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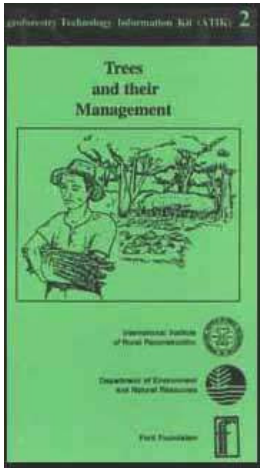

- A guide for the inventory, identification and screening of native plant species with potential for agroforestry
- Fruit trees for harsh environments
- Citrus production
- Jackfruit production
- Mango production
- Middle to high understory shade tolerant crops
- Low understory shade-tolerant crops
- Conserving available fuelwood

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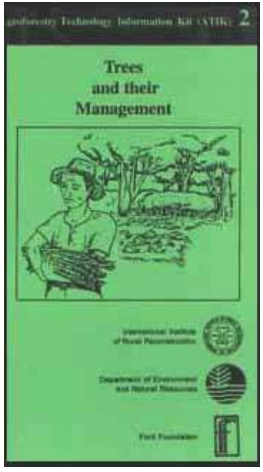

Trees and their Management (IIRR, 1992, 195 p.)

- *(introduction...)*
- Message
- Proceedings of the workshop
- List of participants
- Current program thrusts in upland development
- Trees and their management
- Sustainable agroforest land technology (Salt-3)
- Outplanting seedlings
- Tree pruning and care
- Bagging of young fruits

- Establishing bamboo farms
- Philippine bamboo species: Their characteristics, uses and propagation
- Growing rattan
- Growing anahaw
- Growing buri
- Shelterbelts
- Bank stabilization
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Agroforestry technology information kit (ATIK)
November 1992

International institute of rural reconstruction (IIRR)
Silang 4118, Cavite, Philippines

Tel. No. (0969) 94-51
Fax. No. (632) 522-24-94

Department of environment and natural resources (DENR)
Visayas Ave., Diliman
Quezon city, Philipppines

Ford foundation (FF)
6th Floor, Doa Narcisa Bldg.
Paseo de Roxas, Makati
Metro Manila, Philippines


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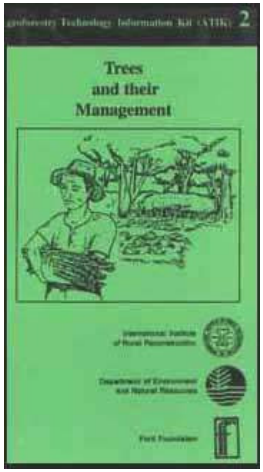
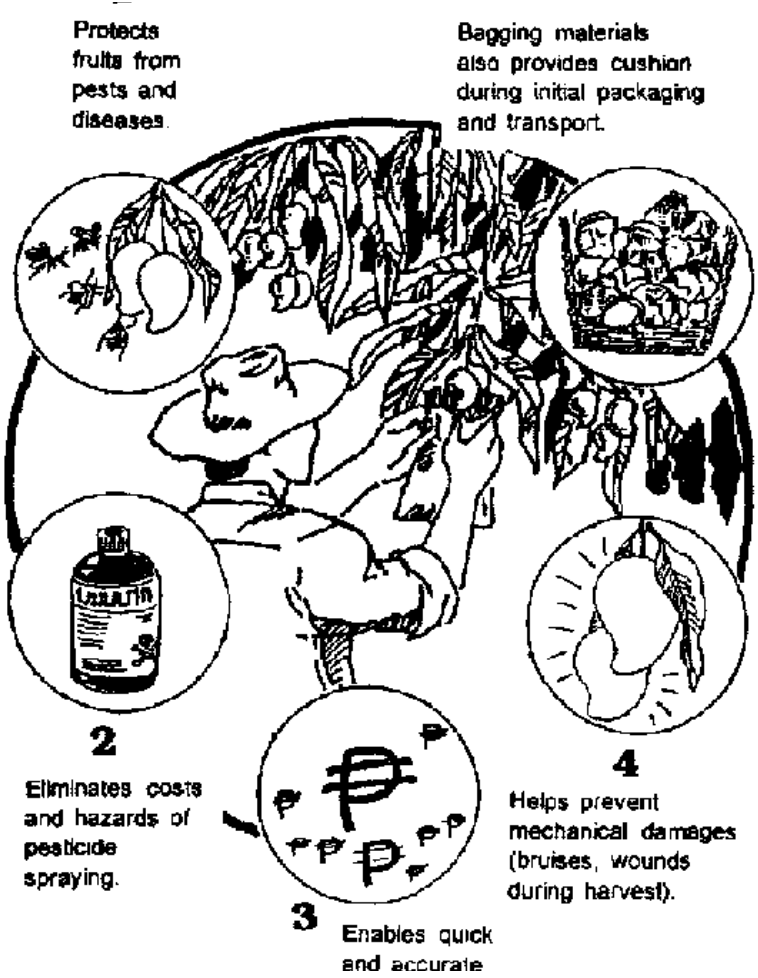


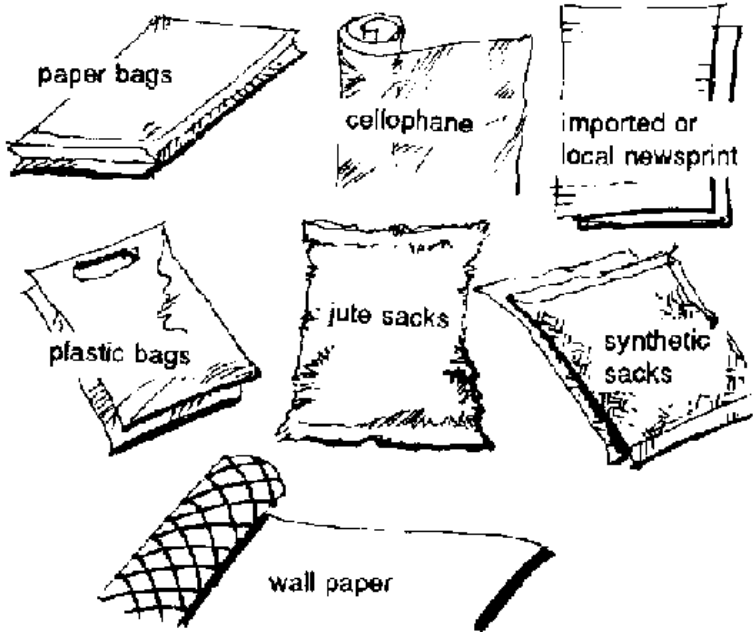
Bagging of young fruits

1 5


Protects fruits from pests and diseases.
Bagging materials also provides cushion during initial packaging and transport.
2
Eliminates costs and hazards of pesticide spraying.
3
Enables quick and accurate
4
Helps prevent mechanical damages (bruises, wounds during harvest).

estimate of harvest.

Importance



Commonly used bagging materials

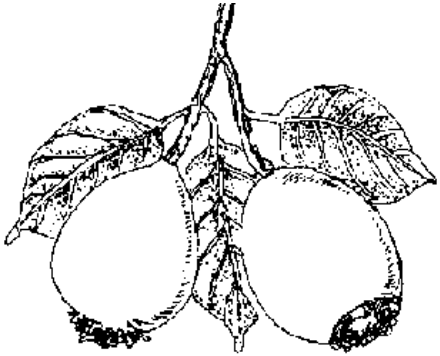
TIME OF BAGGING

1. Mango - 55 days after flower induction or 10-15 days after fruit set

2. Banana - as soon as the male blossom is removed (6-8 hand pair)

3. Jackfruit—at fist size

4. Cacao - when fruits or pods are at least 4-6 cm in length



5. Guava - right after fruit set

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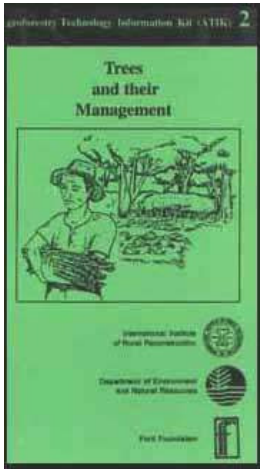


Establishing bamboo farms

SPECIES AND SITE SELECTION

Bamboo plantation should be developed with extreme caution subject to local climatic conditions and irrigation facilities to ensure adequate water supply. Selection of drought-resistant species like Kauayan tinik (8. blumeana) and Bayog (B. blumeana var. Iuzmensis) may help improve bamboo production in dry areas. Whereas in high rainfall areas, Giant bamboo (D. asper), Bolo (G. Ieois) or Buho (S. lumampao) grow better than in the low-rainfall areas.

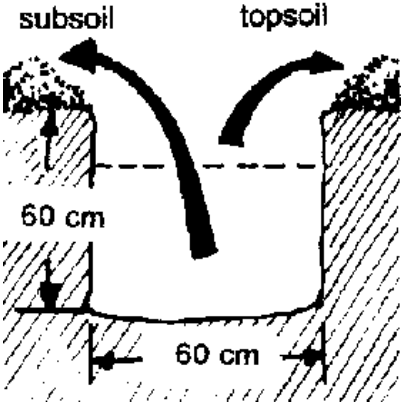
An area with moist, well-drained sand, loam or clay loam soil which is not highly acidic nor alkaline and is high in organic matter and nutrients is ideal for growing bamboos. Area not suited for agricultural crop production, along stream and riverbanks, hillsides and cogonal land can also be planted to bamboos.

SITE PREPARATION

1. Recommended spacing for kauayan tinik, kauayan kiling and kauayan tinik plantations is 7m × 7m and 5m × 5m for riverbank stabilization.

2. Clear weeds and other unwanted vegetation from the area.

3. Prepare planting holes with a dimension of about 60 cm × 60 cm × 60 cm.



Site preparation

TRANSPORT OF PLANTING STOCK

1. Harden the plants in the nursery before transporting to the planting site.
2. Load and unload the potted propagules carefully to avoid damage, especially to the roots.
3. If possible, plant the propagules immediately after transporting them to the site.

PLANTING

Planting bamboo in a plantation can be done either by direct planting of cuttings or by nursery-raised cuttings.

Planting of nursery-raised cuttings

1. Loosen the soil in the prepared hole.

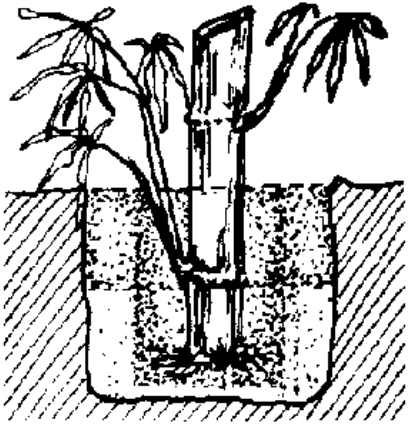
2. Cut and carefully remove the plastic bag without breaking the soil and damaging the roots of the propagules.

3. Place the propagules vertically in the planting hole with the soil intact.

4. Cover the planting stocks with well-pulverized top soil.

5. Gently compress the soil around the newly planted plants.

6. Water and mulch the plants when necessary.



Planting of nursery-raised cuttings

Direct planting of culm cuttings

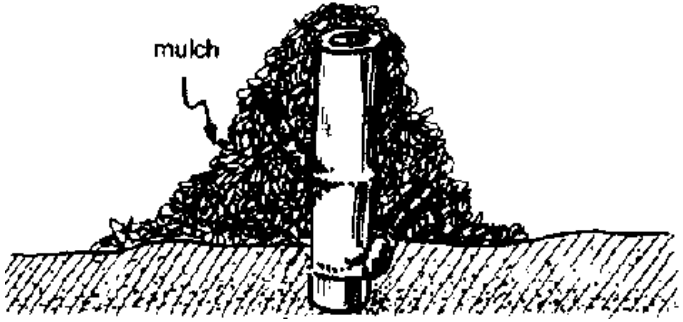
Direct planting of bamboo in the plantation may be used when the plantation area receives

enough rainfall throughout the year.

Selection and preparation of planting stock for direct planting follows the same method as that of nursery-raised cuttings. except that cuttings are directly planted in the field without the benefit of poking.

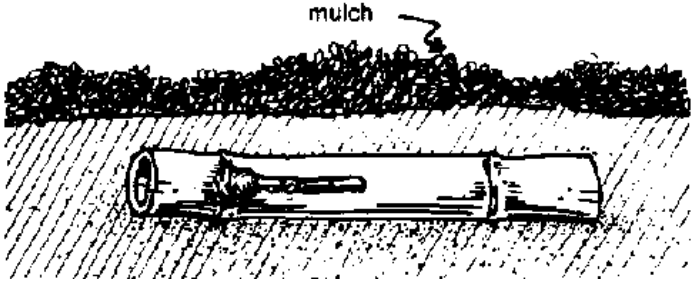
The procedures for direct planting are:

1. Haul the cuttings to the planting site/hole.
2. Loosen the soil in previously prepared planting holes.
3. Place the cuttings in a horizontal, vertical or slanting position.



The procedures for direct planting

For horizontal planting, lay the cuttings horizontally with buds sideways to the planting holes. Fill up the holes with 10 cm top soil to cover cuttings.



Water and mulch the cuttings.

PLANTATION, MAINTENANCE AND PROTECTION

1. Conduct regular ring-weeding and strip-brushing.
2. Apply fertilizer when necessary.
3. Construct firelines, if needed.
4. Replace dead cuttings immediately.

Reference: UNDP/FAO/ERDB-DENR. Manual on Bamboo Farming. Unpublished.

Plantation, maintenance and protection

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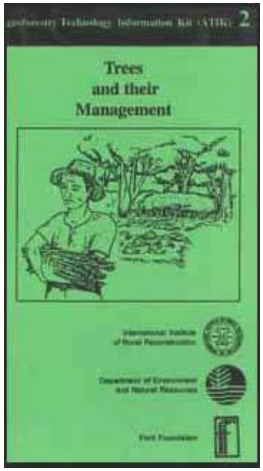

- Bank stabilization
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Philippine bamboo species: Their characteristics, uses and propagation

Bamboo is the tallest perennial grass that belongs to the Graminae family. Due to the long cylindrical woody stem strength and ease of workability, bamboo is a versatile material for a variety of economic uses: handicraft and furniture; farm implements; fishpen, fishcages and other fishing gears; banana props; musical instruments; pulp and paper; and, house construction. Aside from these, young shoots of some species are edible.

Demand for bamboo in the Philippines is steadily increasing However, the demand is not being currently met. Bamboo production is, therefore, a potential source of income for agroforestry farmers.

Bamboo

Bamboo also has ecological benefits as it minimizes soil erosion and stabilizes river banks. Bamboo thrives in a wide range of site conditions making it a suitable reforestation species for environmental protection.

According to a recent report, there are 12 genera, consisting of 49 species of bamboos that are growing in the Philippines -- 30 erect species and 19 climbing species. Nine erect bamboo species are presently utilized by industries for various purposes. These nine species are summarized in Table 3.

TABLE 3: CHARACTERISTICS OF SELECTED BAMBOO SPECIES

COMMON NAME SCIENTIFIC NAME	CULM CHARACTERISTICS Ht.	Diameter	Length of Intermode	DISTRIBUTION
	(m)	(cm)	(cm)	
1. Kauyan tinik Bambusa blumeana	10-25	10-20	40-60	Widely distributed.
2. Kauayan kiling Bambusa vulgaria	10-15	6-10	30-50	Low and medium altitudes. found in backyard along the periphery of cultivated lands, creeks and foothills.
3. Giant bamboo Dendrocalamus as,oer	20	10-20	12-40	Natural groves locally distributed in Bukidnon and South Cotabato. Cultivated lumps in Laguna, Samar and Leyte.
4. Bayog	10-15	8-12	15-30	Widely distributed in Ilocos

Dendrocalamus				Sur, Nueva Ecija, Rizal, Zambales, Pangasinan, Bulacan, Cebu, Bohol and Lanao.
5. Kaychi Gigantochloa atter	22	6-10	40-50	Natural stands and cultivated clumps in Davao, Surigao, Bukidnon, Samar and Leyte.
6. Bolo Gigantochloa levis	10-12	4-6	20-50	Growing in Laguna, Batangas, Mindoro, Palawan, Panay, Leyte, Basilan.
7. Buho Schizostachyum Iumampao	10-12	4-6	20-50	Growing in Laguna, Batangas, Mindoro, Palawan, Panay, Leyte, Basilan.
8. Anos Schizostachyum lima	6-8	2-4	12-60	Occurring in Agusan, Mindoro, Rizal, Central and Northern Luzon.
9. Laak Sphaerobambos Philippinensis	4-6	5	60-70	Cultivated in Davao del Norte on commercial scale.

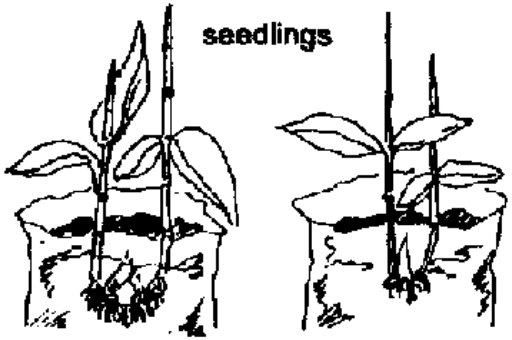
BAMBOO PROPAGATION METHODS

Use Bamboo Seeds. Producing bamboo using seeds is not common due to irregular flowering and fruiting of bamboos; if seeds are produced, a large percentage are infertile and have short viability. However, it is better to utilize them if seeds are available.

Bamboo seeds

Sow bamboo seeds directly in pots (polyethylene bags) or germinate them first in seedboxes or nursery beds. Seeds germinated in seedboxes may be pricked out and transferred in plastic bags after two months or more. Use either ordinary garden soil or sandy loam mixed with compost as a potting medium.

Enhance and maintain the health and vigor of the new bamboo plants. Water plants regularly. Remove competing weeds. Apply either organic (farmerprepared compost or commercially-prepared compost like biotab) or inorganic fertilizers like Urea (46-0-0) or complete (14-14-14).

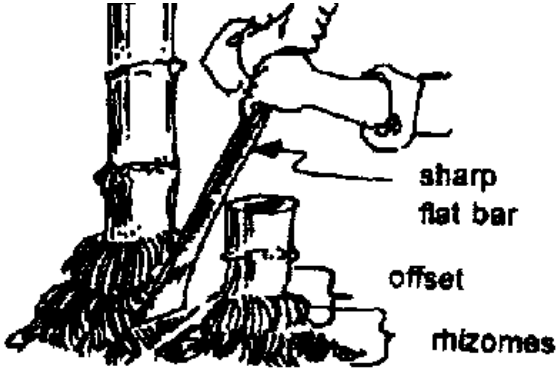


Seedlings

Use of Vegetative Parts. Vegetative parts of the plant like offset, culm cuttings and branch cuttings are preferred propagating materials.

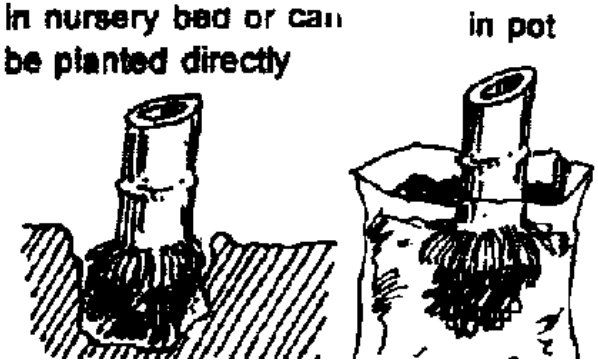
Offset

The offset method can be applied to bamboos such as anos and buho which have loose clumps that are not producing prominent branches with well-developed basal parts. These bamboos are difficult to propagate either by culm or branch cuttings.



The offset method can be applied to bamboos

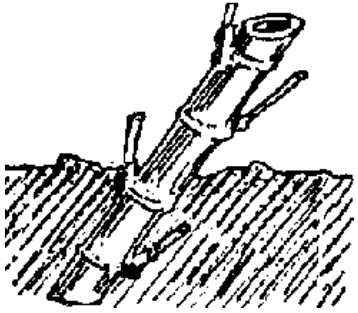
Collect the offset from one to two-year-old culms during the rainy season. Planting offset directly in the field can be done. However, it is better to first raise them in the nursery to ensure higher survival and better growth and development once they are transplanted.



Collect the offset from one to two-year-old culms during the rainy season

Culm cuttings

Longer culm cuttings (2 to 4 nodes) of many species of bamboos are traditionally planted directly in the field. This method is used if planting materials are near the planting area or if the purpose is only to raise a few clumps.



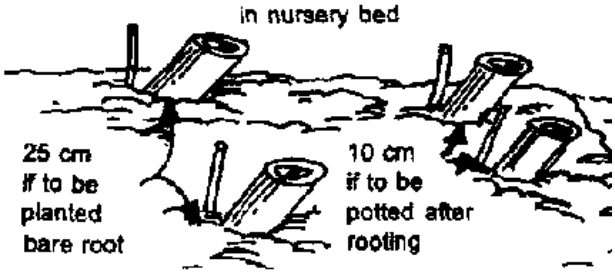
Culm cuttings

One-node culm cuffings

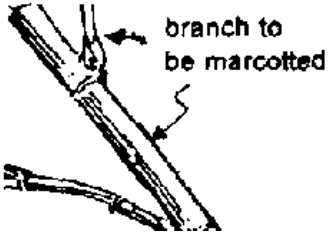
To propagate one-node culm cuttings, it is preferable to collect the culms during rainy season. Prepare the cuttings by pruning the upper portion of the branches. Saw the culm into one-node cuttings ensuring that each cutting has a branch with a prominent swollen basal portion.

These one-node culm cuttings can be raised in containers or in nursery beds. Plant the cuttings in a slanting position with the branch stub at the upper side of the node. Plant the cuttings with a portion of the culm internode the branch node exposed. Ordinary garden soil or sandy loam soil is the preferred growing medium.

One-node culm cuffings



In nursey bed

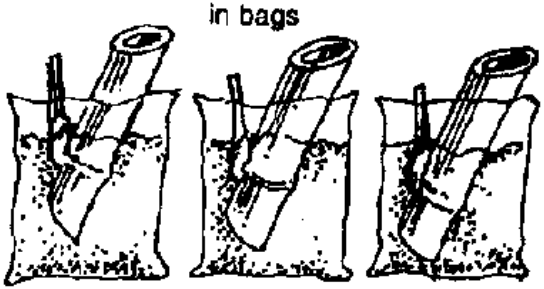


In bags

For faster and easier rooting of culm cuttings, propagate initially in a sand bed with a misting system.

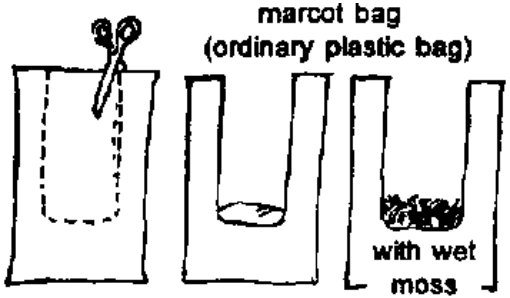
Branch-marcot culm cutting

This method can be applied using secondary culms which are characteristically smaller than mature primary culms. This method works best in culms with fully extended branches and unopened leaves.



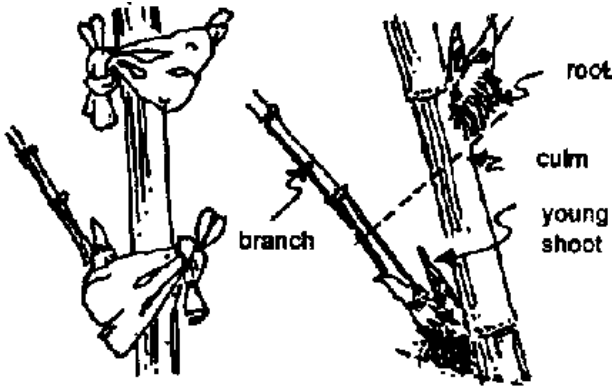
Branch-marcot culm cutting

This propagation the following materials: marcot bags, sphagnum moss and coir dust or any similar waterabsorbing material.



This propagation the following materials: marcot bags

Fill marcot bag with moist sphagnum moss securely tied around the culm. Cover only the lower side of the branch base with sphagnum moss. After 15 days, when roots show through the moss, cut the culm and prepare onenode rooted culm cuttings. Rooted cuttings are planted in pots (plastic bags) with ordinary garden soil or sandy loam mixed with compost.

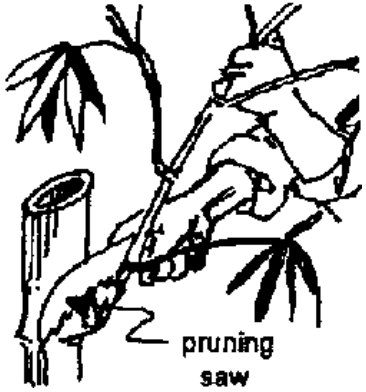


Rooted cuttings are planted in pots

Branch Cuffings

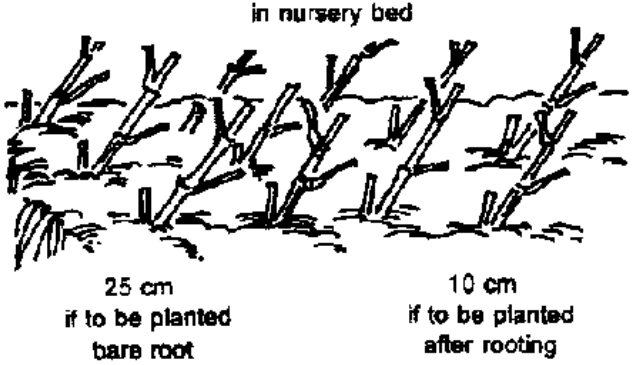
Bamboo, such as bayog, kauayan tinik and kauayan kiling which produce prominent branches, can be propagated using branch cuttings preferably during rainy season.

Gather branch cuttings with two to three nodes from one to two-year-old culms. Select branches with a well-developed base and aerial root primordia. During collection, be sure not to damage the basal part of the branch and buds.



Branch Cuffings

Branch cuttings can be raised in pots or in nursery beds after collection. Branch cuttings, similar to culm cuttings, can be better rooted in a propagation sand bed before transplanting them to pots or plastic bags.



In nursey bed

To plots or plastic bags

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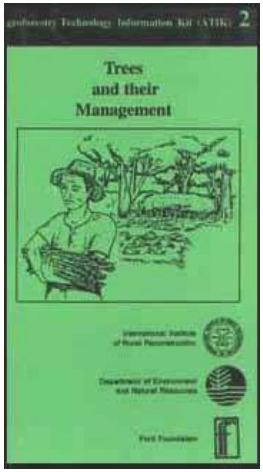


Growing rattan

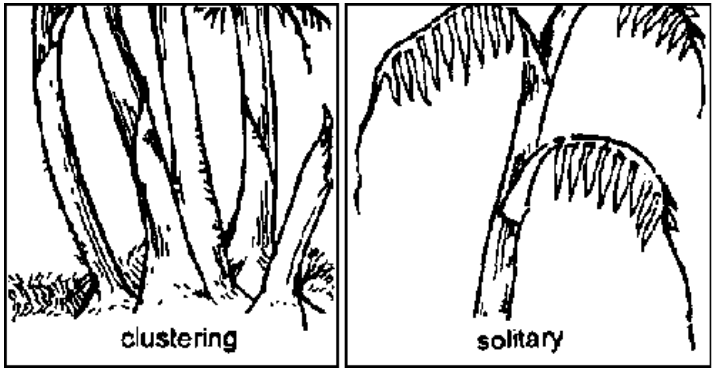
Rattan is a non-timber resource of the Philippine forest. It is the mainstay of a thriving furniture industry which generated an export value of $186.5 million in 1989. Rattan shared about 70 percent of this export amounting to US $138 million.

Rattan is a potential crop for agroforestry projects. As a projects crop, it has some advantages over other perennials of economic value. It can be planted in communal tree farms where other forest trees of commercial value, with 25-35 years rotation, have been planted. The required permanent crops, such as forest trees and fruit trees, for an upland agroforestry development can serve as the support crop for rattan. The integration of rattan plant in a community forest or any tree farm can add to land productivity. Also, while waiting for the harvest of rattan, protection and conservation of watershed areas can be enhanced.

Like other ornamental palms, rattan belongs to the Palmae family. Aside from the manufacture of fumiture, for which it is noted internationally and locally, rattan is used for making fish traps, sleeping mats, baskets, twines, toothbrushes and even the skirts of women of some tribal groups.

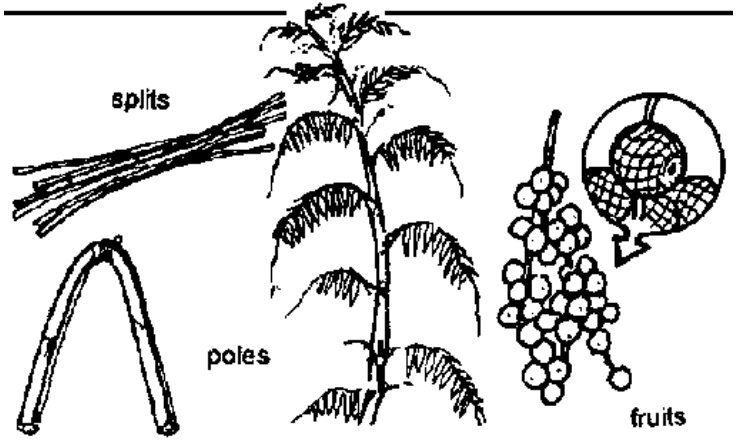
CHOICE OF SPECIES

There are about 90 rattans found in the country. They belong to four genera, namely: Calamus, Daemonorops, Korthalsia and Plectocomia. In commerce, there are 12 known taxa noted for its economic value. They are grouped as clustering or clump-forming and solitary types. The clustering type regenerates by itself. After the mature canes are gathered, there are a number of suckers left which when properly protected and properly raised can also be harvested later. The solitary type is also commercially valuable. However, after harvesting, there is a need to renew the planting.



Clustering, solitary

The choice of species will depend on the end-product a farmer wishes to produce. Rattan can be raised for the production of canes or poles and for its edible fruits. For pole production, it will take 11-15 years before the first pole can be harvested. On the other hand, a seven-year old rattan can bear its first fruits (in case of lituko, Calamus manillensis).



The planting technology for the clump-forming type

The planting technology for the clump-forming type, such as palasan and limuran, is already available.

TABLE 4: SELECTED RATTANS OF ECONOMIC VALUE.

COMMON NAME	SCIENTIFIC NAME	DISTRIBUTION	USES
Palasan	Calamus merrillii	Luzon, Palawan, Mindanao, Masbate	furniture food (young shoots)
Limuran	C. ornatus var. Philippinensis	Luzon, Mindoro, Negros, Mindanao	furniture food (young shoots)
Sika	C. caesius	Palawan	Basketry

Sika	C. caesius	Palawan	Basketry
Panganpanganan	C. filispadix	Palawan, Luzon	Fumiture Basketry
Siksik	C. microspharion	Palawan	Basketry
Panlis	C. ramulosus	Luzon	Basketry
Lukuan	C. reyesianus	Luzon	Fumiture
Malaccacane	C. scipionum	Palawan	Fumiture
Tumalim	C mindorensis	Luzon, Mindanao	Furniture
Lituko	C. manillensis	Luzon, Mindanao	Food (fruits)
Lambutan	C. dimorphacanthus var halconensis	Luzon, Mindoro, Panay Is., Mindanao	Fumiture Basketry
Arorog	C. javensis	Palawan	Furniture
Ditaan	Daemonorops mollis	Luzon, Visayas, Mindanao	Fumiture
Hiyod	Daemono-rops pedicellaris	Leyte, Mindanao	Basketry

SITE REQUIREMENTS

Based on the initial trial on growing rattan, the sites/areas suitable for its growth are the logged-over forests or the residual forests, communal tree farms, reforestation projects and other tree farms not scheduled for harvesting for the next 15 years. Agricultural lands planted with coconut and rubber trees are also potential sites.

Site requirements

SOME SITE FACTORS TO CONSIDER

1. Soil - Rattan grows best in deep, fertile alluvial soils with high moisture and organic content. The best sites are observed to be either sandy clay or clay loam. Rattan thrives best in soils with pH of five to almost neutral. However, in some areas where soil acidity is high, rattan exhibits fast growth once the forest canopy is opened to allow sunlight to reach outplanted seedlings.

2. Topography and elevation - It has a wide distribution and altitudinal range. In most Asian countries, it can thrive at low to high elevations of 200 to 2900 m above sea level. The topography should not be too steep.

3. Climatic requirements - Rattan grows almost everywhere in the Philippines. Rattan introduction on areas with type II climate (no dry season with very pronounced maximum rain period from November to June) has tremendous advantages over areas within types I and III climates.

ACTIVITIES IN RATTAN PLANTING STOCKS

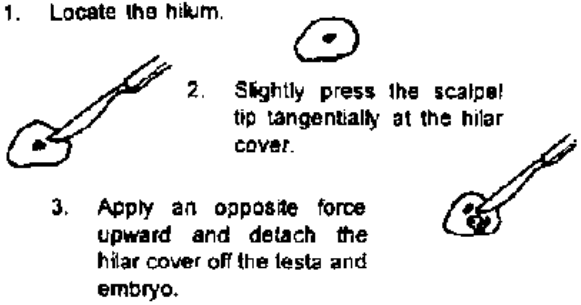
The steps involved in the preparation of planting materials from seeds in the nursery are as follows:

1. Seed Collection and Procurement - Ripe fruits can be gathered from August to November.

2. Seed Extraction and Cleaning - Done immediately after fruit harvest. Depulping is done by hand maceration.

3. Pre-germination Treatments by Hilar Removal Hilar removal was found to hasten germination from the former 90 days to 2-3 days.

4. Fungicidal Treatments - Seeds can be soaked overnight in Delsene Mx or Captan at 2.5 q/li of water.



Locate the hilum

5. Germination -- Seeds are sown in wet gunny sacks or in sterilized soil. The development of

germinants can be observed 2-3 days after sowing.

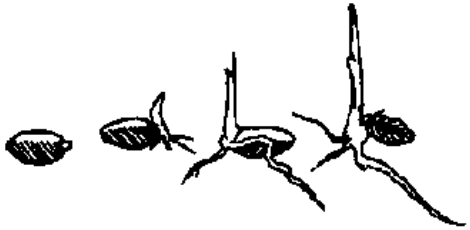
6. Transplanting - Germinants are carefully pricked and planted in plastic bags.

7. Fertilization - Complete fertilizer may be applied at a dosage of five to six grams per pot.

8. Watering and Occasional Weeding

9. Root Pruning and Hardening

10. Hauling of Seedlings to the Plantation Site

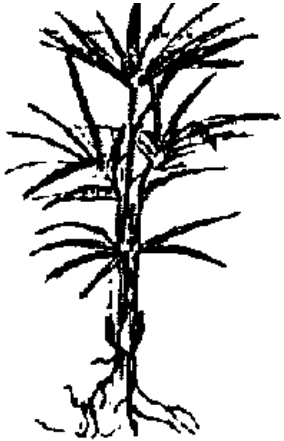


Germination process

Rattan planting stocks can be raised

Rattan planting stocks can be raised through collections of wildlings -- natural germinants found on forest floors. When properly earth-balled and transported, wildlings can be directly planted in the desired plantation site. Otherwise, wildlings should be raised in plastic bags in the nursery. The wildlings or seedlings are ready for outplanting when they reach a height of 30 cm. Through tissue culture, rattan explants can also be used.

Below are the illustrations of Palasan and Limuran for reference. (A)



Below are the illustrations of Palasan and Limuran for reference. (B)

ACTIVITIES FOR OUTPLANTING/PLANTATION ESTABLISHMENT

1. Sib Preparation - Clearing, hole digging and staking

2. Outplanting - Removal of plastic bag without breaking the ball of earth. Rattans can be planted at a density of 400 plants/hectare.

3. Maintenance and Protection -- Weeding, replanting and fertilization

4. Opening of the canopy -- Done to allow adequate sunlight by removing branches.

5. Mulching -- For areas with prolonged dry spells.

GROWTH AND YIELD

Based on research studies and observations, Palasan and Limuran exhibit a grass stage for approximately three years. When the climbing organs (flagellum or cirrus) develop, the canes grow at the average rate of 0.70 m per year. Considering this annual cane growth, at least two four-meter poles of merchantable canes can be harvested from every plant on the 15th year. A four-meter pole of 1 inch diameter can be sold for P15.

HARVESTING

Mature canes can be harvested manually with the use of a bolo. Once the cane is cut, it is pulled manually to attain as much merchantable length as possible. The thorny leafsheath is removed by bolo or by rubbing the stem against a tree. Cleaned canes are cut into four-meter length and then bundled.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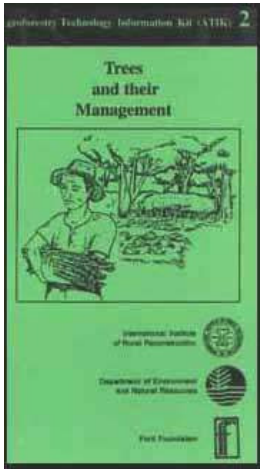
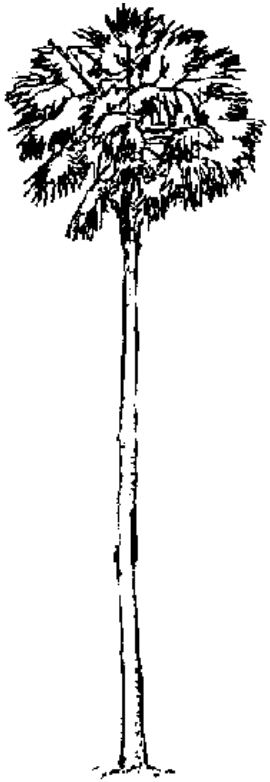
Trees and their Management (IIRR, 1992, 195 p.)
(introduction...)
Message
Proceedings of the workshop
List of participants
Current program thrusts in upland development
Trees and their management
Sustainable agroforest land technology (Salt-3)
Outplanting seedlings



Growing anahaw

DESCRIPTION

Anahaw or anahau (Livistona rotundifolia) is an erect palm reaching a height of 15 to 20 m and 25 cm in diameter. The trunk is smooth, straight, and marked with close, rather shallow obscure rings which are the leaf scars. The leaves are crowded at the top of the trunk and ascending. The green, smooth, flattened petiole may have hard, black spines. The circular, fan shaped, pleated leaf blades are 1 m in diameter and divided into segments 2.5 to 4 cm wide. The green flowers are 2 mm long. The fruit is 1.5 cm in diameter, fleshy and yellow with a hard, round, brown seed inside.

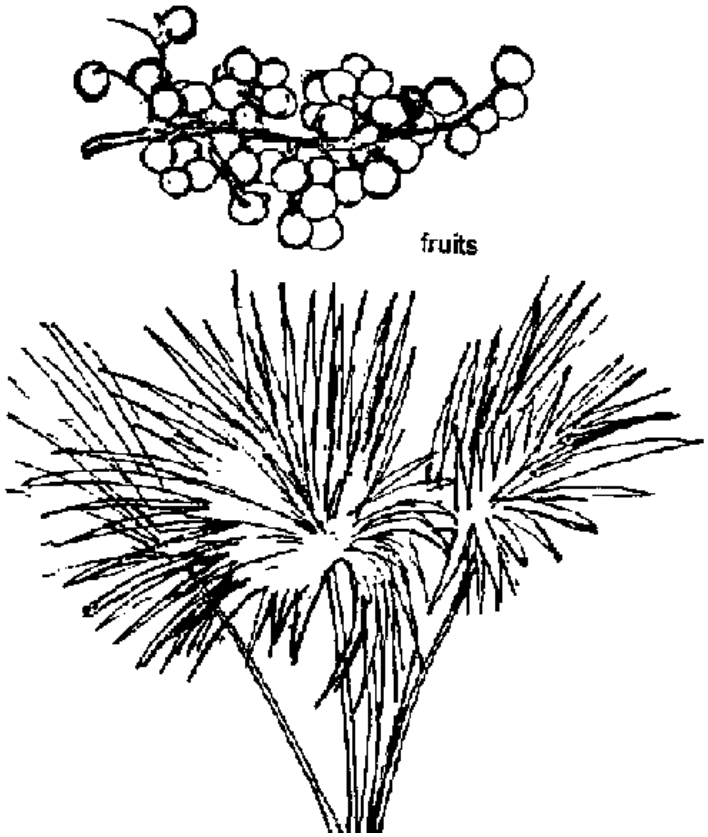


Anahaw plant

DISTRIBUTION

The species is endemic to the Philippines and most commonly found in Luzon (Benguet, La

Union, Cagayan, commonly found in Luzon (Benguet, La Union, Cagayan, Pangasinan, Zambales, Pampanga, Laguna, Ouezon, Camarines, Albay), Negros, Cagayan de Oro and in the provinces of Mindanao.



four-year old
anahaw palm

The species is endemic to the Philippines and most commonly found

USES

Anahaw is often planted as an ornamental plant for indoor and outdoor as it remains bright green even in very dry environment. The trunk is hard, strong and durable. It can be split into strips for flooring, siding and even handles of tools. It is commonly used as posts, piles in fishpen and poles. The buds and shoots are cooked as a vegetable. Mature leaves are used as roofing of houses in rural areas. The leaves last up to 15 years when properly used. The young leaves are made into raincoats, hats, fans and containers for rice, charcoal, etc.

SITE REQUIREMENTS

Typically, anahaw occurs beneath the canopy of dipterocarp and mixed species forest. It is normally scattered in forests at low to medium altitudes. It also grows on brushlands and under coconut plantations.

SEED TECHNOLOGY

Seed Collection

The best time to collect Anahaw fruits is when they are orange in color and still in the branchlets. Fallen fruits are prone to decay and fungi attack. Anahaw fruits can be collected by climbing and chipping off the branchlet using an extension pruner or a pole with a scythe

Seed Extraction

Place the newly collected fruits in clean sacks and store under a shade or inside the room for 3 to 5 days to loosen the pulp. Fruits stored this way easily ripen. After 5 days, the fruits are macerated by putting them in a basin of water to soften the pulp.

Remove the decayed pulp to extract the seeds. Immediately after depulping, soak the clean seeds in water to minimize loss of moisture. Sow the seeds on the same day.

Sowing

The folk technology (Torrente, 1990) involves two steps: (1) sow freshly depulped seeds evenly on previously prepared seedbeds; (2) press the seeds lightly in the seedbeds and cover them with soil; and, (3) cover the seedbeds with coconut leaves, cut grass or other mulching materials. Germination starts approximately 1 month after sowing.

A newly developed technology (ERDS, Region V) involves five steps:

1. Use freshly depulped seeds and remove the covering of embryo with a flat pointed knife, cutter or scalpel. This is to facilitate entry of water and air to the seed.

2. Lay-out seeds on trays lined with white tissue paper or sterilized jute sacks.

3. Saturate substrata with fungicide solution prepared (1 tsp Benlate per 2 li water).

4. Cover the sprouted seeds with the substrata material, then place a polyethylene sheet on top of the trays to preserve seed moisture.

5. Germination starts 2 to 3 days from sowing and a button-like structure will emerge at least 3 mm from the opened hilum.

Seed Storage

Seeds may be stored for 4-6 weeks without losing their viability by keeping them in airtight containers, cans or sealed plastic bags.

NURSERY PRACTICES

Potting

Grown seedlings should be collected from the seedbed when they have developed 1 cm root and 1 cm shoot. Potting is done in 4" × 6" polyethylene bags containing a mixture of 1:1:1 top soil, saw dust and sand, respectively. When the potted seedlings are 3 months old, hardening is done to prepare them for outplanting.

Maintenance of Seedlings

Potted seedlings should be kept under the green house or shed. Watering should be done every afternoon or as often as necessary. Fertilizer may be applied to the potted seedlings based on the soil and plant requirement to ensure vigorous growth.

PLANTATION ESTABLISHMENT

Site Preparation

Underbrush about 1 m strip of vegetation of the selected site where the seedlings are to be planted. Stake and dig holes at a distance of 2m × 2m prior to outplanting.

Outplanting

Outplanting should be done at the onset of the rainy season. In outplanting, the plastic bags of the potted seedlings must be removed carefully. Mulching materials should be placed at the base of the plants, while pulverized topsoil should be placed around the root system to allow good anchorage of the seedlings.

Care and Maintenance

Ring weeding should be done as often as necessary to allow normal growth and development of plants. Replace dead seedlings as soon as possible.

HARVESTING

Poles and Stems

The poles/stems are harvested et the age of 14-16 years (about 10-12 m tall and 20-25 cm in diameter). It has a natural durability period of 8 years. Poles are usually transported by trucks, with an average of 110 stems measuring 10-12 m long and 20-25 cm in diameter per truck.

Leaves

Two to three leaves can be harvested per tree per month. Spaced at 2m × 2m, a hectare of

land can accommodate 2,500 plants with a corresponding yield of R18,000/year with a conservative price of PO.30/leaf

PESTS AND DISEASES

Livistona shoot borer girdles or cuts off young shoots, resulting in stunted growth and eventual death.

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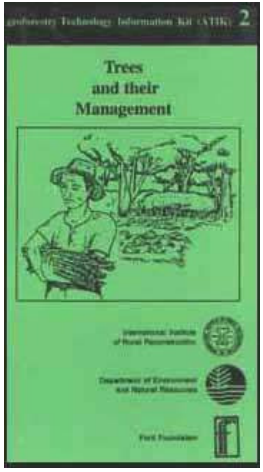
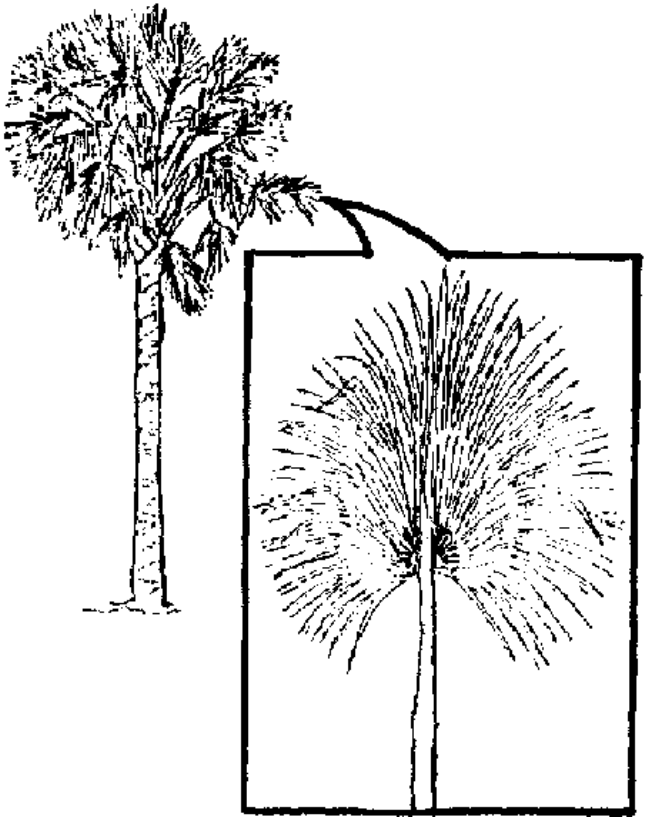


Growing buri

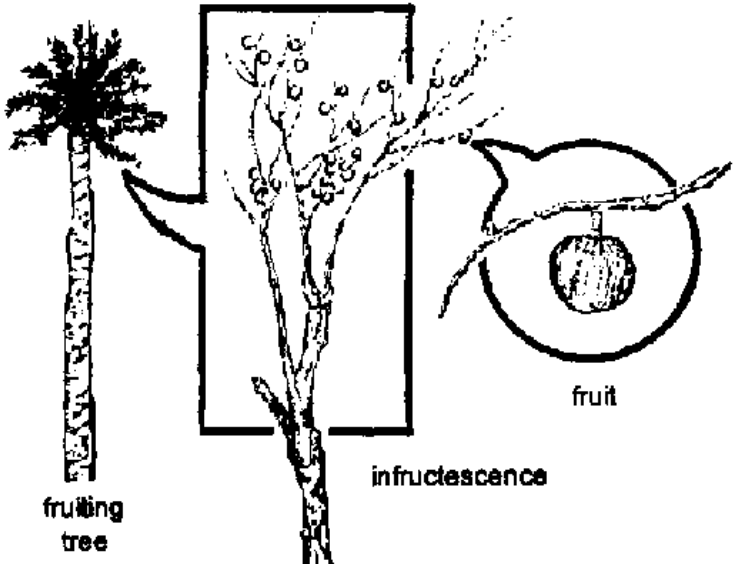
Buri (Corypha elate) is one of the Philippine palms with multiple uses. Buri can survive 70 to 100 years and, for this reason, it is known as the centennial plant by many rural people.

Buri palm has many domestic and industrial economic uses, making it well known in local and international markets. Buntal fiber is the chief raw product and has a variety of uses. Buri is

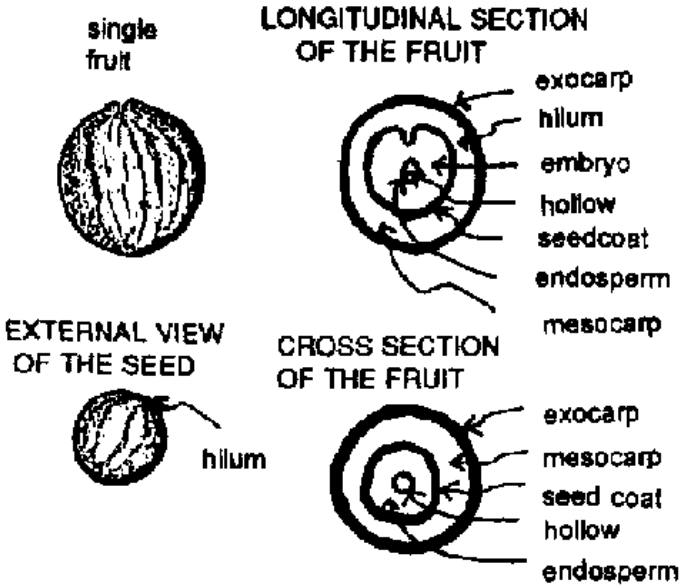
second to coconut and comparable to nipa in terms of economic and industrial importance.



Buri



Fruiting tree



Longitudinal section of the fruit

SITE REQUIREMENTS

Buri is widely adaptable to all types of soils. It grows best at low altitudes although it can thrive on hills and plateaus up to 600 m above sea level.

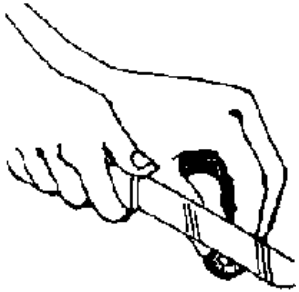
PROPAGATION METHODS

Natural regeneration of burl occurs when ripe fruits naturally fall on the ground or are dispersed by animals such as fruit bats.

In field conditions, seed pre-treatment using hilar removal plus soaking the seeds overnight in a fungicidal solution can accelerate germination. Sowing seeds in sterilized soil can yield satisfactory seed germination results.

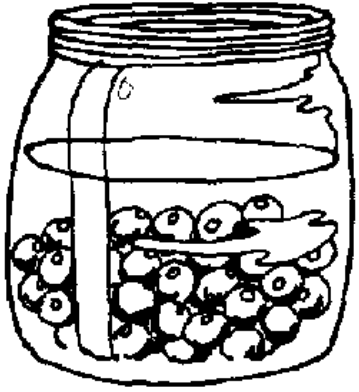
RECOMMENDED PROCEDURE FOR THE RAPID GERMINATION OF BURI

1. If the fruits were collected from the source, the pulp should be yellowish to brown in color indicating the relative maturity The fruit must be sun-dried for 2-3 days, then macerated to remove the pulp and other impurities. Seeds should be washed thoroughly with water.



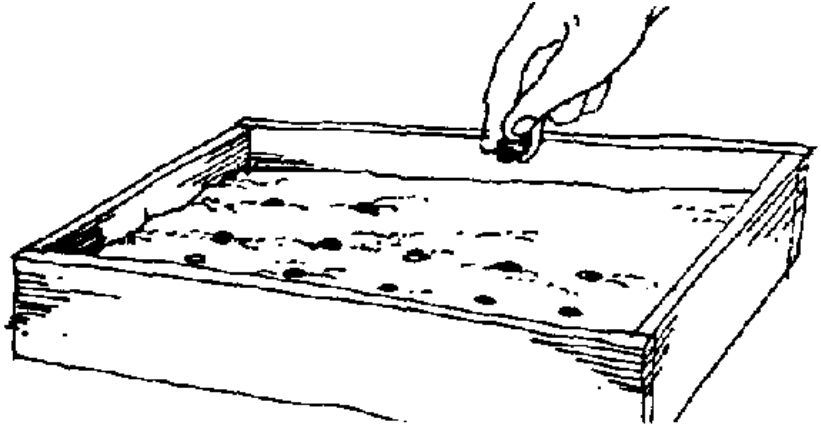
Then macerated to remove the pulp and other impurities

2. Remove the hilar cover by using a sharp cutter. Check to ensure that the embryo is attached to the endosperm of the seed. If not attached, soak the seeds in water for 1 to 2 weeks. If the embryo is already attached to the endosperm of the seed. remove the hilum. Soak the seeds overnight the fungicidal solution (Delsene Mx or Captan) before sowing.
3. Sow the seeds in plastic trays with 3 sheets of filter paper. In the absence of filter paper, a seed germination box may be used.



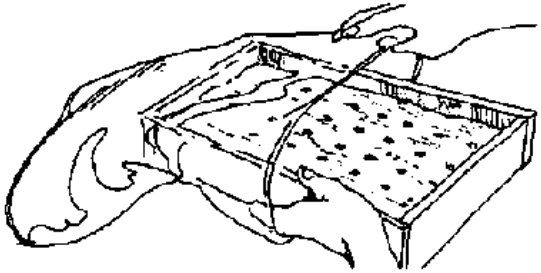
Sow the seeds in plastic trays with 3 sheets

4. Wrap the trays with plastic bags to avoid excessive drying of the substrate.



Wrap the trays with plastic bags

5. Germination starts after 2-3 days. Two-week old germinants can be planted in polyethylene bags filled with soil.



Germination starts after 2-3 days

6. When four leaves have appeared, the seedling may be planted in the field.

PLANTATION ESTABLISHMENT

1. The area should be cleared of brush.

2. Staking and preparation of planting holes are done one month before outplanting. The recommended spacing is 6m × 6m.

3. Ring weeding should be done every month. However, it is recommended to brush the whole area every three months.

4. Dead seedlings should be replaced immediately.

HARVESTING

Buri leaves can be harvested at 7 years. The scarcity of raw materials for handicraft-making is the result of the vanishing natural stands in the country.

Several parts of the burl palm have many uses:

Leaves	- used as weaving material for bags, wallets, hats, trays, placemats, tissue holders, hampers and mats; used as covers for tobacco bales and also for thatches and walling. Young leaves are used in wrapping rice cakes.
Petioles	- made into buntal fibers, hats, ropes, baskets, wallets and bags; pounded and made into brooms.
Midribs	- used in making sale sets, hampers, waste baskets, trays, tables, cigarette cases, brooms and other items.
Sap	- fermented to produce wine (locally known as tuba), alcohol and vinegar; made into syrup, sugar, jam, muscovado sugar (panocha) and starch.
Buds	- eaten raw or cooked as vegetable dish.
Young seeds	- The endosperm are cooked and made into sweets.
Mature seeds	- used as buttons, playing marbles and rosary beads.
Raffia fiber	- utilized in the manufacture of cloth, good quality hats, mats and bags; The coarse fiber of young buds are made into ropes and sacks.
Pitch or Ubod	- used in salads, pickles and other recipes.

Roots	- Water from boiled roots is used as a herbal medicine beverage.
Bahi	- (the outer part of the trunk) as lumber for building/construction materials.
Whole frond	- used as shelter for fish.

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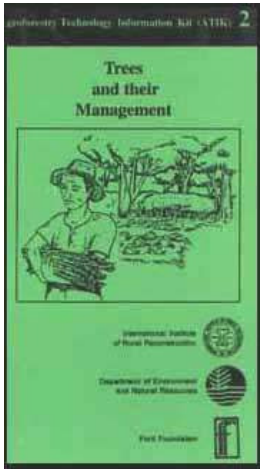


Shelterbelts

Shelterbelts or windbreaks are strips of vegetation composed of trees, shrubs and vines to protect croplands from destructive winds. When established on hills, they can also act as buffer strips to minimize soil erosion. Along rivers, streams or creeks, they serve as a bank protection along farm borders, they serve as live fence and firebreaks. Shelterbelts also serve as source of agroforestry products.

Shelterbelts/windbreaks are recommended particularly in the eastern portion and other areas in the country frequently visited by typhoons.

COMPOSITION OF SHELTERBELTS

Properly established shelterbelts should be dense in their lower part and more open in the middle and upper parts. The vegetative mixture of a good shelterbelt is approximately 65 percent shrubs and vines and 35 percent tall and medium-sized trees.

Shelterbelts

CHARACTERISTICS OF SPECIES FOR SHELTERBELTS

In choosing species to be used in shelterbelts, the following should be considered:

1. The species should be wind-resistant.
2. It must have a deep and well-spread root system.
3. It must have a small crown and light branching habit.
4. Easy to propagate and maintain.
5. Ability to coppice.
6. Can provide other economic benefits, like food, fodder, etc.

POINTERS IN ESTABLISHING SHELTERBELTS

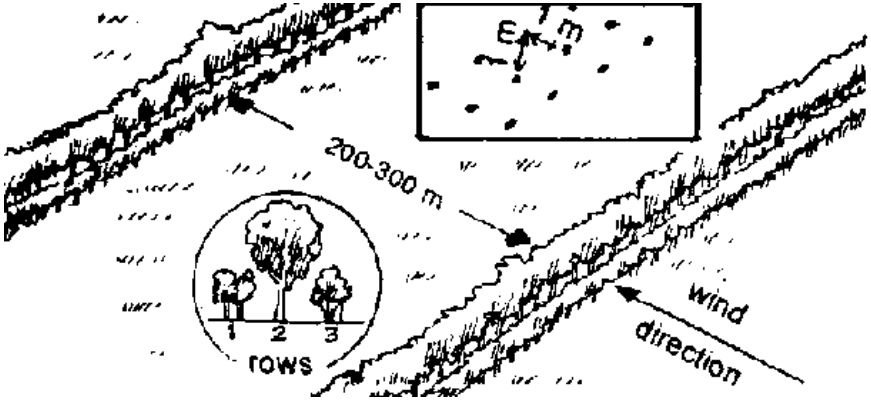
1. The strips should be more or less perpendicular to the main wind direction; on sloping land, the strips should follow more or less the contour lines.

2. The number of rows in the strips largely depends on the velocity of the wind. The higher the velocity, the broader the strip. Usually, the strip for shelterbelts is 1-5 rows.

3. The first and the last rows should be planted mainly to shrubs and the central rows, a combination of tall and medium-sized trees planted in small clusters of 2-5 plants of the same species.

4. Use the quincunx (triangular) method at 1 m distance between tree/shrubs.

5. In areas with high wind velocity, the shelterbelts should be about 100 m apart and about 200-300 meters in ordinary conditions



Pointers in establishing shelterbelts

SUGGESTED SPECIES FOR SHELTERBELTS

TABLE 5. TALL TREES/PALM M (over 15 m)

COMMON NAME	SCIENTIFIC NAME	COMMON NAME	SCIENTIFIC NAME
Anahau	Livistona rotundifolia	Mangium	Acacia mangium
Agoho	Casuarina equisetifolia	Akleng parang	Albizia procera
Narra	Pterocarpus indicus	Kamachile	Pithecellobium dulce
Teak	Tectona grandis	Kamagong	Diospyros philippinenses
Gmelina	Gmelina arborea	Thailand shower	Cassia siamea
Molave	Vitex parviflora	Niyog	Cocos nucifera
Antipolo	Artocarpus blancoi	Caribbean pine	Pinus caribaea
Santol	Sandoricum koetjape	Buri	Corypha elate
Sampalok	Tamarindus indica	Durian	Durio zibethenus

TABLE 6. MEDIUM-SIZED TREES/PALM (5-15 m).

COMMON NAME	SCIENTIFIC NAME	SCIENTIFIC NAME	COMMON NAME
Caimito	Chrysophyllum cainito	Agoho del Monte	Casuarina rumphiana
Chico	Manilkara	Duhat zapota	Syzygium cumini
Kasoy	Anacaridum occidentale	Neem	Azadirachta indica
Banaba	Lagerstroemia speciosa	Dapdap	Erythrina orientalis
Ipil-ipil	Leucaena leucocephala	Alibang-bang	Piliostigma malabaricum
Kakauwate	Gliricidia sepium	Pili	Anacardium ovatum

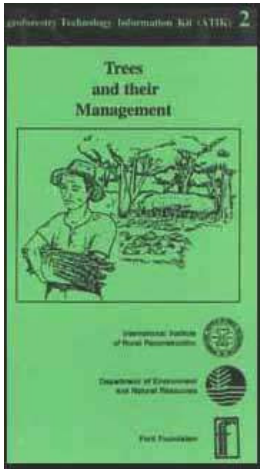
TABLE 7 SHRUBS (up to 5 m) AND BAMBOOS.

COMMON NAME	SCIENTIFIC NAME
Kawayan tinik	Bambusa blumeana
Kawayan kiling	Bambusa vulgaris
Kawayan	Bambusa spinosa
Bolo	Gigantochloa levis
Boho	Schizostachyum lumampao
Aroma	Acacia farnesiana
Bougainvillea	Bougainvillea spectabilis
Kadios	Cajanus cajan
Achuete	Bixa orellana

References:

Hensleigh, T.E. Agroforestry Species for the Philippines, U.S. Peace Corps.

Wiedelt, H.J. 1976. Manual of Reforestation and Erosion Control for the Philippines, GTZ, West Germany.



- *(introduction...)*
- Message
- Proceedings of the workshop
- List of participants
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- Sustainable agroforest land technology (Salt-3)
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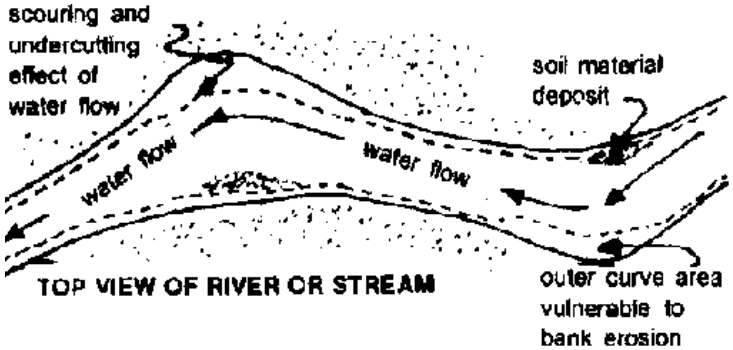
- Tree pruning and care
- Bagging of young fruits
- Establishing bamboo farms
- Philippine bamboo species: Their characteristics, uses and propagation
- Growing rattan
- Growing anahaw
- Growing buri
- Shelterbelts
- Bank stabilization
- Assessing the usefulness of indigenous and locally adapted trees for agroforestry
- A guide for the inventory, identification and screening of native plant species with potential for agroforestry
- Fruit trees for harsh environments
- Citrus production

- Jackfruit production
- Mango production
- Middle to high understory shade tolerant crops
- Low understory shade-tolerant crops
- Conserving available fuelwood

Bank stabilization

River/stream bank erosion is the scouring, undercutting or the collapse of banks of water caused by the flow of water. The factors that contribute to this type of erosion are the soil type, the velocity and the volume of water.

Protection of the river/stream bank will lead to the stabilization of the water courses, the protection of the farm from "being eaten" by the water and making productive the area along the river or stream.



Methods of river/stream bank stabilization

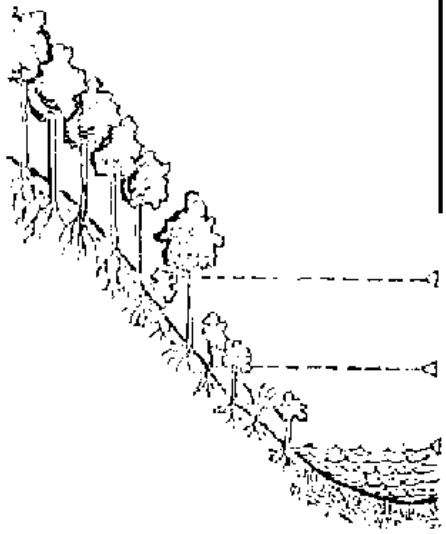
Methods of river/stream bank stabilization

A. Planting of trees, shrubs, bamboos or palms along the bank is a vegetative method of stabilization whereby the roots hold the soil in place and reduce the impact of water flow. Following are some pointers in stabilizing river/stream bank by planting:

1. In the zone from low to medium water level, only grasses and shrubs are allowed to be planted -the species that are able to survive prolonged inundation and are flexible enough not to break in the water current.

2. In the zone from medium to high water level, some tree, palm or bamboo species can be planted with grasses and shrubs.

3. In the zone above the high water level, trees, palms or bamboos are planted with or without shrubs.



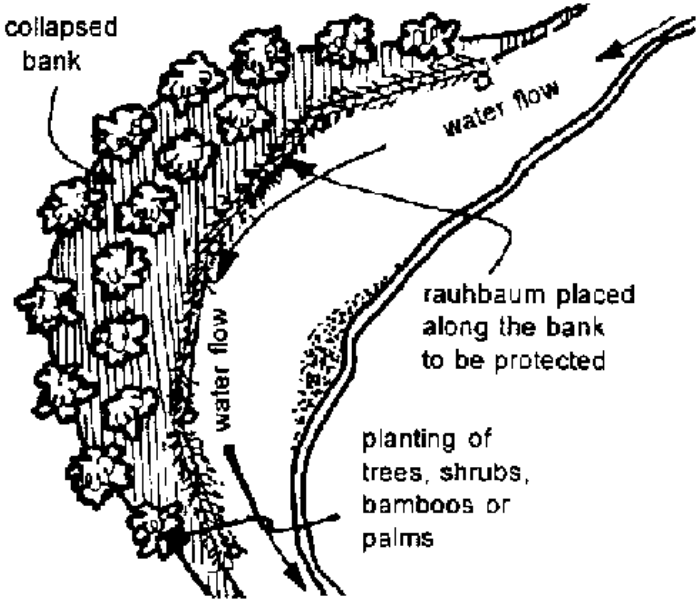
Water Level	Description of the Zone	Type of Vegetation	Recommended Species
	Zone above high water level; soil color is similar with the color of the field.	Predominantly trees, palms or bamboos with or without shrubs.	Please see attached table.
High water level (water level during rainy season)	Zone from medium to high water level. Soil color is lighter than above zone	Predominantly shrubs with some trees, palms or bamboos.	Kakawati, katuray, kamatchile, hibig, katmon, bamboo species below.
Medium water level (normal level of water)	Zone from low to medium water level; soil color is the lightest.	Only shrubs and grasses.	Guava, coronites, durnanay, bermuda, carabao, kikuyu, napier and vetiver grass.
Low water level (water level during summer).			

Stabilization of river/stream banks through planting

B. Construction of temporary and emergency measures. These measures are usually applied in areas along banks that are already collapsed or in danger of collapsing. These measures are used to support the more permanent river/stream bank stabilization.

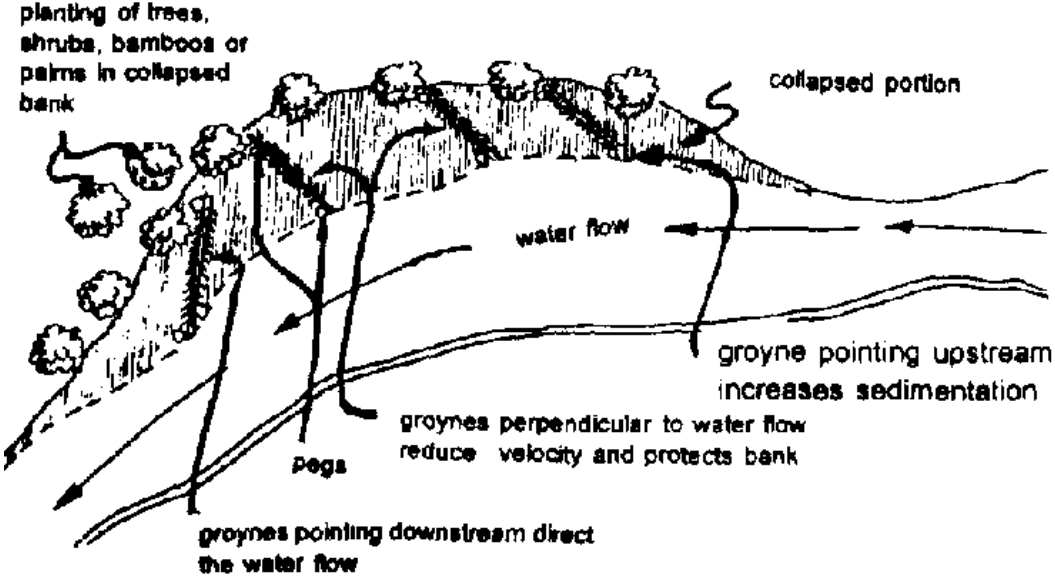
1. Rauhbaum Method -- This is the placing of dense and well-branched trees, tree tips or bamboos along the bank. It is tied and anchored by a strong peg and the butt end is pointing upstream. This measure is used to protect the bank from the direct impact of water flow while

waiting for the establishment of the more permanent stabilization measures.

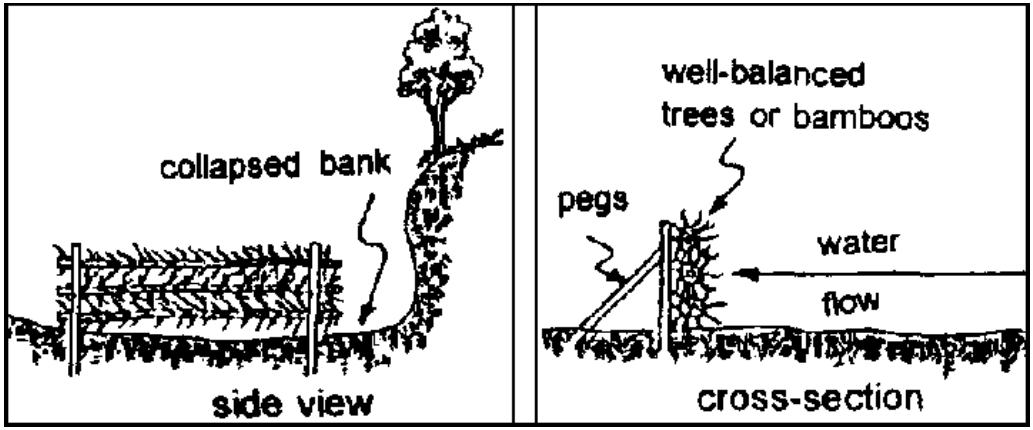


Rauhbaum Method

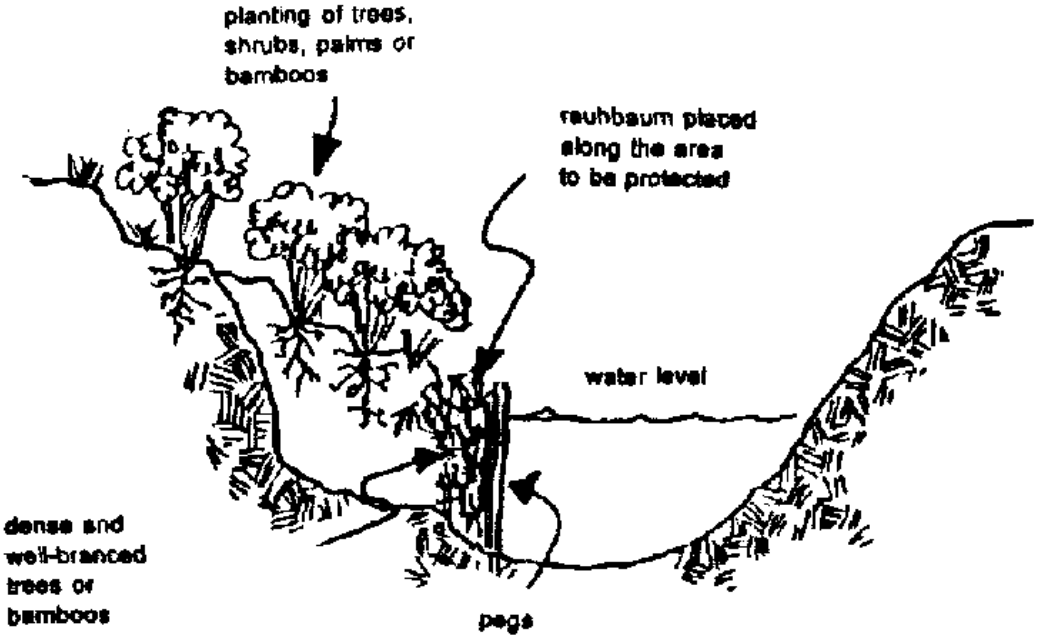
2. Temporary Groynes -- A series of temporary structures of dense and well-branched trees, tree tops or bamboos are used. These structures are placed pointing upstream, perpendicular to the flow of water and pointing downstream in order to direct the direction of flow, reduce the velocity of water and partly accept the deposition of soil sediments. The measure is used only in wide and shallow rivers or streams.



Temporary Groynes

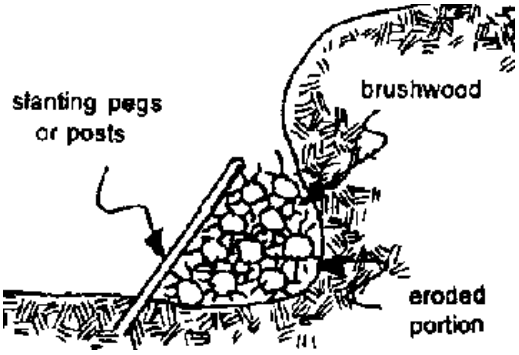


The measure is used only in wide and shallow rivers or streams.



Plugging of river/stream bank

3. Plugging of river/stream bank - This is a temporary, measure to protect banks that are in danger of collapsing by placing dense crowns of brushwood supported by pegs along the eroded portion.



Slating pegs or posts

TABLE 8. RECOMMENDED PLANT SPECIES FOR RIVER/STREAM BANK STABILIZATION (BY Region).

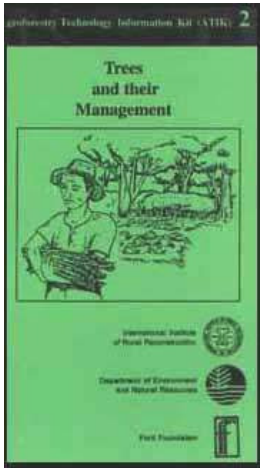
SCIENTIFIC NAME	COMMON NAME	REGION											
		1	2	3	4	5	6	7	8	9	10	11	12
Serialbizia acie	Akle	x	x	x	-	-	x	-	-	-	-	-	-
Cassia spectabilis	Antsoan dilau	x	x	x	x	x	-	-	-	-	-	-	-
Acacia equisetifolia	Acacia	-	-	x	x	x	x	-	x	x	-	-	-
Spathodea campalnulata	African tulip	-	-	-	x	x	-	-	-	x	x	-	-
Paraserianthes falcataria	Mollucan Sau	-	-	-	x	x	-	-	-	x	x	-	-
Artocarpus blancoi	Antipolo	-	-	-	-	-	-	-	x	-	-	-	-
Bamboo spp	Bamboos	x	x	x	x	x	x	x	x	x	x	x	x
Nauclea orientalis ..	Bangkal	x	x	x	x	x	x	-	x	x	-	x	x

Alstonia macrophylla	Batino	x	-	x	-	-	x	-	-	-	x	x	x
Calophyllum inophyllum	Bitaog	-	-	-	x	-	-	-	-	x	-	-	-
Ochroma pyramidale	Balsa	-	-	-	-	-	-	-	-	-	x	-	-
Diplodiscus paniculatus	Balobo	-	-	-	-	-	-	-	-	x	-	-	-
Cinchoma. succirubra	Cinchoma	-	-	-	-	-	-	-	-	-	-	-	x
Cocos nucifera	Niog	-	-	-	x	x	-	-	x	x	-	-	-
Alstonia scholaris	Dita	x	-	x	x	x	x	x	x	x	x	x	x
Dracontomelon dao	Dao	-	-	-	x	x	-	-	-	x	-	-	-
Gmelina arborea	Gmelina	x	x	x	x	x	x	x	x	x	x	x	x
Endospermum peItatum	Gubas	-	-	-	x	x	-	-	-	-	-	-	-
Intsia bijuga	Ipil	x	x	-	-	-	-	-	x	-	-	-	x
Leucaena feucocephala	Ipil-ipil	-	-	-	x	x	x	x	x	x	-	-	x
Cananga odorata	Ilang-ilang	x	-	x	x	x	x	-	x	x	x	x	x
Sterculia foetida	Kalumpang	x	x	-	-	-	-	-	-	x	-	-	-
Anthocephalus chinensis	Katoan	-	-	-	-	-	-	-	-	x	x	-	-
	Bangkal												
Toona calantas	Kalantas	-	-	-	-	-	x	-	x	x	-	-	-
Sesbania grandiflora	Katurai	-	-	-	-	-	x	-	x	x	-	-	-
Sindora inemmis	Kayugalo	-	-	-	-	-	-	-	-	x	-	-	-
Wrightia lanite	Lanete	x	-	-	-	-	-	-	-	-	-	-	-
Aleurites moluccana	Lumbang	-	-	-	-	-	-	x	-	-	-	-	-
Dracontomelon edule	Laniko	-	-	-	-	-	-	-	x	-	-	-	-

Swietenia macrophylla	Mahogany	x	x	x	x	x	x	x	x	x	x	x
Litsea perrottetti	Marang	-	-	-	-	-	-	-	x	-	-	-
Moringa oleifera	Malunggay	-	-	-	x	x	-	-	x	-	-	-
Cinnamomum mindanaense	-	-	-	-	-	-	-	-	x	-	-	-
Mindanao	cinnamon											
Pterocarpus indicus	Narra	x	x	x	x	x	x	x	x	-	x	x	x
Sandorium koetjape	Santol	-	-	-	-	-	-	-	x	-	x	x	-
Sindona supa	Supa	x	-	x	x	x	-	-	x	-	-	-	-
Tectona grandis	Teak	x	x	x	-	-	x	x	-	x	x	x	x
Ficus note	Tibig	x	x	x	x	x	x	x	x	x	-	-	-
Bischofia javanica	Tuai	-	-	-	-	-	-	-	x	-	-	-	-
Afzelia rhomboidea	Tindalo	x	x	x	x	x	x	x	x	x	x	x	x
Hevea brazilensis	Para rubber	-	-	-	-	-	-	-	-	x	-	-	x
Samanea saman	Raintree	x	x	x	x	x	x	x	x	x	x	x	x
Gliricidia septum	Kakawati	x	x	x	x	x	x	x	x	x	x	x	x
Terminalia catappa	Talisai	x	x	x	x	x	x	x	x	x	x	x	x

Sources: Area/Species Guidelines for Reforestation in the Philippines, Wiedelt, H. J. 1976. (Manual of Reforestation and Erosion Control for the Philippines, GTZ. West Germany.)

Home"" """"> ar.cn.de.en.es.fr.id.it.ph.po.ru.sw



- A guide for the inventory, identification and screening of native plant species with potential for agroforestry
- Fruit trees for harsh environments
- Citrus production
- Jackfruit production
- Mango production
- Middle to high understory shade tolerant crops
- Low understory shade-tolerant crops
- Conserving available fuelwood

Assessing the usefulness of indigenous and locally adapted trees for agroforestry

Many farmers and extension workers would like to test and promote indigenous or locally adapted tree species, but there is often little information available to them about some of these species.

Locally adapted species are attractive, because the plant material is readily available for propagation from seed, cuttings or wildlings. Because introduced species are not adapted to local pests and diseases, indigenous species may present a lower risk to the farmers. Another reason for using indigenous species is to maintain biological diversity within agroecosystems.

Assessing the usefulness of indigenous and locally adapted trees for agroforestry

These materials were prepared to provide some guidelines to assessing the potential of indigenous species for use in agroforestry systems. However, these guidelines could be applied to assessing introduced species as well.

Trees are useful because they furnish a certain product that is valued or because they perform a function that is needed. Some trees provide a combination of products and functions although no one species fulfills all the possibilities that are listed below. In assessing a species' potential usefulness for agroforestry, keep in mind the objectives and needs of the farm household. Trade-offs between benefits are usually necessary; therefore, a combination of species often provides best results.

Some of the products from trees include:

- wood (for house and pen construction, bridges, boats, carts, fuelwood, furniture, poles, fencing, packing crates, barrels, pulp, tools, implements, handicrafts and musical instruments);
- livestock fodder (from leaves, fruits, seeds);
- food for human consumption (fruits, nuts, spices, greens);
- medicines (from bark, fruits, seeds, roots, leaves, flowers);
- green manures (from clippings of leaves and small stems); and,
- industrial raw materials (gums, resins, dyes, oils).

Some of the functions of trees include:

- stream bank and watershed protection;
- soil conservation (contour hedgerows or strips);
- soil improvement (N-fixation, nutrient cycling, soil microclimate amelioration);
- shade (around houses, bordering paths and roads, etc.) or as nurse tree for coffee and cacao;
- shelterbelts/windbreaks or firebreaks;

- live fencing;
- live trellis (for black pepper, vanilla, betel leaf, ampalaya);
- insect management: bee forage (Calliandra calothyrsus, Ceiba petandra); silk production (Morus); butterfly farming and, ornamental value and spiritual value.

ASSESSING THE USEFULNESS OF INDIGENOUS TREES FOR FUELWOOD

A good fuelwood has these qualities:

It is easy to light and keep going, especially if used in a wood-burning stove. Wood that will bum when green or wet is especially useful.

It bums well but not too quickly. Many softwoods (like pine) bum up quickly, resulting in more wood being consumed.

It bums down into coals that retain their heat for slow, even cooking or for heating houses.

The stems are not too thick or can be easily split. Wood that is very hard or has interlocking grain is difficult to split into small pieces to fit in a woodburning stove.

It can be used to make charcoal. Charcoal is easier to transport than wood so fuelwood that is to be sold is often converted into charcoal first.

It does not produce irritating smoke, unpleasant odors or give a peculiar taste to food cooked over it. Some people do not like Eucalyptus for fuelwood even though it bums well, because they think it makes food taste funny.

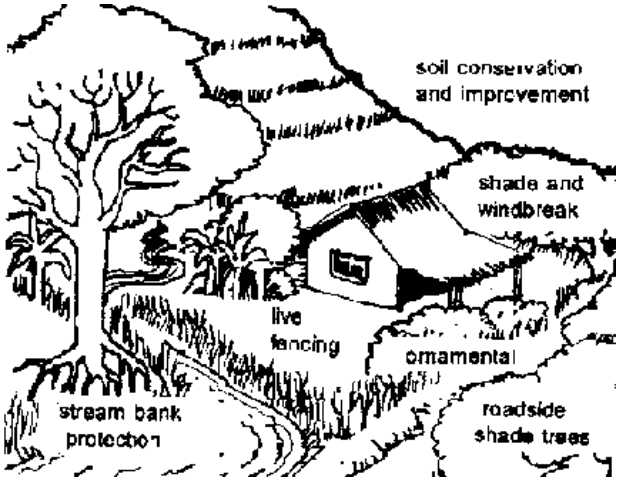
See Properties of Some Fuelwood Species on pages 181-191 for more information.

A - fast-growing fuelwood species
B - slower-growing intolerant fruit tree species

A good tree for producing fuelwood has these qualities:

- is fast-growing and has a high yield of woody biomass;
- sprouts back vigorously after cutting. Some species sprout best if they are cut near the base of the stem while other species are cut higher (1-2 m above ground). Wood can be harvested repeatedly from trees that have a good sprouting ability, without destroying or having to replant the tree.
- is adapted even to less fertile, drier or thinner soils than those used for more valuable agricultural crops; and,
- is multipurpose: has some other products or functions besides fuelwood.

Assessing the usefulness of indigenous trees for live fencing



Assessing the usefulness of indigenous trees for live fencing

The best live fences are often made up of a combination of several species, such as bamboos, shrubs and vines

Species with thorns, spines, nettles or irritating late' are especially good for fencing out livestock.

The plants should form a dense hedge. Often, it i' necessary to prune the stems to encourage stump sprouting and branchiness.

The stems should be usable as living fenceposts and be able to tolerate some damage from nails and wire if wire fencing is used.

Plants that can be propagated from branch cuttings (e.g., Madre de cacao) and that can be rooted in place will produce a live fence quickly. If the plant cannot be propagated from cuttings, sufficient quantities of viable seed should be available for direct seeding.

The leaves and stems should be non-palatable to livestock.

The live fence species should not spread easily into pastures or cultivated fields.

Fire-resistant species (like Gmelina) should be used if possible.

Layering and lattice techniques can be used to make live fences more impenetrable.

Live fence planted using cuttings.

ASSESSING THE USEFULNESS OF INDIGENOUS TREES FOR LIVESTOCK FODDER

Trees and shrubs that are suited for fodder have these characteristics:

- The fodder is palatable and digestible. If livestock will not eat the fodder or if they cannot digest it, K does not matter how nutritious it is.
- Contains no toxins.
- Is suitable for a variety of livestock.
- The leaves, fruits or seeds are nutritious with a highprotein content.
- The plants can withstand frequent pruning.

- They produce leaves year-round and are droughttolerant.
- The ratio of leaf to woody biomass production is high.
- The stems and leaves have no thorns, bristles, nettles or irritating latex.

Often, trees and shrubs that are useful as fodder crops are not suited as live fencing species and vice-versa.

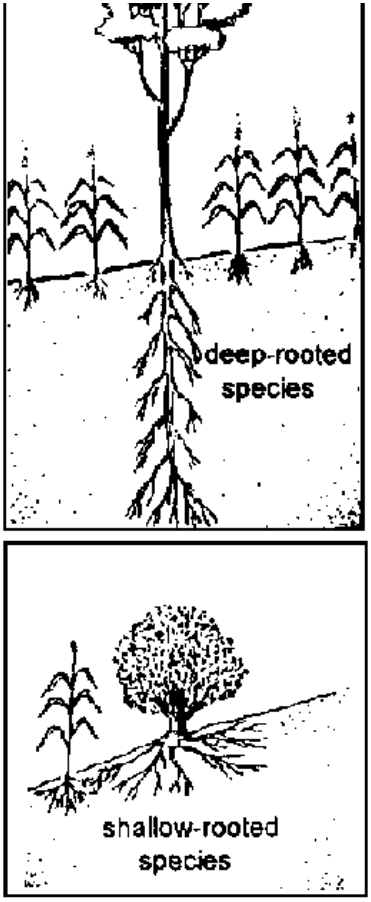
ASSESSING THE USEFULNESS OF INDIGENOUS TREES FOR INTERCROPPING

Agroforestry often involves intercropping of trees or shrubs with annual or herbaceous species. Some of the features to consider in terms of their suitability for intercropping are:

- Type of root structure

Some wood plants have roots that grow deep into the earth and draw water and nutrients from far below the surface. These trees are especially suited for intercropping because they do not compete with shallow-rooted annual crops that draw most of their water and nutrients from the top soil.

Although shallowrooted species may not be as suited for intercropping, they are often useful for erosion control because their roots help bind the soil. On farms with very steep slopes, these species can be used for soil conservation. Some species form roots both close to the surface as well as in deeper soil layers.



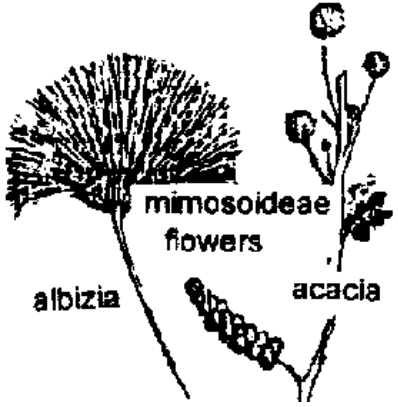
Type of root structure

Effects of Trees on Soil and Water Conservation

Tree roots help to anchor and stabilize soil. Leaf litter and humus that build up under tree stands allow water to percolate into the lower soil layers. Ground cover vegetation under the trees can also contribute to leaf litter and humus build-up and can help to prevent soil loss. Some tree species seem to inhibit understory ground cover by secreting substances into the soil that are toxic to other plants. This is called allelopathy. If normal ground cover does not grow under a certain tree species, this species may not be suited for intercropping.

Ability to Improve soil quality

Trees can improve soil fertility by serving as "nutrient pumps", that is, they efficiently absorb nutrients from the soil. The nutrients that are concentrated in the leaves can then be resumed to the soil as green manures.



Ability to Improve soil quality

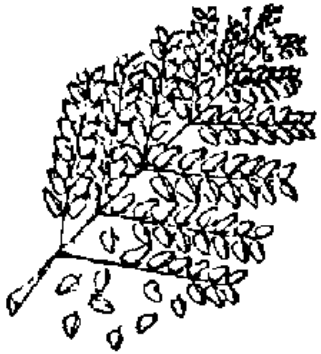
Nitrogen-fixing trees often have nitrogen-rich foliage. Many but not all members of the Legume family are N-fixing. One way to identify an N-fixer is to check the roots for nodules which look like small lumps or knots. Non-legume species that fix Nitrogen are found in the Casuarina and Alnus genera.

Using green manures can also improve soil texture, infiltration and moisture-holding capacity by increasing organic matter in the soil. Trees that have compound leaves with many small leaflets break down quickly. Larger leaves and small stems will provide a slower, longer-term release of nutrients.

Trees also affect the soil microclimate, lowering temperatures and increasing humidity, thus providing favorable conditions for beneficial microorganisms.

Shade-tolerance

A species is shade-tolerant if it can regenerate and thrive under the canopy of other trees where the amount of available light is reduced. In intercropping arrangements, there are often several layers or strata of tree and shrub species, with the lower or understory layers made up of shade-tolerant species.



Shade-tolerance

Rate of height growth and ability to sprout after cutting

It is important to compare growth rates with respect to the strata of the intercropping system that each species will occupy. Slower growing, intolerant species should not be overtopped and shaded out by faster-growing fuelwood species (like Gliricidia) with a slow-growing intolerant fruit tree, you will have to cut the fuelwood species back at first to keep it from overtopping the fruit tree.

Rate of height growth and ability to sprout after cutting

Crown form and leafing pattern

The size and shape of the overstory species crown and the type of foliage will affect the amount of light that penetrates down into the understory. Even if the understory plants are shade-tolerant, they still need light, especially when they flower and bear fruit. Overstory plants that have a high, small, open crown and sparse foliage (like Albizia falcataria) will allow more light through than species with deep, broad spear-heading crowns and dense foliage (like mango).

Seasonal cycles

The amount of overstory foliage can vary depending on the season, affecting the amount of light that the understory species will intercept. Although many tropical trees are evergreen, some (like Teak and Gmelina) drop their leaves during the dry season, allowing more light through. Intercropping with species that flower and fruit during the dry season will take

advantage of these cycles.

Seasonal cycles

However, if a tree is planted specifically to provide shade, an evergreen species is preferable to one that has a deciduous habit. Even though Siniguelas is used to shade understory crops, it loses its leaves during the hot season when shade is most needed.

Finding the Right Niche Within the Farming System for Indigenous Tree Species

Farmers can often recognize plant species that indicate a particular type of soil condition, such as sites that have been recently cultivated, sites that have been in fallow for a long time, severely degraded soils, or soils with a high salt content. Indicator plants are also sometimes used by farmers as a preliminary method to determine soil texture or acidity.

In detemmining the farm niche that an indigenous species might fit, consider where the species occurs naturally and what that might indicate about the tree's site requirements. Is it normally found along stream banks, on thin rocky soils, on deep fertile sites or on sites that are frequently flooded? Does it grow in the forest or is it more often found growing in the

open? If it grows in the forest, which strata of the canopy does it occupy? It is found mostly in open areas, where other trees rarely grow; this may indicate that it is either fire-resistant or that it can compete with other vegetation like cogon grass. Observing the natural habitat of a tree species can give you many clues as to how it may be most useful in an agroforestry system.

TABLE 9: SAMPLE ASSESSMENT OF SOME TREE SPECIES FOR INTERCROPPING.

ASSESSMENT CRITERIA		SAMPLE SPECIES				
	Mollucan Sau	**Nangka**	**Durian**	**Guyabano**	**Kamachile**	**Gliricidia**
Root Structure	deep-rooting	shallow if system cuttings; deeper if planted from seed	deep-rooting grown from	shallow if grown from cuttings; deeper if planted from seed	deep, dense root system	shallow if grown from cuttings; deeper if planted from seed.
Effect on Soil and Water	useful for land reharevege	useful in systems for low impact	useful in tree cropping for erosion	can be used effective as	highly	
Conservation	bilitation	sating difficult,	agricultural land use	control and	hedgerow in hedgerows	species

		degraded sites	on steep sites			
N-fixing	yes	no	no	no	yes	yes
Rate of Height and Growth	very fast	fast	slow	moderately fast	fast	fast
Sprouting	poor	responds to	poor	responds to	coppices	stem
Response after Cutting	response removal of	early removal of leader shoot and lopping	response	occasional pruning	readily after cutting	sprouts vigorously when cut at base or at 1-2 m
Canopy Strata	high	high	high	middle	middle	middle
When Mature	overstory	overstory	overstory understory	understory	understory	
Crown Form	high, spreading crown	deep crown, can be spreading or more compact	high crown. spreading but not deep	Deep compact crown	irregularly-shaped at spreading crown; variable, depends on management	small crown spreading
Leafing Pattern	light foliage	dense	fairly dense	fairly dense	small leaflets	light foliage
	with small	foliage	foliage	foliage	and fairly	small

		with	with			
	leaflets	large thick	large leaves		dense	leaflets,
		leaves			foliage	varies with
						season
Deciduous/Evergreen	semi-evergreen	eve rgreen evergreen	evergreen	semi-	loses leaves evergreen	during dry season and when flowering
Light Penetration	high	low	low	low	low	high (varies with season)
Shade Tobrance light	light shade-demanding	moderately demanding	slightly to tolerant when young; light demanding when older	shade shade-tolerant	moderately shade tolerant light	tolerant at establishment stage, later more demanding
Suitability for	suitable as	overstory	overstory middle	middle strata	low middle	
Intercropping	overstory species or as shade for partially	species for highly shade-tolerant understory	species with	strata can	with light	strata with

	shade-tolerant understory crops	understory crops and crops or as a bonder tree around fields				
			shade-tolerant sufficient light mixed perenniaI cropping systems	be over-topped if open-grown with full penetrates through overstory	overstory shade or open-grown with full sun sunlight	light overstory or

COMMONLY USED TREE SPECIES FOR AGROFORESTRY

SCIENTIFIC NAME	OFFICIAL PHILIPPINE NAME/OTHER LOCAL AND COMMON NAMES	PRINCIPAL USES	RELATED PAPERS
Acacia auriculiformis	Japanese acacia, Auri	Reforestation	NET tables, SALT-3
A. mangium	Mangium	Reforestation	NET tables, SALT-3
A. meamsii	Black wattle		
A. nepalensis	Alder		

A. villosa			
Albizia lebbek	Langil		
Albizia lebbekoides	Kariskis, Malaganit		
Albizia procena	Akleng-parang, Palucheba, Palosebo, Kalai		
Aleurites moluccana	Lumbang	Nut production	
Alnus japonica			
Anacardium occidentale	Kasui, Kasoy, Cashew, Batuban	Nut production, soil	Fruit Trees for Harsh
Anacolosa luzoninsis	Galo, Aluloy, Malabignai, Matabalo, Yupa		
Annona atemoya	Atemoya		
Annona muricata	Guyabano, Bayuba, Carnaba, Labana, soursop	Fruit production	Asexual Propagation
		Methods for Commonly	Used Fruit Crops
A. squamosa	Atis	Fruit production	
Anthocephalus chinensis	Kaatoan bangkal		
Antidesma	Bignai, Bugnay, Isiyo,	Fruit production	

bunius	Dabodabo, Bundeyg		
Artocarpus heterophyllus	Nangka, Langka, jackfruit	Fruit, timber and fodder production	Fruit Trees for Harsh Environments
A. odoriatissimus	Marang, Loloi, eloi, Madang, uloy		
Averrhoa bilimbi	Kamias, Iba, Pias	Fruit production	Asexual Propagation Methods for Commonly Used Fruit Crops
A. carambola	Balimbing, Garangan		
Azadirachta indica	Neem tree. Nim, margosa	Shade, roadside tree	SALT-3
B. blumeana	Kawayan-tinik		
Bambusa vulgaris	Kawayan-kiling, Kawayan		
Bixa orellana	Achuete, Atsuete	Commodity production	
Broussonetia luzonica	Hirnbaba-o, Alakon, bagi		
Cajanus cajan	Kadios, Tabios, kardis	Soil conservation; food and tedder production	
Calliandra calothyrsus	Calliandra		
Cananga	llang-ilang, Tangit	Flower production	

odorata			
Canarium ovatum		Pili, Pilinut	Fruit production
Calliandra haematocephala	Fire ball		
Carica papaya	Papaya, Kapayas, pawpaw	Fruit production	
Cassia alata	Palo - China		
Cassia fistula	Golden shower, Cana, Fistula		
Cassia siamea	Thailand shower	Reforestation	SALT-3
Cassia spectabiIis	Antsoan - diIaw, PaIucheba, Paluchena		
Casuarina equisetifolia	Agoho, Agosol, aroo	Dune fixation, reforestation	
Ceiba pentandra	Kapok, Bulka, Capas, Doldol, Bulak	Fiber production	
Chrysophyllum cainito	Caimito, Kaimito, Starapple	Fruit production	SALT-3
C cochichinensis	Saling-gogon		
C. macroptera	Kabuyaw, Kabugaw	Fruit production	
C. madurensis	Kalamansi, Lemonsito, kalamunding	Fruit production	
Citrus grandis	Lukban, Suha, Suwa, Pomeb, Marangkas	Fruit production	
Cocos nucifera	Niog, Nivog, Lubi, Coconut	Fruit, oil	Multi-storied Sequential

		production	Cropping (Cavite Model)
Coffea spp.	Coffee, kape	Commodity production	
Corypha utan	Buri, Buli, Ebus		
Cordia dichotoma	Anonang		
Crotolaria juncea	Crotolaria		
Cubilea cubili	Kubili		
Delonix regia	Fire tree	Ornamental	
Dendrocalamus merrillianus	Bayog, Botong, butong, Paraot, Kawayan		
Desmodium gyroides	Karikut - rikut		
D. rensonii	Rensoni		
Diospyros philippinensis	Mabolo, Kamagong		
Diplodiscus paniculatus	Balobo		
Duno zibethinus	Durian	Fruit, timber production	
Eleagnus philippinensis	Alingaro		
Erythrina crista-	Dapdap-palong, Coral tree		

Erythrina crista-galli	Dapdap-palong, Coral tree		
Erythrina orientalis	Dapdap, Bagbag	Shade for understory crops	
E. fusca	Anii		
E indica	Dapdap		
E poeppigiana	Dapdap		
E. stipitata	Lubang dapdap		
E subumbrans	Rarang		
E variegate	Mottled dapdap	Shade for understory crops	
Flacourtia rukam	Bitongoi, Bitongol, Palutan, Saua-saua		
Gliricida sepium	Madre da Cacao, Kakawati		
Gmelina arborea	Yemane, Melina	Reforestation, Industrial lumber	
Gnetum gnemon	Bago, Banago, Lamparan, Nabo	Fruit production	
Instia bijuga	Ipil, Kita - kita	Timber	
Inocarpus fagifer	Kayam, Polynosbn chestnut		
Lagerstroemia speciosa	Banaba	Flower, timber production	
Lansium domesticum	Lansones	Fruit production	

Leucaena leucocephala	Ipil-ipil, Kariskis, Kumpitis, Sta. Elena	Soil conservation	
L. diversifolia	Acid ipil-ipil	Soil conservation	
Litchi chinensis	Lichi, Licheas	Fruit production	
L. chinensis var philippinensis	Alupag	Fruit production	
Mangifera altissima	Paho		
M. indica	Mangga, Mango	Fruit production	
M. philippinensis	Paho		
Manilkara zapota	Chico	Fruit, timber production	
Melia dubia	Bagalunga, Paraiso, Bulibising		
Moringa oleifera	Malunggi, Kamunggay, Marunggay, Dool	Food production	
Muntingia calabura	Datiles, Aratiles, Mansanitas		
Musa spp.	Saha, Dippig, Saging	Fruit production	
Nephelium lappaceum	Rambutan, Usau	Fruit production	
Pangium edule	Pangi Fruit production		
Paraserianthes falcataria	Moluccan sau, Falcata, Placata	Reforestation, Industrial timber	
Peltophorum	Siar, Baringbing		

Peltophorum pterocarpum	Siar, Baringbing		
Persea americana	Avocado	Fruit production	
Piliostigma malabaricum	Alibanghang, Kulibangbang, Kalibangbang	Soil conservation	
Pinus carribaea	Carribean pine		
Pinus kesiya	Benguet pine, Saleng, parua, Alal	Reforastation	
Pithecellobium dulce	Kamachile, Kamachilis, Damortis	Fruit production	
Pouteria campechiana	Thea	Fruit production	
Psidium guajava	Bayabas, Guyabas, guava	Fruit production	
Pterocarpus indicus	Narra, Nala, Dungos, Naga	Timber	
Punica granatum	Granada	Fruit production	
Rollinia deliciosa	Biriba		
Sacharum officinale	Tabu, Tubu		
Samanea saman (Albizia saman)	Raintree, Akasya, Acacia		
Sandoricum	Santol, Kantol, Santor, Katul	Fruit production	

koetjape			
Schizostachyum lumampao	Buho, Bagakay, babakan		
Sesbania bispinosa	Prickly sesban		
S. grandiflora	Katurai, Agati, katuday, Diana	Soil conservation, fodder production	
S. formosa	Formosa		
S.sesban	Sesban	Soil conservation	
Spondias purpurea	Sineguelas, Sereguelas, saruelas	Fruit production	
Swietenia macrophylla	Big-leafed mahogany	High-value timber	
Syzygium cumin)	Duhat, Lomboy	Fruit production	
S. jambos	Tampai, Malay apple	Fruit production	
S. polyccephaloides	Lipotee		
S. samarangense	Makopa	Fruit production	
Tamarindus indica	Sampalok, Kalamagui, Sambag, Sanbagi, Salumagi	Fruit production	
Tectona grandis	Teak, Yati, Dalanang, Teka, Kayati, Segunyate	High-value timber	

Terminalia catappa	Talisai, Tatisi, Logo, Sakat, Dao, Salaisan	High-value timber	
T. microcarpa	Kalumpit, Alupi Anagep, Butuang Kotnok		
Theobroma cacao	Cacao, Kakaw	Commodity production	
Trema orientalis	Anabiong, Anadong, Mandaragon, Anagum, Anaradung, Hinlalaong, Hinagdung		
Vitex parviflora	Molave, Camagauan, Sagat, Tagpa, Mol-awa		

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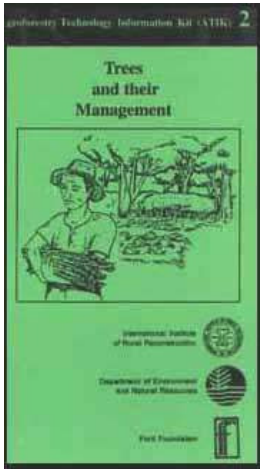

- Outplanting seedlings
- Tree pruning and care
- Bagging of young fruits
- Establishing bamboo farms
- Philippine bamboo species: Their characteristics, uses and propagation
- Growing rattan
- Growing anahaw
- Growing buri
- Shelterbelts
- Bank stabilization
- Assessing the usefulness of indigenous and locally adapted trees for agroforestry
- A guide for the inventory, identification and screening of native plant species with potential for agroforestry
- Fruit trees for harsh environments
- Citrus production
- Jackfruit production
- Mango production
- Middle to high understory shade tolerant crops
- Low understory shade-tolerant crops
- Conserving available fuelwood

A guide for the inventory, identification and screening of native plant species with

potential for agroforestry

Native species abound in the uplands. They need to be inventoried, identified and assessed to determine their potential for agroforestry. To do these, agroforestry technicians need the necessary skills and tools. This simple guide is a helpful reference material.

STEPS

- Inventory. Make a list of native tree and shrub species common in the locality.

- Selection. Single out among the species which ones have potentials based on their productive and protective values.

- Propagule availability. Construct a local seed forecasting calendar for selected species.

- Adaptability. Determine the adaptability of species to various conditions by evaluating their distribution and/or conducting species trials.

- Integration. If adaptability of species are established, assess how the species may be integrated with crops in the agroforest farms.

INVENTORY OF LOCALLY AVAILABLE PLANT SPECIES

Avail of the help of the elderly in the community as guide and informant.

Make a preliminary list of species by spot identification in the field. Record local names and economic uses.

Collect specimens of small branch with leaves and, if possible, with flowers and fruits and

bark.

Place the specimens with their label temporarily in a plastic bag or gunny sack during collection trip.

Immediately transfer the specimens to a pair of pressers. The labeled specimens are placed between sheets of newspaper and then inserted between the pair of pressers. Tie the four comers tightly together.

Label should contain the following information:

- Local Name
- Place of Collection
- Date of Collection
- Elevation
- Habitat or environmental preference
- Color of flower
- Habit
- Economic uses

Send the unknown specimens, as soon as possible, to the taxonomist for proper identification.

If specimens will not reach the taxonomist within five days, dry them by hanging the presser above the stove. This will prevent decay of specimens.

Consult taxonomy books for the official common name and scientific names. These include:

- Lexicon of Philippine Trees

- Flora Malesiana
- Enumeration of Philippine Flowering Plants

PRELIMINARY SELECTION OF SPECIES FOR TRIALS IN AGROFOREST FARMS

Single out species from the list which may be given priority for integration in agroforestry farm.

Base the selection on the uses of species and their features that may make them probably compatible with agroforestry crops.

Conduct survey on how and when local people use a particular species. The sample form below may be used.

Name of respondent: _____ Age:_____
Place of residence:_____
No. of years of residence:_____
If migrant, state place of origin:
_____
_____

Name of Species	:
Local Name	:
Construction	:
Woodcraft	:
Fuelwood	:
Eood	:

Feed-fodder-pasture :
Medicine :
Poison/Pesticide :
Extractives (Oil, easential oil) :
Exudates (gums, resins and latex) :
Fiber :
Etc.

After survey, refer to literature or any published books on the uses of Philippine plant species.

These include:

Brown, W. H. 1919. Philippine Fiber Plants. Phil. Burl For. Bull. 19.

Brown, W. H. 1920. Minor Products of Phil. Forests. Dept. of Agric. and Nat. Res. Burl For. Phil. Is. Bull. 22.

Brown, W. H. 1941. Useful Plants of the Phil. Manila, 3 vols.

Gana, V. Q. 1916. Some Philippine Tanbarks. Phil. Joumal of Science. Sect. A. 261-265.

Guerrero, Leon Ma. 1921. Medicinal Uses of Phil. Plants. Dept. of Agric. and Nat. Res. Burl For. Phil. Is.

Mulier, T. 1913. Industrials Fiber Plants of the Phil., Phil. Burl Ed. Bull. 9.

Quisumbing, E.1951. Medicinal Plants of the Phil. Dept. Agric. and Nat. Res. Manila. Tech. Bull. 16.

Uphoff, J.C. Th. 1968. Dictionary of Economic Plants. New York: Verkag Von J. Cramer, 591.

West, A.P. and W.H. Brown' 1920. Phil. Resins, Gums, Seed Oils and Essential Oils. Phil. Burl For. Bull. 20.

Wester, P.J. 1925. The Food Plants of the Philippines. Dept. of Agric. and Nat. Res. Burl Agric. Phil.

See also journals such as the following:

CANOPY. Published by FORI-MNR (now ERDB-DENR)

TECHNICAL NOTES. Published by FORPRIDECOM (now FPRDI-DOST)

Use index cards when extracting information from the library. Transfer the information in a logbook in alphabetical order. Example:

Anonang Cordia dichotoma EHRETIACEAE small tree

Wood for temporary construct/on, tool handles and agricultural implements (Reyes, 1938; Monsalud, 1968), fuelwood moisture free 22.49 Ibs/cu. ft. burns 4,397 cal/kg or 7,916 BTU/lb, 64,983 cal/cu. ft. or 80,728 BTU/cu. ft. (Aguilar, 1949). Bark yields best fibers made into rope. Medicinal according to Quisumbing (1961), the kernels are a good remedy for ringworm; they are powdered, mixed with oil and applied. Fruits pulpy portion eaten raw

(Monsalud "al., 1986; Brown, 1966; Brown, 1921, 1961), gelatinous substance In fruit is used as glue. Leaves reported as fodder for cattle, DM 46%, Crude protein 16.8%, Crude fiber 14.7%, Ash 13.1% Ca 2.56%, P 0.22#.

Binunga Macaranga tanrius EUPHORBIACEAE small

Bark yields brown glue extract used to fasten together parts of musical instruments. Bark and haves used in making basi (Brown 1921,1951). Bark decoction medicine for dysentery (according to Heyne as cited by Quisumbing, 1951). Growth rate in Makiling 2.60 cm/year (Brown, 1919). Leaves for deer (Lopez, 1935; Sajor, 1936).

Present in a simple matrix the uses and other important information about the species. This matrix serves as the data base on plant uses for a specific locality. A sample format is shown in Table 11.

TABLE 11. ECONOMIC USES AND PROPAGATION OF LOCAL TREES AND SHRUBS COMMON IN (name of place)

SPECIES	ECONOMIC USES AND PROPAGATION METHODS	
Buchanania arborescens	Size Habit	Medium tree
Balinghasai	Construction	x
	Woodcraft	x
	Fuelwood	
	Pulpwood	

	Food	Fruit
	Feed/Fodder	Fruit (swine)
	Medicine	
	Poison/Biocide	Prussic acid (stem, leaves)
	Exudates	
	Extractives	
	Bast Fiber	
	Textile Fiber	
	Ornamental	
	Propagation	Seed
Semecarpus cuneiformis	Size Habit	Small tree
Ligas	Construction	x
	Woodcraft	
	Fuelwood	
	Pulpwood	
	Food	Fruit
	Feed/Fodder	Fruits (bats, birds)
	Medicine	Fruit (ulcer)
	Poison Biocide	Prussic acid (root/bark)
	Exudates	
	Extractives	

	Bast Fiber	
	Textile Fiber	
	Ornamental	
	Propagation	Seed
Cananga odorata	Size Habit	Large tree
Ilang-ilang	Construction	x
	Woodcraft	x
Fuelwood		
Pulpwood		
Food		
Feed/Fodder		
Medicine		
Poison Biocide		
Exudates		
	Extractives	Flower, essential oil
	Bast Fiber	
	Textile Fiber	
	Ornamental	Flowers, necklace
	Propagation	Seed
Alstonia scholaris	Size Habit	Large tree
Dita	Construction Woodcraft	x

Fuelwood		
Pulpwood		
Food		
Food/Fodder		
	Medicine	Bark (diarrhea, dysentery)
	Poison Biocide	Prussic acid slight (stem and leaves)
	Exudates	
	Extractives	
	Bast Fiber	
	Textile Fiber	
	Omamental	
	Propagation	Stump cutting
Ervatamia pandacaqui	Size Habit	Shrub
Pandakaki	Construction	x
	Woodcraft	x
	Fuelwood	
	Pulpwood	
	Food	Fruit
	Feed/Fodder	Fruit (swine)
	Medicine	Leaves, latex, many uses

	Poison Biocide	
	Exudates	
	Extractives	leaves, bleaching agent
	Bast Fiber	
	Textile Fiber	
	Ornamental	
	Propagation	No published work, but use of wildlings may succeed.
Terminalia catappa	Size Habit	Large tree
Talisai	Construction	x
	Woodcraft	x
	Fuelwood	x
	Pulpwood	
	Food	Savory oil from kernel
	Feed/Fodder	Leaves (Tasar, silkworm)
	Medicine	Oil of kernel w/sap, leaves (leprosy)
	Poison Biocide	
	Exudates	
	Extractwes	Tannin, brown dye, black dye
	Bast Fiber	
	Textile Fiber	

	Ornamental	x
	Propagation	Fruit
Cordia dichotoma	Size Habit	Small tree
Anonang	Construction	
Woodcraft		
Fuelwood		
Pulpwood		
Food		
	Feed/Fodder	Leaves
	Medicine	Kernel (ringworm, many uses)
	Poison Biocide	
	Exudates	
	Extractives	Fruit, gelatinous glue
	Bast fiber	bark (rope)
Textile Fiber		
Ornamental		
	Propagation	Cutting, seed
Ehetia microphylla	Size Habit	Shrub
Tsang gubat	Construction	
Woodcraft		
Fuelwood		

Fuelwood		
Pulpwood		
	Food	Leaves as tea
	Feed/Fodder	
	Medicine	Leaves (dysentery, cough, syphilis)
	Poison Biocide	
	Exudates	
	Extractives	
	Bast Fiber	
	Textile Fiber	
	Ornamental	x
	Propagation	No published work, but use of wildlings may succeed.
Ehretia philippinensis	Size Habit	Small tree
Halimomog	Construction	
	Woodcraft	
	Fuelwood	
	Pulpwood	
	Food	
	Feed/Fodder	
	Medicine	Bark of root (dysentery, diarrhea)

	Poison Biocide	
	Exudates	
	Extractives	
	Bast Fiber	
	Textile Fiber	
	Ornamental	
	Propagation	No published work, but use of wildlings may succeed.
Acalypha stipulacea	Size Habit	Shrub
Bogus	Construction	
Woodcraft		
Fuelwood		
Pulpwood		
Food		
	Feed/Fodder	Flowers, leaves (deer, swine)
	Medicine	
Poison Biocide		
Exudates		
Extractives		
Bast Fiber		
Textile Fiber		

Ornamental		
	Propagation	Cutting
Breynia cemua Habit	Shrub	
Matang hipon		
	Construction	
	Woodcraft	
	Fuelwood	
	Pulpwood	
	Food	
	Feed/Fodder	Fruits (wildlife)
	Medicine	
Poison Biocide		
Exudates		
Extractives		
Bast Fiber		
Textile Fiber		
Omamental		
	Propagation	No published work, but use of wildlings may succeed.

CONSTRUCTION OF A LOCAL SEED FORECASTING SCHEDULE

Seed forecasting schedule (SFS) is a chart showing when and where seeds are available for a species in the locality. It serves as guide in seed collection.

Steps in making an SFS are:

1. Identify mother trees of selected species and healthy individuals in the locality.

2. Plot these mother trees in a reference map, properly label them for documentation and monitoring purposes.

3. Mark them to notify people that the trees are under study.

4. Observe at least three mother trees per species and record every year their flowering and seeding patterns.

5. Prepare a chart using Table 12 as an example.

Aside from economic uses, base also the selection of species on characteristics. Trees and shrubs may be large, medium and small. They may have wide spreading, dome-shape crown or with horizontal or diagonal branching; leaves are sparse or dense. Roots are deep and wide or shallow and less spreading. Tolerant or intolerant to shade.

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Ilang-ilang												
Dao												
Lamio												
Amugis												
Bolon												
Lanete												
Tuai												
Pagsahi												
Pili												
Balitbitan												
Ipil												
Siar												

TABLE 12. A SAMPLE OF SEED FORECASTING CALENDAR FOR LOS BAOS, LAGUNA (Based on Observations, 1960 - 1962).

DETERMINATION OF THE ADAPTABILITY OF PRE-SELECTED SPECIES

Determine the environmental conditions preferred by the species.

Do an actual trial planting of the pre-selected species on specific agroforestry farm. Use more

acceptable designs and replications.

Trials can be of two phases: preliminary trial during the first year. Based on performance (survival and growth), reject or retain species. The latter is utilized for final species trials.

An example of the result of species trials is shown in Table 13.

TABLE 13. INDICATIONS OF ADAPTABILITY OF TREES AND SHRUBS OUTPLANTED IN GRASSLAND AND OPEN FOREST BASED FROM ONE YEAR OBSERVATION (OCTOBER 1988-OCTOBER 1989) ON THEIR SURVIVAL, HEIGHT INCREMENT AND VIGOR

	SPECIES GRASSLAND		OPEN FOREST				
Scientific Name	**Common Name**	**Survival**	**Height Increment**	**Vigor**	**Survival**	**Height Increment**	**Vigor**
		(%)	**(%)**		**(%)**	**(%)**	
I. Species with promising adaptabilty							
Buchanania nitida	Balitantan	100	19.56	Good	92	13.56	Good
Szygium cumini	Duhat	100	46.45	Very good	75	62.82	Very good
S. calubcob	Kalubkob	83	28.81	Good	83	25.53	Very good
Buchanania arborescens	Balinghasai	75	102.34	Very good	58	106.19	Very good

Lagerstroenia speciosa	Banaba	75	45.07	Poor	92	24.09	Good
Semecarpus cuneiformis	Ligas	75	44.90	Very good	100	42.31	Very good
II. Species with preferred adaptibility to open forest							
Abarema	Tiagkot	16	69.77	Good	100	30 16	Good
clypearia							
Toona surenii Danupra	8	17.86	Poor	100	53.86	Very good	
Clausena brevistyla	Kalomata	0	0	0	100	48.02	Very good
Celtis luzonica	Magabuyo	17	3.96	Poor	92	22.20	Good
Anisoptera thurifera	Pa losapis	8	-	Poor	83	45.03	Very good
Chisocheton pentandrum	Katong matsing	0	0	0	82	13.65	Good

INTEGRATION OF NATIVE PLANT SPECIES IN AGROFORESTRY FARM

Include the native plant species in an agroforestry farm based on their characteristics and adaptation.

Native species may be integrated in agroforestry farm as border species, live fences, hedges, shelterbelts/greenbelts/windbreaks, upholders to vine crops. Also, for improving/sustaining the

productive and protective value of the farm.

Table 14 shows information relevant for the integration of tree and shrub species in agroforest farm.

Many indigenous tree and shrub species are considered food for farm animals. The following are fodder/browse/forage species, namely: anabiong Trema orientalis, alim Mallotus multiglandulosus, kariskis Albizia lebbekoides, katmon Dillenia philippinensis, kupang (pods) Parkia roxburghii, alibangbang Bauhinia malabarica, tibig Ficus nota, antipolo Artocarpus altilis, salisi Ficus benjamina (strangler habits), binayuyu Antidesma ghaesembilla, binunga Macaranga tanarius, pahutan (young leaves) Mangifera altissima, bagtikan, (tender shoots) Parashorea malaanonan, anubing Artocarpus ovate, aplas Ficus irisana, isis F. ulmifolia, kalios Streblus asper, bolo Gigantochloa levis, libas Spondias pinnate, talisai Terminalia catappa, bogo Garuga floribunda, malubago Hibiscus tiliaceus, malatanglin Adenanthera pavonina, unik Albizia chinensis, and langil A. Iebbeck.

Before integrating native species in an agroforestry farm, ascertain if the site corresponds to the ecological requirements of the species.

TABLE 14. NATIVE SPECIES CLASSIFIED ACCORDING TO SIZE, ROLES IN SUCCESSION AND CORRESPONDING INTEGRATION IN AGROFORESTRY (Based in Carranglan, Nueva Ecija).

	REPRESENTATIVE SPECIES	ADAPTATION AND HABITAT PREFERENCES	POSSIBLE INTEGRATION IN AGROFOREST FARM
Large trees			
- Pioneer	Albizia procera	Open, drought and fire	Border fuelwood, timber crop

		resistant	
- Climax	Shorea contorta	Gullies, mid-slope with vegetation of trees, moist	Buffer in gully, timber crop
- Intermediate		Gullies, mid-slope with vegetation, tolerance for open	Buffer in gully, timber crop
Small trees			
- Pioneer	Pittosporum pentandrum	In open, drought and fine resistant	Border, live fence fuelwood
- Climax	Lichi chinensis var philippinensis	In forest, moist	Border, live fenxce, fuelwood
Shrub			
- Pioneer	Vitex negundo	Open, drought and fire-resistant	Hedge, buffer
- Climax	Wikstroemia sp.	Forest, moist soil	Paper money
- Intermediate	Leucosyske capitellata	Forest, drought-tolerant	Fuelwood, border, hedge, strong rope

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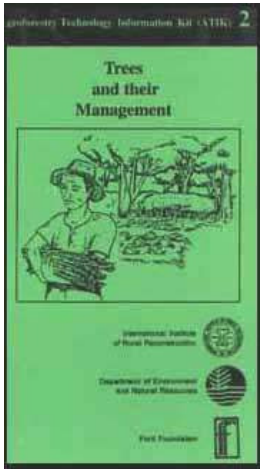
Trees and their Management (IIRR, 1992, 195 p.)
(introduction...)
Message



- Proceedings of the workshop
- List of participants
- Current program thrusts in upland development
- Trees and their management
- Sustainable agroforest land technology (Salt-3)
- Outplanting seedlings
- Tree pruning and care
- Bagging of young fruits
- Establishing bamboo farms
- Philippine bamboo species: Their characteristics, uses and propagation
- Growing rattan
- Growing anahaw
- Growing buri
- Shelterbelts
- Bank stabilization
- Assessing the usefulness of indigenous and locally adapted trees for agroforestry
- A guide for the inventory, identification and screening of native plant species with potential for agroforestry

- Fruit trees for harsh environments
- Citrus production
- Jackfruit production

Message

Agroforestry, the land management system of incorporating crop production with tree and/or livestock production, evolved to become one of the most widely promoted tools for sustaining development in the uplands. To supplement the materials used by upland development extension workers in promoting agroforestry, a group of specialists, technicians and farmers from 11 government and nongovernment organizations met at the invitation of the International Institute of Rural Reconstruction in Silang, Cavite in November 1989 to develop the Agroforestry Technology Information Kit(ATIK). In November 1992, some of the specialists, together with some farmers and an additional number of specialists and technicians, met again at IIRR to revise the ATIK.

The updated kit is handy, easy-to-understand and full of illustrations. It widely uses indigenous technologies. With this kit, it is hoped that extension workers and upland dwellers develop a better understanding and appreciation of agroforestry. The success of agroforestry as a tool for sustaining upland development, however, will depend on how this tool is introduced and implemented. Sustainable agroforestry systems can only be attained if upland dwellers are involved in the planning and establishment of such systems.

I commend all those involved in the production of this useful kit.

Angel C. Alcala Secretary Department of Environment and Natural Resources

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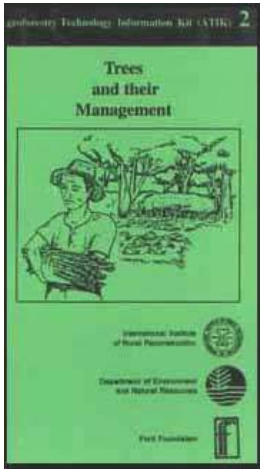
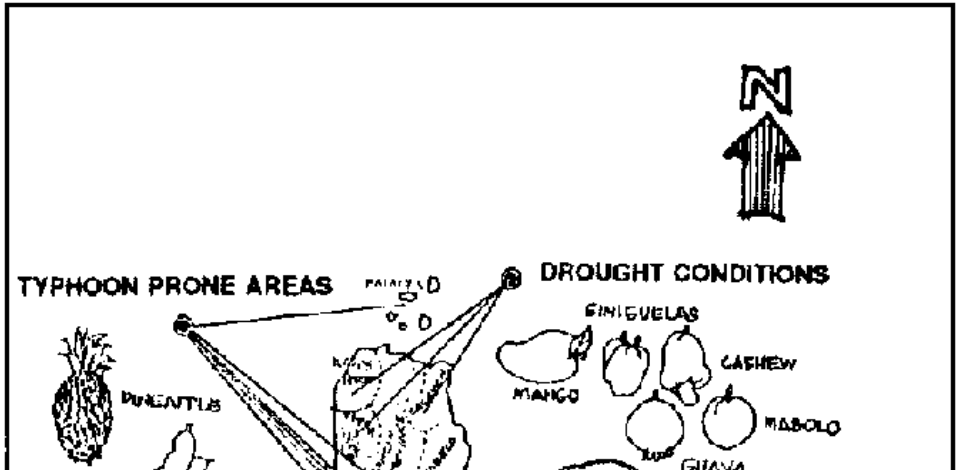
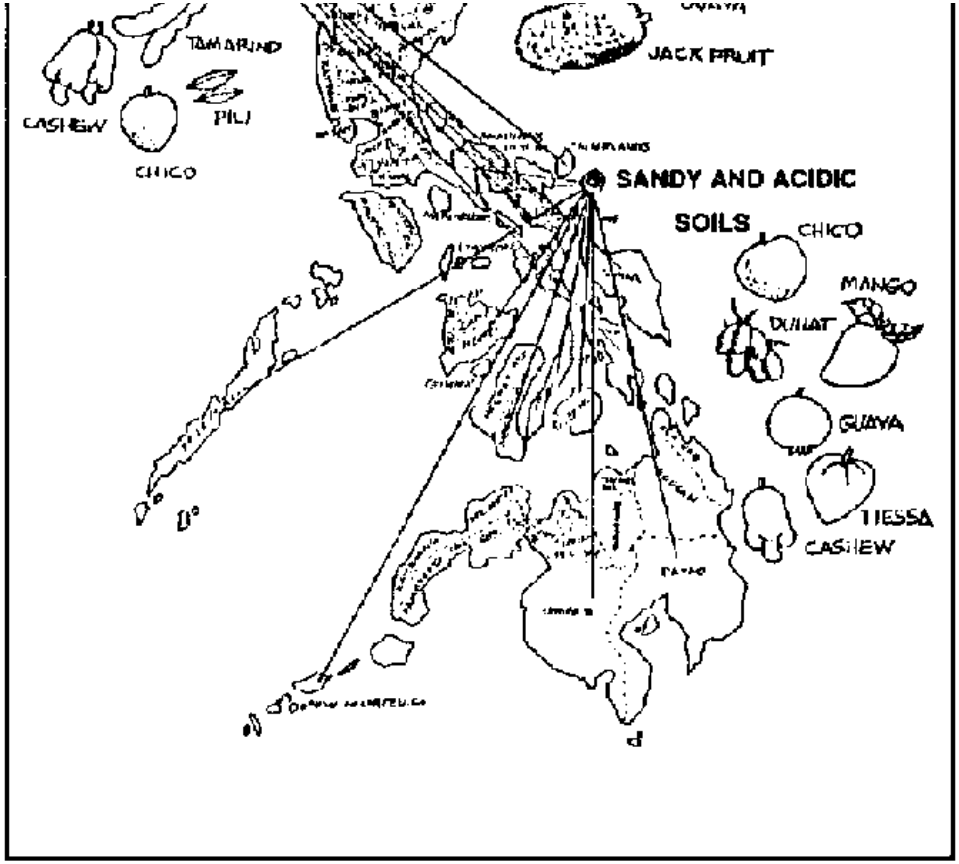


Fruit trees for harsh environments





Fruit trees for harsh environments

TABLE 16. HARVEST SEASON AND ADAPTABILITY OF COMMONLY GROWN FRUITS.

SCIENTIFIC NAME	HARVEST SEASON[1]	ADAPTABILITY		
COMMON NAME	Rainfall[2]	Soil[3]	Elevation4	
Annona squamosa	Jun-Sep	WD, PW	SA	L,M
Atis				
Persea americana	May-Aug	WD, PW	SA	L,M,H
Avocado				
Averrhoa carambola	Jun-Aug	WD, PW	SA	L,M,H
Balimbing				
Musa spp.	Year round	WD, PW	SA	L,M,H
Banana				
Chrysophyllum caimito	Jan-Mar	WD, PW	SA	L,M
Caimito				
Citrus madurensis	Year round	WD, PW	SA	L,M,H
Calamansi				
Anacardium occidentale	Mar-Jun	WD, PD	SA	L,M
Cashew				
Manilkara zapota	Apr-Sep	WD, PW	SA	L,M
Chico				
Cocus nucifera	Year round	WD, PW	SA, A	L,M
Coconut				
Syzygium cumini	Apr-Jun	WD, PW	SA	L,M
Duhat				

Durio zibethinus	Jul-Oct	WD PW	SA A	L M
Durian				
Psidium guajava	Jul-Sep	WD, PD	SA	L,M,H
Guava				
Anona muricata	May-Aug	WD, PW	SA	L,M
Guyabano				
Artocarpus hetenrophyllus	Mar-Aug PD	WP, PW,	SA	L,M
Jackfruit (langka)				
Averroha balimbi	Year round	WD PW	SA	L M
Kamias				
Lansium domesticum	Aug-Oct	WD, PW	SA	L,M
Lanzones				
Diospyros philippinensis	Jun-Sep	WD, PW,	SA	L,M
Mabolo				
Syzygium samarangense	May-Jul	WD, PW	SA	L,M
Makopa				
Citrus sinensis	Nov-Feb	WD, PW	SA	L,M,H
Mandarin orange				
Mangifera indica Linn.	Apr-Jun	WD PD	SA	L,M
Mango				
Garcinia mangostana L.	Aug-Oct	WD, PW	SA	L,M
Mangosteen				

Carica papaya Papaya	Year round	WD, PW	SA, A	L,M
Canarius sp.	Jun-Aug	WD, PW	SA	L,M
Pili				
Ananas sativa	May-Jul	WD, PW	SA, A	L,M,H
Pineapple				
Citrus grandis	Nov-Jan	WD, PW	SA	L,M,H
Pomelo				
Nephelium eappaceum	Jul-Sep	WD, PW	SA	L,M
Rambutan				
Artocarpus altilis	May-Aug	WD, PW	SA	L,M
Rimas				
Sandaricum koetjape	Jun-Aug	WD, PW	SA	L,M
Santol				
Spondias purpurea	Apr-Jun	WD, PD	SA	L,M
Siniguelas				
Tamarindus indica	Oct-Dec	WD, PD, PW	SA	L,M
Tamarind				
Pouteria campechiana	Nov-Mar PD	WD, PW,	SA	L,M
Tiessa				
Jan - January	May - May	Sep - September		
Feb - February	Jun - June	Oct - October		

Mar - March	Jul - July	Nov - November		
Apr- April	Aug - August	Deo - December		

WD - distinct wet and dry seasons
PW - pronounced wet season
PD - pronounced dry season

A - acid
SA - slightly acid
Al - alkaline

L - low
M - medium
H - high

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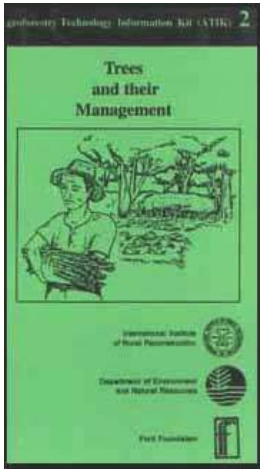

- Sustainable agroforest land technology (Salt-3)
- Outplanting seedlings
- Tree pruning and care
- Bagging of young fruits
- Establishing bamboo farms
- Philippine bamboo species: Their characteristics, uses and propagation
- Growing rattan
- Growing anahaw
- Growing buri
- Shelterbelts
- Bank stabilization
- Assessing the usefulness of indigenous and locally adapted trees for agroforestry
- A guide for the inventory, identification and screening of native plant species with potential for agroforestry
- Fruit trees for harsh environments

- Citrus production
- Jackfruit production
- Mango production
- Middle to high understory shade tolerant crops
- Low understory shade-tolerant crops
- Conserving available fuelwood

Citrus production

Species and varieties

Three species of citrus are commonly grown commercially. They are calamansi, mandarin orange and pomelo. Calamansi has no recognized horticultural varieties and, except for the variegated mutant, all trees belong to only one form.

Ladu, Szinkom and Ponkam are the leading mandarin orange varieties while Amoy Mantan, Sunwiluk and Siamese are the commercial pomelo varieties grown.

PLANTING MATERIALS

Almost all fruit nurseries specializing in citrus propagation produce shield-budded planting materials on calamandarin rootstocks.

ADAPTATIONS

Citrus is known to thrive well in both tropical and subtropical climates. Places with well-distributed rainfall are best although those with distinct wet and dry seasons are equally suitable, especially if irrigation can be provided during the dry season.

For best production, the soil should be deep, clay loam or sandy loam in texture for easy drainage, slightly acidic (pH 5.5-6.5) and rich in organic matter. Lands with flat to gently rolling terrain are preferrable although those with hilly terrain may also be utilized.

PLANTING

Flat to gently rolling lands are deep-plowed once and harrowed 2-3 times during the dry season well in advance of planting. These operations are dispensed with in hilly areas.

Plant at the onset of the rainy season. Set planting materials in previously prepared holes laid at the following planting distances: calamansi, 4-5 m; mandarin orange, 5-6 m and pomelo, 8-10 m. In hilly areas, adjust planting distances according to the slopes.

TRAINING AND PRUNING

Starting on the second year after planting, trim young citrus trees so that they have only a single trunk with 34 well-distributed primary branches. The main branches should originate at different points on the trunk from 30 to 60 cm above the ground. Remove all shoots on the trunk that sprout below 30 cm.

In subsequent years, prune regularly to remove all watersprouts as well as diseased and dead twigs.

IRRIGATION

Water the plants right after planting to effect immediate root contact with the soil. Irrigate regularly during the first dry season after planting.

Irrigation during the subsequent dry seasons can be dispensed with although it is most beneficial to the vegetative and reproductive processes of bearing trees.

FERTILIZATION

Leaf nutrient standards as fertilization have been established for other citrus species (e.g., sweet orange, grapefruit) but not for calamansi, mandarin orange and pomelo.

In their absence, only a general fertilization guide can be made. Thus, for non-bearing trees, apply 100-200 9 ammonium sulfate (or 50-100 9 urea) per tree at the onset and towards the end of the rainy season. At the start of fruiting, apply 300 9 complete fertilizer (NPK) twice a year as indicated. Increase the rate as the trees grow bigger and yield increases. At the peak of production (10-15 years old), each tree should receive at least 2 kg per application.

Use organic fertilizers to reduce the requirements for inorganic fertilizers.

Apply the fertilizer either by broadcasting it or placing it in several shallow holes beneath the tree canopy.

CONTROL OF PESTS

Rind borers (especially in pomelo), green bugs and jumping lice are the most serious pests. Control rind borers by collecting and buming infested fruits and spraying the trees with an

insecticide at the pre- and post-bloom stages at 12-14 days interval for four applications.

Control green bugs and jumping lice (the vector of leaf mottling disease) by regular application of an insecticide).

CONTROL OF DISEASES

Canker, footrot and leaf mottling are the most serious diseases. Control bacterial canker (on leaves and fruits) with sprays of a copper-based fungicide. Cut down and bum infected trees.

Avoid footrot by planting only on well-drained soils. Also avoid too-close planting, too-low budding and deep planting.

Avoid leaf mottling or greening disease by using diseasefree-planting materials and by controlling the jumping lice.

HARVESTING

Harvest calamansi fruits when they have attained full size. At this stage, they are yellowish green in color and very juicy. Harvest mandarin oranges when they show color break and their juice turns subacid. Harvest pomelo when their skin turns yellowish and yields easily to finger pressure.