

**RESEARCH INFORMATION SERIES ON ECOSYSTEMS**

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**REFORESTATION SPECIES**

**Mahogany  
(*Swietenia macrophylla* King spp.)**

Compiled by:

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**Narra  
(*Pterocarpus indicus* spp.)**

Compiled by:

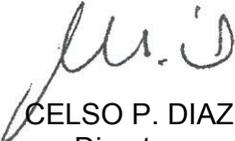
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## **Foreword**

Mahogany and narra are two of the most important premium hardwood species due to their high commercial value. Mahogany logs can be used in the manufacture of veneers and paneling and a raw material for boat and ship building while narra is the best known material for furniture making.

These significant ecological and economic contribution lead many private individuals and entrepreneurs to venture into plantation establishments of these two species. For this reason, we see the demand for appropriate information materials along this need.

Thus, we have prepared an updated and revised version of this RISE issue on mahogany and narra. We encourage our readers to take a closer look at these species.



CELSO P. DIAZ  
Director

## **MAHOGANY**

### ***Swietenia macrophylla* King spp.**

**Common name:** Mahogany

**Scientific name:** *Swietenia macrophylla* King

**Family:** Meliaceae

#### **Description**

It is a large tree that can attain a maximum height of 60 m and a diameter of 4.5 m. Usually, its height reaches to 30 m to 40 m and its diameter is 1.5 m to 2 m.

Its taproots are long and lateral roots are widely spreading. The trunk is buttressed at the base and the bole is straight and cylindrical. The bark is smooth when young and its wood varies from light reddish or yellowish brown to dark red.

The tree sheds its leaves during summer. Generally, it has 5-7 pairs of leaflets, each leaflet varies from 7 cm to 13 cm long and 3 cm to 5 cm wide. Leaves are pinnate and smooth and its upper portion is shiny, brownish or purplish.

Flowers are in panicles at the branch tip and leaf bases. Fruits are large and conical, light chestnut brown capsule, 15 cm to 19 cm long, and 5 cm to 6 cm in diameter which splits open when ripe and liberates numerous seeds with an average of 59 seeds/fruit, 8 cm to 10 cm long, 1.2 cm to 1.7 cm wide, and glossy reddish brown in color.

#### **Uses**

It is used in multistorey systems in the Philippines, boat and ship building, and pattern making. Logs are used in the manufacture of veneers and for paneling. It is also used as shade for coffee and cacao.

#### **Distribution**

This species is native to Peru and Brazil in Central America. It was introduced in the Philippines in 1914 and is now growing in Mt. Makiling, Los Baños, Laguna; Benguit; Ilocos; Isabela; Abra; Samar; Marinduque; and Zamboanga.

#### **Site requirements**

This species can adapt to a variety of soils but has a distinct preference for well-drained, sandy clay slopes. It also grows well on rather shallow as well as deep alluvial soils. It thrives best at temperature ranging from 11°C to 32°C. It is a lowland tree and does not grow properly at an altitude above 600 m. It thrives well at a rainfall range of 1,500 mm to 5,000 mm and tolerates dry season up to seven months.

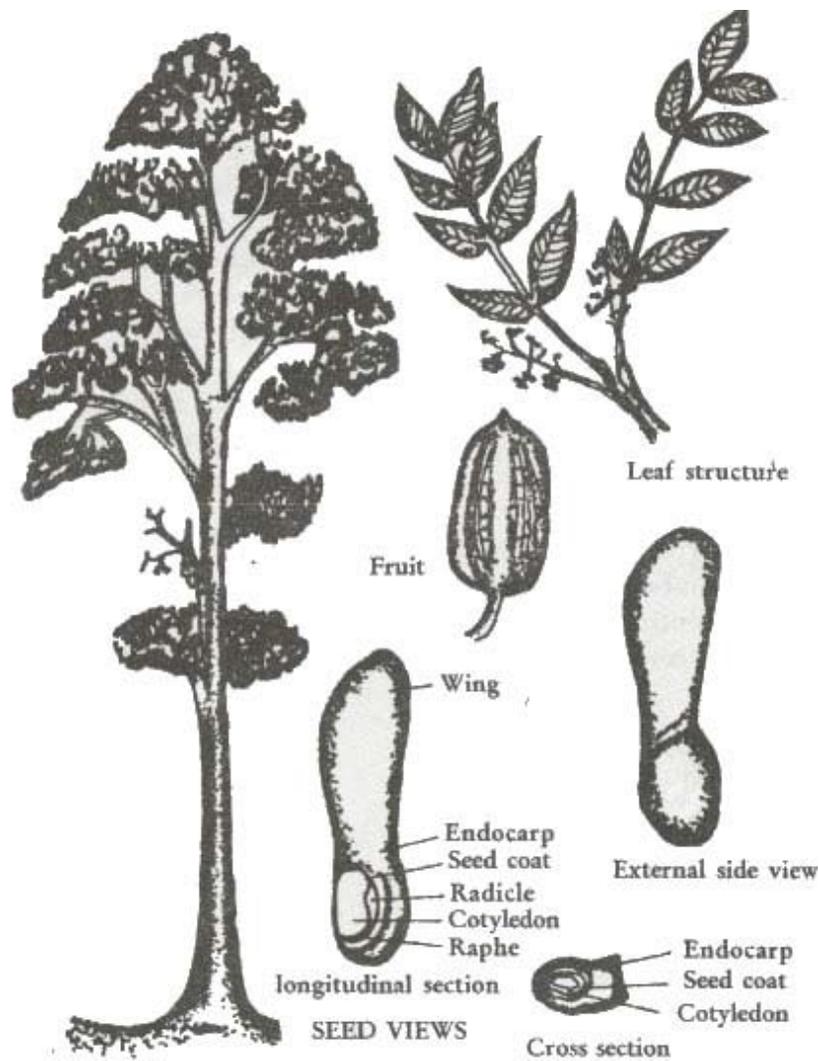


Figure 1. Representative sketch of Mahogany tree (*Swietenia macrophylla* King), seed, and leaf pattern.

### Seed technology

Seeds are available on the months of January, February, March, August, and December. They are removed from the capsule and dried under the shade for one to two weeks to reach moisture content (MC) of 5% to 7%. Seed count per kilogram is about 2,264 (medium size) and 2,933 (small size) and an average of 59 seeds/fruit or capsule. Four (4) fruits have an average of ¼ kg of winged seeds.

Dried matured seeds usually germinate within 8-14 days and have a germinating capacity of 80% or higher.

Seeds with MC of 5% to 7% can be stored in sealed plastic bag at 7°C to 8°C for one year or more. Seeds stored on the same container at room temperature (29°C to 30°C) lose viability after two to three months of storage.

## **Plantation establishment**

### ■ *Nursery*

1. Prepare seedbeds before sowing.
2. Dig the soil about one foot deep. Soil dug should be thoroughly pulverized.
3. Mix one part sand and three parts soil to make the medium friable.
4. Moisten the seeds and sow in seedbeds in drills at 8 cm to 10 cm apart with a distance of 4 cm to 5 cm between the seeds. Depth of sowing is 3 cm to 4 cm.
5. Full light and abundant water supply favor the rapid growth of seedlings.

### ■ *Transplanting*

1. Transfer the seedlings in plastic bags when these reach the height of 15 cm.

### ■ *Outplanting*

1. Outplant seedlings upon reaching 12 in to 18 in tall.
2. Remove grasses and other weeds.
3. Dig holes 2 m x 2 m apart.
4. Outplant only during rainy season.

## **Pests and diseases**

### **Pests**

#### ■ *Leaf Miner – (Acrocercops auricilla) – Lepidoptera*

Egg is laid on the leaf and the larva burrows in the tissues. The mine is at first narrow and irregular but it expands to form a roughly oval, white blotch, averaging about 11 mm x 7 mm where it approaches the edge of the leaf. The mined tissue turns brick red and withers. Pupation occurs within the mine.

Control: Spray with any systematic insecticide.

#### ■ *Leafbug (Helopittis antonii) - Hemiptera*

A slender polyphagous bug which feeds on the sap of the foliage and other soft parts of the plant. The eggs are laid in small groups. Holes are made in soft shoots, petioles, midribs of leaves or sometimes in fruits. The nymphs which are orange in color and bear some resemblance to ants feed at night. Life cycle is about three weeks and breeding continues in warm humid climate. Infested tissues blacken and die. Young shoots may be killed or deformed.

Control: Spray with any contact insecticide.

#### ■ *Shoot borers (Hypsiphyla grandella) - Lepidoptera*

Eggs are usually laid on young green vigorous shoots, wherein it hatches into larva and later develop into pupa. The fruit or bark may also be infected. Attack is usually severe in young trees of age two years and up. The host is usually killed but destruction of

terminal buds result in forking and malformation of the stem and sometimes permanent stunting.

Control: Drench the soil with systematic insecticide. Remove infected trees or plant parts.

## Diseases

### ■ Fungal

Seed diseases of mahogany causing rotting:

1. *Fusarium solani* (Mart) Sacc
2. *Lasiodiplodia theobromae* (B. theobromae) Pat
3. *Aspergillus flavus* Link
4. *Aspergillus niger* van Tregthen
5. *Fusarium moniliforme* Sheldon
6. *Penicillium* spp.
7. *Fusarium equiseti*

Control: Seed dressing with Captan, Antracol, and Bayleton at 2.5 g a.i/kg of seeds and Folicur at 1 ml/kg seed. Air dry and sow the seeds after treatment.

### ■ *Sclerotium root rot*

Symptom: Root and basal stem of the seedlings are invaded. Affected seedlings suddenly wilt. On the soil surface, around the wilted seedlings and on the stem, many light brown and globular sclerotial bodies are produced measuring 0.5 mm to 1 mm. White and thin mycelial growth is usually present in the diseased seedlings.

Damage: A number of woody and herbaceous plants have been recorded as the host of the causal fungus. Mahogany seedlings suffer heavy damage in forest nurseries.

Causal fungus: *Corticium rolfsii* Curzi – (*Sclerotium rolfsii* Jacc.)

Control: Drench the diseased bed with an emulsion of pentachloronitrobenzene (PCNB), 50 to 100 times at 3 li/sq m. PCNB dust at 10 to 20 g/sq m can also be used. Mix well with soil to protect the seedlings to be planted from injury.

Host range: *Sindora supa*, *Pterocarpus indicus*, *Vitex parviflora*, *Swietenia macrophylla*, *Casuarina equisetifolia*, *Terminalia catappa*, and *Barringtonia asiatica* (Mejia 1953; De Guzman and Eusebio 1975; Roldon 1941; Kobayashi 1978; and Kobayashi *et al.* 1982).

### ■ Root rot

Symptom: Roots of seedlings are affected. Growth of affected seedlings is largely suppressed due to the injury of the root system. In severe cases, seedlings become reddish or purplish which later wilt and die.

Causal fungus: *Rhizoctonia solani* Kuhn. and *Fusarium* spp.

Control:

*Soil disinfection prior to sowing.* Drench the soil with diluted emulsion of Captan (3 to 6 li/sq m of soil). Soil burning or soil sterilization is also recommended.

*Seed treatment.* Coat seeds with Thiram fungicide (0.1% to 3 % wt of seeds) or Delsene MX (2.5 li/kg) of the seeds.

Host range: *Pinus kesiya*, *Casuarina equisetifolia*, *Kaatoan bangkal*, *Leucaena leucocephala*, *Albizia falcataria*, *Eucalyptus deglupta*, and *Aleurites moluccana* (Galo 1957; Kobayashi 1978; Madesid 1934; Zamuco 1955; and Tamolang 1948).

■ *Stem Rot (Collaer rot)*

Symptom: Basal stem of the seedling is usually infected. If infection extends around the basal stem, seedlings consequently wilt. On the basal part of the dead seedlings, several black pustules are produced.

Causal fungus: *Lasiodiplodia theobromae* Pat

Control: Seed treatment by Delsene MX or Benlate at 2.5 g per kg of seeds.

## References

- Browne, F.G. 1968. Pest and diseases of forest plantation trees. Clarendon Press, Oxford. pp 12, 354.
- Dayan, M.P. 2004. Fungal seed diseases of forest tree seeds and their control. DENR Recommends 13. ERDB. College 4031, Laguna.
- Hensleigh, T.E. and B.K. Holaway. 1988. Agroforestry species for the Philippines. U.S. Peace Corps. pp 305-307.
- \_\_\_\_\_. 1955. Planting instruction of mahogany (*Swietenia macrophylla*). Research Note (5) Forest Research Division. Bureau of Forestry. DANR. pp. 23-24.
- Kobayashi, T. 1977. Manual of forest tree diseases and their control measures in the Philippines. RP-Japan Forest Development Project (Pantabangan). p. 33.

## **NARRA**

### ***Pterocarpus indicus* spp.**

**Common name:** Narra

**Scientific name:** *Pterocarpus indicus* spp.

**Local name:** Nala (Batanes), laga, nala, sagat, tagga, taggat (Cagayan); udia (Isabela, Pangasinan); dungon (Ilocos, Cagayan); asana (Tayabas, Bulacan, Rizal, Laguna); naga (Camarines, Albay, Sorsogon, Leyte, Davao); vitali (Zamboanga)

**Family:** Fabaceae

#### **Description**

Narra is a large tree frequently with an irregularly fluted or deformed short trunk. The crown is usually narrow, thin and deep, occupying one third of the total height of the tree when grown in plantation and in the forest. The tree is nearly deciduous for a short time during the dry season.

Its leaves are alternate, simple, and odd-pinnately compound; has 7-11 leaflets, ovate to oblong-ovate, smooth margin but wavy, blunt acuminate, thin, glabrous, 5 cm to 10 cm long, 2 cm to 8 cm wide, alternate, and shiny.

Its flowers are numerous, borne in axillary racemes about 5 cm to 7 cm long, bright yellow, about 1.5 cm long, mostly single flowers, and fragrant.

The mature fruit is almost like and orbicular; dry; indehiscent pod; 4 cm to 7 cm in diameter, very shortly beaked; contains 0-3 seeds; and its wings are more or less reticulate and wavy. See representative sketch.

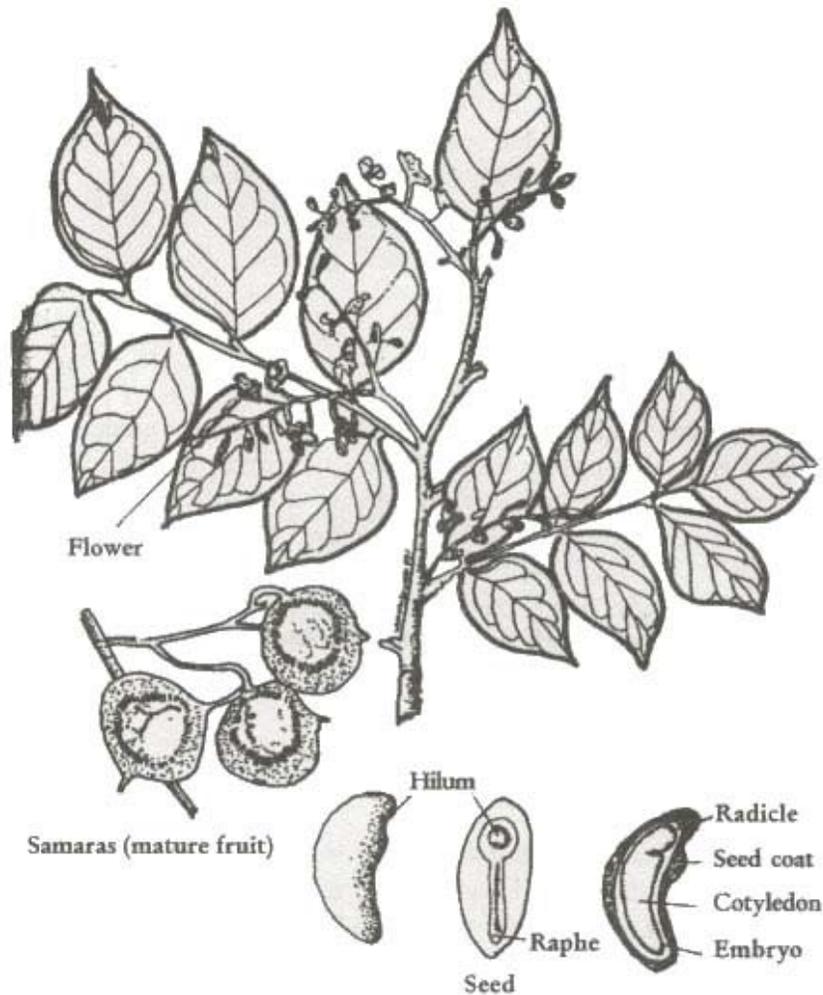
#### **Uses**

Narra is the best known material for furniture making. It is excellent for making radio cabinets, tabletops, piano cases, and sala sets. It is a good source of red dye. It also has medicinal properties because its root juice can be used for syphilitic sores. Young leaves can be applied to ripen boils, ulcers, and prickly heat. It contains a kino or gum which is well known Malay medicine for diarrhea and dysentery after being purified by boiling and subsequent drying.

A yield of approximately 8 m<sup>3</sup> of log can be obtained from a 30-year-old tree raised under favorable condition.

#### **Distribution**

Narra grows throughout the Philippines and it attains commercial size anywhere it is found. A fairly large quantity is found in Cagayan, Mindoro, Palawan, Agusan, and Cotabato. It also grows in other tropical countries like India, Indochina, Borneo, Celebes, New Guinea, and the Caroline Islands.



**Figure 2. Representative sketch of narra (*Pterocarpus indicus*) leaves, mature fruits (samaras), and cross section of seeds.**

The species grows well in a variety of tropical climates and could be grown successfully in any of the four climatic types of the Philippines. It is specially adapted to the Philippine temperature ranging from 22°C to 32°C and under an average annual precipitation of 2,366 mm.

It is also found growing along banks of rivers, immediately behind mangrove swamps and areas extending upstream to headwaters of watersheds. It prefers low damp soils but occasional trees may be found in drier slopes. It thrives best in moist, sandy loam or clay loam soil, along gullies and stream banks of low and medium elevations. It also grows up to an elevation of as high as 1,300 m.

## **Propagation**

### ■ *Seed technology*

The following steps are recommended in the collection and handling of seeds:

1. Collect seeds from superior mother trees. Viable seeds should be free from abnormalities.
2. When fruits or pods fall to the ground, collect them immediately to prevent contamination of microorganisms from the ground.
3. Collect seeds during the regular fruiting season from January-July or September-November.
4. Destroy insects found among the pods by spraying insecticides such as Malathion, Baythion, Silosan, or Methaxylor.
5. Before storing, apply a small amount of inert mineral dust or chemically active dust or a mixture of the two. Calcium carbonate and magnesium oxide are examples of inert compounds.
6. In transporting, pack seeds with powdered charcoal. The charcoal absorbs excess moisture.
7. Sundry the pods for about a week to reduce the MC to 7% to 8% before storing at room temperature.

### ■ *Nursery practices*

1. Sow the seeds (Usually in pods) in prepared 1 m x 6 m plots with shallow drills 15 cm apart. Cover the drills with soil. Cogon and other dry leaves can be used as mulch when sowing during the dry season.
2. The pods can also be directly sown in plastic bags (5" x 6" x .004 mm) filled with topsoil or ordinary soil.
3. Water the seedbeds twice a day during the dry season or water as often as necessary to keep the soil moist but avoid excessive watering.
4. When direct seeding is desired, clean area or spot, make hole by means of mattock. Use 2 m x 2 m spacing and place 2-4 pods in one hole.
5. The seedlings of narra are considered ready for outplanting when it reaches 50 cm in height. This ensures better survival. Outplanting is done using bareroot or potted planting materials. Bareroot planting in dry areas is not advisable.
6. Potted seedlings should be raised for about 5-6 months in the nursery to attain plantable size of about 50 cm.
7. Nursery raised seedling should be planted in the field during rainy season.

### ■ *Asexual propagation*

The following techniques are practiced in asexually propagating narra.

#### Cutting

1. Select superior mother trees as source of cuttings.
2. Cut off desired branches depending on the intended use. For parks and roadside planting materials, a cutting with a big diameter length of 1 m or more is good enough. Removal of twigs and leaves and cutting the upperpoint is necessary to reduce transpiration and loss of moisture.

3. Big branch cuttings about 10 cm in diameter and 2 m long treated with rooting hormones can produce instant trees.

#### Stump planting

The stumps of the seedlings are cut one inch above the root collar and planted barefoot.

Stump planting can improve the diameter and height growth of narra. There is also greater percentage of survival for stump planted seedlings.

#### ■ *Tissue culture propagation*

Plant tissues are artificially grown in a culture medium. Tissue culture is one of the best tools in tree improvement. It enables the propagation of superior planting stocks of selected plants.

Experiments at the Ecosystems Research and Development Bureau (ERDB) showed that stem tissues of six months to two year old narra saplings are promising for tissue culture propagation. This technique, however, has not yet been perfected for large scale application.

#### **Other techniques**

There are other known techniques of propagating trees and can also be tested on narra, namely:

*Grafting* – a piece of tissue (young shoots) is transplanted from one individual to another (stockplant) or to a different place on the same individual and allowed to develop as a single plant.

*Budding* – a method of vegetative propagation in which a single bud is grafted laterally onto the stock.

*Marcotting* – To propagate a plant by air layering in which the rooting medium is bound to the plant rather than enclosed in a pot or other container.

*Layering* – Root formation is induced onto a branch or a shoot attached to the parent stem by covering the plant with soil.

#### **Plantation establishment**

The following steps are recommended in establishing a narra plantation.

#### ■ *Site preparation*

1. Prepare planting site by brushing or clear brushing any existing vegetation in the plantation area.
2. Dig holes of about 15 cm in diameter and 15 cm to 20 cm deep for seedlings and for cuttings about 20 cm in diameter and 30 cm deep.
3. Use initial spacing of 1 m x 1 m for plantation to induce development for longer stems. Gradual thinning maybe done later on to increase diameter growth.

Individuals thinned out may be balled for transplanting in other parts of the planting area. For landscaping in parks, a 4 m x 4 m to 10 m x 10 m spacing may be used.

4. Painting the wood portion of the proximal ends with rootone powder will reduce the destruction of termite on cuttings and enhance earlier rooting. It also gives greater percentage of survival.

#### ■ *Fertilization*

Application of fertilizer on outplanted seedlings is not encouraged since there is little effect on the survival rate of seedlings.

#### ■ *Weeding*

Ring weeding should be practiced from time to time to improve the survival rate of outplanted seedlings.

### **Pests and diseases**

Generally, the tree species has not been reported to be very susceptible to insect and fungus attacks. The common diseases that afflict narra are:

#### ■ *Seed decay*

Causal organism: Associated with seed decay are species of *Fusarium*, *Colletotricum*, *Penicillium*, *Aspergillus*, *Rhizopus*, and many other species of bacteria. Decay of seeds is favored by immaturity of the seeds and improper drying and storage.

Control measures:

1. Collect mature fruits only.
2. Immediately remove the pulp if microorganisms are present and then dry the seeds gradually.
3. Treat seeds with chemical protectants. Ferbam, Arasan, Ceresan, and Semesan are some of the commercially prepared seed protectants and if possible, sow the seeds after treatment.
4. Place healthy and dried seeds in sealed plastic bags and store at 5°C to 7°C.

#### ■ *Seedling Root Rot*

Seedlings of narra growing on nursery beds when newly transplanted, are susceptible to root rot.

Causal organism: Two soil borne fungi have been found associated with this disease: *Botryodiplodia theobromae* and *Sclerotium rolfsii*.

Control measures:

1. Use well drained soil.
2. Avoid too dense sowing.
3. Remove infected seedlings and burn them.
4. Avoid excessive watering.

5. Gradually expose seedlings to sunlight.
6. Sterilize the potting medium by heat or chemicals before sowing.

■ *Damping off*

This is one of the most common diseases of seeds/seedlings in the nursery. In general, damping off refers to any disease that results in the rapid decay of young succulent seedlings or shoots just before and after emergence of young shoots.

Causal organism: The disease is caused by a variety of soil-borne fungi that are usually parasitic. They live saprophytically in the upper layer of the soil and become pathogenic when favorable conditions prevail. Species belonging to the fungal genera are: *Phytophthora*, *Phythium*, *Rhizoctonia*, and *Fusarium*.

Control measures:

1. Avoid using heavy soil. A good growing mixture is a 50:50 mixture of the sand and clay loam.
2. Avoid too dense sowing.
3. Maintain a pH range between 5 and 6.
4. Do not apply fertilizer which will raise the pH value of undecomposed organic matter.
5. Remove diseased seedlings and burn them.
6. Gradually expose the seedlings to sunlight.
7. Sterilize the soil with heat, steam or by fumigants.
8. Treat the seeds with any commercial seed protectant or disinfect before sowing.

■ *Leaf spot*

Causal organism: The disease is very common to narra (*Pterocarpus indicus*) and may infect the plant even during the seedling stage. Three different fungi have been found to be associated with the disease, namely: *Phyllachora pterocarpi*, *Pestotlotia* sp., *Aldona Stella-nigra*, and *Cercospora pterocarpi*.

Control measures:

1. Spray fungicide everytime the seedling produces a new set of leaves. Application should be made before and immediately after the young leaves open. Vitigram blue, copper fungicide, Cupravit, Carbamate, Zineb, and Antracol are some of the brands which could be used.
2. Remove all infected leaflets and burn them. Do not allow the infected leaflets to stay on the ground because the fungi may remain dormant on the fallen leaves and will turn active when conditions become favorable.
3. Follow crop rotation. Plant a succession of different species on the seedbeds before they are to be planted again with the same species.

■ *Stem/Branch Rot*

Causal organism: A wide variety of Basidiomycetes and a few Ascomycetes can cause the decay of living trees. Species belonging to the following genera: *Fomes*, *Polyporus*, *Lenzites*, *Ganoderma*, and *Stereum* are the most common fungi-causing diseases.

Control measures:

1. Prevent occurrence of injuries or wounds.
2. Prune infected branches. Pruning should be done flushed to the stem or main branch. All wounds must be painted with red lead, wood paint or coal tar.
3. Harvest before the decay (heart rot) becomes extensive.
4. Fell trees which have extensive decay.
5. Remove fruiting bodies on infected trees and adjacent dead trees and burn them.

## References

- Assidao, F. and M. Nastor. 1958. Silvical characteristics of narra. Silvical Leaflet No. 1. Bureau of Forestry.
- Briones, J.P. 1978. Slow release tablet fertilizer effects on the growth and survival of outplanted narra seedlings. *Sylvatrop Phil. Forest Research Journal* 3(1):51-54.
- Calinawan, N. and S. Halos. 1981. Shoot development, callus production, and root induction of narra (*Pterocarpus indicus* Willd) as affected by cultural medium and irradiation. *Sylvatrop Phil. Forest Research Journal*. 6(4): 165-179.
- Dalmacio, M.V., E.N. Crizaldo, and Z. Genil. 1978. Production of "instant trees." *Sylvatrop Phil. Forest Research Journal*. 3(1): 51-54.
- Inter Agency Group for Forestry Research Application. 1985. How to establish a plantation. IAGFRA. How to Series.
- Maun, M.M. 1980. Effects of stump planting and fertilization on growth and survival of narra (*Pterocarpus indicus* Rolfe). *Sylvatrop Phil. Forest Research Journal*. 5(1): 67-72.