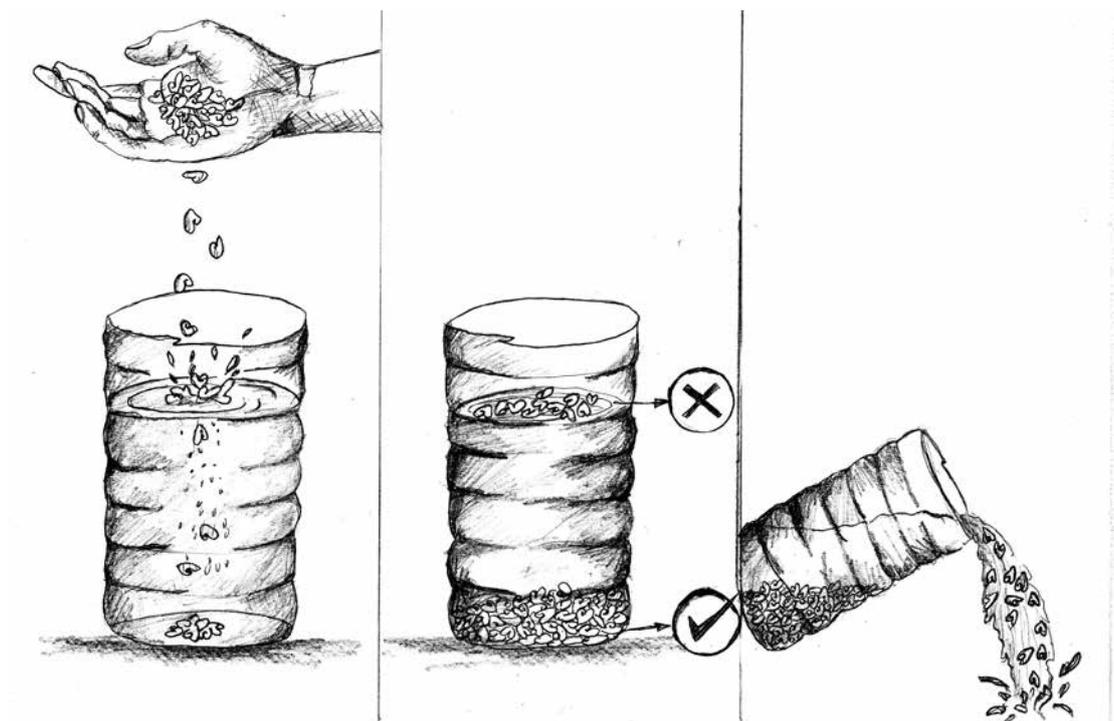
Other benefits of a list include:

- Helps to identify the best place to grow each type of plant
- Identifies differences in types of plants
- Can be combined with other plant lists to form a regional or national plant list
- Helps to assess what a community can produce and what needs to be introduced
- Helps to keep local plant types locally owned

10. SEED TESTING

Seeds can be tested to find out how many will grow. There are two good methods for testing seeds:

1. **For growing your own crops:** place the seed in a container of water. The seeds that sink are good and can be planted. The seeds that float at the top are no good and can be thrown away. Most of the seeds will usually sink.

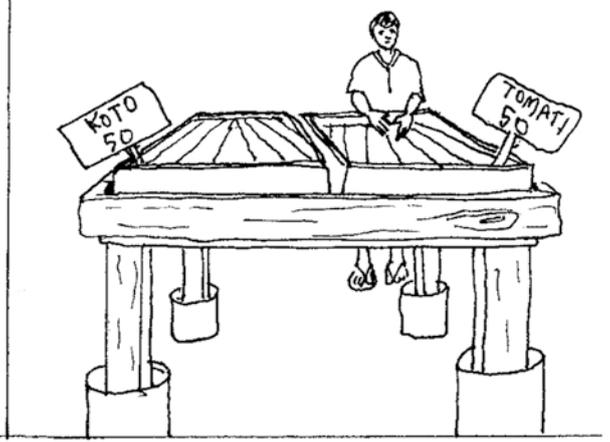


2. **For selling and trading seeds:** seeds that are sold or traded need to be tested first to find out their viability rate. That is the percentage of the seeds that will germinate and grow. The viability rate is then written on the packets. There are different methods to do this. The basic idea is to count a number of seeds (e.g. 50 bean seeds), then plant the seeds and find out how many grow (e.g. 40 bean seeds grow). The number that grows is divided by the number that you planted, to find the percentage of beans that grow. (40 divided by 50 equals 0.8. Then multiply by 100 to find the percentage: 80%.) This is the viability rate (80%).

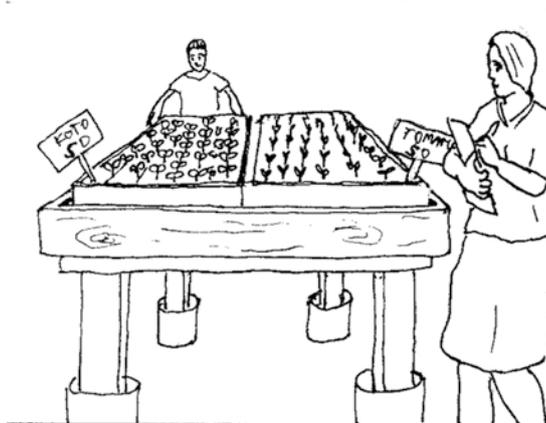
Seed testing for trading and selling seed



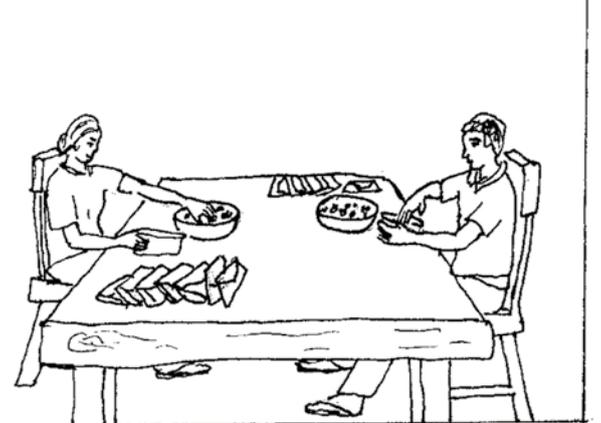
Counting seed



Planting seed



Counting seedlings



Packing and labelling seedlings

It is very important that you:

- Use a good quality potting mix.
- Water the seeds every day.
- Prevent insect attack, e.g. snails, slugs or ants.
- Continue the test until the seeds stop germinating.

When finished, plant the seedlings in the vegetable garden.

SMART IDEA:

Seed testing can be used to check viability rates of seed after six months, one year, eighteen months, two years, three years, etc. More information about seed testing is in the reference chapter.

11. EXCHANGING AND SELLING SEEDS AND PLANT MATERIALS

Seeds can be packaged and exchanged or sold in the community or to other communities, towns, and regions. Within communities seeds are exchanged, traded or sold as needed. Selling to or trading with other communities or groups requires a continuous supply of seeds. It also requires a marketing campaign to advertise your seeds so that people know they can buy them from you. A community group seed garden will help to increase seed supply. Seeds must be tested first to make sure they are good quality before they are sold or exchanged.

Plant materials can also be exchanged or sold. Crops from these plants are improved by selecting the best producing, most disease resistant plants from which to take new plants.



Trading types of bamboo

12. COMMUNITY NURSERY

The next step is to make a community nursery where vegetables, fruit trees, and other plants and trees can be grown, and that is the subject of the next chapter!



RESPONSIBLE SEED AND PLANT USE

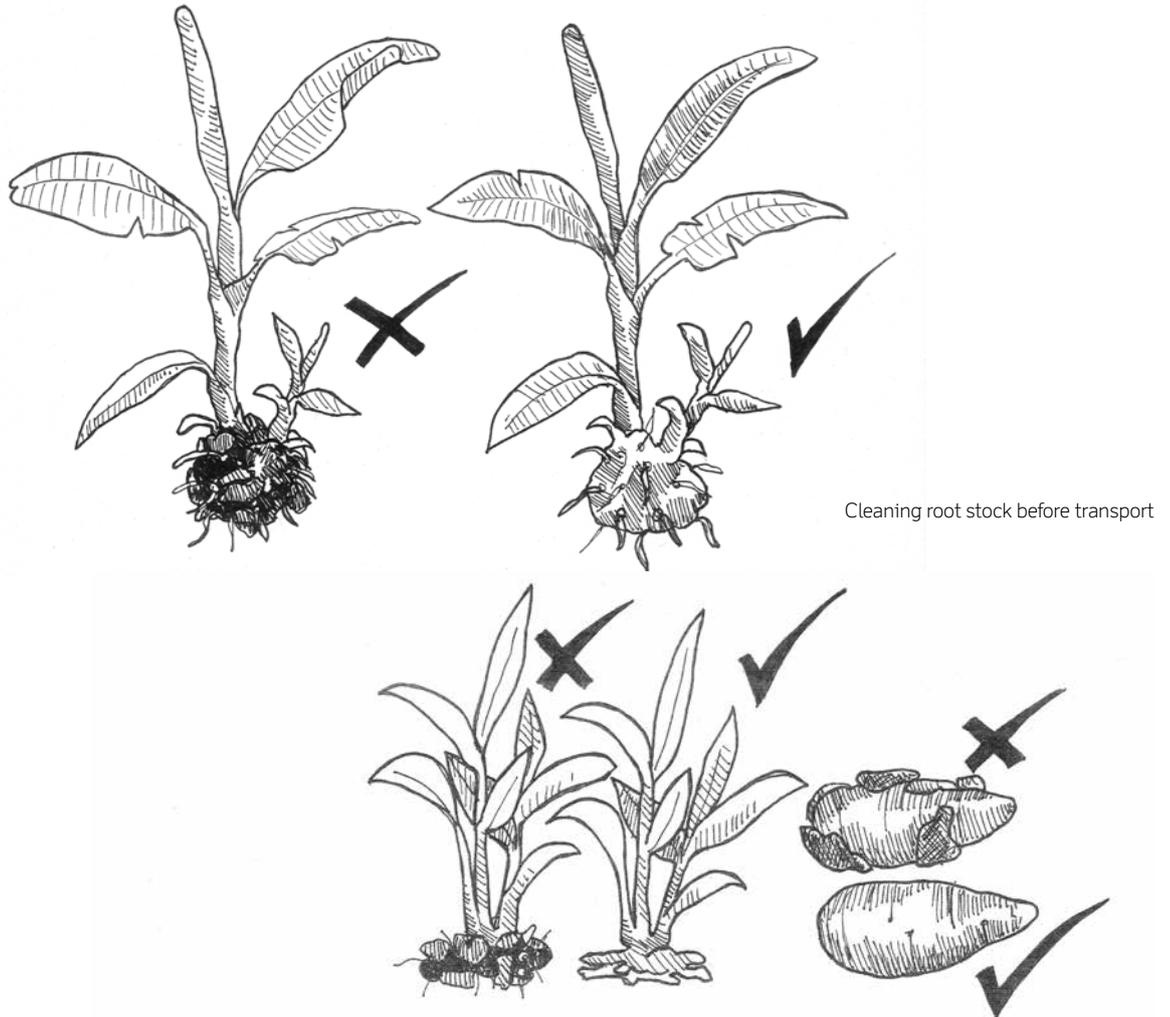
It is great to introduce new seeds and plants to a place, especially if they are very productive, but be **VERY CAREFUL** not to introduce new pests and diseases as well! Spreading diseases or pests creates big problems and can destroy crops. Some plants have the potential to become problem weeds that can do more harm than good.

DO NOT INTRODUCE NEW PESTS OR DISEASES

1. From one region to another.

- Check seeds for insects and insect eggs. Remove seedpods and any plant materials. Wash large seeds well and re-dry. Coat seeds with a fine layer of wood fire ash to help stop further insect problems. Mixing dried, crushed natural pesticide leaves with the seeds will also help to kill insects or eggs.
- Check plants to make sure they do not have any pests, virus, fungus, mould or other diseases. If they do, do not move them!

- Do not move any soil from one area to another if it has fungus, nematodes or other diseases. If you want to move root stock from one region to another:
 - A. Clean off all the soil thoroughly from the root stock.
 - B. Wash it very well.
 - C. Leave it in the open air for an hour or two (oxygen kills a lot of bacteria), but do not put it in direct sunlight which damages the roots.
 - D. Wrap it in wet newspaper or wet old cloth for transport.



2. From overseas. Please follow your country's quarantine regulations and take responsibility to ensure that new pests or diseases are not introduced.

RESEARCH ANY POTENTIAL WEED PROBLEMS

Any new plant or tree that is introduced could become a problem in the future. Plants could spread and become weeds, disrupting local environments. This can happen with all types of plants, and even very productive trees and plants can become problems. Rivers and water catchments are usually the worst affected.

Research any new plants to find out:

- What their growing habits are
- If they spread naturally, e.g. birds or animals eating and spreading seeds
- Whether they have caused problems in other places
- If they suffer from diseases that could spread in a new place

This is very important for protecting the environment and resources for the future.

