Leaflet No.5./80-81

Government of Union of Myanmar
Ministry of Forestry
Forest Department

Silvical Characteristics and Nursery Practice of Some High Value Species

Saw C. Doo
Forest Research Institute
February 1981

Contents

	Page
1. Introduction	1
2. Silvical characteristics	1
Buiga	1
Hnaw	2
Mahogony	3
Mau-lettanshe	3
Padauk	4
Pyinkado	5
Sagawa	5
Sit	6
Taukkyan	6
Tamalan	7
Teak	7
Yemane	8
Yindaik	9
Yinma	9
Yon	10
3. Nursery practice	10
Collection of Seed	10
Planning seed collection	11
Time of seed collection	11
Planning seed handling, transport, and storage	12
Seed extraction	12
The location of Nursery	12
Preparation of Nursery site and seed bed	12
Management of Nursery	12
Watering	12
Cleaning and weeding	13
Protection	13
Sorting	13
Hardening	13
Culling	17
Handling of seedling	17
Seed weight, collection of seeds, treatment, sowing, potting, etc.	
Adina cordifolia	17
Albizzia procera	17
Anogeissus accuminata	18
Anthocephalus cadamba	19
Chukrasia tabularis	19
Dalbergia cultrata	20
Dalbergia oliveri	20
Gmelia arborea	21
Melletia pendula	21
Michelia chanpaca	22
Mitragyna rotundifolia	22
Pterocarpus macrocarpus	23
Tectona grandis	24

Terminalia tomentosa	...	...	...	25
Xylia kerii	...	...	...	25
Root/Shoot development	...	...	...	26
4. Conclusion	...	...	...	28
Estimates of seed demand				
Teak	...	...	...	28
Pyinkado	...	...	...	29
Yinma	...	...	...	29
Measurements	...	...	...	30

1. Introduction

The food and Agriculture Organization of the United Nations has made medium and long term forecasts indicating an increase in the consumption of wood in many tropical countries. The annual demand may become double that of 1960-62 (which was estimated then at 1000 million cubic meters of industrial wood). Accordingly, if the estimates approach actual consumption, the demand for industrial wood will far exceeds the supply, which means more forests for exploitation.

Consumption of wood in Burma has increased as the population increases at the rate of 2.2%. Much of the natural forests has low stocking of valuable species. We expect that changing patterns of use and new technology will bring most of the seconding species into full utilization. However, it is essential that production of primary species be maintained at high levels for domestic and export use.

An unfortunate factor in the management of natural forests is productions is often very low. Growth response and regeneration are often disappointing, usually too little is known about the possibilities of inducing regeneration. Domestic and world need for wood products is placing stress on natural forests and the need for living space and food is continuously restricting forest areas available for cropping.

Where the unit area of land becomes important and much of the accessible forest area has been exploited there is an obvious incentive to establish plantations on the most suitable and productive site. For that purpose, much information is needed on the silvical characteristics of indigenous commercially valuable species: while research on management of natural forest to induce natural regeneration is advancing on the one hand, trial planting of some of the priority listed species is imperative.

The basic objective of production forestry is to supply the domestic and foreign demand for forest products. In production forestry, forest nurseries and plantation culture are essential. While production methods may change forest nurseries will remains the source of high quality trees fore future forests, and although natural regeneration is the traditional means of restocking. The demand for hardwood seedlings will continue to increase as the important species are more thoroughly studied to learn more about their cultural requirements.

For good nursery practices a knowledge of silvical characteristic of tree species is important. Therefore, a brief note on silvical characteristics of some valuable species is introduced here.

BINGA

Botanical Name	*Mitragyna rotudifolis*, O. Ktze.
Vernacular Name	Binga
Location	It is found in mixed deciduous forests of both the upper and the lower type. Sometimes it can be found in the drier forest type.
Leaf	Leaves: -deciduous, glabrous, or pubescent beneath, the lower orbicular – cordate, 25.4 cm.

	Diameter, coriaceous, the upper 4-6 by 5.08-7.62 cm., and membranous, nerves oblique, peticle 1.905-3.81 cm. stipules obovateoblong.
Fruit	The fruits ripen about January to March. Capsules 0.3175 cm. long, smooth, ribbed seeds are minute.
Flowering Season	The panicles of yellow flowers appear in November.
Height & Growth	A moderate – sized to large deciduous trees, height of 12.192 meters or more.

HNAW

Botanical Name	*Adina cordifolia*, Hook.
Vernacular Name	Hnaw
Location	The tree is found most frequently and attains its best development on well-drained ground, for instance, along the lower slopes of hills among boulders; it also grows well on alluvial ground provided the drainage is good. Commonly found in mixed deciduous forests in Pegu Yoma and Tenasserim.
Leaf	The leaves are shed about February and the trees remain leafless until about May-June, when the new foliage appears. The large whitish stipules enclosing the leaf bud are conspicuous; they fall to the ground when the young leaves appear. Leaves deciduous, coriaceous, 10.16-30.48 cm. diam.; peticle stout, stipules orbicular or oblong. Head 1.905-2.54 cm. diameters; peduncle stout 2.54-5.08 cm. small towards the apex.
Fruit	By October the globose fruit-heads are almost full formed, but are still green and unripe; they do not actually ripen and shed their needs until from April to June of the following year. The fruit-head consists of a large number of small twovalved many-seeded capsules. The seeds are very small and light, 0.1524 to 0.3048 cm. long, brown, with numerous minute longtitudinal wrinkles, one and tapering to a point, the other terminating in a pair of pointed appendages.
Flowering Season	The yellow globose flower-heads , about 1.524 cm. in

diameter, appear from June to August.

Height and Growth — The tree height attain 42 meters and has a clean bole of 21 cm. The girth usually has 4 to 4.5 meters.

MAHOGONY

Botanical Name — *Swietennia macrophylla*, King
Vernacular Name — Mahogony

Location — Mahogony is an introduced species from central America. It is planted in Kachin State, Rangoon, Moulmein and in Taungoo forest divisions.

Leaf — Leaves-paripinnate to infrequently imparipinnate, 23.5-35.5 cm. long and 16-27 cm. wide, peticle 4.5-7.5 cm. long, glabrous.

Fruit — Fruiting season is from June to September. The fruits ripen in December-January. Fruit mealy brown capsules about 12 cm. long and 8 cm. wide, woody and rough, deep yellow to light brown.

Flowering Season — The flowers appear from February to May. Flowers – small and greenish yellow, fragrant.

Height & Growth — It is deciduous tree. It reaches a height of about 25 meters.

MA – U – LETTANSHE

Botanical Name — *Anthocephalus candamba*, Miq.
Vernacular Name — Ma-U-Lettanshe

Location — It is usually found on alluvial river banks in the mixed deciduous forest throughout the country. It is also found on swampy ground.

Leaf — Ripen and fell in January – February, containing a number of minute seed, the fruit is 3.18-6.35 cm. in diameter.

Flowering Season — The small orange-coloured flowers, in globose heads 3.81 to 5.08 cm. in diameter, appear chiefly from May to July.

Height & Growth — A large deciduous tree with spreading branches. It is usually grows to a height of 20-25 meters and has a girth of 2-2.5 meters.

PADAUK

Botanical Name *Pterocarpus macrocarpus*, Kurz.
Vernacular Name Padauk

Location

The Burma padauk is usually found on undulating to hilly country, occasionally ascending to 300 meter elevations. The tree requires good drainage, and is found most commonly on sandy loam; where the proportion of sand is in excess.

It is found most typically in the drier types of upper mixed forest, often mixed with teak. It is also found in suitable localities throughout the greater part Burma from degrees of latitude in the Bhamo, Ruby Mines, Katha, and Shwebo district southward to the Amherst district, and to a limited extent in South Tenasserim. It is common in the northern portion of the Pegu Yoma in the Yamethin, Taungoo, Magwa Thayetmyo, districts, extending south to the Prome district on the west and hardly entering the Pegu district on the east. It id found in the Chindwin drainage up to about the 23rd parallel of latitude, and occurs on the eastern slopes of the Chin hills and the Arakan, Yoma, extending as far south as the Thayetmyo district. It is also found scattered in the lower Salween drainage in Kayag State.

Leaf

Leaves 15.24 cm.-17.78 cm. Long with seven to nine coriaceous leaflets. Alternate compound leaves with alternate leaflets.

Fruit

The pods ripen in the cold season, and hang for some moths on the trees, the pods fall for the most part during and towards the end of the hot season. The pods are 4.57-7.62 cm., in diameter including the wing, finely pubescent, light grayish brown when ripen, the central portion hard and bony containing usually one, more rarely two, seeds.

The seeds are dolabriform, reddish brown, 1.016-1.27 cm. long, with a leathery tests.

Flowering Season

The tree is leafless for a time in the hot season, the new leaves appearing in April-May. The racemes of fragrant yellow flowers appear from March to May.

Height & Growth

Exceptionally the tree grows to a height of 27-30 meters and a girth of 3 meters, but ordinarily it attains a height of 18-21 meters with a clear bole of meters to 12 meters and a girth of 1.5 to 2 meters.

PYINKADO

Botany Name	*Xylia Kerii*
Vernacular Name	Pyinkado
Location	Through the greater of Burma ascending to 3000 ft. It extend as 24 N. Latitude. Abundantly found in Pegu Yoma. It is also found in the dry zone of Burma. In Arakan it seems in many localities in patches. It is found both in hilly or flat ground. It thrives best on deep moist porous soil.
Leaf	Leaves bipinnate with one pair of pinnae, each pinna with two to sox pairs of leaflets.
Fruit	The pods ripen usually in January and February, dehiscing on the tree. The pods fall at the time of or not long after dehiscing. The pods are 10-15 cm. Long by 5-6.3 cm. Broad and woody.
Flowering Season	The globoseheads of small yellowish flowers appear in March-April
Height & Growth	The tree reach a height of 36.5 m and a girth of 3.6 m or more.

SAGAWA

Botanical Name	*Michelia Champaca*, Lina.
Vernacular Name	Sagawa
Location	It is found in Popa, and the evergreen forest type in Pegu Yoma hills.
Leaf	Leaves ovate-lanceolate tapering to a long point. The greenish leaves appear alternately: leaves 8-10 by 6.35-10. 16 cm., shining above pale and glabrous or puberulous beneath peticle 2.54-3.81 cm.
Fruit	The fruit ripens about August or later. The seeds, dark-brown and angular, are covered with a pink fleshy arrillus. They are oily and quickly lose their germinative power.
Flowering Season	The scented yellow flowers appear in the hot season and the rainy season.
Height & Growth	A tall handsome evergreen tree with a long clear cylindrical bole, attaining a height of 33.528 meters or more and under ordinary forest condition a girth of 2.4384-3.6576 meters or more.

SIT

Botanical Name *Albizzia procera*, Benth.
Vernacular Name Sit

Location The tree is found most commonly on alluvial ground along streams and in moist places. It is in many localities also a common species in mixed forests.

Leaf Leaf-rachises glabrescent, with a large gland near the peticle, pinnate 4-12, leaflets rigidly subcoriaceous, grey beneath, glabrous, 2.54-3.81 cm. Long, obliquely truncate on the lower side at the base.

The tree becomes almost leafless for a short time during the hot season in April to June.

Fruit The pods ripen from February to May and turn dark reddish brown, 10.16- 20.32 cm. long by 1.27-2.286 cm., broad, thin, strap-shaped, 6 to 12 seeded, dehiscent.

The seeds are 0.508-0.762 cm by 0.381-0.635 cm., flat, elliptical to nearby orbicular, hard, smooth greenish brown, with a leathery tests, about.

TAUKKYAN

Botanical Name *Terminalia tomentose*, W. & A.
Vernacular Name Taukkyan

Location It is plentiful throughout the greater part of Burma, extending into the dry zone and ascending to 1219.2 meters in the Southern Shan States.

It is common in most of the mixed deciduous forests throughout Burma, both in the upper and in the lower mixed types, as well as in theIndaing forest. It is sometimes found in dense evergreen forest.

Leaf Leaves simple, exstipulate, alternate, rarely sub-opposite, 3.302-10.16 cm. by 2.032-4.064 cm. elliptical ovate or obovate, apex and base acute, entire, pubescent or glabrescent above, pubescent beneath, tomentoseround margin and on principal veins beneath, lateral vains 6-8 pairs in young seedling; two small glands present, one on either side of midrib near base of lamina on the under surface.

Fruit The fruits form rapidly, becoming full-sized by about October, though still green; they remain pale yellowish green from November to January, ripening about February-March.The fruit has a hard bony axis with five coriaceous wings, and is brown when ripe. The ripe fruit falls chiefly from March to May, but

many unripe fruits, usually found to be bitten off by insects or possibly birds, fall during January-February, and turning brown after falling, give the false impression of being ripe.

Flowering Season — the panicled spikes of small whitish flowers appear about in July. In the early part of the rainy season, the masses of whitish blossoms can be seen.

Height & Growth — A large deciduous tree with a long clean bole and a full crown. In favourable localities it attains a girth of 3.5 m or more and a height of over 33 m, but on dry rocky ground and other unfavorable situations it is stunted.

TAMALAN

Botanical Name — *Dalbergia oliveri*, Gamble
Vervacular Name — Tamalan

Location — It extends into the dry zone of Upper Burma for example in the southern part of Meiktila district; here it does not attain large dimensions. The tree is not gregarious, but is found scattered in mixed deciduous forests of a dry type, often associated with teak and bamboo. It grows usually on hilly ground in localities similar to those occupied by Padauk. It also occurs in the indaing (dry dipterocarpus) forest in laterite.

Leaf — Leaves compound, imparipinnate, first pair opposite, subsequent leaves alternate, first few with 5 leaflets, the number increasing subsequently to about 13 leaflets by the end of the first season.

Fruit — The pods ripen about February – March. They are brown, flat, 3-5 by 1.27 – 2.54 cm., 1 or 2 seeded; seeds dark brown, hard, flat, reni-form, averaging 1/016 by 0.635 cm.

Flowering Season — In April the panicles of white flowers appear with the new leaves.

Height & Growth — A moderate – sized tree, in Katha district, Upper Burma, has a girth of 2.0574 meters, and a clear bole of 15.24 meters.

TEAK

Botanical Name — *Tectona grandis*, Linn.f.oo
Vernacular Name — Kyun

Location — Teak is indigenous throughout the greater part of Burma. The northern limit of teak lies about 25^{o} 30^{0} N.

lat., that is , some distance outside the tropics, while its southern limit is 15^0 and 16^0 N. lat., on the east it extends beyond the frontiers of the province, while, on the west it does not extend beyond the western watershed of the Arrawaddy and Chindwin rivers.

Leaf Leaves opposite, large, broadly elliptical or obovate, usually 30.48-60.96 cm. Long, but often larger in coppice – shoots and young plants, rough above, stellately gray tomatoes beneath, with minute glandular dots, which are red in young leaves, afterwards turning black.

Fruit The fruits ripen from December to February and fall gradually, Some remaining on the tree through part of the not – season. The fruit is hard, bony, irregularly globose nut, somewhat pointed at the apex, enclosed in a thick, felt light brown covering, usually 1.016 – 1.524 cm. in diameter, but varying much in size, containing one to three, rarely four, seeds.

Flowering Season The large terminal panicles of small white flowers appear during the rainy season, as a rule from June to August of September according to season and locality, but in abnormally wet seasons they may begin to appear as early as April. During the rainy season the teak trees are conspicuous from a distance with their masses of white inflorescences.

Height & Growth Among large trees recorded, one has a girth of 4.84 meters at 1.83 meters from ground – level, and clear bole to the first branch is 34.74 meters.

YEMANE

Botanical Name *Gmelina arborea*, Linn.
Vernacular Name Yemane

Location The tree is distributed generally through out Burma, but is usually scattered; it is common in the Pegu Yoma.

Leaf Opposite, broadly ovate, acuminate, usually cordate leaves, glaucous beneath, or stellately hairy or tomentose beneath in one variety.

Fruit The furits ripen from the end of April (Burma) to July. The fruit is a sucoulent avoid or oblong drupe, 2.286-3.048 cm. long, yellow when ripe, with a leathery shining pericarp, a sweetish pulp, and a hard bony stone.

Flowering Season The panicles of flowers appear from February to April, when the tree is more or less leafless, or with the young leaves, and the irregular tabular, about 2.54 cm. long, dull chestnut, with a yellow lip and throat, quickly fall from the trees and cover the ground in the neighbor-hood.

Height & Growth A moderate – sized to large deciduous tree. Under the most favourable conditions it attains a height of 30.48 meters or more a girth of 4.57 meters.

YINDAIK

Botanical Name *Dalbergia cultrate*, Grah
Vernacular Name Yindaik

Location Throughout the greater part of Burma, in upper and lower mixed forests and indaing forest. It is a common companion of the teak both in upper and in lower mixed forest.

Leaf Compound, imparipinnate, subsequent leaves alternate leaflet. Leaflets of earlier leaves smaller than of later leaves, terminal leaflet often larger than lateral leaflets.

Fruit The pod ripen in the cold season and hang sometime on the trees; they are brown, flat, 30.48 cm. to 10.16 cm. by 1.016 cm. to 1.324 cm., 1 to 3 seeded.

Flowering Season The new leaves appearing about April. The white or pale pink flowers in small panicles, appear with the young leaves.

Height & Growth A moderate – sized to large deciduous trees.

YINMA

Botanical Name *Chukrasia tabularis*, A. Juss
Vernacular Name Yinma

Location In Burma it is scattered in tropical forests often in moist valleys.

Leaf Compound, first pair opposite, subsequent leaves alternate, exstipulate. First pair 2.54-4.32 cm. long, 5 foliate or 3-foliate with terminal leaflet deeply 3-partite. Sub-sequent leaves 5 or 7

foliate, leaflets glabrous above, puberulous below, very variable, terminal leaflet 3.05 – 5.08 cm. long, ovate acuminate.

Fruit The woody ovoid dark brown capsules, about 3.81 cm. long ripen January to March, the winged seeds on escaping are disseminated by the wind.

Flowering Season The yellowish white flowers appear in April-May.

Height & Growth A very large handsome tree with a tall straight trunk, a spreading crown and paripinnate leaves. It has a cyclindrical trunk 18.28 to 24.38 meters to the first branch and 4.27 meters in girth.

YON

Botanical Name *Anogeissus acuminate*, Wall
Vernacular Name Yon

Location The tree is frequent not only along river banks but also in the upper mixed deciduous forests with teak and its associates. It is plentiful in the lower mixed deciduous forests of the plains. It is also found in the dry forest on poor shallow soil.

Leaf The tree is leafless for a short time in the hot season. Leaves – elliptic or oblong acute at both ends. Villous or pubescent, beneath, peduncles solitary.

Fruit The fruits ripen in April-May, falling as soon as they ripen. The seed, like that of other species of this genus, is very unfertile.

Flowering & Season Flowers appear in February-March.

Height & Growth A large handsome deciduous tree with a tall straight bole and graceful drooping branches.

3. Nursery Practice

Collection of Seed

Seed collection is time consuming, expensive, and requires most appropriate timing of collection periods. Thus it is important that good viable seed be collected and that no time be lost locating seed trees. Usually seed from local sources produces seedlings better adapted to local planting sites than imported races.

The seed collector should constantly watch for potential seed sources for all species that might be grown in his nursery. He should also look for stands or groups of trees of good vigor, form and the optimum age to produce seed. Poorly formed seed trees should be avoided. The following guideline in the selection of seed will be helpful.

(1) Freedom from insects and disease, and reformed trees.

(2) Absence or limited fluting.

(3) Outstanding height and diameter growth.

(4) A long straight bole, circular in cross section.

(5) Flat branching, branching, branch angle approaching 90 degree.

(6) Good bole form, tapering only slightly.

(7) Absence or limited buttressing.

(8) Good flower and seed production.

Seed should be collected from stands that contain several trees of the species rather than from isolated trees. Pollination of isolated trees may be poor and the seed from isolated trees although numerous may not be viable.

When several trees of the same species are present adequate pollination of flower is more likely, which results in a higher percentage of sound seed. Potential collection areas should be marked on a fairly large scale map and a record kept of the area showing species, number of trees and amount of seed that may be expected. It is also helpful to know how long the seed collection could last for the various species. Ripeness of some species must be forecast because seed capsule open and the wind borne seed is dispersed in a very short time. Seed collection is best done in the natural forest to keep the identity of the seed source. Seed collections from planted trees in yard, farm or garden cannot be identify for seed source, which might be required at a later time.

Planning Seed Collection

A literature search may provide some information on the extent of the natural range of the species and the general pattern of its distribution. Records of flowering and fruiting periods in different parts the range may be obtained from the Forest Divisions concerned. Information from local village is also helpful in the location of the collection sites. A local guide may be able to enhance collection time by pinpointing the exact location of seed trees.

Before exploring the seed area contact with Divisional Forest Officer through correspondent may also provide useful information. All the information gathered should be recorded on the map and the collector in charge arranged personnel for collection simultaneously over a wide range of the country.

Before collection, recognizance and marking, the location of the seed trees on the map also may be helpful

Time of Seed Collection

When ever possible, it is preferable to collect seed only in a year of abundant seed production since this offer much greater freedom of action in the choice of stands and treed as well as the possibility of obtaining more seed for a given cost. In good seed years the seed is usually of best quality. Assessment of seed yields made a few months before harvest are useful and can be progressively improved in accuracy if they are later compared with the actual quantities of seed obtained. The germination percentage of seed collected too soon is lower than average and often does not store well because of immature embryos. If collection is delayed too long the seed will have fallen and be lost, this applies especially to Leguminous species. All the seed collected should be secured immediately in a tight container to avoid having the pods or fruits crack open and the seed lost in transit. If possible seed should not be collected in very wet weather because wet seed is more difficult to prepare for storage and may mould or heat up rapidly.

Planning Seed Handling, Transport and Storage

The period between the collection of the seed and its arrival in the seed laboratories where it can be properly cared for is of critical importance. Careful planning is needed to provide the most favorable conditions practicable and to reduce the transit time as far as possible. Without careful planning viability and vigor of seeds may be affected. Especially, seed like *Michelia champaca* should be handle carefully and sown immediately together with aril us. Unless this is done the germination percent of the seed will be very low. At the collection site temporary shelters may be needed to protect the seed from sunshine and rain. When large quantity of seeds are stored in high humidity care must be taken to avoid spoilage.

Seed Extraction

Seeds of most of the species described have to be collected together with pods or fruits. After collections pods or fruits may need to be stored in sacks while awaiting extraction. Such sacks must be stored kin very well ventilated sheds where they are protected from rain. If possible sacks must be arranged on shelves or struts so that there is free circulation of air on all sides. Seed extraction for each species is specifically mentioned in the following chapter.

The Location of Nursery

Careful location of the nursery site is vital in nursery practice. The nursery site should be located as closely as possible to the planting site to avoid long haulage distance and must be readily accessible for close supervision. A site on a river bank is advisable for the reason that there is usually a spacious flat area and a water supply is readily available. To avoid labour problems, nursery sites are chosen near villages but sufficiently removed to avoid damage by domestic animals.

Preparation of Nursery Site

A well drained site is essential. Waterlogged areas must be avoided. Undulating ground should be leveled and stumps and trees removed. Partial shade is constructed with posts and bamboos at a height of 2 meters from the ground with 18% available light. Whenever necessary, it is advisable to have the area thoroughly cleaned for sanitation purposes.

Preparation of Seed Bed

Temporary beds for containers are prepared with bamboos wooden plank. The slots are 15 cm. high, have a width of 0.9 meters and length of 9.15 meters. Pregermination seed beds are raised above the general land level to improve soil aeration and drainage. River and is used in the beds, which are 0.9 meters wide, 3.0 meters in length, and 20 cm. high. The sand used should be sieve through a No. 18 mesh.

Management of Nursery

Good management is the most important part of nursery practice. Watering, cleaning, weeding, and protection from disease and pests are important elements of a successful operation. To produce vigorous, healthy seedlings a nursery-man must be diligent in supervision to be sure that the plants are tended with care.

Watering

Care in watering is very desirable. During pregermination minute seeds should be watered with a sprinkler that has droplets no large than 0.5 mm. This is done to avoid

disturbing the seeds in the seed beds or cover them too deeply. For a bigger seeds the sprinkler may have a water drop of 1.0 mm. or more.

After potting, continued care in watering is necessary. Newly potted seedlings, young and tender, can be destroyed by large droplets.

In watering it should borne in mind that the soil should be moist at all time. Frequency of watering depends on daily temperature and wind velocity. A high temperature and wind velocity usually dry up the soil and in such case more watering is needed. Normally, two to three times per day are sufficient. Another point is to be careful in watering not to produce edge effect. It can often be seen that the seedlings in the middle of the seed bed grow better. Too wet a soil encourages damping off in most of the cases.

When the seedlings under partial shade cannot be transplanted in time, during rains the shade should be removed to avoid big water drops that usually kill the seedlings.

Cleaning and Weeding

Hygenic around the nursery site is important. The area in the vicinity of nursery bed should be kept clean at all time for the reason that some of the weeds and plants may be host plant of disease pests. Weeding in the nursery bed or pot to avoid competition to the seedling is important. Frequency of weeding depends on the density of weeds. Normally three to four weeding are necessary. It is advisable to fumigate the soil mixture with a reemergence weedicide before potting.

Protection

Even though the seedlings may appear healthy and free of pests or blight, it is necessary to protect them by spraying fungicide fortnightly.

Insect pests are quite common in the nursery and they are very destructive to many seedlings. (refer plate I, II, III). Spraying with an insecticide such as Nogos, Dimecron, or malathion, fortnightly is necessary. When an infection is found an entomologist should be consulted to determine the proper treatment. Fencing the nursery site for protection from humans and animals is advisable.

Sorting

Most of the hardwood species do not germinate at the same time. In many cases, the time from the first to the last germination take as long as one to four weeks – a result of different sizes of seedlings in the nursery beds. To avoid the larger seedlings dominate the smaller ones the same size of seedlings should be sort out and nurse in a different place Soil working and manuring of the inferior seedlings may be necessary.

Hardening

Removal of partial shade one to two weeks before planting time is necessary. This will harden the seedlings to adapt to adverse conditions in the field. Watering may also be reduced but care must be taken not to totally cut off moisture for the seedlings growth. Sometimes the leaves of the seedlings turn yellow which may probably be a sign of wilting. In such case more watering may be necessary. This operation must be scrutinized properly according to the intensity of seasonal heat.

PLATE I.

Fig. 1. A temporary nursery with (15) hardwood species.
Seinye. South Taungoo Forest Division.

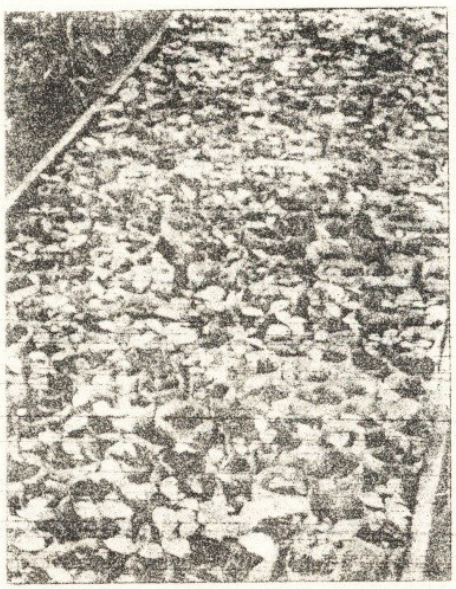

Fig. 2. Serious insect attacked on padauk (Pterocarpus macrocarpus) seedling.

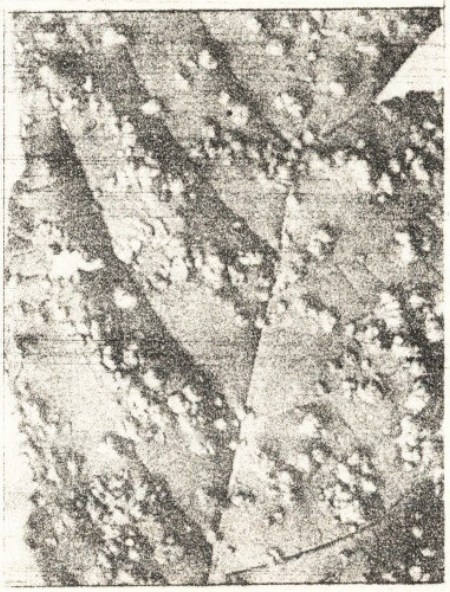

Fig. 3. Severe gall Formation on binga (Mitragyna rotundifolia).

Fig. 4. Teak Leaves skeltonised by Hapalia machaeralis.

PLATE II.

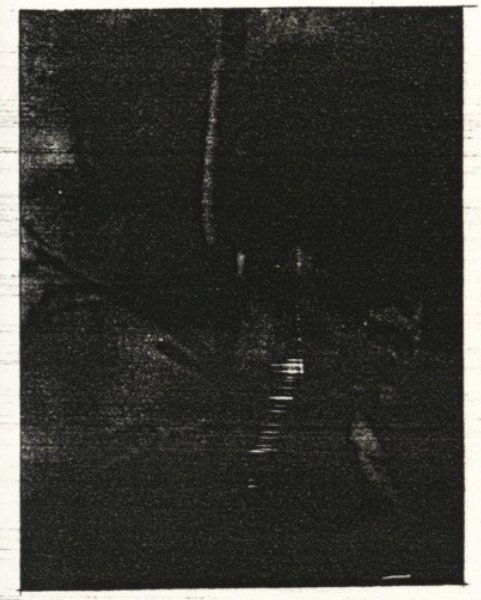

Fig. 1. Geomatrid Larvae on padauk (Pterocarpus macrocarpus).

Fig.2. Geomatrid Larva on yinma (Chukrasia tabularis).

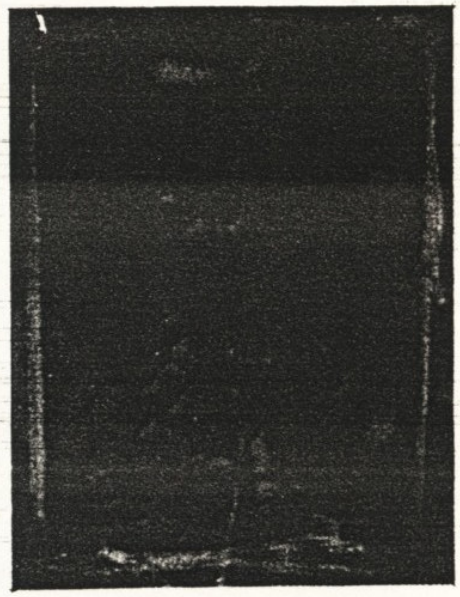

Fig.3. Larva of spodoptera sp. on teak (Tectona grandis).

Fig.4. Lepidopterous pupa on taukkyan (Terminalia tomentosa).

PLATE III.

Fig.1. Damage to thinwin (Millettia pendula) by an unidentified disease.

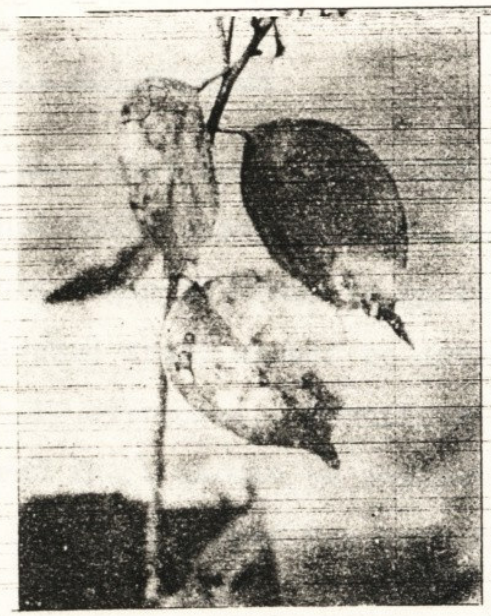

Fig.2. Damage by leaf minors to padauk (Pterocarpus macrocarpus).

Fig.3. Damage to teak seedling by an unidentified disease.

Fig.4. Dieback of mau-lettan-she (Anthocephalus cadamba) in nursery.

Culling

Culling is a must in nursery practice. To provide a healthy vigorous seedlings for planting, all the inferior seedlings in the nursery should be discarded. Mechanically damaged pots and seedlings should be removed. Especially seedlings with disease should be destroyed immediately.

Handling of Seedlings

A seedling in the juvenile stage should be taken care in handling. Most often the seedlings are injured by improper handlings. Loading and unloading must be done with patience and care. A vehicle loaded with seedlings should travel slowly and cautiously.

Adina Cordifolia
Seed Weight –3.968/KG
Seed Collection, Treatment, and Storage

By October the fruit heads are fully formed. They usually ripen and shed their seeds in April to June. Collection of the fruit should begin in March to April before the seed dispersed. The collected fruit should be dried for 48 hours and the seed manually extracted . Fertility of the seed is poor. Only well matured fruit should be collected and the seed sowed immediately. The seed stored for more then 3 months lost its viability.

Sowing

Pregermination of the seed is done in the seed box or bed containing the river sand as medium. The seeds are spread on the sand sterilized compost is thinly spread on top of the seed. Germination takes place after 3-4weeks of sowing.

Potting

Potting is done after the germinated seed produced 2 pairs of leaves. The seedlings are tender and should be handled with care.

Field Planting

The seedling can be planted in the field after 8 weeks of potting, when it attained a height of 30-40 cm.

Germination

30-40/gm

Means of Propagation

Seedling transplant

Albizzia Procera
Seed Weight – 24900 Seeds/Kg.
Seed Collection, Treatment, and Storage

Normally, the pods ripen in February to May. The time for pod collection should begin in the end of February through March and April. The collected pods are then dried for 48 hours and the seeds are manually extracted. The seed is flat and extraction is rather laborious. The seeds are then stored in a tight sealed container.

Sowing

Pregermination is required as the germination percent of the seed is very low. The seeds are sown in the seed bed containing the river sand medium. Lines are drilled 2 cm depth and 5 cm apart within rows. The seeds are then placed in the line and thinly covered with loose sand.

Potting

Potting is done when the germinated seed produced 2 to 3 pairs of leaves. The seedlings is rather tender and care should be taken not to damage the seedling while transferring in the container.

Field Planting

The seedlings attained a height of 30-40 cm after 8 weeks. The seedlings can be transplant after 6 weeks of potting.

Germination Percent

25 percent

Means of Propagation

Seedlings transplant

Anogeissus Accuminata
Seed Weight – 6.64 Litre/Kg.
Seed Collection, Treatment and Storage

The fruits ripen in March and April, falling as soon as they ripen. The fruit should be collected before it falls. The fruits are dried for 24 hours and kept in a cool dry place. The seed like other of this genus, is very unfertile. The seed should be germinated immediately after collection. Viability of the seeds remain for only 3-4 months.

Sowing

Pregermination of the seed in the send box or sand bed is necessary. Lines 1 cm. depth and 5 cm. apart within rows are drilled, and the seed are spread thinly in the lines. The seeds are then covered with loose sand. Watering is done with a fine spray.

Potting

The seeds germinate after 7-10 days. The germinated seeds are transferred to the pot after it produced two pairs of leaves.

Field Transplanting

The seedling can be planted in the field after 2 months of potting, which normally attained a height of 20-30 cm.

Germination

20/gm

Means of Propagation

Seedling transplant.

Anthocephalus Cadamba
Seed Weight - 1.8 Litre/Kg
Seed Collection, Treatment and Storage.

The ripen fruit of ma-u-lettan-she usually falls in January. Seed collection should begin prior to the fallen fruit. The appropriate time for seed collection is in November through December. The collected fruit is dried for 48 hours and the seed is manually extracted. The seeds are minute and cannot be separated from uncleaned materials. The seeds are dried and stored in tight container.

Sowing

The seeds are broadcast on the seed box containing sand medium. It is necessary that the boxes or beds should be sheltered from the sun and rains. Watering must be very careful and a fine only a fine spray is used. The water should be sprayed frequently but sparingly.

Potting

It takes at least 8 weeks to have a germinated seeds transferred to pot. The seedling is transferred when it attains a height of 5 cm. The pots are then kept under shelter for 7 days and transferred again to partial shade.

Field Planting

Initially, the seedlings are very slow to get established, but once it has been transferred to the pot and taken care of, it grows fast and attain an average height of 40 cm. after potting in 12 weeks. The seedling should be planted in the field when it is 30-35 cm. high.

Means of Propagation

Seedling transplant.

Chukrasia Tabularis
Seed Weight – 6.5 Litre/Kg.
Seed Collection. Treatment and Storage

The woody capsule of yinma normally ripen in January. A timely collection of capsule is vital, because the winged seeds escaping and being disseminated by wind. The appropriate time for collection is in February through March. The collected capsule is dried in the sun. The capsule cracked opened and the seeds escaped. A timely collection of seeds from the container is important. The seed is stored in a tight can and placed in a cool dry place.

Sowing

As the seeds are small and thin pre-germination is necessary. The seeds are sown in a river sand box or in a sand bed for large scale planting. The line is drilled about 6 cm. apart and a depth of 2 cm. The seed are spread in the line and cover loosely with fine sand.

Potting

The germinated seed is transplanted in to the pots when it bears a two pairs of leaves. The pots are placed under partial shade and tended with care.

Field Planting

The seedling are planted in the field after 10 weeks of potting. The seedling attain about 45 cm. in height and it is the right size for transplant.

Germination

35/gm..

Means of Propagation

Seedling transplant.

Dalbergia Cultrate
Seed Weight – 1160 Seeds/Kg.
Seed Collection, Treatment and Storage

The yindaik pods normally ripen in December and January. Collection of the pods should begin February through March. The collected pods are dried for 2 days and the seed is manually extracted by slit opening of the pod. The seed is dried for 24 hours and stored in a cool place.

Sowing

Pregermination of seed is done in a river sand medium. About 2 cm. depth are drilled in the sand and the seed is placed 2 cm. apart within row and 5 cm. apart between rows. The seed is loosely covered with sand on top. Direct sowing in the container is possible but not preferable.

Potting

Potting is done when two pairs of leaves are produced.

Field Planting

The seedlings are planted in the field 8-10 weeks after potting when the seedlings are 30-35 cm. high.

Means of Propagation

Seedling transplant.

Dalbergia Oliveri
Seed Weight – 12565/Kg
Seedling Collection, Treatment and Storage

The pods of Tamalan usually ripen in the wet season. The time for pod collection should begin in May through July and September. The collected pod should be dried immediately after collection. Often the pods are spoiled by moul. The seed from the pod should be manually extracted after the pod is dried. The seed then dry again for 48 hours and stored in a tight sealed container.

Sowing

Direct sowing the whole pod in the container is possible, but sowing the seed is preferable. No pregermination is required. 24 hours soaking prior to sowing give faster germination.

Field Planting

The seedling can be planted in the field after 12 weeks of sowing, which attained a height of 30-40 cm.

Germination Percent

Seeds stored for one year has approximately 25 per cent germination.

Means of Propagation

Seedling transplant
Direct sowing.

Gmelina arborea

Seed weight – 1840 stone/Kg

Seed collection, treatment and storage

Normally yemane fruit ripens in April. Collection should begin from the end of April through May. Mature fruits which has a yellowish colour are picked from the ground. For fresh fruits the pulp should be softened by soaking in water for about 5 to 7 days. Then macerate the flesh against an half-inch mesh wire. The stone are then separated by floating the macerated pulp in water. The stone are sun dried for about 2 days and stored in a cool dry place. The maximum length of storage should not exceed 3 months. Storing the stone beyond that result in only about 30% germination.

Sowing

The stones are soaked in water overnight prior to sowing. The stones are sown on a seed bed or directly in the pot. Sandy loam soil is used as germination medium. The atones are sown 2 cm. apart within rows and 5 cm. apart between rows.

Potting

Potting is done when two pairs of leaves are produced.

Field Planting

The plant is planted in the field after 4-6 weeks of potting when an average height of 20-25 cm. is attached.

Means of Propagation

Direct sowing.
Seedling transplant.

Melletia Pendula

Seed Weight – 2400 Seeds/ Kg.

Seed Collection, Treatment and Storage

Thinwin pods normally ripe in the month of December. The pods should be collected in the end of December through January and the first part of February. A timely collection is vital because the pods are readily crack opened and the seeds dispersed. The collected pods should be packed in a tight sealed containers in transit. The pods are dried in the sun surrounded by an enclosure at a height of 2.5meterc. The seeds are then dried for 24 hours and stored in a tight can. The can is placed in a cool dry place for storage.

Sowing

No pregermination is necessary. The seed can be sown directly in the pots with prior soaking of seed foe 24 hours.

Field Planting

The seedling can be planted in the field , at a height of 15 cm. After 21/2 months the seedlings attained an average height of 45 cm. which is the best time for transplanting.

Germination Percent

60%

Means of Propagation

Direct sowing.
Seedling transplant.

Michelia Champaca

Seed Weight

Seed Collection, Treatment and Storage

Sagawa fruit normally ripens about August or in the early part to September. Collection of fruits should begin in October through November. The collected fruits should be stored in a cool dry place before extraction of seeds. It is to be careful not to destroy the pinkish aril us while extracting seed. The seed is manually extracted.

Sowing

As soon as seed in extracted, it should be sown immediately together with arillus. The seed is pregerminated in the seed bed using river sand medium.

Potting

Potting is done when two pairs of leaves are produced. It takens about 20-30 days for seed germination.

Field Planting

Initially sagawa grows very slowly. The seedlings has to be prepared at least 6-8 months ahead to be able to be planted in the field. An average height of 35 cm. is attained after 6 months of potting. The seedling is then transplanted in the field.

Means of Propagation

Seedling transplant.

Mitragyna Rotundifolia

Seed Weight – 3.76 Litre/Kg.

Seed Collection,- Treatment And Storage

The fruits to Binga has numerous small two valved seeded capsules. The fruits begin to ripe in December to February. Time for seed collection should begin in February through

March. The extraction of seeds is nether laborious. The capsule has to be dried after collection. Sometime the seed has to be extracted manually by splitting the valves of the capsule. The seeds colleted has to be clean thoroughly. The clean seeds are stored in the bottles or tight sealed can.

Sowing

The seeds are minute. Germination is very slow. It takes at least 30 days to have the seed germinated. The seeds are pregerminated in the sand box or bed. The seeds are spared on the sand, and a sterilized compost is thinly covered on the top of the seeds. Only fine spray is used in watering.

Potting

The germinated seeds are slow to establish. The germinated seed is transferred to the pot when it has two pairs of leaves. The seedlings are delicate and should be handled with care.

Field Planting

The field plantating is done after the seedling reach a height of 35-40 cm. or after 2½ -3 months of potting.

Germination Percent

Germination percent is very low. Viability of seed is short.

Means of Propagation

Seedling transplant.

Pterocarpus Macrocarpus
Seed Weight – 18020 Seeds/Kg.
Seed Collection, Treatment and Storage

Padauk pods normally ripen in the month of November. Maturity of pod depends largely on climatic conditions in the locality. A dry year usually produces ripen pods earlier then a wet year. Collection of fruit should be done in November through January. Seed years differ from locality to locality. A collector should always look each year for the most promising locality for collection of pod. Seed extraction is laborious work. However, manual extraction of seed is advisable. The extracted seed should be stored immediately in a tightly sealed jar or bottle. No treatment is required for storage. The viability of seed in a well sealed container will last for a year without treatment when stored in a cool dry place.

Sowing

The seed should be soaked in a cold water for 24 hours for faster germination. The more buoyant immature seed will float for faster germination. The more buoyant immature seed will float on the water and can be stored from mature seed. Pregermination is done in river sand in a box or bed, The lines are drill approximately 5 cm. apart at a depth of 2 cm. in the seed box. The seeds are placed about 1 cm. apart in the line and covered with loose sand.

Potting

The soil mixture for potting can be prepared with 2 parts of forest soil one part of compost, and one part of river sand by volume. After the seed germinates and produce a pair of leaves the seedling is transplanted into the container. Padauk is hardy and root pruning may be done while transplanting into the container.

Field Planting

The seedlings can be planted in the field at a height of 15 cm. but seedlings 30 cm. high are better, The seedlings can be field planted 2 –2½ months after potting.

Germination Percent

40-50%

Means of Propagation

Seedling transplant.

Cutting.

Tectona Grandis
Seed Weight – 1117 Fruits/Kg.
Seed Collection, Treatment and Storage

Normally the teak fruits ripen in February. Time for collection of fruit should begin in the end of February and continue through March and April.

The collected fruit should be dried for at least 48 hours. The fruits should be stored in a tight can or in a w3ell-sealed earthern jar. Fruits in containers should be stored in a cool dry place.

Sowing

Treatment of fruit is necessary for faster germination. An alternate dry and wet treatment for at least (7) days is necessary. Pregermination is done in a seed –bed composed of forest top soil. The seed bed should be well drain and raised about 25 cm. from the ground. The bed is approximately one meter in breadth and 10 meters in length.

Potting

The soil mixture for potting can be prepared with 2 part forest soil, 1 part of compost, and 1 part of sand by volume. After the fruits germinate and produces 2 pairs of leaves the seedling is transplanted into the containers.

Field Planting

The seedlings can be planted in field at about 15 cm. in height. But a 30 cm. high seedling is preferable and can be grown in 10-12 weeks after potting.

Germination Percent

40%

Means of Propagation

Direct sowing of fruits.

Seedling transplant.
Stump planting.

Terminalia Tomentosa
Seed Weight – 2840 Fruit/Kg.
Seed Collection, Treatment and Storage

Taukkyan fruits normally ripen in the month of February. Collection of fruits should begin in the end of February through March. It is to be careful that immature fruit will not germinate or only about 10% germinates. The collected fruit is dried for 24 hours and stored in a tight container and placed in a cool dry place for storage.

Sowing

The fruits can be sown directly in the pot before sowing. The pedicel end of the fruit should be cut opened for faster germination. It is to be careful not to cut the seed inside the fruit the while in the process of scarification.

Field Planting

Normally the seed in the fruits germinate after 10 days. The seedling may be planted in the field after 10 weeks after potting which attained an average height of 45 cm.

Germination Percent

60% - 65%

Means of Propagation

Seedling transplant.

Xylia Kerii
Seed Weight – 3480 Seeds/Kg
Seed Collection, Treatment and Storage

Pyinkado pod usually ripen in January – March. The pod should be collected in March through April. It is to be careful that the time of collection should be before the pods crack opened and dispersed the seeds. The collected pods must be packed in gunny bags or a well tight baskets in transit. The pods then dried in the sun surrounded by a tight enclosure made of mats or tarpaulin up to height of 2½ meters. The seeds then dry for 24 hours and store in a tight container. The container is stored in a cool dry place.

Sowing

The seeds can be sown directly in the pot without prior germination. 24 hours soaking of seeds prior to sowing is advisable.

Field Planting

Pyinkado initially is a very slow growing species. The seedling can be planted in the field at a height of 15 cm. but a 30 cm. seedling which can be attained after 3 months of potting is preferable.

Germination Percent

60% -65%

Means of Propagation

Direct sowing.

Seedling transplant.

Root/Shoot Development

The roots development of hardwood species may be classified into the three groups.

1. Distinctive carrot-like tap toot with adventitious roots.
2. Carrot-like tap root with many adventitious roots.
3. No distinctive tap root but many rootlets.

Accordingly, Pyinkado, Padauk, Teak, Taukkyan, thinwin, Yon, Yinzat and Yindaik may be classified as group one, Binga, Sit, Yemane in the group two and Ma-u-lattanshe and Sagawa in group three.

It can be observed from the illustration 1 that the root development of hardwood species differ from one another. It also indicated that the containers to raise the seedling in the nursery can be of different sizes. The first group may need a longer but narrow orifice, while the second group may need a longer and wider orifice, and the third group may need a shorter bur wider orifice container.

(1) HNAW	(2) PADAUK	(3) PYINKADO	(4) YINDAIK	(5) YON
(6) YINZAT	(7) TAUKKYAN	(8) THINWIN	(9) TEAK	(10) BINGA
(11) YINMA	(12) SIT	(13) YEMANE	(14) MA-U LETTANSHE	(15) SAGAWA

ILLUSTRATION(1)

ROOT/SHUOT DEVELOPMENT OF 3-4 MONTHS OLD SEEDLINGS.

4. Conclusion

The time for seed collection mentioned in the text may vary. The climatic changes effects seed production in many localities. The seed year for each species also varies from place to place. These factors have to be borne in mind in preparation of seed collection.

The germination percent of hardwood species depends largely on the maturity of seed, temperature and relative humidity. With mature seed high germination percent will obtained. Moist and high temperature will also favour seed germination. The germination percent giving in the text were determined in the field during the month of February and April. These data provide information, but a more elaborate determination has to be carried out in the control environment in the laboratory.

Supervision of nursery is important. Only person with interest and well experience in nursery work should be given the charge.

The nursery practice mentioned in the text provide much information, but some of the procedured may be modified through experience.

Estimates of Seed Demand

1.	Species	(Tectona grandis) Teak
2.	Plants per acre (0.4 hect.)	
(a)	Number planted	540 (9' x 9') (2.7m x 2.7m)
(b)	Add field replacement at 25%	135
(c)	Total requirement plantable plants	675
(d)	Add lossess and culls in nursery 62.5%	1125
(e)	Total requirement germinated seeds	1800
3.	Estimated number of germinated seeds per kg. Cleaned fruits (at 40% germination)	446
4.	Kg. cleaned fruits needed per acre	4
5.	Annual planting acres	500
6.	Annual requirement of cleaned fruits 2000 kg.	

---

1. It is estimated that 25% of germinated seeds produce plantable plants in one year and aurther 12.5% in the second year.

Estimates of Seed Demand

1.	Species	Xylia Kerii (Pyinkado)
2.	Plants per acre (0.4 hect.)	
(a)	Number planted	540 (9' x 9') (2.7m x 2.7m)
(b)	Add field lost at 20%	108
(c)	Total requirement – plantable plants	648
(d)	Add losses and cull in Nursery at 25%	216
	Total required germinated seeds	864
	Ditto rounded up	900
3.	Estimated number of seed required at 60% germination	1500 or 0.43 kg.
4.	Annual planting (acres)	500 or (200 hect.)
5.	Annual requirement of cleaned seeds	215 kg.

Estimates of Seed Demand

1.	Species	Chukrasia tabularis (Yinma)
2.	Plants per acre (0.4 hect.)	
(a)	Number planted	540 (9' X 9') (2.7m x 2.7m)
(b)	Add field requirement at 20%	108
(c)	Total requirement plantable plants	648
(d)	Add field replacement at 30%	277
		925
3.	Estimated number of seed required at 1 gm/35 germination	26.4 gm. Or 158.4 ml.
	Rounded upward	27 gm or 160 ml.
4.	Annual planting acres	500 or (200) hect.
5.	Annual requirement of cleaned seed	13.5 kg. or 80 litres.

Measurement

Weight

g	gram(s)
kg	kilogram(s)
ton	metric ton
oz	ounce = 28.49 gm
lb	pound = 16 oz = 0.454 kg
viss	20.9 kg (paddy)

Length

mm	millimeter(s)
cm	centimeter(s)
m	meter(s)
km	kilometer(s)
inch	25.4mm
ft	foot (feet) = 12 inches = 30.48 cm
mile	5,280 feet = 1.609km

Area

sq. cm	square centimeter(s)
sq. m	square meter(s)
sq.km	square kilometer(s) = 100ha
ac.	Acre(s) = 4,047 sq.m
sq.mile	square mile = 2.59 sqkm =640 ac
ha	hectare = 2.52 ac