Seedling Maintenance
SEEDLING MAINTENANCE

1. REPLACEMENT PLANTING

1.1. Percentage calculation of dead seedlings

- We shall define at least five pilot lots per hectare, each with a size of 10 square meters (equaling 5% per hectare). We shall randomly select the locations of the pilot lots throughout the field.

Lot sampling for seedling counting

- Count the dead and alive seedlings within each pilot lot. The seedlings that are considered dead are those with dead, dry leaves that have fallen to the ground, those with faded leaves, any seedling with a broken trunk, or those that have been removed from the hole.
The percentage of dead seedlings can be calculated using the formula below:

\[
\text{Percentage of dead seedlings} = \frac{\text{Total number of dead seedlings from all lots} \times 100}{\text{Total seedling (dead or alive seedlings) from each lot}}
\]

The number of seedlings that need to be replaced can be calculated using the formula below:

\[
\text{Number of seedlings to be planted} = \text{Percentage of dead seedlings} \times \text{number of seedlings planted previously}
\]

1.2. Appropriate time for replacement planting
We shall do replacement planting twice within the planting year:
- **First**: one month after planting, which mostly occurs in August or September.
- **Second**: one month after the first replacement planting, which mostly occurs in October or November.

1.3. Replacement planting methods
Before planting a seedling to replace a dead one, we shall seek the reason it died so that the new seedling can be planted appropriately, as follows:
- In the case of poor preparation for the original planting, or the use of a poor quality seedling, we shall re-dig the hole and plant the new seedling;
- If the previous seedling was destroyed by water run-off, we shall plant the new seedling in another place to avoid this;
- If the seedling was destroyed by through water logging, we shall mound the soil higher than the water level when planting the new seedling.
2. PREVENTION OF SEEDLING DESTRUCTION BY ANIMALS

To prevent the newly planted seedlings from being destroyed by animals, we have three methods as outlined below:

2.1 Protective fence

- We shall use locally available resources such as small poles, bamboo, palm stem, vine or rattan to make protective frames for the seedlings.
We can use bamboo or thorny plants around the field to protect the seedlings from animals, but if we want to have long lasting fence we should grow other plants such as cactus, water buffalo-horn plant (*sneankrar bey*), *Hura crepitans*, and *Bambusa spp.*
2.2 Education for cattle herding children

Elderly people in the village are key persons to educate cattle herding children to prevent animals from destroying seedlings as follows:

- We shall tell the children where the seedlings were planted and where they should herd their cattle;
- We shall tell them not to release their cattle to graze near or within the field when the seedlings are still young; and
- We shall explain to them the importance of trees for the villagers.

2.3 Implementing the rules and regulations of the village

The Village Chief or Village Development Committee shall organize a discussion for people in the village on the preparation of by-laws and regulations to protect the property of villagers, such as forest. The by-laws and regulations shall be recognized by commune and provincial authorities to ensure their effective use in resolving conflicts between people within the village as well as with those from outside.
3. PREVENTION OF SEEDLING DESTRUCTION BY RODENTS, TERMITES OR WORMS

3.1. Problems

- Rodents that destroy plants include rabbits and rats, which mostly bite through the stem of the seedling or eat the buds.

- Damage by insects and worms mostly affect the root, stem and leaves, whilst termites mainly destroy the part of the seedling or tree that has already been damaged.
3.2. Protection measures

- Weeding and clearing the seedling plantation is important work because it helps to reduce destruction by rodents and insects;
- We shall make a botanical pesticide from bitter and poisonous plants (leaves of *Azadirachta indica*, *Strychnos nuxvomica*, *Gloriosa superba*, bitter vine, etc) by soaking them in a water jar, then spraying or sprinkling the solution on the seedlings to control insects or to keep them away from the seedlings. We shall stand away from the wind direction and wear a mask when spraying botanical pesticides.
4. FOREST FIRE PREVENTION

4.1. Forest fire prevention measures

There are two measures to deal with forest fires; firstly, we can establish a fire protection barrier by setting up a system to prevent the spread of fire from an outside source into the seedling plantation, or to prevent the spread of fire from one plantation to another; secondly, we can work with local people, particularly in education for children.

4.1.1 Building fire barriers

- Cut and clear forest, weeds or grass to form a path of 2-5 meters wide around the tree plantation. The firebreak shall be cleared at the end of the rainy season (end of the rice harvest). The waste collected shall be removed and carefully burned.
- Select evergreen plants, plants with thick bark, or species with a high rate of moisture within the leaves or stem (such as cactus, \textit{Jatropha curcas}, and \textit{Pandanus spp}) for planting around the seedling plantation, before the rainy season or one year before planting the seedlings, so that we can have a natural green barrier to prevent forest fires. It is recommended that grafted seedlings be planted in order to save time.

- For areas with tall grass, it would be more effective to create an additional green barrier in between the firebreaks. This can be done early in the wet season by clearing an area 6-10 meters wide, for planting 2-3 rows of trees as a green barrier in the center. At the end of the wet season, we shall clear the firebreak again.
It is also possible to use natural gaps, such as streams, canals, waterways, pathways, and oxcart paths, as firebreaks by clear-cutting the dead plants or bush, which are very inflammable. If the waterway already has green plants growing along it, we should clear away the dead plants that may easily burn.
4.1.2 Work to be carried out with people in the local area

- Measures and resolutions for forest fires should be prescribed in the by-laws of the village or community.
- The Village Chief, elderly people, and parents are key persons to educate children about fire prevention through the following recommendations:
  - Do not leave fires to burn after its use in honey collection;
  - Do not set fire to the forest to catch wildlife;
  - Do not set fire to rice stubble, grass, etc.
4.2. Extinguishing forest fires
Extinguishing forest fires is difficult and risky work, so the fire fighters in the local community should be aware of the following:

4.2.1 Tools to extinguish forest fires

- Machetes, axes, and sickles are used for cutting green branches to put on the fire, or for clear-cutting an open space to prevent the spread of fire.
- Hoes, spades, picks and rakes are used to clear open spaces, for shoveling earth onto the fire, or to gather branches, stems or grass from the area.
- Buckets and empty sacks are used to carry water and to cover the fire. For a large forest fire, oxcarts or horse-carts are the most useful means for transporting water.
4.2.2 Methods to extinguish forest fires

- To extinguish the fires on slightly burning grass we shall stand in front of the fire, and begin to extinguish it from the side, and finally towards the back.
Ways to extinguish large forest fires:
   o We shall extinguish the fire indirectly. If it is possible we shall start from the side and from the rear of the fire.
   o We shall clear grass, or cover the fire with earth to prevent its spread to other parts of the area.

Precautions:
   ▪ In the situation where the climate is hot, with a strong wind, a lot of inflammable materials (tall or dead grass, etc), a dense forest, and sloped area, where the forest fire is strong, the fire fighters shall stay far away from the fire and shall act very cautiously.
   ▪ You shall identify a way to escape in case you get trapped whilst extinguishing the fire.
   ▪ You shall stay close to each other while putting out the fire so that it does not spread to a place where there are no fire fighters.
5. WEED CLEARANCE
Weed clearance shall be done once in the first year, after the wet season (November-December). The following year, early in the wet season, you should rake up the soil to form a mound around the trees, and clear the weeds again when the wet season ends.

Weed clearance helps to free the seedlings from competition with other plants or weeds and enables them to access enough sunlight and dew for their growth. Weed clearance is useful for:

- Prevention of soil fertility absorption by other plants;
- Reduction of damage by insects; and
- Prevention of the spread of forest fire.
When the seedlings have grown for 2-4 years or more, some might have vines growing on them. Therefore, we shall clear the vines to allow the seedlings to grow at full capacity.
6. TRIMMING
Trimming is generally performed on trees grown in agro-forestry areas, or on trees planted along the fencing. In the tree plantation, trees are left, but we may trim the trees growing at the edge. When crops in an agro-forestry area need sunlight, we shall trim the branches of trees. Generally, we trim during the season in which the trees grow at full capacity.

We use tools such as knives, saws, and scissors that are sharp and easy to use for trimming branches of seedlings. When using knives, we shall be careful not to tear the bark of the seedling. We shall leave 1-2 centimeters between the stem and the trim. For trimming a large branch (fruit tree) we shall use a hand saw to cut three places on the branch so that the branch will not torn apart. Branches to be trimmed are:

- On the lower part, equal to ¼ of all branches;
- Multiple stems;
- Diseased branches.

After trimming, we shall clear away the cuttings to be burnt, or for use as firewood.
7. THINNING-OUT
When we recognize that the seedlings in the plantation are growing and vying for sunlight, we shall thin out some of the trees to make them less dense, and to enable the remaining trees to grow larger. Thinning-out shall be done in early or late wet season.

We shall gradually sort out poor trees, so that the plantation is not thinned out too quickly, under the following criteria:

- Diseased trees;
- Trees that are competing with ones of higher benefit;
- Trees of high benefit that are small and developing slowly; and
- Bent trees or those with many stems shall be cut at the last stage.

We shall seek advice from forest extension officials to avoid unsuccessful or inappropriate thinning. We shall remove the trees that have been cut down, or use them as firewood.
8. MAINTENANCE OF COPPICE
In Cambodia, coppiced forest is abundant. Coppice grows from the trunks of trees that have previously been cut for use. It grows mainly in sparse forest areas. Coppices can be harvested every 4-10 years according to desired product, such as poles or firewood. However, its success also depends on the soil quality, and therefore, after harvesting the coppice, we shall take good care of the trunks. During the intervals between harvests, farmers need to clean the trunk after harvest, and to take care of the coppice stems.
8.1. Additional work to enable the coppice to grow well after the harvest

After the harvest, cleaning of the trunk is the most crucial work, so that the coppice can grow fast and strong. After exploitation, there are two types of trunks:
- Old trunks with existing coppice;
- New trunk, first cut of plantation or natural forest.

Whatever the type of trunk, the method of cleaning is the same and follows for guidance below:
- The new trunk shall be cut very close to the ground;
- The cut surface shall be leveled but shall be slightly sloped to allow water to flow off the surface; and
- The old trunk shall be cut close to the old cutting surface.
8.2. Coppice maintenance
8.2.1 First year
After cleaning the trunk, we shall clear the surrounding weeds and grass to enable enough sunlight to access the trunk. The coppice from the new trunk needs sufficient sunlight to grow fast and strong. If the coppice is in the shade, it will grow at a slower rate.

At the end of the first year of coppice growth, we can identify which are good or bad. Then we can cut out the bad stems and keep the good, healthy coppice to 3-4 stems per trunk. The remaining coppice will then be able to develop at full capacity.
8.2.2 Subsequent years
We shall gradually cut away some branches to allow the stems grow faster and to have sufficient sunlight to nurture other plants underneath. The branches should be cut as close to the stem as possible.

- We shall clear away vines that are climbing the trees.
- For coppice that has been harvested many times, where the soil has become infertile, we shall use decayed residues and wastes to enrich the soil fertility.
- When the coppice becomes bushy again after trimming, we shall thin out the stems which are weak, not straight, or useless, so that the remaining stems can grow faster. We shall not cut all the coppice stems from any one trunk. If there are technical requirements, you should consult the nearest forestry extension officials. It is necessary to thin gradually so that we can observe the development of the trees and their needs.
- We shall prevent forest fires every dry season.