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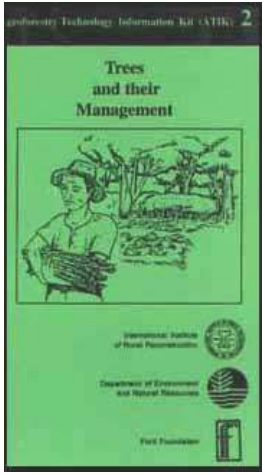
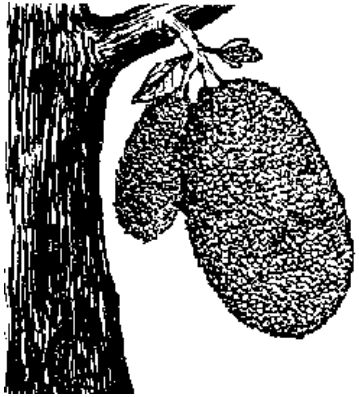


Jackfruit production

VARIETIES

There are no standard horticultural varieties for commercial production. The Torres jackfruit, a recent selection of the U.P. at Los Baos, is now being popularized. The Department of Agriculture in Central Visayas has also selected several promising jackfruit varieties.



Varieties

PLANTING MATERIALS

Seedlings are still widely used but they do not come true to type. Grafted trees make better planting materials.

ADAPTATIONS

Jackfruit grows well on all climatic types although warm and moist surroundings are best.

LAND PREPARATION

Prepare the land for planting before the onset of the rainy season. For flat to gently rolling lands, plow the field once and harrow two or more times. These operations are dispensed with in very hilly areas.

PLANTING

Plant at the onset of the rainy season. The suggested planting distance for jackfruit in flat to gently rolling lands is 8-10 m. In hilly areas, adjust plant spacing according to the slopes of the land.

TRAINING AND PRUNING

Not much is known about training young jackfruit trees. But since the fruiting stalks are produced on the trunk and large branches, train the young trees to develop as many primary and secondary branches close to the ground as possible. Once this is attained, limit pruning to the removal of interlacing interior branches and diseased twigs.

IRRIGATION

Irrigate young jackfruit trees during summer. If water is readily available, continue this practice throughout the life of the trees.

FERTILIZATION

Jackfruit trees are seldom fertilized. They would grow better and produce more fruits if they are fertilized in some way. To avoid additional expense or at least reduce the need for inorganic fertilizers, apply organic materials instead. Mulching around the trunk throughout the year would substitute for fertilization.

CONTROL OF PESTS

There is no serious disease that attacks the jackfruit. However, fruit flies are very serious

pests. This is effectively controlled by wrapping the fruits while still young with any of these materials: sacks, made of any material, used cement bags, leaves of coconut or banana and rice straws.

HARVESTING

The fruit is usually harvested before it ripens on the tree. A mature fruit produces a hollow sound when its spiny peel is tapped with the fingers.

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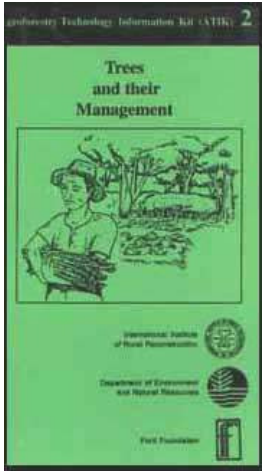
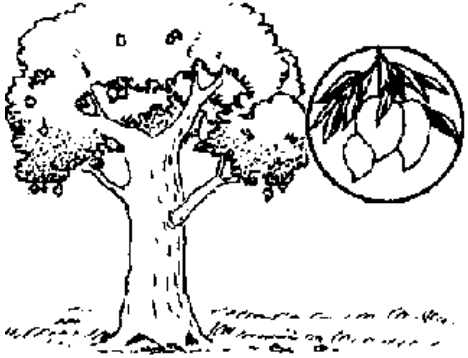


Mango production

VARIETIES

Carabao, Pico and Katchamitha (Indian) are the three commonly grown varieties. Carabao is grown commercially for export while Pico (for ripe fruit) and Katchamitha (for green fruit)

are limited to backyard planting.



Varieties

PLANTING MATERIALS

Grafted plants are best because they come true to type, grow smaller and produce fruits earlier than seedlings.

ADAPTATIONS

Carabao and Pico grow best in places with distinct dry season that lasts for five months or longer. Katchamitha is less selective of climatic type.

Preferred for planting are those with net to gently rolling slopes, although hilly lands can also be planted. The soil should be deep, fertile, well-drained and slightly acidic.

LAND PREPARATION

This is best done before the onset of the rainy season. Shrubs and trees should be cut down, preferably uprooted and the debris removed from the site. In flat to gently rolling lands, one deep plowing and two to three harrowings are adequate. In hilly areas, these operations are dispensed with.

PLANTING

In net to gently rolling lands, the recommended planting distance is from 10 m (100 trees per ha) to 15 m (44 trees per ha) depending on the fertility of the soil and the amount of rainfall. In hilly areas, planting distance is adjusted according to the contour of the land. Planting is best done at the onset of the rainy season.

The planting hole should be just large enough to accommodate the ball of soil of the planting material. After removing the plastic bag, set the plant at the center of the hole and fill up the extra space with the previously dug top soil.

TRAINING AND PRUNING

Allow the trees to grow upright for some time. When about 50 cm high, pinch the terminal bud to force lateral shoots to sprout. Allow the shoots to mature and again pinch the terminal bud on each shoot. Repeat this process until the end of the third year. Allow all shoots to mature and start forcing them to flower.

Once the trees are bearing, limit pruning to removing weak branches at the tree interior and those damaged by pests.

IRRIGATION

Water the trees right after planting and during period when rain falls irregularly. The first dry season after planting is the most critical stage. Water the trees regularly during this whole period. During the subsequent dry seasons, the trees will survive without irrigation although they will grow better and produce more and larger fruits if irrigated.

FERTILIZATION

Soil and leaf analyses will aid the grower on the kind and amount of fertilizers to apply to the mango trees. In the absence of this information, apply 200-500 9 ammosul (or equivalent amount of urea) to each non-bearing tree (1-3 years old) at the onset and end of the rainy season. Shift to complete fertilizer (N-P-K) starting on the 4th year by applying 500 9 per tree twice a year. Increase the amount every year so that at the peak of fruiting (20-25 years old), each tree should get at least 5 kg per application.

Broadcast the fertilizer evenly or apply in several shallow holes beneath the tree canopy.

If organic fertilizers (e.g., compost, manure) are available, apply liberal amount to reduce the need for inorganic fertilizer.

CONTROL OF PESTS

Leaf hoppers and oriental fruit flies are the most serious insect pests. Control hoppers with carbaryl or malathion insecticide when the inflorescence starts to emerge. Repeat this three or more times at 7-10 days interval depending on the degree of infestation.

Control fruit flies using an attractant (e.g., methyl eugenol, powdered kalingag bark) treated with an insecticide.

Vapor heat treatment of fruits after harvest also effectively kills fruit fly eggs and larvae.

Anthracnose is the most serious disease and attacks the flowers, young leaves and young fruits. To control, spray the tree with benomyl (e.g., Benlate) or mancozeb (e.g., Dithane M-45) fungicide regularly from fruit set until a month before harvest.

FLOWER FORCING

Force mature trees to flower off-season by smudging or foliar spraying with potassium nitrate. Apply the latter at 12 percent dosage (10-20 g/li water). Commercial formulations in solution are applied at recommended dosages.

Trees can be forced to flower any month although the common practice is to time the application at the onset of the dry season in November. Even then, not all trees can be forced to flower at the same time because only those with 6-month-old shoots or older are responsive.

One spraying is enough and flowers appear after about two weeks. Trees that failed to flower or whose flowers were destroyed may be sprayed again.

FRUIT BAGGING

To reduce mechanical injuries as well as pest damage, wrap the fruits individually about 55 days after flowerforcing using used newspapers.

HARVESTING

Harvest fruits 110-120 days after flower-forcing or 82-88 days after full bloom.

Harvesting

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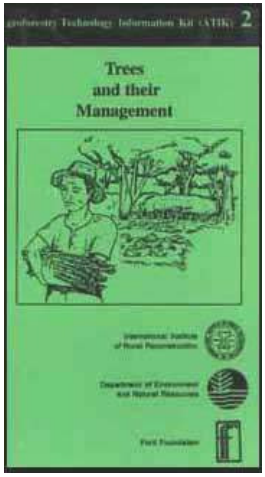

- Outplanting seedlings
- Tree pruning and care
- Bagging of young fruits
- Establishing bamboo farms
- Philippine bamboo species: Their characteristics, uses and propagation
- Growing rattan
- Growing anahaw
- Growing buri
- Shelterbelts
- Bank stabilization
- Assessing the usefulness of indigenous 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

Middle to high understory shade tolerant crops

The species can grow in the understory of taller tree species. They occupy the middle to high understory. Although they are shade-tolerant, they still need some light to penetrate the canopy (about 50 percent shade/light).

TABLE 16. SPECIES DESCRIPTION.

SCIENTIFIC NAME	COMMON NAME	HEIGHT (ft.)	USES
Acacia meamsii	Black wattle	6-20	Fuelwood poles, green manure, tannin erosion control, soil improvement
Albizzia lebbek	Langil	up to 30	Fuelwood timber, fodder, soil improvement
Alnus nepalensis		up to 30	Fuelwood timber, fodder, soil improvement
Annona muricata	Guyabano	5-9	Fruit
Averrhoa bilimbi	Kamias	2-12	Fruit
Bixa orellana	Achuete	2-8	Fruit (cosmetics dye), live fence
Calamus merillli and many other species	Rattan	up to 50	Furniture, fiber
Calliandra calothyrsus	Calliandra	4-10	Fuelwood, fodder, erosion control, soil improvement, bee forage
Casuarina equisetifolia	Agoho	4-10	Fuelwood, fodder, erosion control, soil improvement bee forage
Coffea spp.	Kafe	4-5	Fruit (coffee beans), fuelwood
Desmodium gyroides	Karikut-	1-4	Fodder, soil improvement, erosion control

Desmodium gyroides	Kurikut rikut	1-4	Fodder, soil improvement, erosion control
Flemingia macrophylla	Flemingia	2-3	Soil imp row meet, erosion control
Lancium sp.	Lanzones	5-9	Fruit
Livistona rotundifolia	Anahau Fan palm	15-20	Fiber, food (fruit, buds, shoots), small timber
Musa textilis	Abaca	1.54	Fiber
Musa spp. Var saba	Saba	1.5-4	Fruit
Pithecellobium dulce	Kamachile	18-20	Fruit, fuelwood, small timber, fodder, soil improvement, fencing
Psidium guajava	Bayabas fuelwood	3-10	Fruit, erosion control
Theobroma cacao	Cacao	5-8	Fruit (chocolate)

TABLE 17. SPECIES REQUIREMENT.

Species name	Shade	Climatic	Elevation	Soils
	Tolerance[1]	Adaptability[2]		
Acacia meamsii	M	WD, PW	100-2500m	Deep fertile soils, sandy loams, shale or slate derived neutral to acid soils
Albizzia lebbek	S	WD, PD	Up to 1400m	Highly adaptable including saline soils; alkaline to neutral soils
Alnus	H	WD, PW	1000-	Deep loamy acid to neutral soils; also

nepalensis			3000m	tolerates steep, rocky eroded sites
Annona muricata	M	WD, PW	Up to 1000m	Suited to most soils, but does not tolerate waterlogging
Averrhoa bilimbi	S-M	WD, PW	Up to 500m	Needs well-drained soil, pH can be neutral to alkaline
Bixa orellana	S	WD, PW	Up to 800m	Adaptable, but prefers moist, deep, loamy soil
Calamus merillii	H	PW		
Calliandra calothyrsus	S	WD	250-1500m	Adaptable to wide range of site conditions, including acid soils
Casuarina equisetifolia	S	WD, PD	Up to 500m	Thrives on sandy soils, coastal dunes
Coffea spp.	M	WD, PW	Up to 750m	Needs deep, well drained, acid to alkaline soils, but does well on day soils
Desmodium gyroides	M	WD,PD	Up to 1000m	Tolerates infertile soils, adaptable to acid or alkaline soils and can tolerate water logging
Flemingia macrophylla	S-M	WD	Up to 2000m	Adaptable to wide range of soils and can be grown on infertile or heavy clay soils
Lancium spp.	H	WD, PW	Up to 800m	Prefers moist, fertile, medium textured, slightly acidic soil with good

				drainage and high organic matter content
Livistona rotundifolia	H	WD, PD	Low to medium elevation	
Musa textilis	M	PW	Up to 1600m	Deep, friable, fertile loam with good drainage: tolerates pH from acid to alkaline
Musa spp. var saba	S	WD, PW	Up to 1800m	Prefers well-drained soils, but can also tolerate heavy clays
Pithecellobium dulce	S-M	WD, PD	Up to 1800m	Prefers well-drained soils, but can also tolerate heavy clays
Psidium guava	M	WD, PD	Up to 1500m	Highly adaptable
Theobroma cacao	S	PW	Up to 700m	Prefers soil with good moisture retention, but welt drained; does not last on clay loam soil

1 Shade tolerance:

H = highly shade-tolerant;
M = moderately shade-tolerant;
S=sibhtly shade-tolerant

2 Climatic adaptability:

WD = with distinct wet and dry seasons
PW = pronounced wet season;
PO = pronounced dry season

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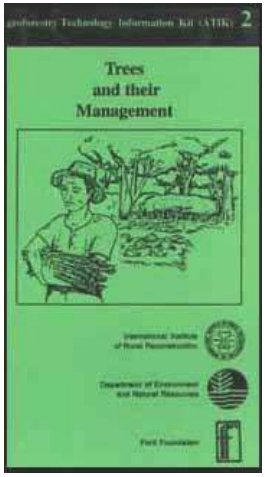

Low understory shade-tolerant crops

TABLE 18. SPECIES DESCRIPTION AND USE.

SPECIES NAME	COMMON NAME	SHADE	FORM	HEIGHT	USE
		TOLERANCE			
ARACEAE					
Acorus calamus	Lubigan	M	Perennial	0.5-1.5	medicinal

			herb	m	
Amorphophallus campanulatas	Pongapong	Perennial herb	0.5-1.5 m	livestock feed	(tuber), food (stem)
Amorphophallus variabilis (A. oncophyllus)		H	Perennial herb	1.0-2.5 m	medicinal (tuber)
Colocasia esculenta	Gabi, Gabing Tagalog	S	Perennial herb	1.0-2.0 m	food (tuber), stem and leaves
Xanthosoma nigrum	Gabing Cebu	S	Perrenial herb	1.0-2.0 m	food (tuber),
(Xanthosoma sagittifolium)				animal feed	(stem and leaf)
MARANTACEAE					
Maranta arundinacea	Arrowroot, Uraro	H	Perrenial herb	0.5-1.0 m	food (tuber)
TACCACEAE					
Tacca palmata		H	Perennial herb	0.75-1.25m	
DIOSCOREACEAE					
Dioscorea alata	Ubi	H	Climbing vine	3.0-10 m	food (tuber)
Dioscorea bulbifera		M	Climbing vine	3.0-10 m	food, medicinal
Dioscorea esculenta	Tugui	M	Climbing	3.0-5.0	food (tuber)

Dioscorea hispida		M	Climbing vine	5.0-20 m	food (tuber)

CANNACEAE

Canna edulis	Edible canna	H	Perennial herb	1.0-3.5 m	hod, fodder

BROMELIACEAE

Ananas comosus	Pinya	S	Perennial herb	0.5-1.25 m	food (fruit), fiber (leaves), animal feed (leaves).

ORCHIDACEAE

Vanilla fragrens (V. planifolia)	Vanilla, Banilya	H	Climbing vine	10-15 m	Spice (pod)

ZINGEBERACEAE

Amomum cardamomum	Indonesian cardamon	H	Perennial herb	1.5-3 m	medicinal, spice (root)
Boesenbergia pandurata		H	Perennial herb	0.25-0.8 m	medicinal, spice
(Kaempferia pandurata)				(root)	
Catimbium		H	Perennial	1.0 4 0 m	medicinal

malaccensis			herb		(root)
Costus spp		H	Perennial hero	0.5-3.0 m	medicinal (root)
Curcuma aeruginosa	Wild turmeric	H	Perennial herb	0.5-2.0 m	medicinal (root)
Curcuma domestica	Luyang-dilaw,	M	Perennial herb	1.0-1.5 m	medicinal, spice,
(C. longa)	Dilaw, Kunig				dye (root)
Curcuma heyneana		H	Perennial herb	2.0 m	medicinal (root)
Curcuma purpurascens		H	Perennial herb	0.5-1.5 m	medicinal, spice (root)
Curcuma xanthorizza		H	Perennial herb	0.5-2.0 m	medicinal dye (root)
C. zeodaria	Bolon, Tamahibak, H	Perennial herb	0.5-2.0 m	medicinal (root)	
	Barak, Tamo-karsi,				
	Luya-luyahan				
Elettaria cardamomum	Cardamon	H	Perennial herb	2.0-3.0 m	spice
Hedychium coronarium	Kamya	M	Perennial herb	1.5-3.0 m	medicinal (root)
Kaempferia galanga	Duso, Dusog, Dusol, Galanga, Gisol, Gusol		Perennial herb	0.27 m	spice, medicinal

					(root)
Kaempferia rotunda		M	Perennial herb	0.5-1.0 m	medicinal (root)
Languas galanga		S	Perennial herb	1.5-2.5 m	medicinal, spice
(Alpinia galanca)					(root)
Zingiber aromaticum	Wild ginger	M	Perennial herb	1.84.0 m	medicinal. Spice (root)
Zingiber cassumunar		H	Perennial hero	1.5 m	medicinal (root)
Zingiber officinale Roxb. Luya	M	Perennial herb	0.5-1.0 m		medicinal, spice (root)

PIPERACEAE

Piper bete L	Ikmo, Gawed, Betel vine	H	Climbing vine	5.0-15 m	medicinal (leaves)
Piper cubeba	Forest pepper	H	Climbing vine	3.0-15 m	medicinal, spice (seed)
Piper nigrum	Black pepper, Paminta	M	Climbing vine	4.0-10 m	spice (seed)
Piper retrofactum (P longum)	Long pepper	H	Climbing vine		medicinal, spire (seed)

LEGUMINOSAE

Calapogonium mucunoides	Calapogonium	M	Climbing herb	0.3-0.5 m	green manure (leaves, stems)
Centrosema pubescens	Centrosema	M	Climbing herb	0.45 m	green manure, fodder (leaves)
Desmodium gyroides	Desmodium, Karikut-rikut	M	Small shrub	1.0-2.5 m	fodder
Dolichos lablab	Batao	S	Climbing herb	1.5-6.0 m	food (beans), buds.
Mucuna pruriens	Velvet beans,				
M. derengiana	Kokoa				
Pachyrrhizus erosus	Singkamas, Yam bean	M	Climbing herb		food (tuber)
Vigna unguiculata var. Sesquipedalis	Long beans, Sitao	S	Climbing herb		food (bean)

CONVOLVULACEAE

Merremia mammosa	H	Climbing herb	medicinal

LABIATAE

Coleus amboinicus	Oregano	S	Herb		medical (leaves)
Ocimum basilicum	Basil	S	Herb	0.3-0.6	medicinal

				m	
Orthosiphon aristatus (O. stamineus)	Balbas pusa	S	Herb	1.0-1.5 m	medicinal (root)
Pogostemon -cablin	Patchouli	H	Perennial shrub	1.0-1.5 m	essential oils (leaves)

GRAMINAE

Brachiaria decumbens		M	Perennial grass	0.25-0.65m	fodder (leaves)
Panicum maximum	Guinea grass	M	Perennial grass	0.8-2.5 m	fodder (leaves)

URTICACEAE

Boehmeria nivea	Ramie	M	Perennial herb	1.0-3.0 m	fiber (leaves)

CAPSICACEAE

Capsicum sp.	Sili	S	Annual	0.5-1.0 m	food (leaves); spice (fruit)

Note:

H = Highly shade-tolerant
M = Moderately shade-tolerant, and,
S = Slightly shade-tolerant.

TABLE 19: SPECIES REQUIREMENTS AND YIELDS

SPECIES NAME	COMMON NAME	ELEVATION	SOILS	RAINY	INPUTS	YIELDS
				SEASON LENGTH (mos)		
ARACEAE						
Acorus calamus	Lubigan	< 2000	Clay loam	9-12	L	3000kg/ha
Amorphophallus campanulatas	Pongapong	< 800	Sandy team	4 5-9	L	
Amorphophallus variabilis (A. oncophyllus)		< 700	Sandy loam	6-9	M	2.5kg/tuber
Colocasia esculenta	Gabi, Gabing Tagalog	< 1000	Adaptable	7.5-12	M	2-17 tons/ha
Xanthosoma nigrum (Xanthosoma sagittifolium)	Gabing Cebu	< 1000	Adaptable	7 5-9	L	32 500 kg/ha
MARANTACEAE						
Maranta arundinacea	Arrowroot, Uraro	< 900	Sandy	9-12	L	75-37 tons/ha
TACCACEAE						
Tacca palmata		< 900	Sandy	7.5-9		
DIOSCOREACEAE						

Diosconea alata	Ubi	< 800	Loamy clay	7.5-12	M	10-35 tons/ha
Dioscorea bulbifera		< 800	Loam, clay	9-12	M	0.5 kg/tuber
Dioscorea esculenta	Tugui	< 700	loam	7 5-12	M	
	Dioscorea hispida	< 850	Humus	6-9	M	
CANNACEAE						
Canna edulis	Edible canna	< 2000	Rich in	6-9	M	18 - 38 tons/ha
BROMELIACEAE						
Ananas comosus	Pinya	< 1000	Adaptable	7.5-10.5	M	38-75 kg/ha
ORCHIDACEAE						
Vanilla fragrens (V. planifolia)	Vanilla, Banilya	400-800	Rich in humus	7.5-10.5	H	800 kg/ha
ZINGIBERACEAE						
Amomum cardamomum	Indonesian Cardamon	300-1500	Humus	7.5-10.5	M	
Boesenbergia pandurata		< 700	Calcareous	6-9	M	
(Kaempferia						

pandurata)						
Catimbium malaccensis		< 1500	Clay	6-9	M	
Costus spp		<1000	Fertile	9-12	L	
Curcuma aeruginosa	Wild turmeric	400-700	Adaptable	6-9	L	
Curcuma domestica Val.	Luyang dilaw,	< 2000	Clay team	7.5-9	13	
(C. longa)	Dilaw, Kunig				35,000 kg/ha	
Curcuma heyneana		< 750	Adaptable	6-9	L	
Curcuma purpurascens		< 1000	Adaptable	6-9	L	
Curcuma xanthorizza		< 750	Adaptable	7.5-10.5	L	
C. zeodaria	Bolon, Tamahibak Barak, Tamo-karsi Luya-luyahan	< 1000	Clay	6-9		
Elettaria cardamomum	Cardamon	< 1500	Rich humus	9-12	H	100-350 kg/ha
Hedychium	Kamya	< 2000	Deep, rich	5-12	L	5.7 tons/ha

coronarium						
Kaempferia galanga	Duso Dusog, Dusol, Galanga, Gisol, Gusol	80-600	Sand, clay	7.5-12	L	
Kaempferia rotunda		< 750	Clay	9-12	L	
Kaempferia rotunda		< 750	Clay	9-12	L	
Languas galanga (Alpinia galanga)		< 1200	Loose, fertile	7.5-10.5	M	
Zingiber aromaticum	Wib ginger	< 1000	Clay	9-12	M	
Zingiber cassumunar		< 1300				
Zingiber officinale Roxb.	Luya	250900	fertile	9-12	H	30,000 kg/ha
PIPERACEAE						
Piper betel L	Ikmo, Gawed, Betel vine	< 700	Clay	6-10.5	L	Variable
Piper cubebe	Forest pepper	< 400				
Piper nigrum	Black pepper, Paminta	< 1000 alluvium	Rich	9-12	H	
Piper retrofactum (P. longum)	Long pepper	< 600	Sandy	6-9		
LEGUMINOSAE						

LEGUMINOSAE						
Calapogonium mucunoides	< 700	Adaptable	7.5-12			6000 kg/ha
Centrosema pubescens	Centrosema	< 300	Adaptable	7.5-12	L	
Desmodium gyroides	Desmodium, Karikut-rikut	400-1000	Adaptable	9-12	M	2000 kg/ha
Dolichos lablab	Batao	< 500	Fertile	6-9	M	1400 kg/ha
Mucuna pruriens	Velvet beans					
M derengiana	Kokoa					
Pachyrrhizus erosus	Singkamas, Yam bean	< 500	Sandy loam	6-10.5	M	95 000 kg/ha
Vigna unguiculata var.	Long bean, Sitao sesguipedalis		Adaptable, well-drained neutral	drought-resistant	H	
CONVOLVULACEAE						
Merremia mammosa						
LABIATAE						
Coleus amboinicus	Oregano	< 250	H			
Ocimum	Basil	450-110	Clay	7.5-10.5	M	

basilicum						
Orthosiphon aristatus (O. stamineus).	Balbas pusa	<1000 o.m.	Rich in	7.5-12	L	
Pogostemon cablin	Patchouli				M	
GRAMINAE						
Brachiana decumbens						
Panicum maximum	Guinea grass					
URTICACEAE						
Boehmeria nivea	Ramie	< 1200	Rich sand loam	9-12	H	
CAPSICACEAE						
Capsicum sp.	Sili		adaptable	up to 8 months	H	

Note:

H = High;
M = Medium; and
L = Low.

COMMONLY-USED NITROGEN-FIXING TREE PROFILES

SAMPLE MATIX FORMAT 1.

SPECIES NAME	DESCRIPTION	SITE REQUIREMENTS
Scientific name: Acacia mangium Local name Mangium	Mangium grows to 25-30m in height. It is straight-boled and is usually branch-free up to about one half its height. It has a spreading crown and the dense foliage casts a heavy shade. Mangium has some similarities to Acacia auriculiformis but its phyllodes (flattened leaf-like petioles that replace the juvenile teevee) are longer and broader.	Mangium prefers a rainfall range of 1500 3000mm/yr but can withstand a minimum rainfall of 750-1000mm/yr. It can survive in areas with a prolonged dry season, but growth will be affected. It can be planted on a wide spectrum of soil typos and grows well even on infertile, eroded, rocky, shallow and acidic (down to pH4.5) soils. K prefers moist, well-drained soils and coos not tolerate flooding. Mangium is wind-firm and moderately light demanding. Seedlings and young saplings are killed by fire, but older tree are fire - resistant.
Scientific name: Acacia meamsii (A. decurrens var. Mollis) Local name: Black wattle	Black wattle is a tree usually 6-10m height, may reach 15-20m. It has a good, straight stem form and a narrow crown when grown in a closed stand, but develops a spreading crown if open-grown. It has light, feathery, dark green foliage.	Minimal rainfall requirements are 500-700mm/yr, but it grows well in much higher rainfall zones. It can only withstand 2 3 months of dry season. Black wattle grows best on sandy loams and shale or slate derived soils. It can also tolerate shallow and unproductive acid soils and on steep, unstable slopes. It does not survive well on alkaline or calcareous soils. It is a high elevation species, planted at 100-2500m

		in cold climate zones. Growth can be reduced if temperatures are too warm. It is moderately shade-tolerant, but can also be grown in full sun.
Scientific name: Albizia lebbek Local name: Langil	Langil grows to be a 30m single-stemmed tree with a large spreading crown, but a is also managed as a multistemmed shrub. It forms a It is suited for areas areas 500-2500mmiyr straight bole if grown in a closed stand, but a develops a low, spreading crown if open- grown. It can be easily recognized by its numerous paper-skinned pods that rattle in the wind.	Langil is especially suited to dry areas and d can withstand a dry season up to 6 months. rainfall. It tolerates wide range of sites including both acid and alkaline soils and saline soils. On highly eroded sites, it may require more intensive safe preparation and maintenance. It can grow in full sun or partial shade and a develops fire resistance with age.
Scientific name: Alnus nepalensis Local name: Alder	Alder can grow to be a large tree, 10-30m in height. It has a spreading, deep, dense root system and a has a deep crown when grown under shade.	Alder requires a minimum of 800mm rainfall/yr and grows best in areas where rainfall is higher and evenly distributed. It is a high elevation species, thriving in a cool climate at 1000-3000m. It grows best in moist, deep, loamy soils, but it tolerates infertile, acid, poorly drained, steep, rocky and eroded soils. Alder is wind-firm and it and eroded soils. Alder is wind-firm and it can survive occasional flooding but

		not lengthy waterlogging nor extremely dry soils. It tolerates shade well.
Scientific name: Cajanus cajan Local name: Kadios, Pigeon pea	Kadios is a small tree or shrub 1-5m tall. Its form highly variable, but usually described as shrubby.	Kadios is an important crop plant in dry to moist climates. It is drought-hardy and tolerates up to 6 months dry season, with a rainfall range of 500-2500mm/yr. It is widely adaptable as to soil conditions and can be planted up to 1000m. It does not tolerate waterlogging and requires full exposure to sunlight for fruiting.
Scientific name: Desmodium rensonii Local name: Rensoni	Rensoni is an erect shrub.	Rensoni grows well in moist areas with even rainfall distribution and it also shows very good drought-tolerance. It is able to grow on acid soils. Probably best adapted to lower elevations of the uplands.
Scientific name: Flemingia macrophylla Local name: Flemingia	Flemingia is a shrub, attaining 2-3m in height. It has a deep root system and produces dense foliage. It looks somewhat similar to Kadios, but does not produce edible beans.	Flemingia is moderately drought-tolerant, but requires at best 1100mm/yr rainfall and not longer than 6 months of dry season.
Scientific name:	Acid ipil-ipil is a small tree up to 18m in height with usually	Acid Ipil-ipil grows well in a humid to dry climate with a minimum rainfall of 500mm/yr

Leucaena diversifolia Local name: Acid ipi-ipil	good but sometimes shrubby form. Its appearance is very similar to that of Leucaena leucocephala, but Acid Ipil-ipil's flowers are pink rather than white and it can also be differentiated by the leaf rachis which does not have button-like glands.	and up to 8 months, dry season. Growth is better in higher rainfall zones. Acid Ipil-ipil gets its name from the fad that it tolerates acid soils somewhat better than L. leucocephala. It is also more productive at higher elevations than giant and native ipil ipil, with best growth up to 1000m, but a can be planted up to 1500m. It is strongly light demanding.

SAMPLE MATRIX FORMAT 2.

CHARACTERISTICS		**SPECIES**			
	Mangium	Black wattle	LangiI	Alder	Kadios
Height	25-30m	Average 6-10; up to 15-20m	15-30m	15-30 cm variable	1-5 m
Stem form	Straight	Poor	Often poor, but varies with stand density		Highly
Crown form	Spreading dense foliage	Narrow or spreading, depending on stand density	Spreading	Deep crown when grown under shade	
Annual rainfall					

Annual rainfall					
Optimum range	1500-3000mm	700-2000	700-2500		
Minimum range	750-1000mm	500-700	500-600		
Dry season length	3-4 months, but tolerates prolonged dry season	2-3 months	2-6 months	Prefers evenly distributed rainfall	Up to 6 months
Soil type	Tolerates wide range, hardy on infertile, rocky, or eroded soil	Prefers deep fertile soils, sandy loams, shale or slate derived soils	Tolerates wide range, including saline soils	Best in deep, loamy soils tolerates steep, rocky, eroded soils	Widely adaptable
Soil pH	Neutral to acid	Neutral to acid	Alkaline to acid	Acid to neutral	
Soil drainage	Moist, well-drained soils, does not tolerate flooding	Moist but well drained soils	Free draining soils	Prefers moist soils, but tolerate poorly- drained sites	Does not tolerate water logging
Elevation	0-720m	100-2500m	0-1400	1000-3000m	Up to 1000m
Wind resistance	Wind-firm	-	-	Not wind firm	
Fire Resistance	Older trees are fire-resistant	Fire resistant	Develops fire resistance		

			with age		
Shade tolerance	Moderately light demanding	Can grow in full sun or partial shade	Can grow in full sun or partial shade	Tolerates shade well	requires full sun for fruiting

PROPERTIES OF SOME FUELWOOD SPECIES

		AGE AT FIRST				
SCIENTIFIC NAME	**COMMON NAME**	**FUELWOOD HARVEST (YEARS)**	**CHARCOAL QUALITY**	**SPROUTING AFTER CUTTING**	**OTHER USES REQUIREMENTS**	**SITE**
Acacia auriculiformis	Japanese acacia	2-5	Good	Poor	Land rehabilitation furniture, pulp shade, N-fixing, roadside tree	Adaptable tolerates harsh sites, poor soil conditions, flooding, 4-6 months dry season, 4-600 m elevation
Acacia mangium	Mangium	2-5	Fair	Poor	Land rehabilitation,	Tolerates infertile and

					erosion control, N- fixing pulp, timber, firebreak	acidic soil, rainfall 1500-3000 mm/year
Acacia meamsii	Black wattle	3-5	Good	Poor	N-fixing, tannin, poles, green manure, windbreaks	Grows well on shallow or poor acid soils
Albizia falcataria (Paraser-ianthes falcataria)	Moluccan	3	Good	Vigorous	Pulp, light industrial wood, coffee shade, green manure, N-fixing, ornamental tannin	Grows well on alkaline soils, does not tolerate prolonged drought, can tolerate 2-4 mo dry season if some rainfall occurs
Albizia lebbek	Langil	5-10	Good	Vigorous	Fodder, N fixing, medicinal shade for plantation crops; for pulp and paper	-Rainfall 500-2500, tolerates wide range of soils, 2-6 months dry

						season, adaptable but not suited for every graded sites.
Alnus nepalensis	Alder	3-5	Good	Vigorous (pollarding)	Erosion control, N- fixing, coffee and cacao shade, fodder, tannin	High elevations: 100-300m Tolerates infertile, acid soils
Calliandra calothyrus	Calliandra	2-3	Excellent	Vigorous	N-fixing, erosion control, land rehabilitation, green manure, bee forage, firebreaks, coffee shade, fodder	Optimum rainfall 2000-4000mm/yr but withstands less, tolerates dry season of 3-6 months and grows well on depleted

						soils and steep slopes elevation 250-800 m
Cassia siamea	Thailand shower	2-3	Good	Vigorous	Small timber (fumiture), fodder, soil improvement	Tolerates up to 6 months dry season with minimum rainfall 650 mm/yr. Prefers good sibs, but can grow on lateritic soil up to 800
Cassia spectabilis	Antsoan-dilau	3-5	Good	Vigorous	Ornamental	Tolerates dry season of at least 3 months, thrives on poor sites, including sandy and clay soils up

						to 300 m
Casuarina equisetifolia	Agoho	3	Excellent	Vigorous	Coffee shade, N-fixing, dune stabilization, live fencing, pulp	Tolerates diverse and difficult sites, coastal areas, limestone, 6-8 months dry season, does poorly on heavy clays
Eucalyptus camaldulensis		3-5	Good	Vigorous	Windbreaks, roadside tree, medical	Tolerates calcacerous, acid or saline sot 4-8 mo dry season
Gliricidia sepium	Madre de Cacao	2-3	Excellent	Vigorous	Coffee shade, green manure, N-fixing trellis tree, rat poison, fodder, insecticide	Highly adaptable, tolerates low soil fertility, tolerates

						long dry season, 6 months or more, but needs at least 1000 mm/yr rainfall, windfirm
Gmelina arborea	Yemane	3-4	Good	Vigorous	Pulp, light industrial wood, roadside trees, bee forage	Highly adaptable, tolerates acidic calcacerous or lateritic soils and 6 7 months dry season
Leucaena diversifolia	Acid Ipil-ipil	2-5	Good	Vigorous	Pulp, pules, N-fixing	500 mm/yr minimum rainfall with up to 8 months dry season, somewhat tolerant of

						acid soils (pH 5.0) up to 1000 m
Leucaena leucocephala	Ipil-ipil	2-5	Excellent	Vigorous	Timber, poles, fodder, N- fixing green manure	Tolerates 6 months dry season with best rainfall range 600-1700 mm/yr, does not tolerate acid soils, elevation to 500 m
Melia azedarach	Paraiso	5		Vigorous	Tools and implements, pulp insecticide	Adaptable to various soils, tolerates 6 months dry season
Muntingia caladura	Datiles	2-3		Vigorous	Fruit, ornamental	Withstands 6 months dry season, but requires

						rainfall 100 mm/yr. Can tolerate sandy, limestone and saline soils up to windfirm
Piliostigma malabaricum	Alibang-bang	4-5	Good	Vigorous	Leaves used to season foods, medicinal uses	Requires distinct dry season, tolerates 6 months dry drought and dry rocky sites
Pinus kesiya	Benguet pine	20	Poor	No	Timber	Rainfall 1000 2000 mm/yr with 2-6 months dry season, grows on poor acid soils at 450-2900 m
Pithecello-	Kamachile	34	Good	Vigorous	Construction	Adapts to a

Pithecello-bium duke	Kamachile	34	Good	Vigorous	Construction poles, fodder, fruits, N-fixing,	Adapts to a variety of soil conditions and 8 months dry erosion season control, live fencing, bee forage, medicinal use
Psidium guajava	Bayabas	3-5	Good	Vigorous	Fruits, fire wood, medicinal	adapts to a variety of soil condition
Samanea saman (Albizia saman)	Raintree	34	Good	Vigorous	Timber, craftwood fodder, roadside tree	Rainfall 600-2500 mm/yr with dry season up to 6 months, prefers good soils but can

						grow on poor acid soils up to 500-700 m
Syzygium cumin)	Duhat	2-5	Good	Vigorous	Poles, light construction, guitars, fruits, medicinal use, roadside tree, live fencing, ornamental	Can grow on variety of sites, including shallow, rocky soils if rainfall sufficient. Prefers distinct dry season tolerates 6-7 months drought
Tamarindus indica	Tamarind	5	Excellent	Vigorous	Fruit, timber roadside tre shade, food seasoning (fruits and extract)	Very drought resistant, prefers deep soils, but adapted to wide

						range of sites, including sandy and rock soils
Trema orientalis	Anabiong	3-6	Good	Vigorous	Pulp, poles coffee shade, fruits, fodder, tannin	Tolerates poor soils and 6 months dry season, but prefers humid climate


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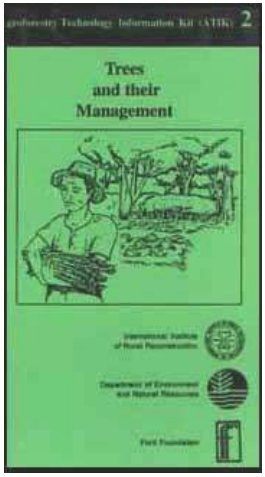

- Sustainable agroforest land technology (Salt-3)
- Outplanting seedlings
- Tree pruning and care
- Bagging of young fruits
- Establishing bamboo farms
- Philippine bamboo species: Their characteristics, uses and propagation
- Growing rattan
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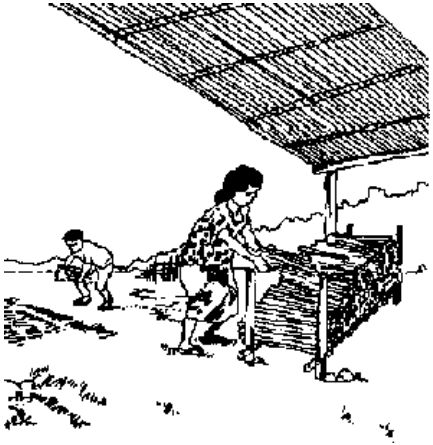
- Middle to high understory shade tolerant crops
- Low understory shade-tolerant crops
- Conserving available fuelwood

Conserving available fuelwood

The fuelwood crisis is a fight against time. The less wood there is in an area, the more the consumption of firewood threatens the survival of forests. Also, more often than not, growth rate of trees is outpaced by the rate by which they are cut. Fortunately, there are some simple ways of conserving firewood.



Conseving available fuelwood

1. Use trees with high calorific value.
2. Cut trees at the right age.

TABLE 23. MINIMUM AGE AT CUTTING.

SPECIES	MIN. AGE AT

	CUTTING (YEARS)
Gliricidia septum	2
Leucaena leucocephala	2
Leucaena diversifolia	2
Acacia auriculiformis	2
Cassia siamea	2
Prosopis chilensis	3
Eucalyptus camaldulensis	3
Casuarina equisetifolia	3
Gmelina arborea	3
Derris indica	4

3. One-and-a-half inch diameter wood would be ideal. It is easier to dry and will provide enough burning surface.

4. Improve wood drying. Moisture affects the heating value of wood. A wood with 50-percent moisture content provides at most 57 percent of its heating value as it utilizes the remaining heat to dry itself.

Dry them under the sun for two consecutive days.

Gather the sun-dried wood before the sun sets. Do not gather them late at night as they absorb moisture from the atmosphere very fast.

Pile them in an elevated and shaded platform to avoid their absorption of moisture from the

soil.

Protect sun-dried firewood from rain.

Dry wood for next meal cooking over the stove to further remove moisture.

5. Use improved stoves. Open-fire stoves are known to have 10 percent or less efficiency in moderate breeze. Improved woodstoves can give as much as 25-35 percent efficiency, saving as much as half the volume of wood used in open-fire stoves.

Use improved stoves

6. Other simple and practical ways to further reduce fuelwood consumption:

Before cooking hard-coated seeds like mungbeans and cowpea, soak them in tap water ovemight.

For tough meat, add papaya or any other materials known to speed up cooking.

If food being cooked is brought to a boil, reduce firewood. Maintain one or two species - enough to maintain the simmer.

If hot food is desired, construct a hay box to keep the food warm. No need for reheating.

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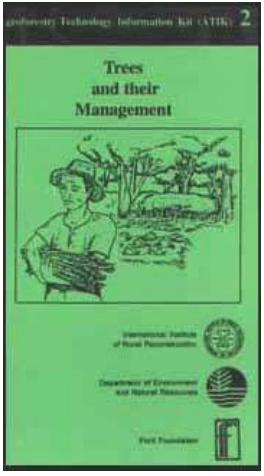

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Proceedings of the workshop

Workshop to revise the agroforestry technology information kit (ATIK)

The first workshop to develop the Agroforestry Technology Information Kit- now more popularly known as ATIK - was conducted by the International Institute of Rural Reconstruction (IIRR) in its Silang Campus, Cavite, Philippines, on November 4-13, 1989. There were 39 participants to this workshop who came from 11 government and

nongovernment organizations (GOs and NGOs).

ATIK was produced primarily for use by DENR technicians who have been implementing the Social Forestry Program nationwide. DENR conducted a nationwide survey among its staff who were involved in the implementation of its Integrated Social Forestry Program and also primary users of ATIK. A questionnaire was formulated, focused on the actual experiences of these technicians in using the ATIK and on specific revisions they proposed to make on the kit. A Planning Committee was created to study the technicians' proposed modifications to the ATIK, as well as to plan for the workshop'to revise it. The committee was composed of For. Domingo Bacalla of DENR, For. Moises Butic of DENR, Ms. Rowena Cabahug of UPLB College of Forestry, Dr. Romulo del Castillo of UPLB College of Forestry, Ms. Remedios Evangelista of DENR, Dr. Julian Gonsalves of IIRR, Mr. Scott Killough of IIRR and Mr. Jaime Ronquillo of IIRR.

The workshop to revise the ATIK took place also in IlRR's Campus in Silang, Cavite, on November 16-21, 1992, with 45 participants representing 13 agencies. These agencies included: the Department of Environment and Natural Resources; Farm and Resource Management Institute; Southern Mindanao Agricultural Programmer Mag-uugmad Foundation, Inc.; University of the Philippines at Los Baos; Upland Development Prograrn/Sungay Upland Farmers' Golden Harvest Association; Soil and Water Conservation Foundation; Quirino Livelihood Concept and Development Resource Center, Inc.; Winrock Intemational; Mindanao Baptist Rural Life Center; Visayas State College of Agriculture; International Rice Research Institute; and, IIRR.

In the workshop, the same process for materials production was followed. Old sheets and first drafts of new topics were presented by the authors in plenary sessions. These materials then underwent continuous improvements through the critiquing of the other workshop

participants. Communication experts (writers, editors, layout and design artists) were on hand to assist the authors in revising/preparing the texts, illustrations and designs of their papers. Before the materials were prepared in a camera-ready format, they were submitted to their authors for final review and revision to ensure that the additional corrections were incorporated.

The major revisions of ATIK are the following:

A. Format

1. From a set of loose-leaf single sheets in folder/binder to six, pocket-size (4" × 7") booklets, individually classified and bound according to major topics.

2. Using simple, white, ordinary bookpaper, rather than the thicker, colored and more expensive bristol board.

3. Using a thick binder to hold the six booklets, instead of an individual folder for each kit.

B. Content

1. Some old topics which were found not relevant/useful from the survey were dropped from the kit.

2. Other topics were revised, focusing on the specific needs of the DENR technicians.

3. Additional, new topics were included, again to respond to the expressed needs of the technicians.

4. Many old topics - which were adapted by farmers -- remained as they were.

The revised ATIK - with its new format and content - is expected to further facilitate the work of DENR's 1,200 technicians in its Integrated Social Forestry (ISF) Program nationwide. Ultimately, the kit will help enable DENR's ISF's program to give the Filipino uplanders access to forest lands for a tenure of 25 years or more.

WORKSHOP TO REVISE THE AGROFORESTRY TECHNOLOGY INFORMATION KIT (ATIK)
November 16-21, 1992 IIRR, Silang, Cavite


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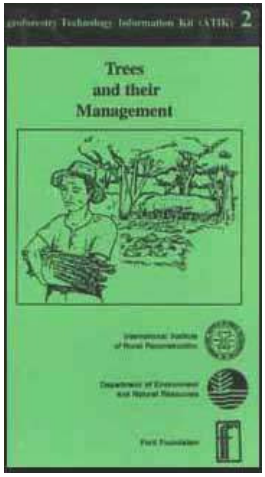
Trees and their Management (IIRR, 1992, 195 p.)
(introduction...)
Message
Proceedings of the workshop
List of participants
Current program thrusts in upland development
Trees and their management
Sustainable agroforest land technology (Salt-3)



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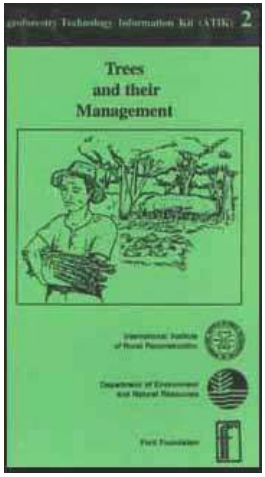
Trees and their Management (IIRR, 1992, 195 p.)
(introduction...)
Message



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

Current program thrusts in upland development

Human greed, abuse and misuse of the country's forest resources have resulted in the sad state of our uplands today. Resource depletion, environmental degradation, inequitable access to resources, tenurial issues, upland poverty and the continuous influx of lowland migrants into the uplands are among the current issues in natural resources management.

In recent decades, the Philippines witnessed an unprecedented commercial exploitation of the timber resources leading to an annual rate of deforestation reported to have reached an average of 119,000 hectares during the declining years of the timber boom between 1969 to 1987. From a leading exporter of precious "Philippine Mahogany", the Philippines has become a timber deficit country where the cost of a board foot of lumber is beyond the means of an average wage eamer. The disappearance of forests has resulted in the loss of jobs and livelihood in neighboring communities; destructive floods and drought during wet and dry seasons, respectively; and, landslide and siltation of rivers and dams. Other consequences of deforestation have become common occurrences in many parts of the country.

Through the years, landlessness and unemployment have driven hundreds of thousands of poor families in the lowlands to migrate and eke out a living in upland areas where they have become "squatters" by operation of law. In many cases, these have resulted in the total destruction of remaining forest vegetation in the area. The land has become marginally

productive as the top soil continues to be lost through erosion brought about by improper agricultural practices. The result is poverty and a degraded upland environment affecting not only the people who subsist in these areas, but even the poor farmers in the lowlands who likewise suffer from the inevitable consequences of forest destruction. Latest estimates show that as much as 8.25 million hectares are now severely eroded.

In view of these problems, the government has in recent years formulated programs directed at arresting resource depletion and environmental degradation while searching for solutions to the issues of secured access to land, poverty alleviation and increased sustainable productivity. Among the major programs being implemented by the Department of Environment and Natural Resources are me Integrated Social Forestry Program (ISFP) in noncritical areas of the public domain that are under various forms of cultivation; the National Forestation Program (NFP) in degraded areas and in residual stands that are inadequately stocked; the Forest Land Management Agreement (FLMA) in newly reforested areas under the NFP that need to be maintained and cared for; and, the Community Forestry Program (CFP) in residual forest lands occupied by farming families.

1. INTEGRATED SOCIAL FORESTRY PROGRAM (ISFP)

Initiated about a decade ago, the ISFP draws strength from the DENR Upland Development Program (UDP) started by the Bureau of Forest Development in 1980 which was aimed at distilling lessons and developing methodologies for participatory management of the uplands. The ISFP incorporates the best features of three people-oriented forestry programs implemented in the 1970's, i.e., Forest Occupancy Management, Communal Tree Farming and Family Approach to Reforestation. The major features include granting longterm tenurial arrangements to qualified applicants, technical and modest material assistance and institution building aimed at developing capability for community-based resource

management.

ISFP addresses the twin problems of rural poverty and ecological stability in occupied forest lands. Through ISFP, forest land occupants are provided secure access to land as well as technical and material aid to make the land productive without depleting it. Secure land tenure comes through either the Certificate of Stewardship Contracts (CSCs) for individuals, or the Community Forest Stewardship Agreements (CFSAs) for community organizations. In both cases, farm families are granted renewable 25-year leases on the public land which they occupy and cultivate. In the first years of the lease, the farmer receives technical assistance for developing self-sufficiency and sustainable farming practices.

The program provides assistance in the areas of agroforestry, land tenure and community organizing. Community organizing is applied to mobilize groups to obtain stewardship contracts, promote agroforestry and soil/water conservation and build local institutions. ISFP emphasizes improvement of existing farmer practices, not introduction of new ones except in situations where such may be necessary. Participatory strategies are used to gather data, diagnose field situations and monitor technical problems. Farm visits and training courses develop farmers' skills in agroforestry and organization. In the process, community leaders are prepared to take responsibilities for continued development after the end of the project, tentatively set at five years.

Recently, the implementation of the Local Government Code obligated the DENR to devolve to the Local Government Units (LGUs) the management of all ISF project sites except some of the "model sites" (one model site per province) and the UDP sites. These projects will remain under the care of the DENR for use as learning sites where new technologies and approaches are expected to be generated. These sites will also be used as training areas for LGU technicians and other development workers as part of the outreach program of the

DENR.

2. NATIONAL FORESTATION PROGRAM (NFP)

In 1988, the DENR implemented the NFP which consists of three major components, namely: reforestation, watershed rehabilitation and timber stand improvement. The reforestation component is concerned with the replanting of denuded forest lands with indigenous and exotic forest species, including fruit trees, bamboos and minor forest species. One of the reforestation strategies used is assisted natural regeneration (ANR) where augmentation planting of climax species is done to improve future yield at minimum cost. The timber stand improvement (TSI) involves the removal of over-mature and inferior trees to improve growth in logged-over areas. Reforestation, ANR and TSI are approaches used in rehabilitation of identified critical watersheds and catchment areas.

DENR enters into contract with upland settler families, community and civic/religious organizations, entrepreneurs, local and other government offices and other NGOs for any of the above NFP activities in areas identified by DENR. The contract may be for survey, mapping, planning, community organizing/training, monitoring and evaluation or actual comprehensive site development of a given area.

3. FOREST LAND MANAGEMENT AGREEMENT (FLMA)

FLMA provides a long-term tenure to the people who plant and care for trees in newly reforested areas by granting farmers access to these areas for purposes consistent with sound ecological principles. When the reforestation contract terminates after three years, the contractor may apply for an FLMA if at least 80 percent of the trees planted are surviving and properly maintained. Family contractors must organize into associations or cooperatives

covering a total of at least 100 hectares. DENR employs local NGOs to help organize communities and train them in forest management.

Like stewardship contracts under ISFP, FLMAs are for 25 years, renewable for another 25 years. The contractor may use the area to grow and harvest minor forest products or interplant cash crops, fruit trees and other agricultural crops using sound agroforestry practices. The contractor may also harvest, process and sell timber when the trees mature, following the principles of sustained yield forest management. In return, the contractor provides DENR 30 percent of the total proceeds until the whole cost of reforesting the area has been recovered. The proceeds will be deposited into a "trust fund" for expanding reforestation activities.

4. COMMUNITY FORESTRY PROGRAM (CFP)

The need to democratize access in the use of the forests and allow organized upland communities to benefit from the resource compelled the government to adopt policies that would enable communities to protect, manage and rehabilitate fragmented residual and old growth forests. CFP is emerging as a community-based approach in managing certain portions of abandoned, canceled and expired areas of Timber License Agreements (TLAs).

CFP makes upland dwellers stewards of residual forest areas. Communities are awarded 25-year Community Forestry Management Agreement (CFMA). Again, these agreements are renewable for another 25 years if mutually agreeable to DENR and the community. The community organization can harvest, process and sell forest products from the area according to a management plan submitted to DENR beforehand. The plan must comply with prescribed rules and follow principles of sustained yield management.

Under the CFP, DENR assists the holder organization to set up and strengthen the community organization. This includes on-the-job training in resource inventory, preparation of forest management and conservation plans and developing livelihood opportunities. For this assistance, DENR employs qualified NGOs.

ROLE OF NGOs

Through the years, the NGOs have been doing a proactive role in upland development through advocacy, training and technical assistance. However, the latter part of the 1980s offered greater opportunities for their direct involvement in the implementation of government programs such as reforestation, social forestry and community forestry. In addition to their traditional roles, the NGOs are now involved in technical work such as survey. and mapping; resource appraisal and planning; community organizing; reforestation; resource management; and, harvesting, processing and sale of forest products.

A TOOL IN UPLAND DEVELOPMENT

Agroforestry is an important tool in the development of the uplands. If practiced properly, it helps promote soil and water conservation while increasing productivity and sustainability of upland farms to the benefit of the people.

There are traditional astute agroforestry practices being employed mostly by indigenous people in the uplands. The great majority of the population, however, remains in need of improving their system of farming the uplands to increase income and protect the environment.

Meanwhile, the number of people being engaged in promoting appropriate agroforestry technologies has dramatically increased in recent years. They come from national

government agencies, various nongovernment organizations and, more recently, technicians of local government units to whom the upland development functions have been devolved.

This Agroforestry Technology Information Kit (ATIK) has been developed for use by these types of development workers as a quick reference. It consists of simple, illustrated technologies being used in various parts of the country. It is a product of a week-long materials production workshop among agroforestry practitioners in the government and nongovernment organizations, farmer groups and the academe.

TABLE 1: SUMMARY PROFILE OF DENR'S PEOPLE - ORIENTED UPLAND DEVELOPMENT PROGRAMS.

PARTICULARS	ISFP	NFP	FLMA	CFP
Target areas	Occupied forest lands except national parks and critical watersheds	Denuded and understocked areas	NFP contracted areas	Fragmented residual and old growth forest areas
Target participants	Upland farmers and communities	POs, NGOs, LGUs and with at least 80% families	Community contractors	Upland resident POs survival after 3 years
Stewardship contract	25 years	3 years	25 years	25 years
Funding source	DENR and CARP	ADB	ADB	ADB and USAID-NRMP
DENR office concerned	National ISF Secretariat/Social Forestry Division	NPCO	NPCO	CFP Secretariat

Project implementor	DENR,NGOs and LGUs	Contractors	FLMA awardees	Communities
Implementing strategies	CO-driven agroforestry intervention	Reforestation contract	Management contract	Management contract/agreement

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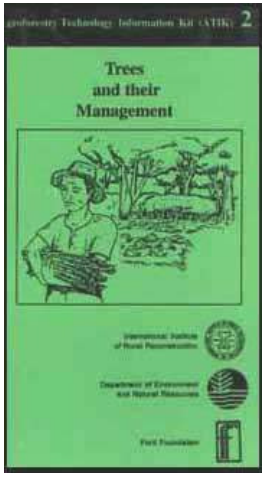

- Growing rattan
- Growing anahaw
- Growing buri
- Shelterbelts
- Bank stabilization
- Assessing the usefulness of indigenous and locally adapted trees for agroforestry
- A guide for the inventory, identification and screening of native plant species with potential for agroforestry
- Fruit trees for harsh environments
- Citrus production
- Jackfruit production
- Mango production
- Middle to high understory shade tolerant crops
- Low understory shade-tolerant crops
- Conserving available fuelwood

Trees and their management

Trees have many uses to people. For this reason, the tree deserves to be given the recognition as "nature's greatest provider."

Trees and their management

From birth to death, man uses wood and other products from trees. The truth is, humanity would not have survived this long without trees. Taken collectively, trees supply life-giving oxygen and help purify the air. They provide shade and add beauty to the landscape. They serve as protective barrier for crops and animals against destructive wind. At the same time, the leaves, fruits and seeds of many species contribute to humankind's supply of work energy Furthermore, the roots of trees hold the soil together and help minimize erosion and the occurrence of floods during the rainy season. It is for these reasons that trees and woody perennials, in general, are important components of an agroforestry system.

One of the important characteristics of trees is their long life cycle (they are perennials). To a large extent, this characteristic is responsible for many of their beneficial influences to the environment and associated crops. For example, a canopy of trees provide long-term protection to soil against the erosive impact of raindrops. However, their long life also implies that farmers need to be careful in selecting trees to plant because once established, they are

hard to replace.

Tree culture normally involves nursery management, tree establishment in the field, care and maintenance and harvesting.

There are cultural practices that are peculiar to trees. Seeds are not as widely available and there are usually no established centers where one can buy tree seeds. In many cases, farmers may have to rely on collecting seeds from standing trees. Tree seedlings take a longer time to raise than annual crops. Some trees may take as long as one year in the nursery before they are ready for field planting.

In the establishment of trees in the field, spacing is usually very important because it will largely control the rate of growth, size and form of the trees. One peculiar care and maintenance activity is pruning which is undertaken to remove unwanted branches or, in some cases, to suppress growth as in alley cropping.

A few years after planting, trees normally need minimal care while, at the same time, their beneficial effects continue to increase.

Harvesting of trees for wood is another unique activity.


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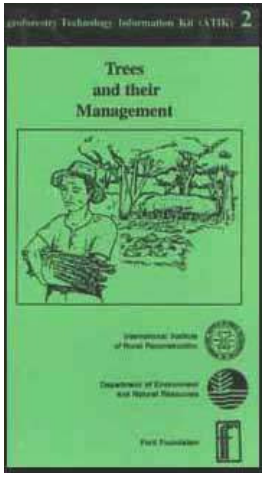
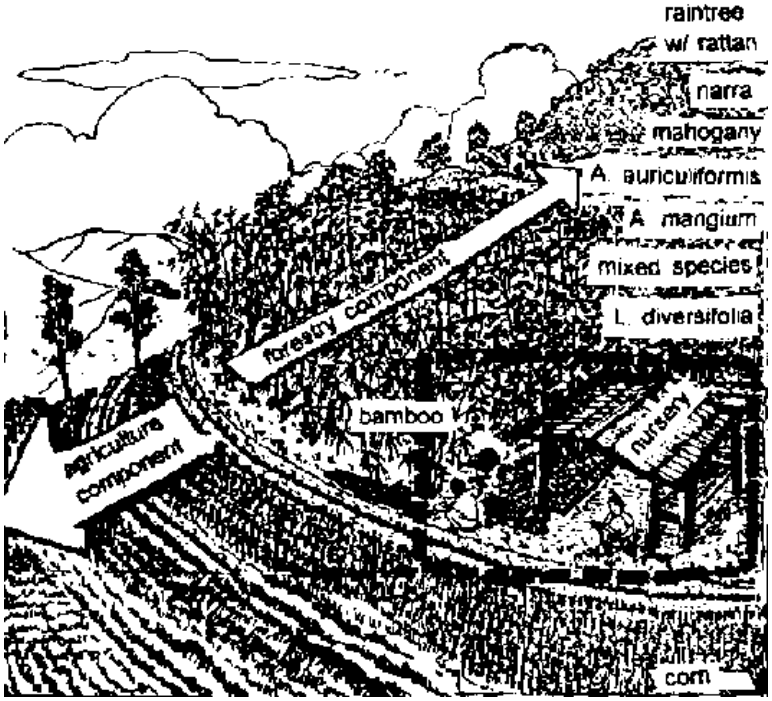


- Jackfruit production
- Mango production
- Middle to high understory shade tolerant crops
- Low understory shade-tolerant crops
- Conserving available fuelwood

Sustainable agroforest land technology (Salt-3)

SALT-3 is a two-hectare model of a small-scale reforestation integrated with food production. The farm is devoted to about 40 percent agriculture and 60 percent forestry. This "food-wood" intercropping, as designed by the Mindanao Baptist Rural Life Center in Bansalan, Davao del Sur, shows that it can effectively conserve the soil, thereby providing abundant food, wood and income to hilly-land farmer.



Sustainable agroforest land technology

This information material will guide you on how to establish SALT-3.

Agroforestry -- the system of land management whereby both forest and agricultural crops are produced on the same piece of land - has been regarded with high hopes by many sectors as the most probable answer to deforestation and degrading food production. SALT-3 is a

variant of agroforestry and here is how to establish it on your hillyland.

Step 1: Set up the agroforestry nursery. Ensure sufficient supply of planting materials for your agroforest farm by setting up your own nursery. Establish an accessible nursery (10 meters by 25 meters) with the' following fixtures: potting shed, transplant shed and seedbeds. Basic materials like sprinklers, shovel and spade should also be made available.

Set up the agroforestry nursery

Step 2: Care for and manage your seedlings. For better growth and field survival, the production of healthy and vigorous planting stock is necessary.

Sowing the seeds. Most forest seeds are hard to germinate so they need scarification either by
mechanical or hot-water treatment. The most common problem encountered in seed germination is damping off and insect defoliators. One way of avoiding this is to treat the seeds with chemicals. In some instances, seeds can be planted directly in plastic bags.

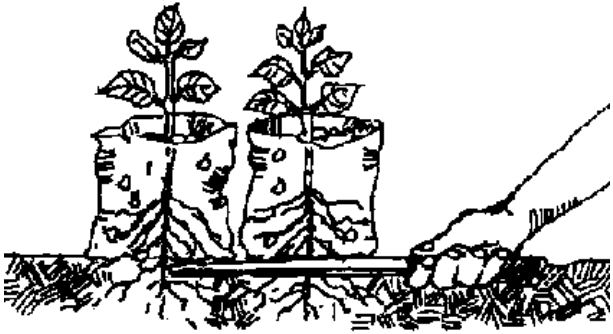
Sow the seeds in a sterilized soil to avoid damping off. Sterilization may be done by pouring boiling water in the soil media where you will sow the seeds. Keep the seedbeds moist at all times. Mulch and shade the plants. Transfer the seedlings later on into plastic bags.

Sowing the seeds

Transplanting. Prune the roots of species that can be outplanted bare root (mahogany, teak, etc.). Do not allow weeds to compete with your transplants. Fertilizer may be applied in conjunction with watering long before transplanting. Dissolve complete fertilizer (14-14-14 or 15-15-15) at the rate of 10 g/l water. If commercial fertilizer is not available, liquid fertilizer from leguminous trees may be used.

Before transplanting them to the field, harden the seedlings first by gradually exposing them to more adverse conditions. Do this three to six months before transplanting. Seedlings ready to be planted should have sturdy, well-developed crowns and many fine, fibrous lateral roots.

Step 3: Find the contour lines and establish your hod crops on the lower half of the farm. Find the contour lines of the farm's lower half portion using an A-frame. Plant the identified contours with any of the following hedgerow species: Flemingia macrophylla, Desmodium renzonii, Gliricidia septum, Leucaena diversifolia and L. leucocephala. In acidic soils, Cassia spectabilis and/or C. siamea may be planted.

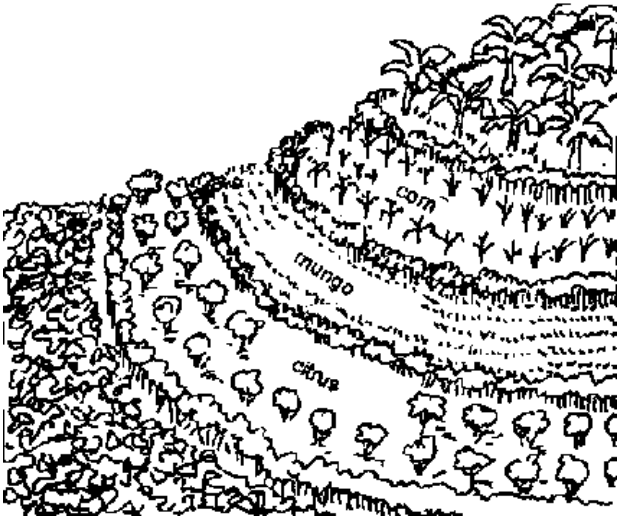


Find the contour lines

Plant preferred short-term crops (examples: ginger, corn, upland rice, sweet potato, mung bean, melon, etc.) in every first and second strip. Plant long-term crops (citrus, cacao, coffee, banana, black pepper, etc.) on every third strip. These can be intercropped with fruit trees (rambutan, durian, lanzones, guava, mangosteen etc.) following appropriate planting distances. Multistorey cropping may also be practiced (e.g., pineapple + cacao + durian) in one strip.

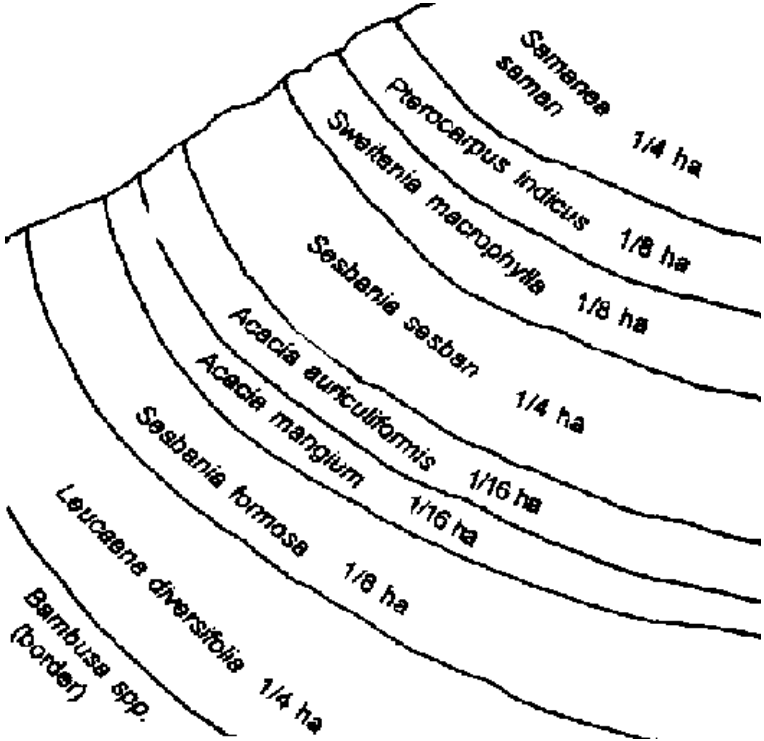
The earlier you establish your food and cash crops, the better off you will be in meeting your immediate needs. Follow the SALT-1 steps in establishing your food crops.

Step 4: Prepare the site for your wood crops. Locate the woodlot at the upper half of the project so that the agricultural component on the lower portion will benefit from the conserved moisture and nutrients from the wood crops.



Prepare the site for your wood crops

On areas with steep slope and with erodible soil, extra care must be exercised so as not to induce soil erosion when clearing the area. You can use either partial or complete removal of vegetation whichever is more favorable to you. Avoid burning.

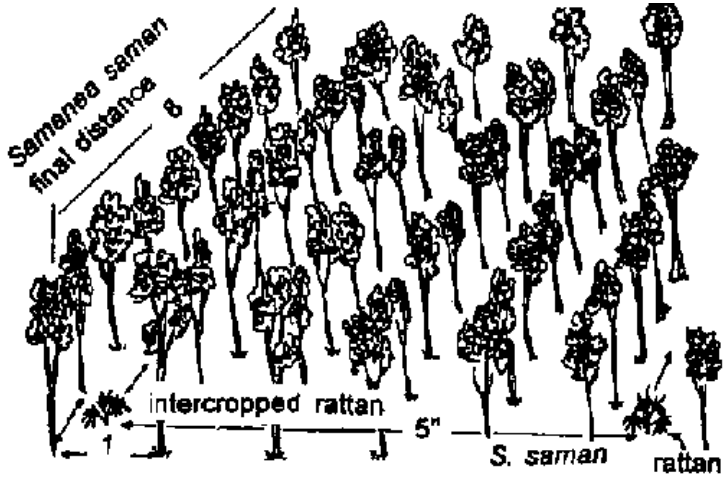


Compartmentalize and space your wood crops

Step 5: Compartmentalize and space your wood crops. For a threefold objective of soil rehabilitation, firewood production and timber growing, you can minimize the use of land space by following the high density strategy of establishing small-scale woodlots.

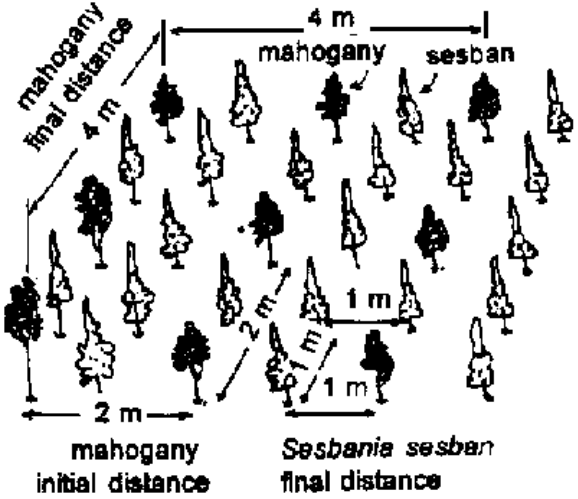
As jointly designed by representative foresters, agriculturists, farmers and countryside developers consulted by MBRLC in developing SALT-3 (2 ha), the following were recommended:

An intercropping layout of Samanea saman and rattan



An intercropping layout of Samanea saman and rattan

An intercropping layout of mahogany or narra and Sesbania sesban



An intercropping layout of mahogany or narra and Sesbania sesban

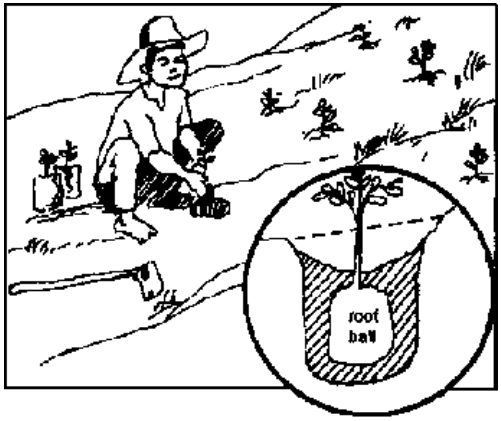
TABLE 1: SPACING OF TREES IN SALT - 3.

COMPONENTS ON TOP-DOWN SEQUENCE		SPACING		
	ha	Initial	Final	Duration
Samanea saman	1/4	1 × 1	8 × 8	Long term
Calamus merillii (as intercrop of S. saman)	1/4	8 × 8	8 × 8	Long term
Pterocarpus indicus	1/8	2 × 2	4 ×	Long term

Sweitenia macrophylla	1/8	2x 2	4 × 4	Long term
Sesbania sesban(as intercrop of P. indicus and S.macrophylla)	1/4	1 × 1	1 × 1	Short
Acacia auriculiformis	1/16	2x2	2x2	Medium term
Acacia mangium	1/16	2 × 2	2 × 2	Medium term
Sesbania formosa	1/8	1 × 1	1 × 1	Short term
Leucaena diversifolia	114	1 × 1	1 × 1	Short term
Bambusa spp. (boundary)	on bordor	4-5 m	4-6 m	Long term

Step 6: Outplant the trees. This may be done at the start or up to the middle of the rainy season so that seedlings can get established prior to the dry season.

You can also follow the contour when outplanting although it is not so imperative. Be sure not to break the earth-ball when setting the seedling into the planting hole. The upper part of the earth-ball should be level or slightly deeper than the edge of the hole. Soil is filled into the spaces and tamped firmly all around.



Outplant the trees

For fast recovery of the seedlings, follow basal application of 50-100 grams of complete fertilizer mixed with an equal amount of urea. Mulch the seedlings to insure higher linability.

Step 7: Intercrop your tree crops. Short and medium-term food and cash crops (ginger, sweet potato, yam, bean, cassava) can be intercropped in the forestry component during the first two years. Long-term ones like black pepper and rattan can be incorporated at the start of the second year. Geese or sheep may be raised underneath the tree crops during the following years.

For effective soil management, see to it that non-legume short-term crops are replaced by leguminous ones and vice versa in every cropping.

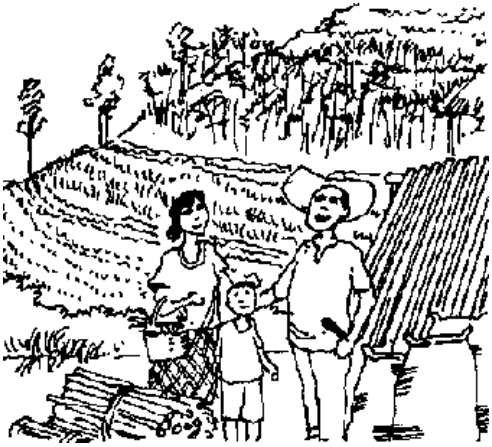
Do tree stand improvement

Step 8: Do tree stand Improvement. Apart from regular ring-weeding and liberation cutting, improve the stand of your trees. Remove the malformed trees. Replant the missing hills if you feel the replanted trees can still catch up.

However, replanting is laborious and expensive and should be done only to maintain required spacing or density. This is also performed when mortality is more than 30 percent.

Do tree stand improvement - continue

Step 9: Harvest your agroforest products regularly. Timely harvesting of crops saves waste. All households and useful products must be gathered, processed and marketed. In the forestry components, forage from tree prunings, fuel wood and roundwood from thinnings commence during the second year. Thin out regularly your forestry area until the timber crop spacing requirement is complied with. In some instances, minor forest crops can be planted under the trees.



Harvest your agroforest products regularly

Step 10: Maintain your SALT-3 farm. For one, trim the hedgerows regularly. Trim the hedgerows once they start to shade the agricultural crops. Spread trimmings evenly throughout the field to check weeds and also conserve soil moisture. Practice crop rotation in your food crop production.

TABLE 2: HARVESTING PLAN OF TREES IN SALT -3.

YEAR	SPECIES	HARVESTING METHOD	USE
1	None	Selective	Fuelwood/charcoal, fodder etc.
2	Sesbania sesban	All-out	-do-
3-5	S. sesban	All-out	-do-
	Leucaena diversifolia	All-out	-do-
	Samanea saman	Selective	-do-
	Sweitania macrophylla	Selective	Fuelwood and light construction, etc.
	Pterocarpus indicus	Selective	-do-
	Acacia mangium	Selective	-do-
	Acacia auriculiformis	Selective	-do-
6-14	Bamboo	Selective	Light construction, furniture, etc.
	Rattan	Selective	-do-
	A. mangium	All-out	Fuelwood and light construction, etc.
	Acacia auriculiformis	All-out	-do-
	P. indicus	Selective	Timber and furniture
15-25	Rattan	All-out	-do
	P. indicus	All-out	-do
	S. macrophylla	All-out	-do-
	S. saman	All-out	-do-

All-out harvesting refers to the harvesting of trees planted during the first year of establishment. While doing selective cutting, it is highly recommended that replanting be done.

Establishing a two-ha SALT-3 farm needs about P6,000. Cost and return analysis on the 5th year of operation shows that the technology can generate a cash net profit of P1,547.43 per month. Its return on investment (ROI) is 7.97 percent. But on top of this economic benefit, an upland farmer who follows the system has a farm that is well-protected and ameliorated soil due to integration and diversification scheme, thus resulting to a sustainable farming system.

Note: This system which was started in 1987 is still being monitored. The crops mentioned earlier are only suggestions and farmers can use any other crops suitable in their respective areas.

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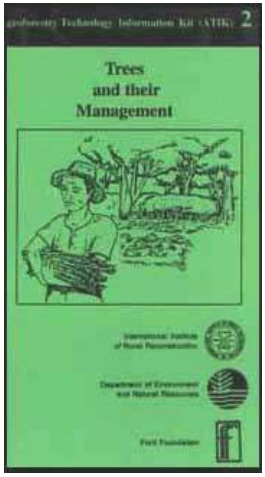


Outplanting seedlings

Many seedlings from the wilds die when planted out in the field. High seedling mortality is often caused by careless handling and planting. While proper species choice is of primary importance, a farmer should be able to greatly increase his success in raising trees by following these guidelines.

PREPARE THE SEEDLINGS

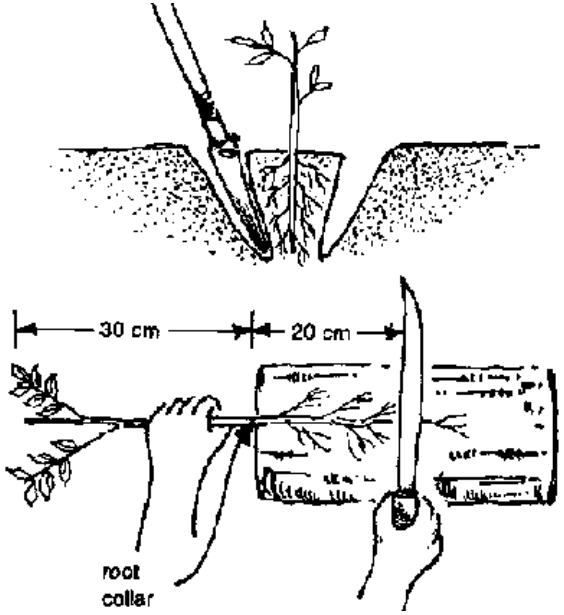
Use only good seedlings. This means seedlings that have been properly hardened off, with a woody stem 30-50 cm tall. Discard all damaged, deformed or diseased ones. Taller seedlings may be used in cogonal areas so they will soon overtop the grass. For dry and harsh environments, older seedlings with a more developed root system and thicker stem (more sugar reserves in the stem) will survive better.

Potted seedlings will survive better in harsher sites than bare-root seedlings because they have a more complete roots system which will not be disturbed.

Make sure potted seedlings have a well-developed rootball. Do not water them on the day

they are outplanted because this will soften the soil and cause it to compact when planted. Seedlings brought from a distant nursery should be brought to the planting site and allowed to recover from the transportation shock for 24 weeks before outplanting. Fruit tree seedlings purchased from a commercial or government nursery usually need to be hardened off at the planting site before outplanting as this is not done at the nursery.

Gently lift bare-root seedlings from the seedbed with a spade or shovel. Trim the tap root to about, 20 cm for easier planting. Also, trim the crown to reduce water loss through transpiration and bring it into balance with the root system. Cut back any soft green shoots, leaving at least 30 cm of woody stem.

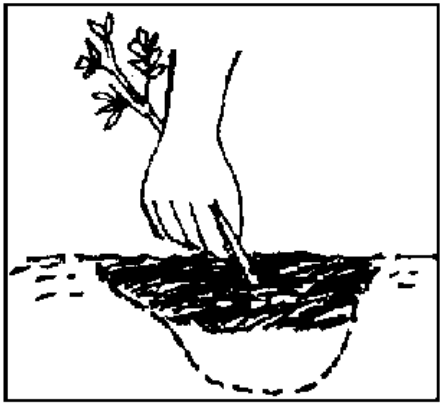


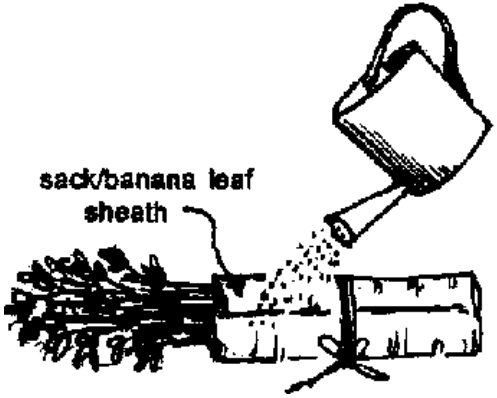
Cut back any soft green shoots

Mud-pack bare-root seedlings when they are to be transported. Dig a hole and mix in pure clay soil and water to make a slurry. Rinse off the seedling roots and dip them in, coating them well. Wrap them in folded banana stem sections or sacks and keep them in the shade. Roots and stems are easily killed when exposed to heat or direct sunlight. If the trip is long, remoisten the containers.

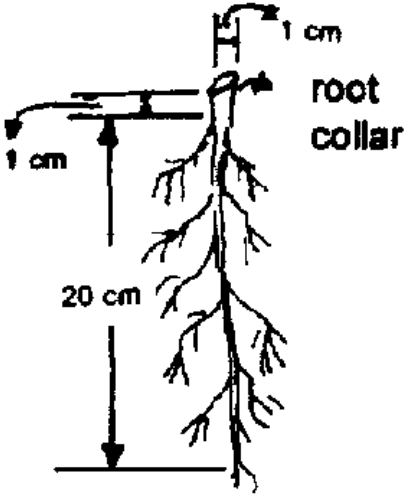
Some trees, such as Gmelina arborea, can be planted by stumps. Prepare as for bare root

seedlings but cut back the stem to only 1 cm. Ideally, stumps should be 1 cm acmes. This is one way of handling overgrown seedlings.





Sackbanana leaf shealth



stumps should be 1 cm acmes

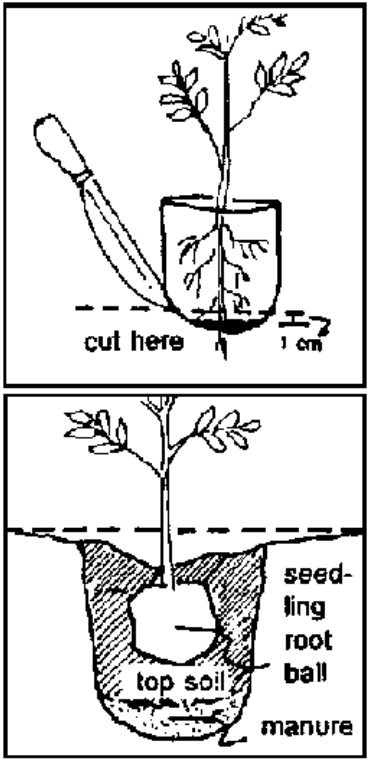
They are also easier to transport to the field.

OUTPLANTING

Timing of outplanting is crucial. Plant at the beginning of the rainy season but only after the soil has become fully moistened. In areas with a severe dry season, make sure trees are in the ground early enough to develop a deep root system before the dry season hits. Cuttings, such as kakawate, may be planted late in the dry season so the cut end or wound dries out before the soil becomes wet.

When outplanting potted fruit trees, slice off the bottom 1 cm off the plastic bag. This will

eliminate any bend that has begun to form in the taproot. Slice the rest of the bag down the side and remove before planting.



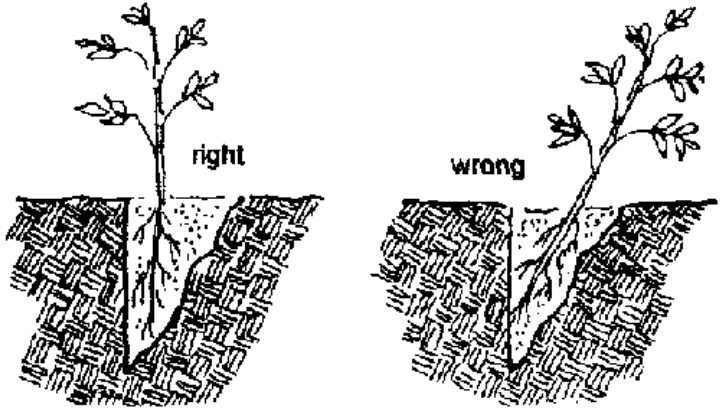
Outplanting

In poor soils, plant in a hole much larger than the root ball. If manure is to be added and has

not yet been allowed to decompose, put it in the bottom of the hole and cover it with 10 cm of soil. If chemical fertilizers are to be used mix them in with the soil to be used in filling up the hole. Scrape topsoil from the area around the hole and use it to fill it up after planting the seedling. Gently step on the soil around the seedling to tamp it down firmly.

In drier sites, recess the seedling slightly into the ground to form a small catchment to trap moisture.

Bare-root seedling outplanting is easiest with two people, one to hold the seedling upright in the hole and one to fill the hole in and tamp the soil down. Be careful not to bend the taproot.



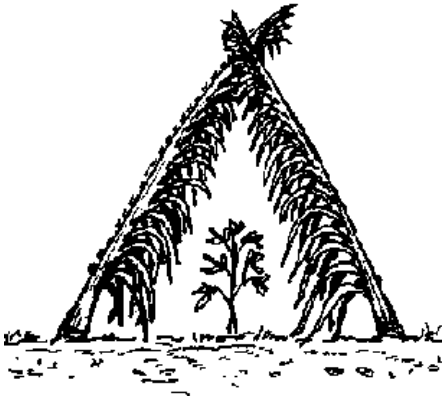
Bare-root seedling outplanting is easiest with two people

Mulch newly planted seedlings to conserve moisture and keep soil surface temperatures cool.

Apply a 10cm thick layer of mulch in a ring 10-cm away from the stem. This can be renewed every two weeks.

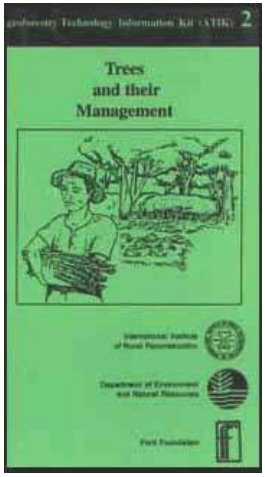
In areas where livestock are allowed to wander loose, fence newly planted seedlings off from grazing areas.

Erect a temporary shade for especially valuable seedlings or seedlings that have not hardened off enough. This can be as simple as two coconut leaves leaned against each other or it can be made of cogon grass.



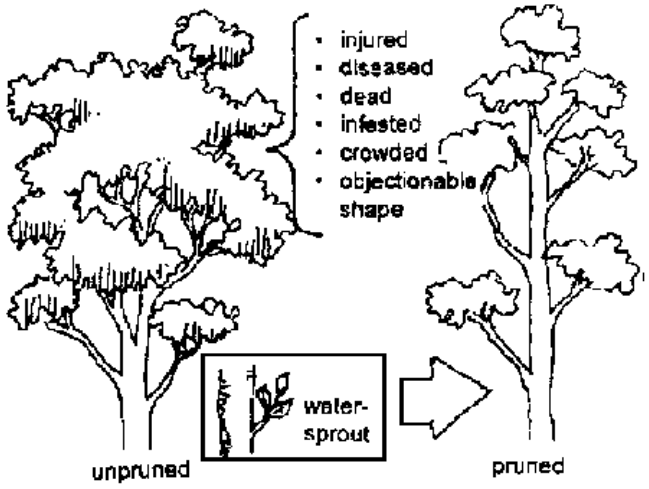
Two coconut leaves leaned

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



Tree pruning and care

Tree pruning is the art of cutting or removing unwanted plant growth to make the plant grow or behave the way we want it to.



Tree pruning and care

OBJECTIVES OF TREE PRUNING

1. Removal of diseased or broken branches;

2. Removal of tree parts which will inhibit the proper growth of tree such as when one limb nubs on another limb;

3. Removal of branches to allow adequate light, to promote better fruit production and to allow wind to pass through the tree canopy;

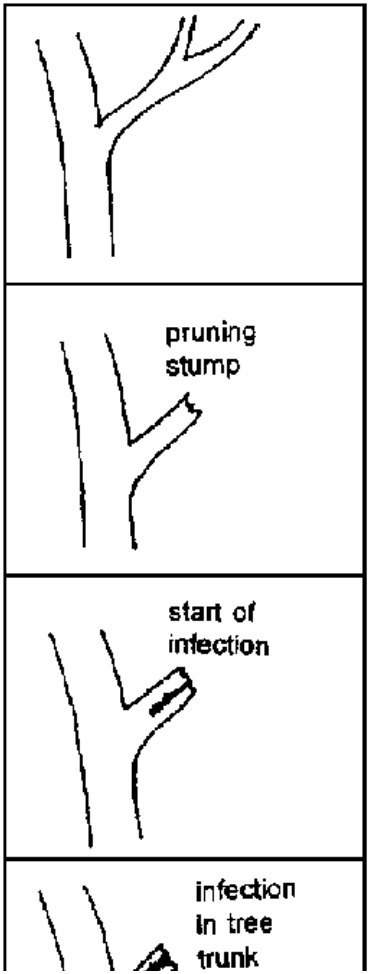
4. Trim trees to prevent interference with electric or telephone lines (or cable TV);

5. Encourage/increase flowering and fruit production; decrease the number of fruit so larger fruits are produced;

6. Rejuvenate old plants (or trees with good coppicing ability); and,

7. Create special effects and shapes; enhance the natural lines of a tree or shape a plant to accommodate space.

Tree pruning, if done correctly, will enhance the beauty and production of a tree without causing damage and infection to the tree. Frequently, people prune a tree by cutting branches with a bolo without thought to what will happen to the cut portion of the tree. If the branch stump is not properly pruned, there is a good chance of infection to set in. Once the infection starts in the tree, it can travel to the trunk and eventually kill the tree. The damage will generally not be seen from the outside of the tree.


pruning
stump
start of
infection
infection
in tree
trunk

Growth of infection in improperly pruned tree

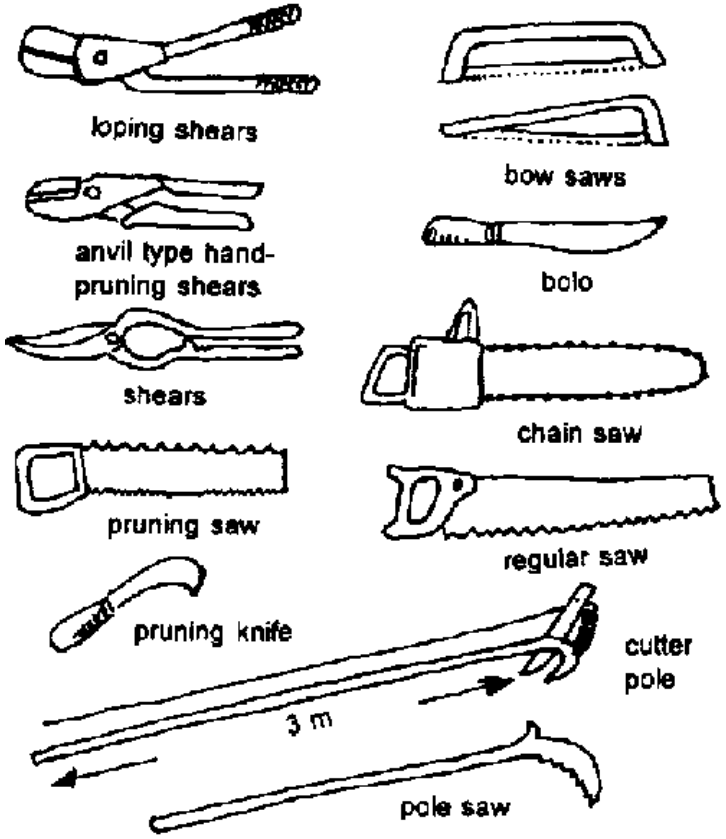
Growth of infection in improperly tree

THE IDEAL TIME FOR PRUNING

1. After the harvest season for fruit bearing trees
2. Before the rainy season for light pruning or trimming
3. Two to three months before the rainy season for rejuvenation
4. When infection, infestation, objectionable branches and damages are noted.

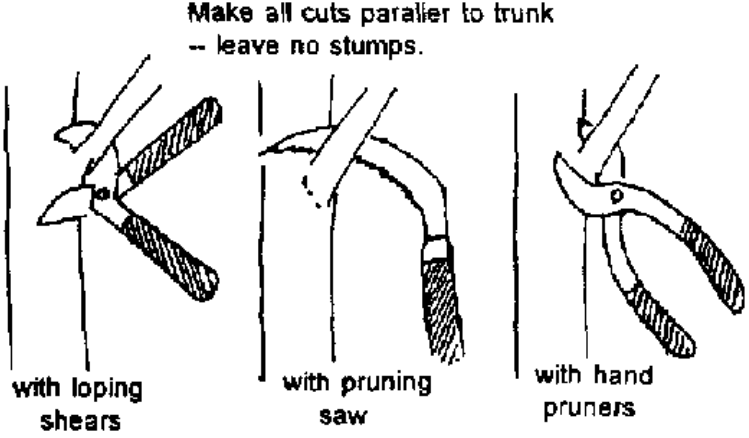
PROPER TOOLS FOR TREE PRUNING

There are a number of tools which are used to prune trees. These range in size from a small hand-held pruning shears to large pole cutters and chain saws. The size of the branch, the height above the ground and the reason for pruning will determine which tool to use.

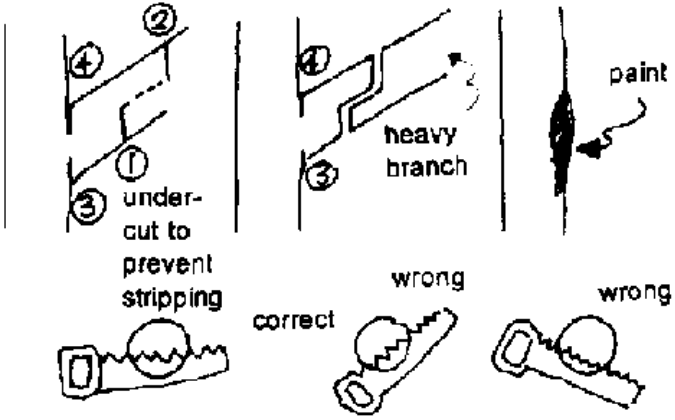


Proper tools for tree pruning

BRANCH REMOVAL



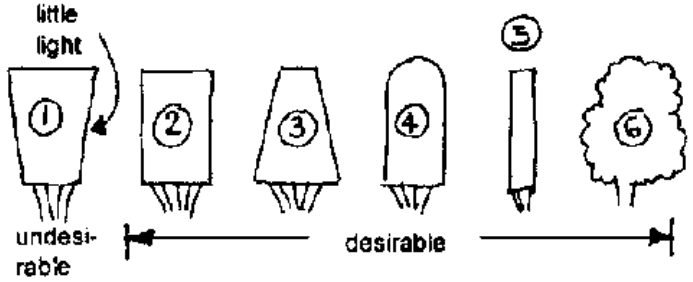
1. Small branches



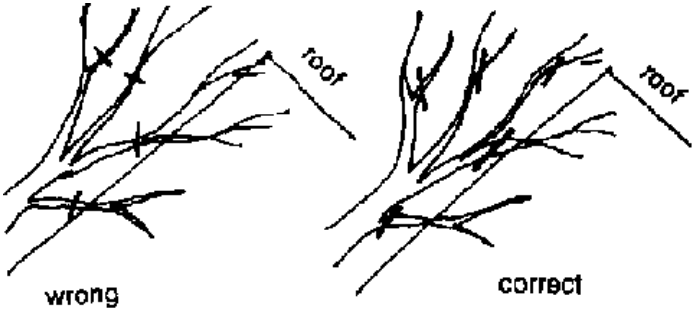
cross-section showing undercut

2. Large branches

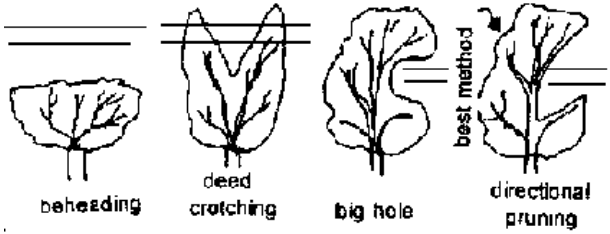
DIFFERENT TYPES OF TREE-PRUNING TECHNIQUES



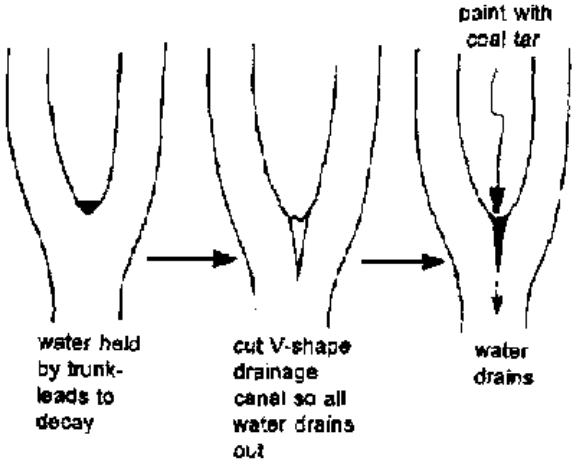
1. Hedges



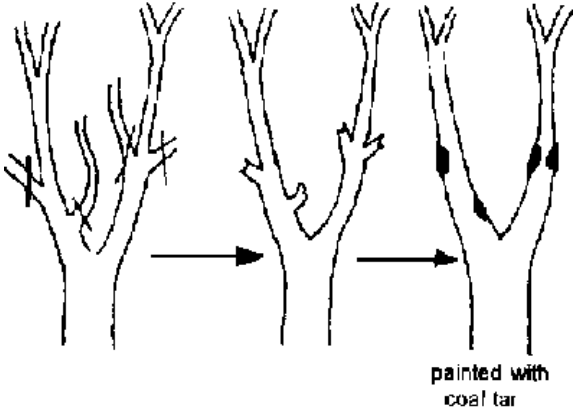
2. Branches near houses or other structures



3. Telephone, electric and other lines



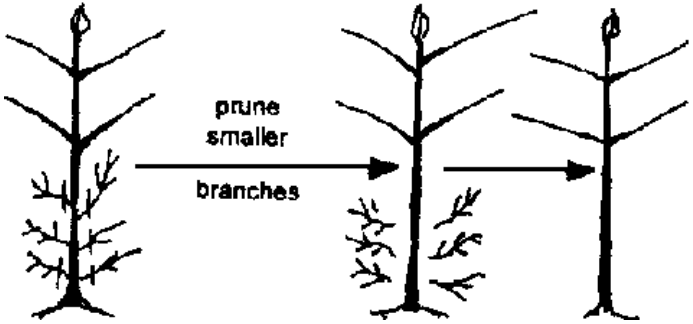
4. Opening so water flows out of the trunk



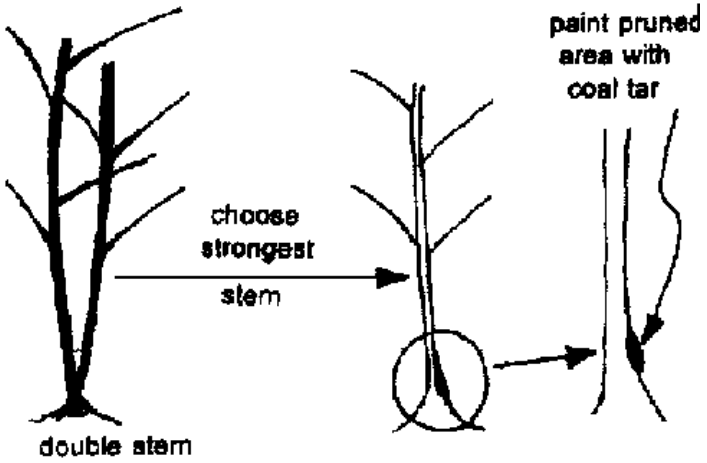
5. Cleaning all the branch stumps

6. In reforestation projects (unnecessary branches and the double stem)

Examples:



Gmelina arborea

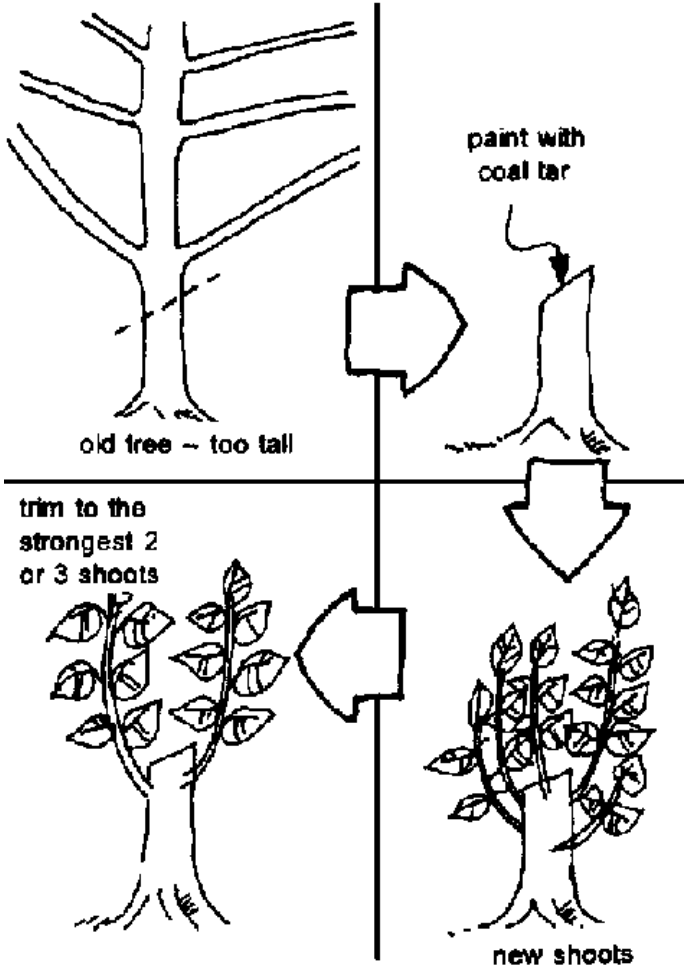


Mahogany

7. Pruning for rejuvenation

When pruning the main trunk for rejuvenation, make a slanting cut through the trunk so water will nun off the cut. If possible, paint the cut with coal tar.

Example: Coffee


paint with
coal tar
old tree – too tall
trim to the
strongest 2
or 3 shoots
new shoots

Coffee