

MBRLC How-To Series No. 8

SMALL AGROFRUIT LIVELIHOOD TECHNOLOGY (SALT 4)

A guide on how to integrate fruit trees
into the SALT system



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**MINDANAO BAPTIST RURAL LIFE CENTER
OFFICE OF THE DIRECTOR**

To our valued reader:

You are now reading a manual written especially for you. This is your special guide on how to grow fruit trees in your hilly areas. In the past, high value crops like fruit trees were grown mostly in the lowlands. But as population continues to grow and economy booms, areas planted to fruits and other crops dwindle.

The influx of population in the uplands is now a common reality. Their number continues to surge each day. Most of these people don't know how to farm the ecologically-fragile uplands. Most hilly lands are susceptible to erosion. If erosion is not curbed, a time will come when food production will definitely dip. Erosion must be controlled and Sloping Agricultural Land Technology (SALT), which the Mindanao Baptist Rural Life Center (MBRLC) had developed in the early 1970s, has been identified as one of the best methods to control erosion in the uplands. Several modifications were introduced into the system. In 1990, fruit trees were integrated and this system is called Small Agrofruit Livelihood Technology (SALT 4).

This manual will help you to start your own SALT 4 farm. However, this is not meant to be the final word on the system. Farmers can modify the system to suit their needs.

Sincerely yours,

JON JEFFREY PALMER
Director

May, 1997

SMALL AGROFRUIT LIVELIHOOD TECHNOLOGY (SALT 4)

Introduction

In recent years, agroforestry has become a byword among rural developers and environmentalists not only in the Philippines but in other Asian countries as well. Wherever introduced, agroforestry has generally received a welcome commendation from various sectors.

Agroforestry has been defined as "a scheme of producing food hand-in-hand with wood in the same piece of land." Others considered agroforestry as "a system of land management whereby forest and agricultural crops are produced in the same management unit at the same time or sequentially." Possible strategies include intercropping, multiple cropping, monocropping and/or succession cropping in the various sub-units.

The Philippine government described agroforestry as "a sustainable management of land" which can help in increasing overall production. The system combines agricultural crops, tree crops and forest plants and/or animals simultaneously or sequentially. Agroforestry also applies management practices which are compatible with the cultural pattern of local production.

Agroforestry, environmentalists claim, is an ecologically sound system of land management whereby forest and agricultural products are produced optimally on appropriate and suitable areas simultaneously or sequentially for the social and economic benefits of the community.

Agroforestry opportunities

Like most systems, agroforestry offers several opportunities. The regional office of the Food and Agriculture Organization said agroforestry can play an increasingly vital role in the following situations:

- Agricultural lands where trees can play an important role on the most productive lands. Agroforestry projects may be most successful when initiated on good quality lands before being transferred to poorer quality sites.
- Critical watershed areas of major river systems where the overriding demand is for conservation. Here, land use solutions should attempt stabilization of farming practices through appropriate land preparation (e.g. terracing) agroforestry, and other conservation farming practices.
- Shifting cultivation areas which occur mainly in the humid tropics. Agroforestry could be the land use option which harmonizes the ecological considerations with the socio-economic imperatives of slash-and-burn (*kaingin*) practices, which are of themselves a form of agroforestry.

- ❑ Deforested land encroached for the purpose of "controlling" land resources and for practicing marginal agriculture. These areas are prime candidates for agroforestry, both from ecological and socio-economic view points.
- ❑ Marginal lands and wastelands where the land tenure status is varied. These can be wholly owned by the state, or may be common-property, resources, or even privately-owned lands. For one reason or another, these land resources are wasted.

Small Agrofruit Livelihood Technology

Experts identify several types of agroforestry; among them agrosilvicultural (trees with agricultural crops and silvopastoral (trees with pastures and livestock). In recent years, fruit crops and other perennial horticultural crops are integrated in agroforestry projects. The Mindanao Baptist Rural Life Center (MBRLC) in the southern part of the Philippines introduced fruit trees into a new SALT system called Small Agrofruit Livelihood Technology (SALT 4).

The system's general objectives are to produce food, increase income and practice soil conservation in a limited sloping land (one-half hectare). Marketing of agricultural crops has been cited by most farmers as one of the biggest problems as most uplands have no farm-to-market roads. Because of this, the MBRLC introduced the growing of high value crops like fruits. Fruits, after all, can be easily marketed, not mentioning they can stand the rigors of spoiling unlike the easily perishable vegetables and other perennial crops. In cases where fruits easily rot, farmers may resort to planting those fruits that can easily be marketed right in their farm or neighboring areas.

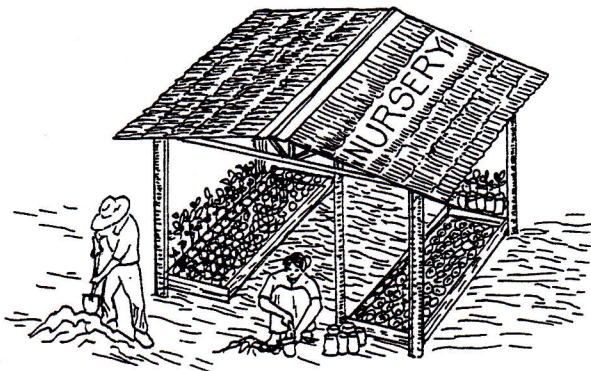


1 ESTABLISH A NURSERY AREA LOCATED AT THE CENTER PORTION OF THE FARM

To make sure that you have a sufficient supply of planting materials at lower cost, set up your own nursery. The nursery must be near the house and a reliable source of water and is free from pest and disease problems.

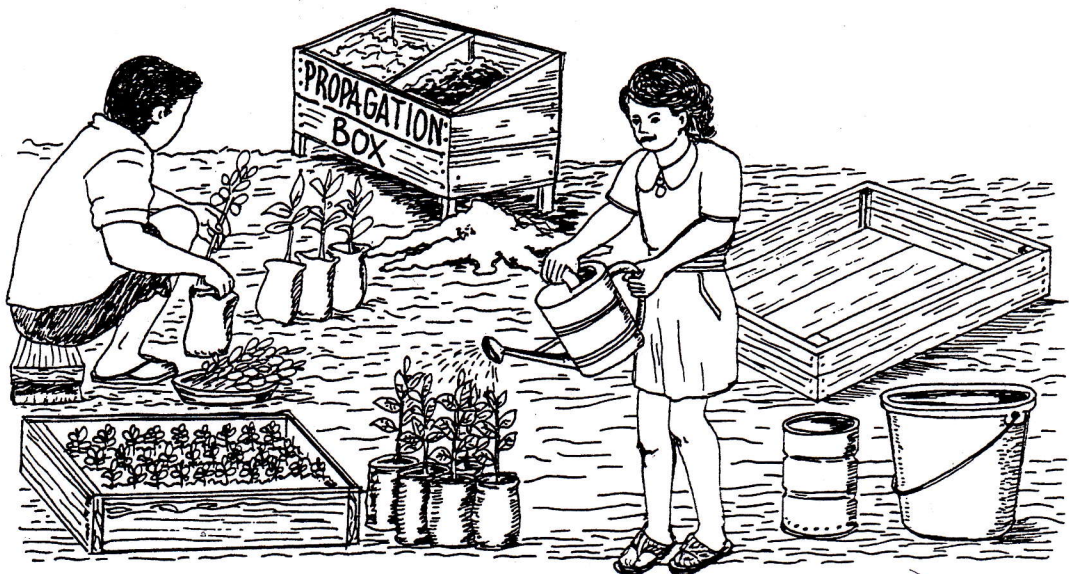
Nursery shed

Upon selecting an area, remove debris and grasses. A nursery with a dimension of 3 meters by 1.5 meters is sufficient for half-a-hectare farm. You need only four poles and a roof made of locally-available materials.



Materials needed

Among the equipment needed in a nursery are watering cans (with sprinkling head or a can with small holes punched in it), plastic bags for potting, several seed boxes, a spray bottle, and cans for boiling water.



2 PREPARE HIGH QUALITY PLANTING MATERIALS OF FRUIT TREES

Fill the seedboxes with river sand (not sea sand). If sand is not available, you may use the ordinary soil. Pour boiling water over the seedbox to sterilize the sand. The seedbox and sand should be soaked thoroughly. Before sowing the seeds, wait for 3-4 hours for the sand to cool down.

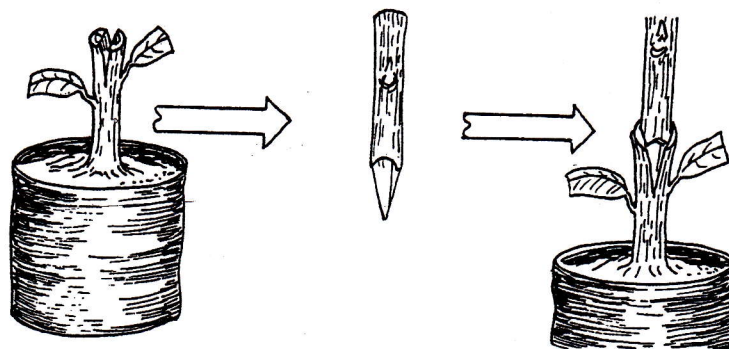
Fruit selection

In choosing the fruit species to grow on your SALT 4 farm, it is important to choose fruit species that grow well in your locality. A simple way of finding this is by observing the fruits that grow well in the area. Fruits from other areas can also be used on a trial basis before planting them in large numbers.

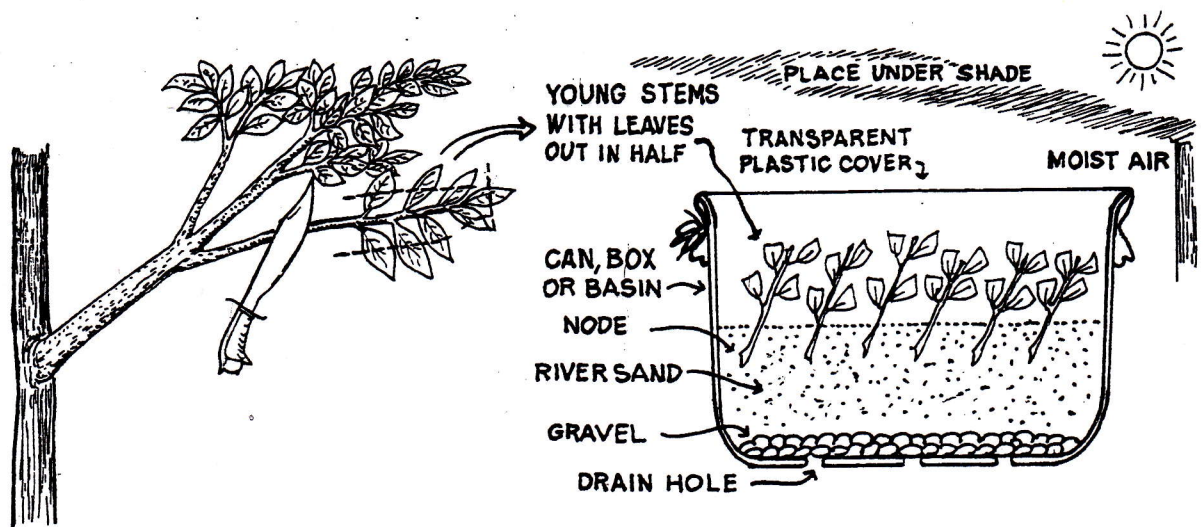
Seed collection and grafting

Collect seeds which are very prolific and disease-free. Plant them in your sterilized seedbeds. Water the boxes 2 times a day, keeping the soil moist at all times. When the seedling has 2-true leaves, it is ready for transplanting and bagging. Punch several holes in the bottom of your plastic bags. For bagging, use a mixture of equal parts sand, soil and goat manure (other manures can be used, but should be dried first before using). Fill the bags with the mixture and transplant the seedlings. Care for the seedlings for 6-8 months. At this time, the seedlings are ready to be grafted. Fruit trees are grafted for these reasons: (1) true-to-type (you get the exact type of fruits like the mother plant); (2) less time to fruiting; (3) the strengths of a native rootstock can be paired with the high quality fruit of an exotic (introduced) variety; (4) decreases the height of the fruit tree; (5) easy to adjust to its environment; and (6) resistant to pests and diseases.

Collect scions (tip cuttings) from healthy fruit trees known to produce high quality fruit. Graft the scion to the seedling. Wrap the connection with thin plastic. Remove plastic after 21 days. The following fruits are highly recommended for grafting: durian, mango, rambutan, and lanzones.



Cuttings are best for coffee, black pepper, citrus and Barbados cherry.



Hardening and transplanting

Allow the grafted planting materials to harden for 3 months. Hardening is done by gradually withdrawing water and exposing to the sun. At the end of the 3 months, the grafted materials are ready for planting in the field. Grow as many planting materials as you can. This ensures a steady supply of planting materials. Excess planting materials may be sold to other interested farmers or individuals.

Large planting materials

Many commercial fruit growers, however, leave their seedlings in the nursery for a longer period of time to become so-called large planting materials (LPMs). This means the grafted seedlings are left in the nursery for up to 2 years before being outplanted. The advantage of LPM is that they survive much better once planted. Durian and mangosteen benefit the most from this practice.

3 ESTABLISH AND DEVELOP YOUR CONTOUR HEDGEROWS

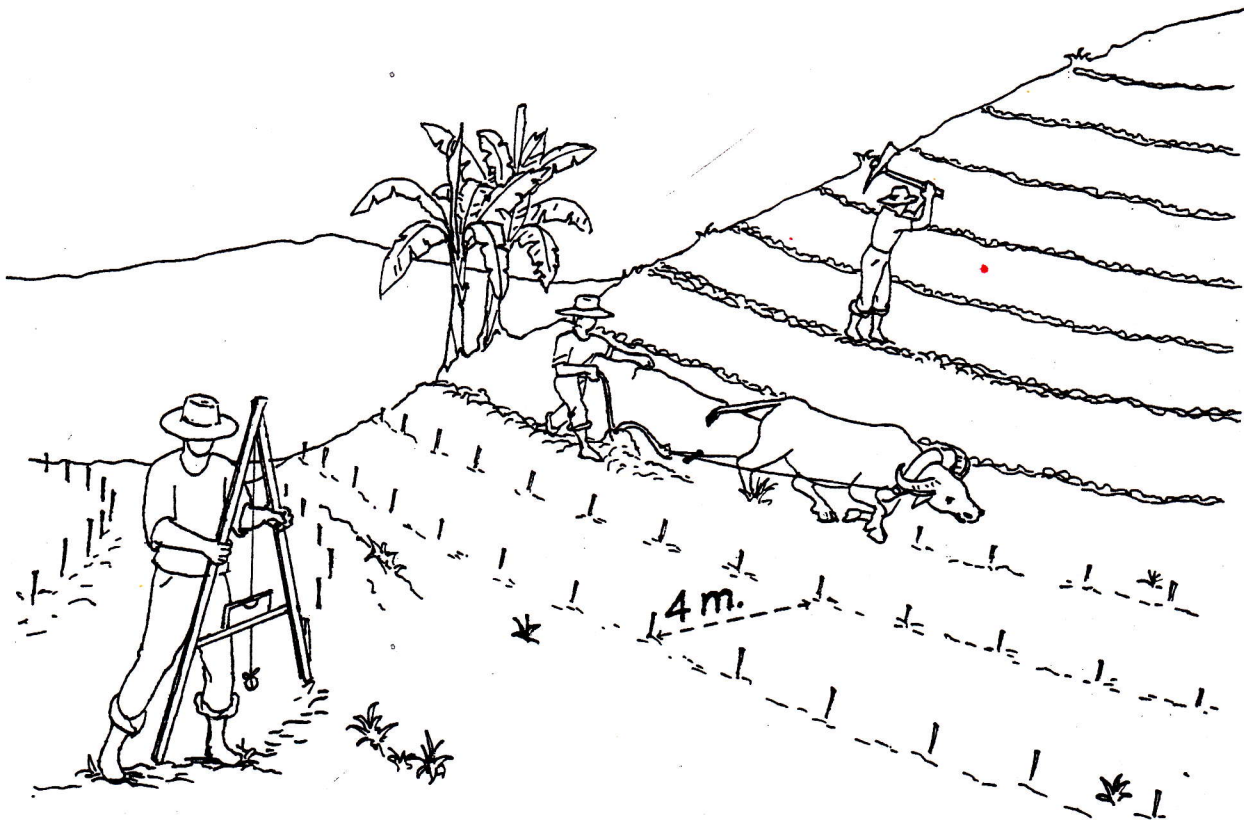
Locating contour lines

Contour lines of the farm may be found by using an A-frame (read **Appendix 1** on how to make an A-frame). Let the A-frame stand on the ground. Without moving the rear leg, lift the front leg. Then, put the front leg down on the ground that is on the same level with the rear leg. When the air space in the carpenter's level stops in the middle, you have already found a contour line.

Mark with a stake the spot where the rear leg stands. After doing so, move the A-frame forward by placing the rear leg on the spot where the front leg stood before. The process is repeated again. The recommended distance between contour lines is 3-4 meters. Be sure to locate the contour lines of the farm accurately. Cultivate the identified contour lines. If laid out haphazardly, you may create a channel on the slope, thus assisting erosion in removing your precious topsoil.

Contour lines preparation

After finding the contour lines, prepare them by plowing and harrowing until ready for planting. The width of each area to be prepared should be one meter. The stakes will serve as your guide during cultivation. As in other SALT systems, every third strip is cultivated at the beginning.



Recommended nitrogen fixing trees and shrubs

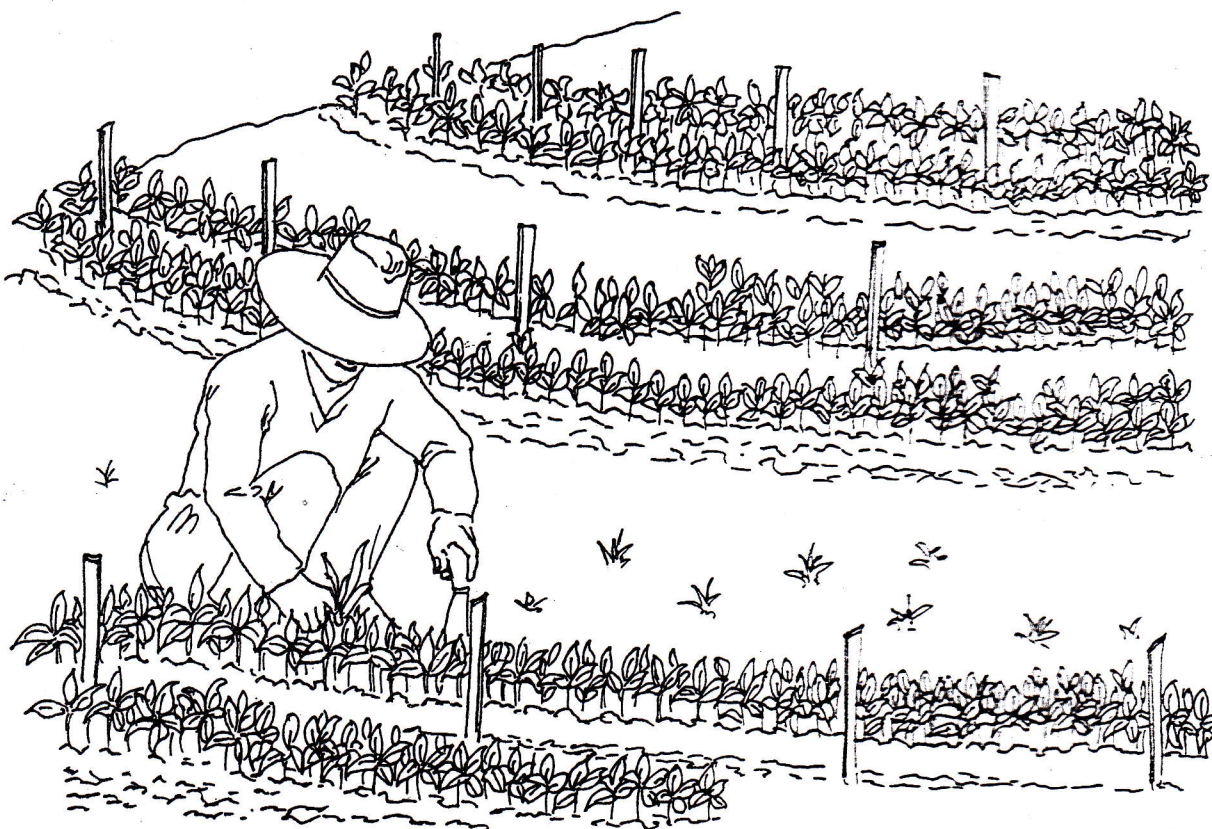
The recommended hedgerow species are nitrogen fixing trees and shrubs like *Flemingia macrophylla* and *Desmodium rensonii*. You need at least 3 kilograms of both species to plant half a hectare. The hedgerows will occupy at least 20% of the farm area. Other species which can be used for hedgerows include *Gliricidia sepium* (locally known as "madre de cacao" or "kakawate"), *Leucaena leucocephala*, *L. diversifolia*, *Caillandra calothyrsus*, *Indigofera tysemani*, and those that are locally grown in the area.

Planting hedgerow species

On each prepared contour line, make two furrows at a distance of 50 centimeters apart. Plant one seed per centimeter. Planting must be done at the start or during rainy season. To avoid washing out of newly-planted seeds, cover them with mulching materials. Newly-planted hedgerows must be weeded and cultivated at least once a month or more if necessary.

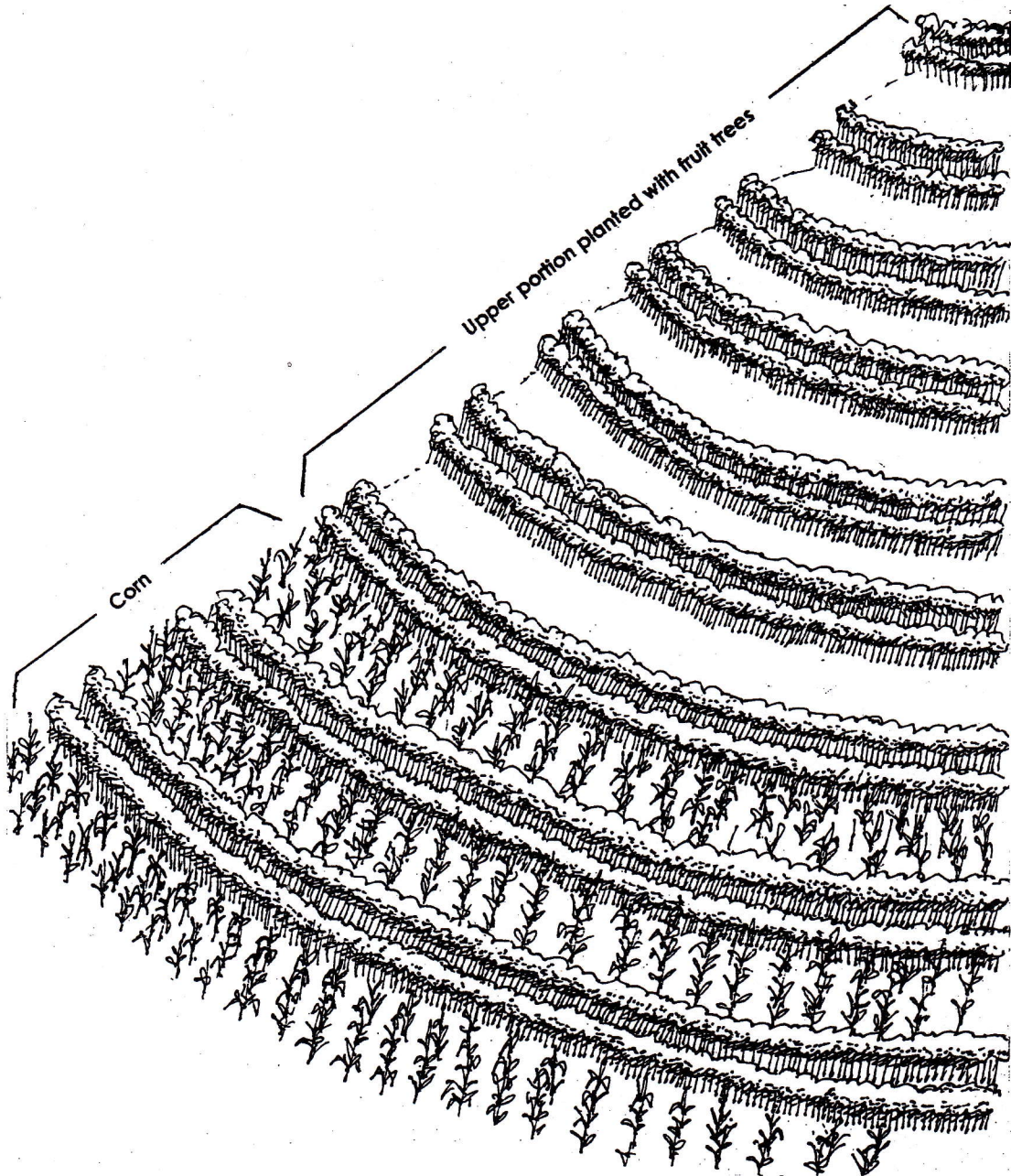
Importance of nitrogen fixing species

Nitrogen fixing species are important because they manufacture their own nitrogen. Therefore cuttings of the leaves and stems have a lot of nutrients. These cuttings are very useful source of organic fertilizer when placed on the soil.



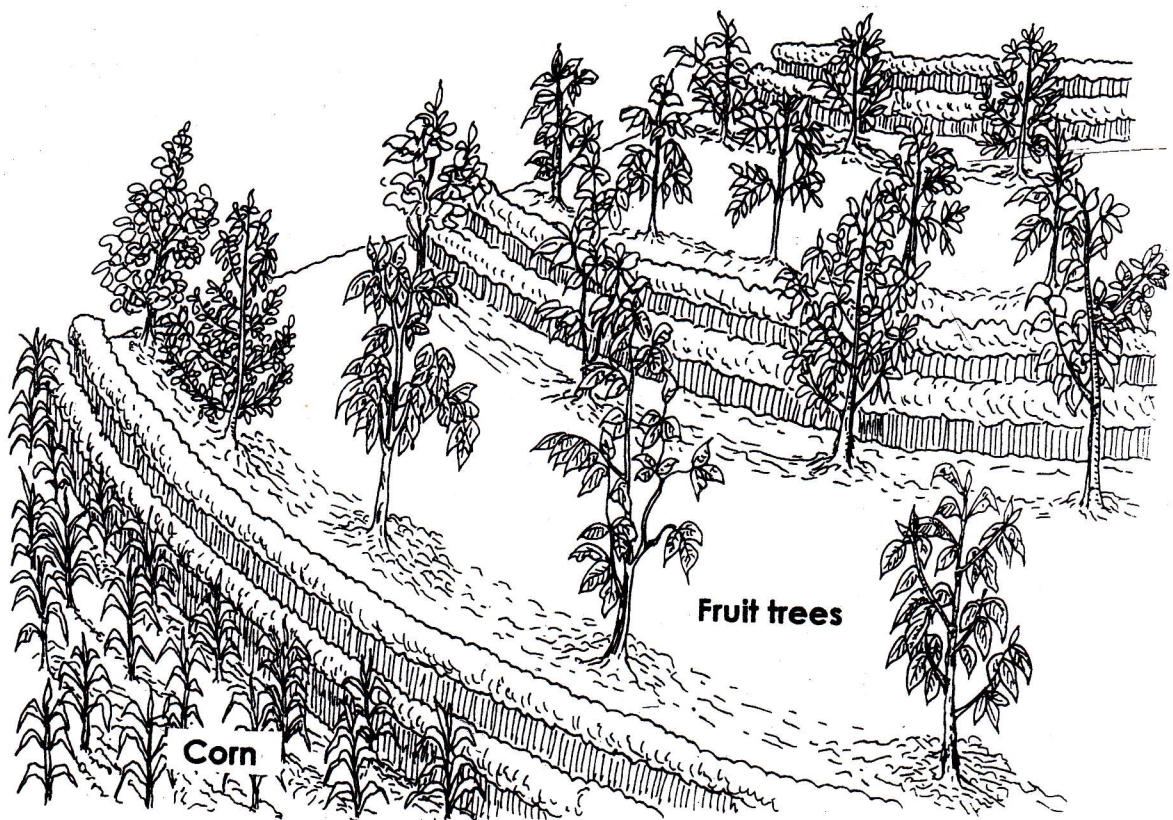
4 PLANT FOOD CROPS AT THE LOWER ONE-THIRD PORTION OF YOUR FARM

Plant your preferred short-term crops on the lower 1/3 portion of the farm. Short-term crops (such as corn, upland rice, mungo, beans, and others) should be planted in the strips between the hedgerows. Planting the food crops on the lower portion of the farm allows them to receive the largest amount of sunlight. The earlier you establish your food and cash crops, the better off you will be meeting your immediate needs.



5 PLANT FRUIT TREES AT THE UPPER TWO-THIRDS PORTION OF YOUR FARM

Plant fruit tree seedlings when they are 9-11 months old and at the start of the rainy season. The fruit trees, which will be the farm's main cash provider in the future, must occupy about 2/3 of the whole farm. Draw a map showing the areas where you intend to plant your fruit trees along with the proper spacing. The map could serve as your guide and record of planting. Provide proper spacing for the fruit trees so as to prevent overlapping and competition for nutrients when full grown (see **Appendix 2** for proper planting distance). Design your pattern to suit the needs of your farm.



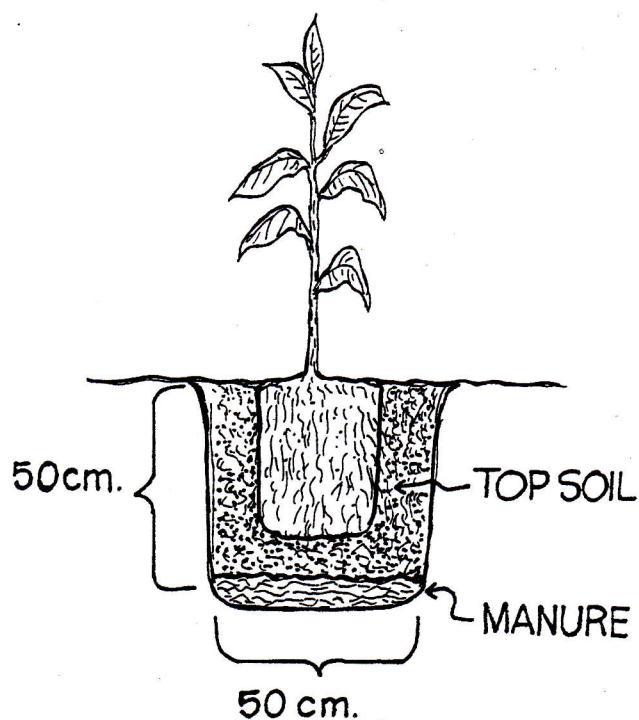
It is recommended that fruit trees with short production life (1-5 years of fruit production) be planted together with fruit tree species that have longer production of life (15-50 years of production), especially during the first year of establishing your SALT 4 farm. By doing this, you can have fruits within 2-3 years (coming from the short-term fruit trees). When production from short-term fruits declines, the long-term fruits will by then be in full production. Examples of short-term fruits are *kalamansi* (Philippine lime), balimbing, coffee, and bananas. Long-term fruits include mango, durian, lanzones, mangosteen and the like. You may also plant other fruit trees that are very popular and saleable in your area.

Alternate planting

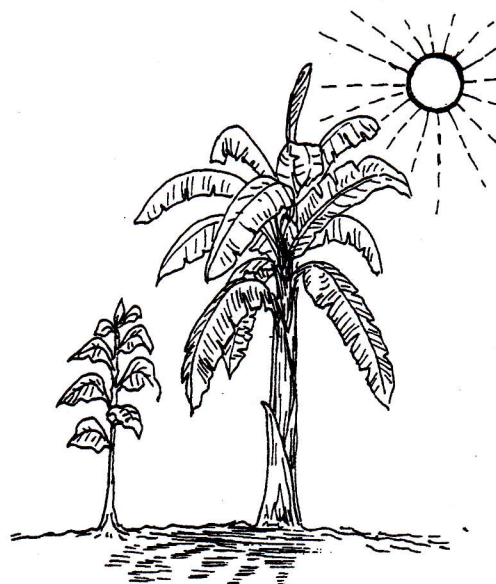
Plant several and different fruit species in your SALT 4 farm to add diversity; 3-5 species is best. Alternate these species to help prevent disease and insect problems. Doing this will lessen monetary loss if there is a poor fruiting year from one species.

If a farmer can buy all the necessary planting materials for the farm, this is also an option. The advantage is that you do not have to wait 9-11 months for the seedlings in your nursery to grow. The problem is that this can be very expensive. Buy your stock from reliable nurseries. However, it is still important to maintain a nursery to ensure you have replacement seedlings.

How to plant fruit trees



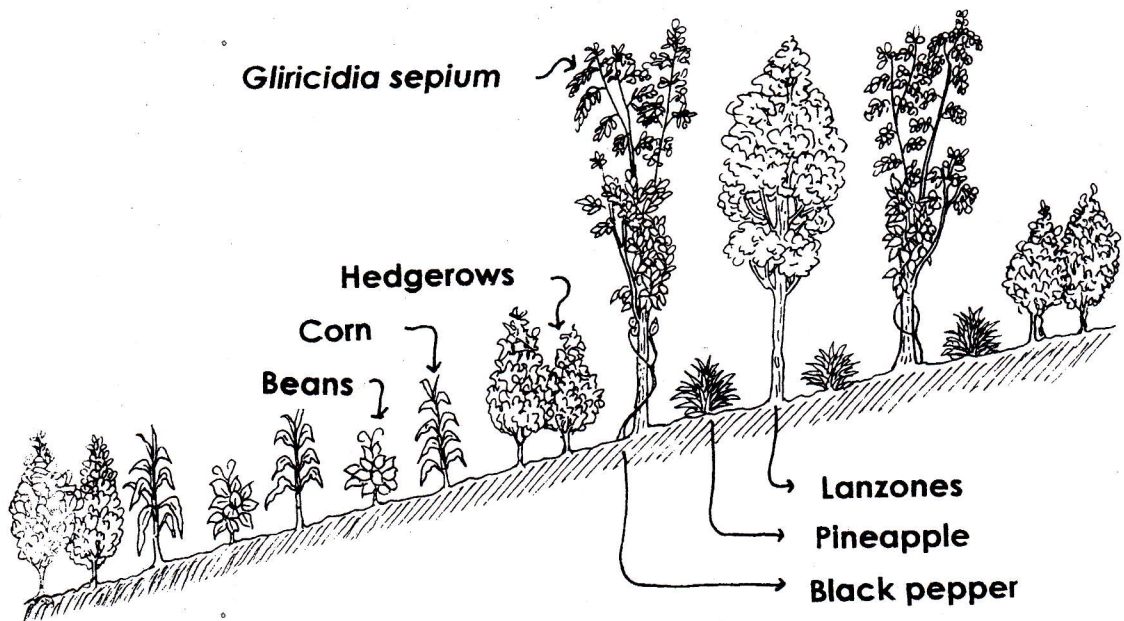
Provide shade for the young seedlings, especially durian and mangosteen, for the first 2 years. Water them if it is very dry and keep leaves and mulch around the base of the seedling.



6 INTERCROP YOUR FRUIT TREES WITH SHORT-TERM CROPS

Intercropping is the growing of different crops within the same area. This is done to best use the space and the available sunlight. Plant banana, coffee, pineapple, papaya, or root crops around the fruit trees while they are still developing. Some intercrops provide the much-needed shade in the growing stage of trees.

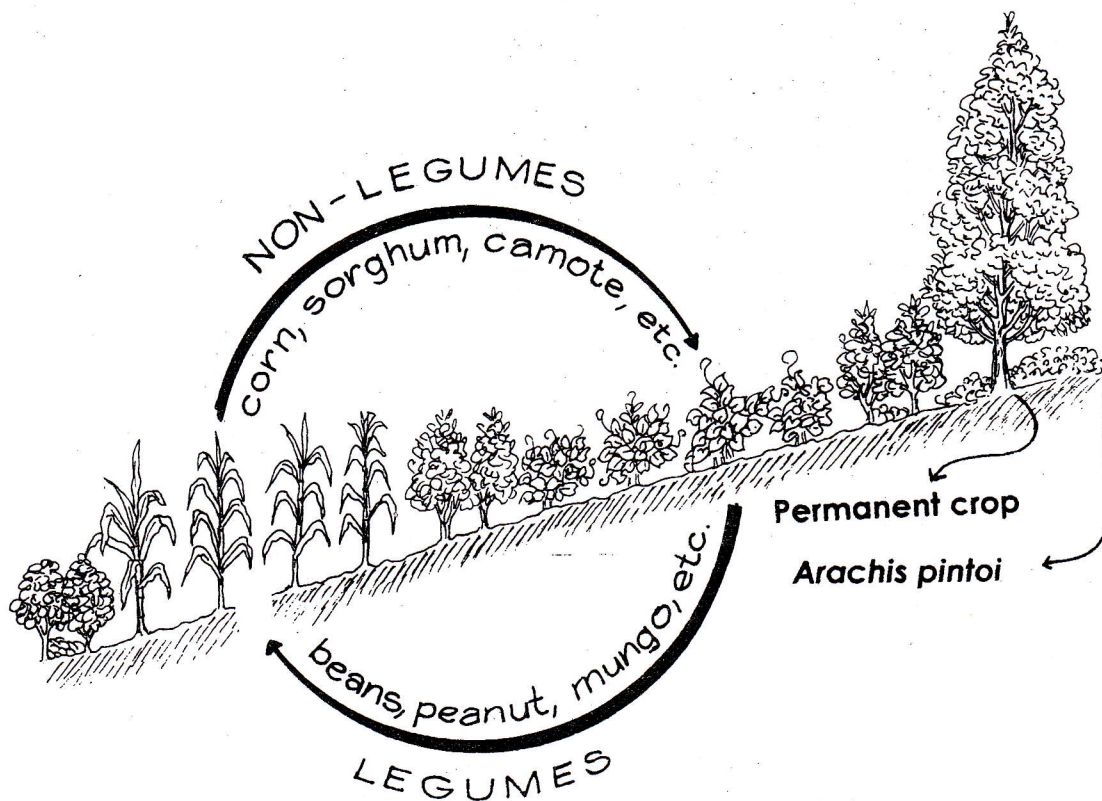
Continue growing intercrops until the fruit trees are big enough to shade them out. Even then, crops that require less sunlight (like pineapple, ginger and ube) can be grown under the fruit trees. The short-term intercrops will serve as your primary source of income in the first 3 years. If plowing is employed, it is important not to plow too close to the seedlings. A good rule is not to plow any closer than the leaf drop. This prevents the roots of the fruit tree seedling from being damaged. Examples of intercropping are listed in **Appendix 3**.



7 PRACTICE CROP ROTATION AND COVERCROPPING

Crop rotation

To make sure that you are not depleting your soil of nutrients, rotate your food crops. This means that after planting corn, you can plant legumes (beans, pulses, and peas) in the next cropping season or vice versa. Do not burn anything. Slash the standing stalks and allow them and the remains of the legumes to rot in the field. They serve as mulching materials, suppress the growth of weeds, and add nutrients to the soil. In addition, they hold moisture and reduce raindrop splash erosion.



Covercropping

When the fruit trees have fully grown and/or are starting to bear fruits, you may plant covercrops like *Desmodium heterophyllum* and *Arachis pinto* underneath. Aside from helping control erosion, covercrops can also be used as forage for rabbits.

8 TRIM YOUR HEDGEROWS REGULARLY FOR MULCHING

Six months after planting, the hedgerows should be tall enough for their first pruning. The nitrogen-rich hedgerow prunings will become the fertility component of the system. When the young hedges reach a height of about 2-3 meters and have a waist high basal diameter of at least 2.5 centimeters, they are ready for their first trimming.

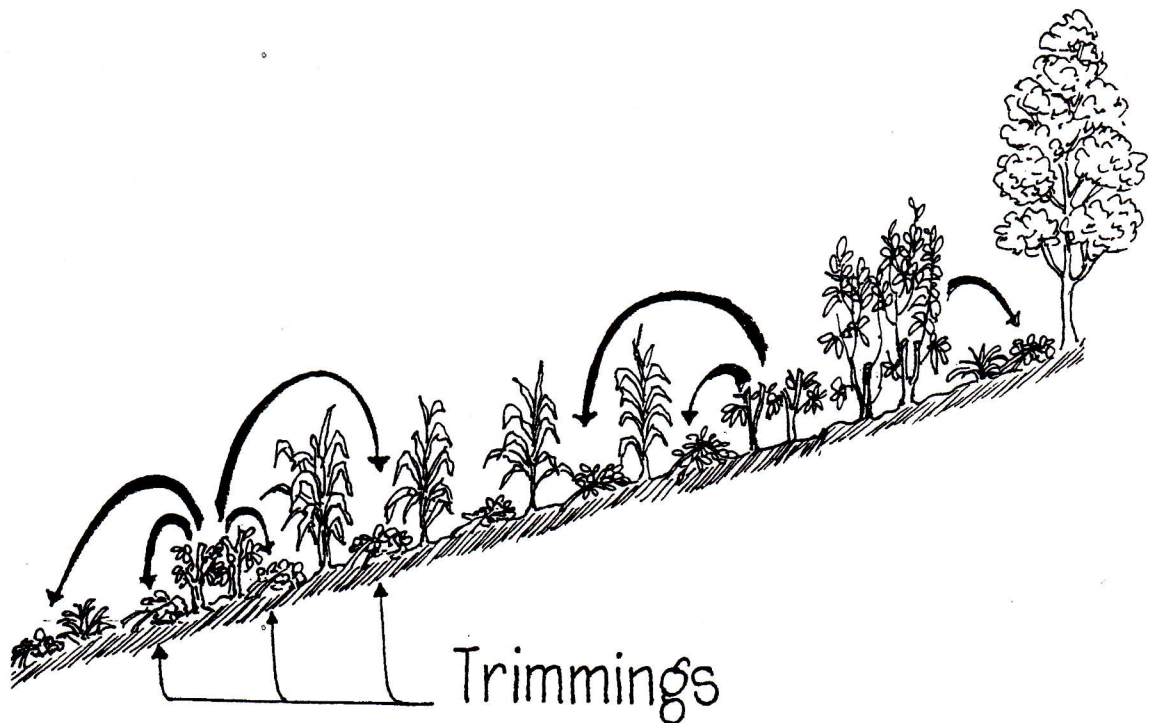
Pruning hedgerows

Prune them regularly to a height of one meter (or about waist-high) from the ground. Use a sharp bolo when pruning in order to avoid breaking the remaining twigs and branches which will eventually cause the hedgerows to die. Trimming of hedgerows is done every 30-45 days after the initial pruning.

Always pile the cut leaves and twigs at the base of the fruit trees or dispersed them evenly over cash crops areas. In intercropping areas, some of the trimmings may be concentrated around the trees while the rest may be distributed over the cash crops.

Green manuring/fertilization

The prunings serve as fertilizer for both cash crops and fruit trees. In some instances, particularly during the developing stage of fruit trees and cash crops, you may fertilize them with organic matter. Should there be more than enough prunings for the crops - this happens during the rainy season - they may be used as forage for goats and other livestock raised in the farm. However, if prunings are used for animal feeds, manures should be brought back into the system and placed on the fruit and food crops.



9 HARVEST AND MARKET YOUR PRODUCTS ON TIME

Do not delay in harvesting your food crops. Corn must be harvested from 90-120 days after planting. Papaya are ready for harvest six months after planting. As for pineapple, you may harvest them one year after planting and every month thereafter. For further details about harvesting, refer to **Appendix 4**.

Methods of harvesting

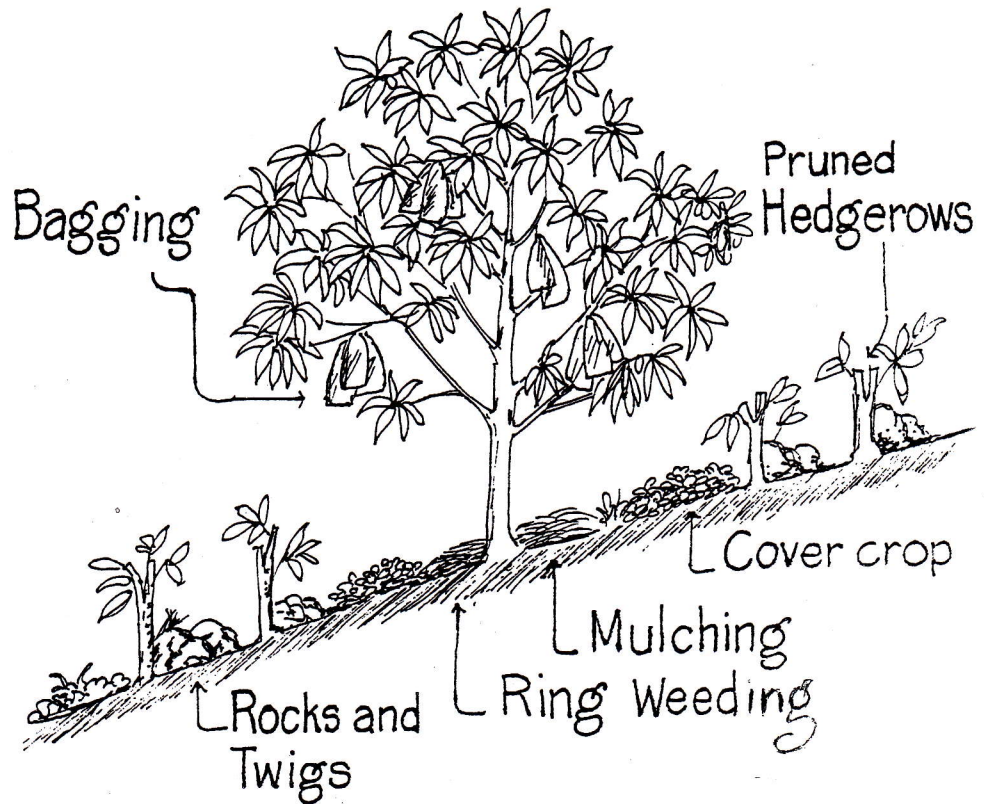
Fruit trees may be harvested in several ways. You may harvest them using a sharp bolo or pruning shears. Some fruits just drop; harvest them by hand or by using a bamboo pole with a net attached. But before harvesting your fruit crops, plan ahead how and where you will market your products. Planning ahead will enable you to get the best price for your fruits.



10 MAINTAIN YOUR SALT 4 FARM

Among the cultural practices that you need to follow in this kind of farming are weeding, pruning of hedgerows, planting hedgerow skips, and controlling of pests and diseases. Only ring weeding is recommended for fruit trees. The weeds may be used as mulching materials. Should there be skips and die-backs in hedgerows, be sure to do replanting.

Also build your terraces by putting rocks and stones, twigs and branches, and leaves at the center of your hedgerows. By doing this regularly, you can build strong, permanent, naturally green and beautiful terraces which will hold the topsoil on your farm.



Cultural practices

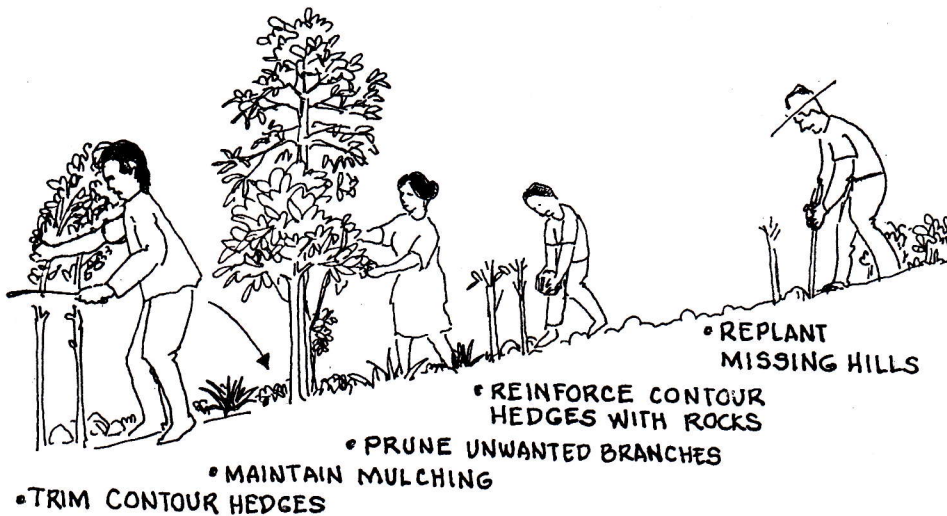
Replant fruit trees that have died. Pruning is also needed by some fruit trees. Bagging of young fruits, such as jackfruit and mango, protects them against pests and diseases. Maintain your supply of nursery seedlings. Collect the seeds and grow them in your nursery. Take the scions and cuttings from healthy, high quality fruit trees. You may sell some of the seedlings to interested farmers and individuals.

Pest management

If fruit production is greatly affected by pests and diseases, spray the fruit trees with recommended chemicals. Generally though, by having alternating species, healthy seedlings, proper spacing, and good fertilization, most pests and diseases will not greatly affect your fruit harvests. It is much easier to prevent pests and diseases than to treat them.

Fertilization

Fruit trees produce fruits even without fertilizer. But for high yields and quality, it is best to fertilize the fruit trees with manure and/or commercial fertilizer. As soil fertility is different in each area, it is not possible to give specific fertilizer needs. In addition, different fruit tree species require different amount of fertilizer. When fertilizing fruit trees, place the fertilizer in a ring around the trunk 20 centimeters away. On older trees, place the fertilizer at the leaf drop.



Appendix 1. How to make an A-frame.

A-frame with carpenter's level

You need not to have expensive soil surveying equipment to locate the contour lines of your farm. You can do this by using an A-frame, a simple and practical instrument, which you can easily make using locally available materials. Below are the steps in making an A-frame:

1. Secure the following materials:
 - Three wooden or bamboo poles with a 1.5-inch diameter (2 of which should be 2.1 meters long and one about 1.2 meters long)
 - Sturdy string for tying or nails
 - A carpenter's level.
2. Nail together the upper ends of the longer poles. Let the lower ends of the legs stand on level ground.
3. Spread the legs about one meter apart to form a figure just like a letter A. Brace horizontally the shorter pole to become a crossbar between the two legs.
4. Tie the carpenter's level on top of the crossbar. Use the A-frame to find the contour lines of your farm.

A-frame with a stone

If you don't have a carpenter's level, you can also use a stone or any similar heavy object. Below are the steps in making this kind of A-frame:

1. Get the following materials: three wooden or bamboo poles with a 1.5-inch diameter (two should be "head high" of the user and one as crossbar), sturdy string for tying or nails, and a stone about the size of a fist or any similar object.
2. Tie or nail the two longer poles at one end, about 10 centimeters from the end. Make sure they are securely fastened. These will make the legs of the A-frame. Make notches on the points of contact so that the poles will not slip.
3. Spread the legs and brace with the shorter pole to make a figure "A." Tie or nail the crossbar (about 10 centimeters each from each end) to the middle of the legs of the "A." The crossbar will support the legs of the frame and will serve as guide in marking the level ground position.
4. Tie one end of the string to the point where the two legs of the A-frame are joined.
5. Tie the other end of the string to the stone or any object for weight. The stone should be heavy enough so that when suspended, it will not sway with the wind. The stone should hang about 20 centimeters below the crossbar.

Calibrating the A-frame with stone

- Locate reasonably level ground and place the A-frame in an upright position. Mark the spots where the legs (A and B) touch the ground. Then, mark the crossbar where the weighted string passes.

- Reverse the position of the A-frame's legs such that leg A is exactly on the same spot where leg B was and vice versa. Again, mark the crossbar when crossed by the string.
- * If the two marks exactly coincide, this means that you have the midpoint on the and the A-frame is standing on level ground.
- * If the marks are separate, make another mark at the midpoint between them.
- To check accuracy, move one leg around until the string passes the level point of the crossbar. Mark the point where the adjusted leg touches the ground. Reverse the placement of the legs of the A-frame. If the string passes the same point, the level position has been located.

Appendix 2. *Planting distance and uses of different fruit trees.*

Fruit trees	Scientific name	Purposes/Uses*	Distance (m)
Avocado	<i>Persea americana</i>	Fr, M, Fw	8-10
Balimbing	<i>Averrhoa carambola</i>	Fr, Fw	5-7
Calamansi	<i>Citrus microcarpa</i>	Fr, M	2-3
Cashew	<i>Anacardium occidentale</i>	Fr, Fw, Tm, M	8-9
Chico	<i>Manilkara zapota</i>	Fr	7-9
Durian	<i>Durio zibethinus</i>	Fr, Fw, Tm	10-12
Guava	<i>Psidium guajava</i>	Fr, Fw, M	4 x 4
Jackfruit	<i>Artocarpus heterophyllus</i>	Fr, Tm, M	8-10
Lanzones	<i>Lansium domesticum</i>	Fr, Fw, M	5-7
Mangosteen	<i>Garciana mangostana</i>	Fr, M	8-10
Papaya	<i>Carica papaya</i>	Fr, M	3 x 3
Pineapple	<i>Ananas comosus</i>	Fr, M	30 x 60 x 90**
Rambutan	<i>Nephelium lappaceum</i>	Fr, Fw	8-12
Siniguelas	<i>Spondiar purpurea</i>	Fr	7-9

* Fr - fruit; Fw - fuelwood; Tm - timber; M - medicinal

** In centimeters

Sources: Coronel, R.E. (1983). *Promising Fruits of the Philippines* (Laguna, Philippines); Samson, J.A. (1980). *Tropical Fruits* (New York, U.S.A.)

Appendix 3. Some recommended intercrops for fruits in SALT 4.

Fruit	Fruit intercrops	Cash crop intercrops
Atis	Mango, chico, citrus, pineapple and papaya	Annual field crops and vegetables
Avocado	Papaya, pineapple, and banana	Corn, mung beans, peanut eggplant or sweet potato
Balimbing		Corn, mung beans, peanut or sweet potato
Caimito	Banana, lanzones and coffee	Corn, root crops and other annual crops
Cashew	Banana, papaya and pineapple	Some annual field crops and vegetables
Chico	Banana, papaya, pineapple calamansi and atis	Peanut and other legumes
Durian	Banana and pineapple	Corn, mung beans or peanut
Guava		Vegetable and short-term crops
Guyabano	Avocado, santol, pineapple and papaya	Cassava, ginger, cowpea and mung beans
Jackfruit	Shade tree for coffee/black pepper	Short-term crops
Lanzones		Corn, mung beans, bush sitao and other short-term crops
Mango	Atis, guava, guyabano	
Mangosteen		Short-term crops
Marang		Short-term crops and vegetables
Pili	Banana, papaya and pineapple	Field crops and vegetables
Rambutan		Annual crops and coffee/cacao
Rimas	Citrus, chico, atis, guyabano, pineapple, papaya and pineapple	
Santol		Many possible intercrops
Siniguelas	Banana, papaya, and pineapple	Field crops and vegetables

Source: Coronel, R.E. (1983). *Promising Fruits of the Philippines*.

Appendix 4. Recommended harvesting time for Philippine fruits.

Fruits	Seeds	Asexual Propagation
Atis	2-4 years	1.5-2 years
Avocado	4-8 years	1-2 years; but should not be allowed to bear fruits until 4-5 years
Balimbing	4-6 years	2-3 years
Caimito	5-6 years	3-4 years
Cashew	3-4 years	*
Chico	6-10 years	3-5 years
Durian	7-8 years	5-6 years
Guava	4-6 years	2-3 years
Guyabano	3-5 years	2-3 years
Lanzones	12-15 years	2-4 years (marcotted); 7-9 years (grafted)
Jackfruit	6-8 years	4-5 years (grafted)
Mango	5-7 years	*
Mangosteen	10-15 years	7-9 years
Marang	4-6 years	*
Pili	5-4 years	2-3 years
Rambutan	5-6 years	3-4 years
Rimas	8-10 years	3-4 years
Santol	5-7 years	*
Siniguelas	*	3-4 years (marcotted)

* / Data not available

Source: Coronel, R.E. *Promising Fruits of the Philippines.*