



Propagation Protocols for Indigenous/Endangered and Exotic Forest Tree Species and Some Fruit Trees



National Greening Program

Production of Quality Planting Materials



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Information Bulletin # 1: Propagation Protocols for Indigenous And Exotic Forest Tree
Species and Some Fruit Trees
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PROPAGATION PROTOCOLS FOR INDIGENOUS AND EXOTIC FOREST TREE SPECIES AND SOME FRUIT TREES

Introduction

This information bulletin is a compilation of forest tree seed and clonal propagation protocols developed by ERDB from 1995 to 2007. The said protocols were lifted from the Seed Technology Manual of Some Reforestation Species, Forest Tree Seeds: A Phenological Guidebook (1995); DENR Recommends for Indigenous Species in Laguna #15a (2006) and #15b (2007); and Manual on Mass Propagation of Dipterocarps Using Non-mist Technique. The basic information contained in this bulletin on forest tree seed technology and seedling production includes common and scientific names, seed count/kg, pretreatments needed to enhance seed germination and rooting of cuttings, sowing medium to guide the end- users in the propagation of the species needed in the National Greening Program for the production of high quality planting materials (NGP-PQPM) of the Department of Environment and Natural Resources.

The mass propagation of some dipterocarp (indigenous) species includes the use of non-mist technology as an effective way for rooting cuttings. The available propagation protocols for few fruit trees developed by the Horticulture

1. Tindalo – *Azelia rhomboidea* (Blanco) Vidal

Place and date of collection:

Lobo, Batangas	– Oct-Dec
Sorsogon	– Oct
Albay	– Feb
Leyte and Samar	– Dec

Seed count: 230/kg



2. Akle – *Albizia acle* (Blanco) Merr.

- Place and date of collection:
 - Sariaya, Quezon – May-June
 - Camp 7, Minglanilla, Cebu – Oct
- Seed count: 597/kg
- Seed type: Orthodox
- Pretreatment: Nicking or cutting of the seed coat and soaking in tap water or in 0.02% fungicide solution overnight
- Sowing medium: 1:1:1 garden soil, dried humus, and fine sand



3. Akleng parang – *Albizia procera* (Roxb.) Benth

- Place and date of collection:
 - Camp 3, Tuba, Benguet City Limit, – Apr-June
Ambuklao Road, Baguio City
 - Mangatarem, Pangasinan – Mar-April
 - Ilocos Norte – April
 - Manleluag Reforestation, Pangasinan – Mar-Apr
 - La Union – Mar-Apr
 - Sallacong, Bantay, Ilocos Sur – Jan-Feb
 - Diadi, Nueva Vizcaya – Apr
 - Caylabne Resort, Cavite – Mar-Apr
 - Temate, Cavite – Mar-Apr
- Seed count: 17,600-25,300/kg
- Seed type: Orthodox
- Pretreatment: Soak seeds in boiling water for 1 minute and keep soaked in tap water for 24 hours
- Sowing medium: 1:1:1 garden soil, dried humus, and fine sand.



4. Lumbang – *Aleurites moluccana* (L.) Willd.

- Place and date of collection:
 - Botanic Garden, UPLB – July-Aug
 - Diadi, Nueva Vizcaya – Aug
 - Valmayorville, College, Laguna – Feb
- Seed count: 116/kg
- Seed type: Orthodox
- Pretreatment: Cracking of seed coat and soaking in tap water overnight
- Sowing medium: 1:1:1 sand, topsoil, dried organic matter



5. Batino – *Alstonia macrophylla* G. Don

- Place and date of collection:
 - Cavinti & Luisiana, Laguna – July-Sept
 - Palawan Experimental Station – Sept-Oct
 - Camp 7, Minglanilla, Cebu – Nov
 - Calamba, Laguna – Jan-Feb
 - Biñan, Laguna – Sept
- Seed count: 365,000/kg
- Seed type: Orthodox
- Pretreatment: None
- Sowing medium: Ordinary garden soil, dried organic matter



6. Dita – *Alstonia scholaris* (L.) R. Br. var. *scholaris*

- Place and date of collection:
 - Ilocos Norte – Jan - Feb
 - La Union – Feb - Mar
 - Caniaw, Taleb, Bantay, Ilocos Sur – Feb
 - Echague, Isabela – Jan
 - Binahaan, Pagbilao, Quezon – Aug-Sept
 - Calauag, Quezon – May-June
 - Sooc, Camarines Sur – June
 - San Roque, Sorsogon – July-Sept
 - Calamba, Laguna – Jan-Feb
- Seed count: 365,000-370,000/kg
- Seed type: Orthodox
- Pretreatment: None
- Sowing medium: 1:1:1 ordinary garden soil, dried humus, and fine sand



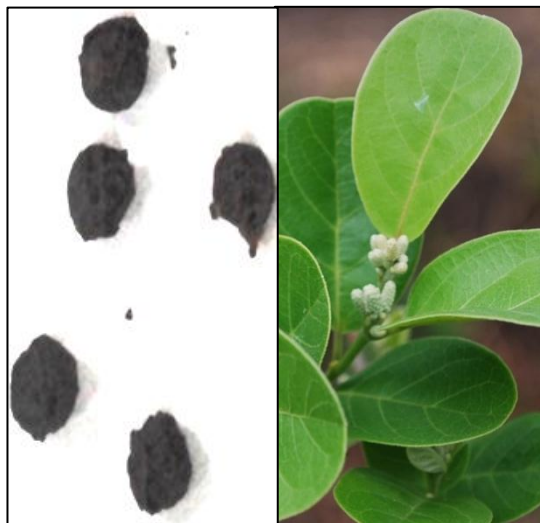
7. Palosapis – *Anisoptera thurifera* (Blanco) Blume ssp. *thurifera*

- Place and date of collection:
 - Leyte – Sept-Oct
- Seed count: 830-900/kg
- Seed type: Recalcitrant
- Pretreatment: Removal of wings before sowing
- Sowing medium: Plastic trays with moistened paper towel or seed boxes with fine sand or 10.16cm x 15.24cm (industry specs) plastic bags with 1:1:1 ratio of sand, topsoil, and dried organic matter



8. Binayuyu – *Antidesma ghaesembilla* Gaertn. var. *ghaesembilla*

- Place and date of collection:
 - Cawag, Subic, Zambales – Aug
 - Castillejos, Zambales – July
 - San Juan, Cabangan, Zambales – May
 - San Marcelina, Zambales – July
 - Angat, Norzagaray, Bulacan – July
 - Mayantoc, Tarlac – July-Aug
 - Arayat, Pampanga – Aug
 - Tanawan, Dingalan, Quezon – July-Aug
 - Palawan Experimental Forest, Bagumbayan, Napsan, Palawan – July-Aug
- Seed count: 78,277/kg
- Seed type: Orthodox
- Pretreatment: None
- Sowing medium: Fine sand or in mixture of garden soil and dried humus.



9. Alibangbang – *Piliostigma malabarica* Roxb.

- Place and date of collection:
 - Ilocos Norte – Apr
 - Manleluag Reforestation, Pangasinan – Feb - Apr
 - La Union – Mar - Apr
 - Caniaw and Taleb, Bantay, Ilocos Sur – Feb
 - Diadi, Nueva Vizcaya – Apr
 - Mt. Makiling, Laguna – Apr - May
 - Leyte – June - July
- Seed count: 12,000-12,200/kg
- Seed type: Orthodox
- Pretreatment: Nicking or cutting of seed coat and soaking in tap water overnight or soaking of seeds in boiling water until water turns cold
- Sowing medium: 1:1:1 ratio of ordinary garden soil, dried humus, and fine sand



10. Bitao – *Calophyllum inophyllum* L.

- Place and date of collection:
 - Ilocos Norte – Jan
 - Burgos, Bangui – Mar-Apr
 - La Union – Dec
 - Laongen, Sto. Domingo; Barbar, San Juan; Nagkolloban, Sinit, Ilocos Sur – Dec
 - Sooc, Camarines Sur – Sept-Oct
 - Legaspi – Dec-Feb
 - Camp 7, Minglanilla, Cebu – July
 - Leyte and Samar – Feb-Mar
- Seed count: 100-210/kg
- Seed type: Intermediate
- Pretreatment: Removal of the shell completely or partially then soaking the seeds in tap water overnight
- Sowing medium: 1:1:1 ratio of ordinary garden soil, dried humus, and fine sand in plastic trays or seed boxes



11. Ilang-ilang – *Cananga odorata* (Lamk.) Hook. f. & Thoms.

- Place and date of collection:
 - Binga, Itogon, Benguet – Aug-Sept
 - Mangatarem, Pangasinan – Sept
 - Region II – Jan-Dec
 - Tarlac Province – Sept-Oct
 - Ternate, Cavite – Aug-Sept
 - Sapián, Capiz – June-Aug
- Seed count: 12,300-12,400/kg
- Seed type: Orthodox
- Pretreatment: None
- Sowing medium: Mixture of fine sand, dried organic matter, and ordinary garden soil(1:1:1)



12. Agoho – *Casuarina equisetifolia* L.

- Place and date of collection:
 - ISU, Cabagan, Isabela – Aug
 - Bulacan (NLEX) – June-Aug
 - Laguna – June-July
 - Palawan Experimental Forest, Sta. Monica, Palawan – June-July
 - Legaspi – Aug-Oct
 - Leyte – Aug
- Seed count: 44,260/100g
- Seed type: Orthodox
- Pretreatment: None
- Sowing medium: Fine sand or 1:1:1 ratio of sand, topsoil and dried organic matter



13. Kamagong – *Diospyros discolor* Willd.

- Place and date of collection:
 - Bangued, Abra – Aug-Sept
 - Dupaz, Nueva Vizcaya – Aug
 - Claveria, Cagayan – June
 - Mt. Makiling, Los Baños, Laguna – July-Sept
- Seed count: 238/kg
- Seed type: Recalcitrant
- Pretreatment: Not necessary
- Sowing medium: Fine river sand in plastic trays or seedbeds or in 10.16cm x 15.24cm (industry specs) plastic bags with 1:1:1 ratio of sand, topsoil, and dried organic matter



14. Panau – *Dipterocarpus gracilis* Blume

- Place and date of collection:
 - Palawan Experimental Forest – June-July
- Seed count: 145-200/kg
- Seed type: Recalcitrant
- Pretreatment: None
- Sowing medium: Mixture of 1:1:1 ratio of fine sand, dried organic matter and ordinary garden soil



15. Apitong – *Dipterocarpus grandiflorus* Blanco

- Place and date of collection:
 - Palawan Experimental Forest – Aug-Sept
 - Leyte – Sept-Oct
 - Valma, Compostela Valley – Sept
- Seed count: 63/kg (large size); 93/kg (medium size)
- Seed type: Recalcitrant
- Pretreatment: Removal of wings before sowing
- Sowing medium: Plastic trays or seedbeds with fine sand or in 12.7cm x 20.32cm (industry specs) plastic bags with 1:1:1 ratio of sand, topsoil, and dried organic matter



16. Dao – *Dracontomelon dao* (Blanco) Merr. & Rolfe

- Place and date of collection:
 - Caniaw, Taleb, Bantay, Ilocos Sur – Sept-Oct
 - Diadi, Nueva Vizcaya – Sept-Oct
 - Mt. Makiling, Los Baños, Laguna – Sept-Oct
 - Leyte and Samar – Aug
 - CARAGA – July-Sept
- Seed count: 1,525/kg
- Seed type: Orthodox
- Pretreatment: Scraping of seed coat and soaking in tap water overnight (for small volume of seeds) or just soak in tap water overnight (for large volume of seeds)
- Sowing medium: Fine river sand in plastic trays or seedbeds or in 10.16cm x 15.24cm (industry specs) plastic bags with 1:1:1 ratio of sand, topsoil, and dried organic matter



17. Igyo – *Dysoxylum gaudichaudianum* (A. Juss.) Miq.

- Place and date of collection:
 - Mt. Makiling, Los Baños, Laguna – Dec-Jan
 - Calauag, Quezon – Dec-Jan
 - Albay – Nov-Dec
- Seed count: 1,536/kg
- Seed type: Intermediate
- Pretreatment: Removal of seed coat and soaking in 0.02% fungicide solution overnight
- Sowing medium: Mixture of ordinary garden soil, dried humus, and fine sand (1:1:1)



18. Earpod – *Enterolobium cyclocarpum* (Jacq.) Griseb.

- Place and date of collection:
 - Magat, Diadi, Nueva Vizcaya – Apr-May
- Seed count: 1,059/kg
- Seed type: Orthodox
- Pretreatment: Nicking or cutting of seed coat and soaking in tap water or in 0.02% fungicide solution overnight
- Sowing medium: Fine river sand in plastic trays or seedbeds or in 10.16cm x 15.24cm (industry specs) plastic bags with 1:1:1 ratio of sand, topsoil, and dried organic matter



19. Mountain agohe – *Gymnostoma rumphianum* (Miq.) L. Johnson

- Place and date of collection:
 - Palawan Experimental Forest – June-July
 - Hawii, Aklan – Aug
- Seed count: 40,000/100g
- Seed type: Orthodox
- Pretreatment: None
- Sowing medium: Fine sand in seedbeds and thinly covered with ordinary garden soil



20. Dalingdingan - *Hopea foxworthyi* Elmer

- Place and date of collection:
 - Mt. Makiling, Los Baños, Laguna – July-Sept
 - Leyte – Sept-Oct
- Seed count: 9,900-10,000/kg
- Seed type: Recalcitrant
- Pretreatment: Removal of the wings of seeds before sowing and sowing them right after harvest to obtain high percent germination
- Sowing medium: Plastic trays with moistened paper towel or in seedbeds with fine sand, or in 5.08cm x 10.16cm (industry specs) plastic bags with 1:1:1 ratio of sand, topsoil, and dried organic matter



21. Ipil – *Intsia bijuga* (Colebr.) O. Kuntze

- Place and date of collection:
 - Diadi, Nueva Vizcaya – Feb
 - Palawan Experimental Forest – May-June; Aug-Sept
 - Bulusan, Sorsogon – Sept
 - Carcar, Cebu – Jan-Feb
 - Pasonanca, Zamboanga City – Nov-Dec
- Seed count: 184/kg
- Seed type: Orthodox
- Pretreatment: Nicking or cutting of seed coat and then soaking them in 0.02% fungicide solution overnight
- Sowing medium: Plastic trays or seedbeds with fine sand or in 10.16cm x 15.24cm (industry specs) plastic bags with 1:1:1 ratio of sand, topsoil, and dried organic matter



22. Nato – *Palaquium luzoniense* (F. –Vill.) Vidal

- Place and date of collection:
 - Quezon National Park, Quezon – May-June
 - Palawan Experimental Forest – June-July
 - Bandilaan, Siquijor – Nov
- Seed count: 160-200/kg
- Seed type: Recalcitrant
- Pretreatment: None
- Sowing medium: 1:1:1 ratio of ordinary garden soil, fine sand, and dried humus



23. Bagtikan – *Parashorea malaanonan* (Blanco) Merr.

- Place and date of collection:
 - Quezon National Park, Quezon – June-July
 - Mt. Makiling, Los Baños, Laguna – July-Aug
 - Leyte – Sept-Oct
 - Valma, Compostela Valley – July
- Seed count: 503/kg
- Seed type: Recalcitrant
- Pretreatment: Removal of the wings and treat the seeds with 3-4g fungicide/kg before sowing
- Sowing medium: Plastic trays with moistened paper towel or with fine sand or in 10.16cm x 15.24cm (industry specs) plastic bags with 1:1:1 ratio of sand, topsoil, and dried organic matter



24. Kupang – *Parkia roxburghii* (DC.) Merr.

- Place and date of collection:
 - Diadi, Nueva Vizcaya – Apr
 - Mt. Makiling, Los Baños, Laguna – Apr-May
 - Camp 7, Minglanilla, Cebu – Apr
- Seed count: 1,258/kg
- Seed type: Orthodox
- Pretreatment: Nicking or cutting of seed coat and soaking in tap water or in 0.02% fungicide solution overnight; or soak the seeds in concentrated (96%) Sulfuric acid for 30-60 minutes and soak in tap water overnight
- Sowing medium: Plastic trays with moistened paper towel, or in 10.16cm x 15.24cm (industry specs) plastic bags with 1:1:1 ratio of sand, topsoil, and dried organic matter



25. Benguet pine – *Pinus kesiya* Royle ex Gordon

- Place and date of collection:
 - Busol Watershed, Baguio City – Dec-Jan
 - Mt. Province – Dec-Jan
- Seed count: 52,934/kg
- Seed type: Orthodox
- Pretreatment: None
- Sowing medium: Plastic trays with moistened paper towel or in seedbeds with fine sand



26. Malapapaya – *Polyscias nodosa* (Blume) Seem.

- Place and date of collection:
 - Ilocos Norte – June July
 - Caniaw, Taleb, Bantay, Ilocos Sur – Nov-Dec
 - Calauag, Quezon – Nov-Dec
 - Cavinti and Luisiana, Laguna – Oct-Nov
 - Pagbilao, Quezon – Dec-Jan
 - Calamba, Laguna – June; Oct-Nov
 - Pitogo, Quezon – Jan-Mar
 - Gumaca, Quezon – Jan-Mar
 - Padre Burgos, Quezon – Jan-Mar
 - Macalelon, Quezon – Jan-Mar
 - Bagumbayan, Palawan – Oct-Nov
 - Sooc, Camarines Sur – July-Sept
 - San Roque, Sorsogon – Sept-Nov
 - Leyte and Samar – Jan-Feb
 - Maco, Mabini, Compostela Valley – September
 - Maharlika, Bislig City – Sept – Dec
- Seed count: 220,000/kg
- Seed type: Intermediate
- Pretreatment: Alternate wet and sundry method for 14 days
- Sowing medium: Sterilized potting mixture of 1:1:1 ratio of ordinary garden soil, fine sand, and dried humus



27. Kalumpit – *Terminalia microcarpa* Decne.

- Place and date of collection:
 - Magat, Diadi, Nueva Vizcaya – Oct-Nov
 - Mt. Makiling, Los Baños, Laguna – June
 - Leyte and Samar – July
- Seed count: 3,000-3,500/kg
- Seed type: Orthodox
- Pretreatment: None
- Sowing medium: Plastic trays or in seed beds with 1:1:1 ratio of ordinary garden soil, dried humus and fine sand



28. Smooth narra – *Pterocarpus indicus* Willd. forma *indicus*

- Place and date of collection:

- Bangued, Abra/Camp 4, Benguet – July
- Pilar, Bataan – July
- Mariveles, Bataan – Nov
- Carrangalan, Nueva Ecija – Nov
- General Tinio, Nueva Ecija – July
- Angat, Bulacan – Aug-Sept
- San Rafael, Bulacan – Sept
- Floridablanca, Pampanga – Aug-Sept
- Masinloc, Zambales – Aug
- Olangapo, Zambales – Sept
- Mt. Makiling, Los Baños, Laguna – July-Sept
- Calauag, Quezon – July-Sept
- Batangas, City – July-Sept
- Lopez, Quezon – Aug-Sept
- Gumaca, Quezon – Jan-Mar
- Pitogo, Quezon – Aug-Sept
- Palawan Experimental Forest – Aug-Sept
- Agtiwa, San Fernando, Romblon – Aug
- Torrijos, Marinduque – Aug
- Albay – Nov-Dec
- Legaspi – May-July
- Sorsogon – June-Aug
- Masbate – Apr
- San Jacinto – May
- Lambunao, Iloilo – July-Aug
- Lantawan, Cebu – July-Aug
- Leyte – Nov-Dec
- Davao del Norte – May
- Esperanza-Bagumbayan Sultan Kudarat – Jan
- Alabel, Malungon, Malapatan, Glan, Sarangani Province – June

- Seed count: 1,794/kg
- Seed type: Orthodox
- Pretreatment: Soak the seeds in tap water overnight (for small quantity), nick the seed coat and soak seeds in tap water, overnight (for large quantity), cut the edge of the samara and soak in tap water overnight (for mass propagation)
- Sowing medium: Plastic trays with moistened paper towel; in plastic trays or seedbeds with fine sand; in 10.16cm x 15.24cm (industry specs) plastic bags with 1:1:1 ratio of sand, topsoil, and dried organic matter.



29. White Lauan – *Shorea contorta* Vidal

- Place and date of collection:
 - Ilocos Norte – June-July
 - Adams and Pagudpod, Ilocos Norte – Apr
 - Cacadiran, Barbar, Cabugao, Ilocos Sur – Aug
 - Mt. Makiling, Los Baños, Laguna – Aug
 - Quezon National Park, Quezon – Nov-Dec
 - Camarines Sur and Sorsogon – June
 - ERDS Compound, Legaspi City – Oct-Nov
 - Camp 7, Minglanilla, Cebu & Negros Oriental – Dec
 - Leyte and Samar – Sept-Oct
 - Valma, Compostela Valley – Aug
- Seed count: 150-160/kg
- Seed type: Recalcitrant
- Pretreatment: None
- Sowing medium: Plastic bags with 1:1:1 ratio of ordinary garden soil, dried humus and fine sand



30. Mayapis – *Shorea palosapis* (Blanco) Merr.

- Place and date of collection:
 - Ilocos Norte – May-June
 - Camp 7, Minglanilla, Cebu – Oct-Nov
 - Leyte and Samar – Sept-Oct
 - Valma, Compostela Valley – Aug
- Seed count: 140-160/kg
- Seed type: Recalcitrant
- Pretreatment: Remove the wings and coat the seeds with fungicide at the rate of 3-4g/kg
- Sowing medium: Plastic bags with 1:1:1 ratio of sand, topsoil, and dried organic matter; or in plastic trays or seedbeds with fine sand



31. Talisai – *Terminalia catappa* L.

- Place and date of collection:
 - Ilocos Norte – May
 - La Union – Oct
 - Caniaw Taleb, Bantay, Ilocos Sur – Aug
 - Angat & Norzagaray, Bulacan – May
 - Palawan Experimental Forest – Sept-Oct
 - Legaspi – July-Aug
 - Camp 7, Minglanilla, Cebu – May-June
 - Upper Calarian, Zamboanga City – Sept-Oct
- Seed count: 66-70/kg
- Seed type: Unknown
- Pretreatment: Remove the exocarp and the mesocarp of the fruit and cut the stony endocarp (for small quantity of seeds)
- Sowing medium: Seed boxes filled with sand



32. Molave – *Vitex parviflora* Juss.

- Place and date of collection:
 - Diadi, Nueva Vizcaya – Aug
 - IRR/ Mt. Makiling, Los Baños, Laguna – Sept-Oct
 - Bangued, Abra/Camp3 along Kennon Rd – Nov
 - Ilocos Norte – June-July
 - Vintar – Mar
 - La Union – Apr
 - Caniaw, Taleb, Bantay, Ilocos Sur – Apr
 - Dasol & Mangatarem, Pangasinan – Aug-Sept
 - Diffun, Quirino – Nov
 - Peñablanca, Cagayan – Jan
 - NLEX (Bulacan, Pampanga, Tarlac) – Aug-Sept
 - Pagbilao, Quezon – July-Aug
 - Macalelon, Quezon – Dec-Jan
 - Pitogo & Agdongan, Quezon – Dec-Jan
 - San Roque, Sorsogon – Sept-Oct
 - Masbate & Sorsogon – Oct-Dec
 - Catanduanes – Oct
 - Capiz – July
 - Pasonanca, Cabatagan & Manicahan, Zamboanga City – Oct-Nov
 - Kitaotao, Bukidnon – Aug-Sept
 - Columbio-Talayan, Sultan Kudarat – Jan
 - Alabel, Malungon, Malapatan, Glan, Sarangani Province – June
- Seed count: 8,594/kg
- Seed type: Orthodox
- Pretreatment: Alternate wet and sun-dry treatment for 6 days
- Sowing medium: Plastic trays with moistened paper towel or fine sand, or sow seeds in seedbeds or plastic bags with 1:1:1 ratio of sand, topsoil, and dried organic matter



33. Lingo-lingo – *Vitex turczaninowii* Merr.

- Place and date of collection:
 - Valmayorville, College, Laguna – July-Aug
 - Camp 7, Minglanilla, Cebu – Nov
- Seed count: 23,500/kg
- Seed type: Orthodox
- Pretreatment: Alternate wet and sun-dry treatment for 6 days
- Sowing medium: 1:1:1 ratio of ordinary garden soil, dried humus and fine sand



34. Bitongol – *Flacourtia rukam* Zoll. & Mor.

- Place and date of collection:
 - Brgy. Cueva, Sta. Maria, Laguna – Oct-Nov
- Seed count: 18,000/kg
- Seed type: Orthodox
- Pretreatment: Alternate wet and sun-dry treatment for 6 days
- Sowing medium: Seeds sown in potting medium with a ratio of 1:1:1 garden soil, dried humus, and fine sand or in plastic trays with moistened paper towel



35. Kaningning – *Guioa bicolor* Merr.

- Place and date of collection:
 - Brgy. Cueva, Sta. Maria, Laguna – Mar-Apr
- Seed count: 13,750/kg
- Seed type: Recalcitrant
- Pretreatment: Dehisce fruit to extract seeds manually, remove fleshy aril and wash seeds in running water to completely remove the pericarp
- Sowing medium: 1:1:1 ratio of ordinary garden soil, fine sand, dried humus



36. Bakan – *Litsea philippinensis* Merr.

- Place and date of collection:
 - Brgy. Cueva, Sta. Maria, Laguna – Mar-Apr
- Seed count: 430/kg
- Seed type: Recalcitrant
- Pretreatment: Soak fruit in water basin overnight to soften pericarp, extract seeds by removing the pulp of the fruit, air-dry before sowing
- Sowing medium: 1:1:1 ratio of ordinary garden soil, dried humus, and coconut coir dust



37. Toog – *Petersianthus quadrialatus* (Merr.) Merr.

- Place and date of collection:
 - Mt. Makiling, Los Baños, Laguna – Dec-Feb
- Seed count: 15,000-20,000/kg
- Seed type: Recalcitrant
- Pretreatment: None
- Sowing medium: 1:1:1 ratio of ordinary garden soil, fine sand, dried humus



38. Kamanigum – *Archidendron clypearia* (Jack) Nielsen var. *casai* (Blanco) Nielsen

- Place and date of collection:
 - Brgy. Cueva, Sta. Maria, Laguna – April-May
- Seed count: 1,509/kg
- Seed type: Intermediate
- Pretreatment: Nicking or cutting off a part of the seed coat and soaking in tap water for 5 hours
- Sowing medium: Plastic trays with moistened paper towels



39. Supa – *Sindora supa* Merr.

- Place and date of collection:
 - UPLB and Mt. Makiling, Los Baños, Laguna – June
- Seed count: 715/kg
- Seed type: Orthodox
- Pretreatment: Cut the seed coat and soak in tap water or in 0.02% fungicide solution overnight
- Sowing medium: Plastic trays with fine sand, or in 4" x 6" (industry specs) plastic bag with 1:1:1 ratio of sand, topsoil, and dried organic matter



40. Amugis –Blanco (Merr.)

- Place and date of collection:
 - Mt. Makiling, Los Baños, Laguna – May-July
- Seed count: 1,603/kg
- Seed type: Recalcitrant
- Pretreatment: None
- Sowing medium: Plastic trays with moistened paper towels or in seedbed with fine sand, or in 4" x 6" (industry specs) plastic bag with 1:1:1 ratio of sand, topsoil, and organic matter



41. Apin – *Ternstroemia gitingensis* Elmer

- Place and date of collection:
 - Brgy. Cueva, Sta. Maria, Laguna – April-June
- Seed count: 200,000/kg
- Seed type: Recalcitrant
- Pretreatment: Fruits are to be soaked in tap water to soften pericarp, macerate the fleshy part to separate the seeds
- Sowing medium: Plastic trays with moistened paper towel or in plastic trays with a medium of 1:1 ratio of ordinary garden soil and coconut coir dust



42. Laneteng gubat – *Kibatalia gitingensis* (Elmer) Woods.

- Place and date of collection:
 - Brgy. Cueva, Sta. Maria, Laguna – April-May;
November-December
- Seed count: 33,000/kg
- Seed type: Intermediate
- Pretreatment: Seeds are extracted from the follicle and hairy tufts are removed manually
- Sowing medium: Plastic trays with moistened paper towel or in plastic trays with a medium of 1:1 ratio of ordinary garden soil and coconut coir dust



43. Paguringon – *Cratoxylum sumatranum* (Jack) Blume ssp. *Sumatranum*

- Place and date of collection:
 - Brgy. Cueva, Sta. Maria, Laguna – May-June; Aug-Sept
- Seed count: 3M/kg
- Seed type: Intermediate
- Pretreatment: Seeds are extracted by shaking the twigs with fruits, small winged seeds will easily be dislodged from the capsule
- Sowing medium: Potting medium with a 1:1 ratio of ordinary garden soil and coconut coir dust



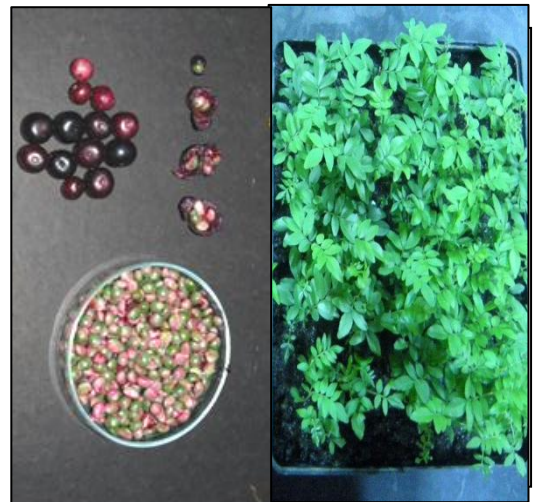
44. Makaasim – *Syzygium nitidum* Benth.

- Place and date of collection:
 - Sta. Maria & Alaminos, Laguna – July-Aug
- Seed count: 1,112/kg (for bigger seeds); 2,500/kg (for smaller seeds)
- Seed type: Recalcitrant
- Pretreatment: Seeds are extracted by soaking the fruit in tap water to soften pericarp, macerate to remove fruit remnants, air-dry for 2-3 hours before sowing
- Sowing medium: Plastic trays with a medium of 1:1 ratio of ordinary garden soil and coconut coir dust



45. Tulibas mabolo – *Micromellum inodorum* (Blanco) Tan

- Place and date of collection:
 - ERDB Special Project Area, College, Laguna – July-Aug
- Seed count: 6,000/kg
- Seed type: Recalcitrant
- Pretreatment: None
- Sowing medium: Petri dishes with moistened paper towel or in trays with 1:1 garden soil and coconut coir dust.



46. Balubar – *Aglaia rimosa* (Blanco) Merr.

- Place and date of collection:
 - Brgy. Entablado, Rizal, Laguna– Oct-Nov
- Seed count: 3,000/kg
- Seed type: Recalcitrant
- Pretreatment: None
- Sowing medium: Plastic trays with a medium of 1:1 ratio of ordinary garden soil and coconut coir dust



47. Salaktok – *Gomphia serrata* (Gaertn.)

- Place and date of collection:
 - Sta. Maria, Laguna – Oct, Apr-May
- Seed count: 8,333/kg
- Seed type: Recalcitrant
- Pretreatment: None
- Sowing medium: Plastic trays with a medium of 1:1 ratio of ordinary garden soil and coconut coir dust



48. Haikan – *Camellia lanceolata* (Blume) Seem.

- Place and date of collection:
 - Sta. Maria, Laguna – Sept-Oct
- Seed count: 1,000/kg
- Seed type: Recalcitrant
- Pretreatment: Extract fruit by cracking capsule/fruit with a knife, soak seeds in tap water for 5 hours
- Sowing medium: Potting medium of 1:1:1 ratio of ordinary garden soil, dried compost, and coconut coir dust



49. Bagalunga *Melia azedarach*

- Place and date of collection:
 - Diadi, Nueva Vizcaya – July
 - Los Baños, Laguna – Aug-Oct
 - Matalom, Maasin – Oct-Nov
 - San Roque, Tolosa, Leyte – Nov-Dec
 - Patalon & San Ramon, Zamboanga – Aug-Nov
- Seed count: 4,162/kg
- Seed type: Orthodox
- Pretreatment: Extract the seeds from the stone; or crack the endocarp and soak in tap water overnight
- Sowing medium: Potting medium of 1:1:1 ratio of ordinary garden soil, dried humus, and fine sand



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D. PROPAGATION PROTOCOLS DEVELOPED FOR SOME DIPTEROCARP SPECIES THROUGH NON-MIST TECHNIQUE

SPECIES	Rooting Survival (%)	Treatments (rooting hormone)*	Concentration (ppm)	Length of Soaking	Rooting Media*
1. Guijo (<i>Shorea guiso</i>)	98	IBA	1,000	1 hr	RS + CCD
2. Gisok-gisok (<i>Hopea philippinensis</i>)	95	No rooting hormone			RS
3. Palosapis (<i>Anisoptera thurifera</i>)	95	IBA	500	1 hr	RS + CCD
4. Dagang (<i>A. aurea</i>)	91	IBA	500	1 hr	RS + CCD
5. White lauan (<i>S. contorta</i>)	88	IBA	2,000	1 hr	RS + CCD
6. Dalingdingan (<i>H. foxworthyi</i>)	77	IBA	600	1 hr	RS
7. Mayapis (<i>S. palosapis</i>)	89	IBA	150	1 hr	RS + CCD
8. Saplungan (<i>H. plagata</i>)	73	No rooting hormone			RS + CCD
9. Bagtikan (<i>P. malaanonan</i>)	72	No rooting hormone			RS + CCD
10. Tanguile (<i>S. polysperma</i>)	58	IBA	500	1 hr	RS + CCD
11. Narig (<i>V. mangachapoi</i>)	91	IBA	100	1 hr	RS + CCD
12. Mangasinoro (<i>S. assamica</i>)	100	IBA	100	1 hr	RS + CCD
13. Red lauan (<i>S. negrosensis</i>)	72	IBA	100	1 hr	RS + CCD
14. Narek (<i>H. caqayanensis</i>)	53	IBA	100	1 hr	RS + CCD
15. Apitong (<i>Dipterocarpus grandiflorus</i>)	50	IBA	1,000	1 hr	RS + CCD
16. Almon (<i>S. almon</i>)	47	NAA	500	1 hr	RS + CCD
17. Yakal (<i>S. astylosa</i>)	78	No treatment			RS
18. Hagakhak (<i>D. validus</i>)	33	IBA	500	1 hr	RS + CCD
19. Panau (<i>D. gracilis</i>)	10	IBA	1,000	1 hr	RS + CCD

* IBA - Indole Butyric Acid
 RS - River Sand
 CCD - Coconut Coir Dust
 NAA - Naphthalene Acetic Acid

Reference:

Cadiz, R.T., E.C. Calzeta and H.V. Liwanag. 2004. A Manual on Mass Propagation of Dipterocarps Through Non-mist Technique. ERDB. DENR. 27p.

C. EXOTIC FOREST TREE SEEDS

1. *Acacia* – *Acacia auriculiformis* A. Cunn. ex. Benth

- Place and date of collection:
 - Mangatarem, Pangasinan – Mar-Apr
 - Region 2 (Regionwide) – Dec-Jan
 - Mariveles, Bataan – Dec
 - Carranglan, Nueva Ecija – Mar-Apr
 - Fort Magsaysay, Nueva Ecija – Mar-Apr
 - Norzagaray, Bulacan – Mar-Apr
 - Masinloc, Zambales – Nov
 - Olongapo, Zambales – Dec
 - Mt. Makiling and Cavinti, Laguna – Dec-Jan
 - Calauag, Quezon – Dec-Jan
- Seed count: 49,500/kg
- Seed type: Orthodox
- Pretreatment: Soak seeds in boiling water for 3-4 minutes, then in tap water overnight; or soak seeds in tap water overnight (for newly collected seeds)
- Sowing medium: Plastic trays with moistened paper towels, or with fine sand, or in seedbeds



2. *Mangium* – *Acacia mangium* Willd.

- Place and date of collection:
 - Diadi, Nueva Vizcaya – Feb
 - Mariveles, Bataan – Dec
 - Fort Magsaysay, Nueva Ecija – Mar
 - ANZAP, Mayontoc, Tarlac – Apr-May
 - Masinloc, Zambales – Nov
 - Victoria, Oriental Mindoro – Feb-Mar
 - Ternate, Cavite – Feb-Mar
 - Glan, Sarangani – Dec-Jan
 - NALCO, CARAGA – July
 - Pagbilao, Quezon – Mar-Apr
 - PICOP, CARAGA – June-Sep
 - Mangatarem, Pangasinan – Mar-Apr
- Seed count: 130,353/kg
- Seed type: Orthodox
- Pretreatment: Soak seeds in boiling water for 3-4 minutes, then in tap water overnight; or soak seeds in tap water overnight (for newly collected seeds)
- Sowing medium: Plastic trays with moistened paper towels, or with fine sand, or in seedbeds with 1:1:1 ratio of sand, topsoil and dried organic matter



3. Kaatoan-bangkal – *Anthocephalus chinensis* (Lamk.) A. Rich. ex. Walp.

- Place and date of collection:
 - Ilocos Norte – June-July
 - Caniaw, Taleb, Bantay, Ilocos Sur – Nov-Dec
 - Magat, Diadi, Nueva Vizcaya – Oct
 - Mt. Makiling, Los Baños, Laguna – July-Aug
- Seed count: 18-26 million/kg
- Seed type: Orthodox
- Pretreatment: None
- Sowing medium: Ordinary garden soil in seed boxes under the shade. Seeds covered thinly with fine soil



4. Neem – *Azadirachta indica* A. Juss.

- Place and date of collection:
 - Mangatarem, Pangasinan – Sept
 - Laguna – July-Aug
 - Quezon – July-Aug
 - Alabel, Malungon – June-July
 - Malapatan, Glan Sarangani Province – Dec-Jan
- Seed count: 3,300/kg
- Seed type: Intermediate
- Pretreatment: None
- Sowing medium: Potting medium of 1:1:1 ratio of ordinary garden soil + dried humus + sand



5. Fringon-morado – *Bauhinia purpurea* L.

- Place and date of collection:
 - Camp 3 along Kennon Road, Benguet – Apr
 - Diadi, Nueva Vizcaya – Apr
 - Mt. Makiling, Laguna – Apr-May
- Seed count: 4,670/kg
- Seed type: Orthodox
- Pretreatment: None for newly collected seeds; for stored seeds, nick or cut the seed coat, then soak in tap water overnight to enhance seed germination
- Sowing medium: Mixture of ordinary garden soil, dried humus, and fine sand (1:1:1) ; or use blotter medium, moistened paper towel in plastic trays



6. Sibukau – *Caesalpinia sappan* L.

- Place and date of collection:
 - Cabatangan, Zamboanga City – Aug-Nov
- Seed count: 400-450/kg
- Seed type: Orthodox
- Pretreatment: Nick or cut the seed coat, then soak the seeds in tap water overnight
- Sowing medium: Potting mixture of 1:1:1 ratio of ordinary garden soil, fine sand and dried humus; or sow seeds in seedbeds



7. Calliandra – *Calliandra calothyrsus* Meisn.

- Place and date of collection:
 - ERDS, Loakan Road, Baguio City – Mar-Apr
- Seed count: Not applicable/kg
- Seed type: Orthodox
- Pretreatment: Soak the seeds in hot water (70⁰C) for 10 minutes, then in cold water for 12-24 hours (for large volume); nick the seed coat and soak the seeds in tap water overnight (for small volume)
- Sowing medium: 1:1:1 ratio of ordinary garden soil, dried humus, fine sand.



8. Golden shower – *Cassia fistula* L.

- Place and date of collection:
 - Cordon, Isabela – Apr
 - Olongapo, Zambales – Sept
 - Laguna; Batangas City – Mar-Apr
 - Legaspi & Ligao, Albay – Sept-Nov
 - Mambusao, Dumarao, Capiz – Dec
- Seed count: 5,500/kg
- Seed type: Orthodox
- Pretreatment: Soak seeds in concentrated sulfuric acid for 15 minutes and soak in tap water overnight
- Sowing medium: Seedbeds, or in plastic trays with moistened paper towel



9. Spanish cedar – *Cedrela odorata* L.

- Place and date of collection:
 - Legaspi City – Mar-Apr
- Seed count: 40,000-89,000/kg
- Seed type: Intermediate
- Pretreatment: None
- Sowing medium: Seed boxes with 1:1:1 ratio of ordinary garden soil, dried humus, and fine sand



10. Dap-dap – *Erythrina orientalis* (L.) Murr.

- Place and date of collection:
 - Region 2 (Regionwide) – Feb-Mar
 - Mt. Makiling, Los Baños, Laguna – Nov-Dec
 - Lobo, Batangas; SLEX – Dec-Jan
 - San Roque, Sorsogon – May-Dec
- Seed count: 1,250/kg
- Seed type: Orthodox
- Pretreatment: Cut the seed coat and soak the seeds in tap water or in 0.02% fungicide solution overnight
- Sowing medium: Fine sand in plastic trays or seedbeds, or in 10.16 cm x 15.24 cm (industry specs) polyethylene bags with 1:1:1 ratio of sand, topsoil, and dried organic matter; or in plastic trays with moistened paper towel



11. River red gum – *Eucalyptus camaldulensis* Dehnh.

- Place and date of collection:
 - Mangatarem, Pangasinan – Sept-Oct
 - NLEX (Bulacan; Tarlac) – Aug-Sept
 - Mt. Makiling, Los Baños – Aug-Sept
 - Victoria, Oriental Mindoro – Aug
- Seed count: 348,000/kg
- Seed type: Orthodox
- Pretreatment: None
- Sowing medium: Sterilized mixture of soil and fine sand



12. Kakawate – *Gliricidia sepium* (Jacq.) Steud.

- Place and date of collection:
 - Mangatarem, Pangasinan – June
 - General Tinio, Nueva Ecija – June
 - Norzagaray, Bulacan – May-June
 - Doña Remedios, Trinidad, Bulacan – May-June
 - Pagbilao; Lopez; Lucban; and Tayabas, Quezon – June-July
 - Batangas City; San Juan, Batangas City – June-July
 - Calamba, Laguna – Apr-May
- Seed count: 7,706/kg
- Seed type: Orthodox
- Pretreatment: Soak in seeds in tap water overnight
- Sowing medium: Plastic trays or seed boxes with fine sand; or in 10.16 cm x 15.24 cm (industry specs) polyethylene bags with 1:1:1 ratio of sand, topsoil, and dried organic matter



13. Moluccan sau – *Paraserianthes falcataria* (L.) Nielsen

- Place and date of collection:
 - Caniaw, Taleb, Bantay, Ilocos Sur – Jan
 - Diadi, Nueva Vizcaya – Aug
 - Mt. Makiling, Laguna – Apr-May
 - Bagumbayan-Esperanza, Sultan Kudarat – Jan
 - Agusan – Sept
- Seed count: 15,000-22,000/kg
- Seed type: Orthodox
- Pretreatment: Soak the seeds in boiling water for three minutes and let water cool for 24 hours
- Sowing medium: Seedbeds with 1:1:1 ratio of ordinary garden soil, fine sand, and dried humus



14. Raintree – *Samanea saman* (Jacq.) Merr.

- Place and date of collection:
 - General Tinio, Nueva Ecija – Aug
 - Angeles, Pamapanga – Oct
 - Baliuag, Bulacan – Aug
 - Mt. Makiling, Laguna; & Pagbilao, Quezon – Nov-Dec
 - Batangas City – Nov-Jan
 - Sariaya, Quezon – Nov-Jan
 - Albay, Sorsogon – Apr-June
 - Esperanza-Bagumbayan, Sultan Kudarat – Dec
 - Alabel, Malungon, Malapatan, Glan, Sarangani Province – July-Aug
- Seed count: 4,798/kg
- Seed type: Orthodox
- Pretreatment: Nick or cut the seed coat and soak the seeds in tap water, or in 0.02% fungicide solution overnight (for small volume of seeds); or soak seeds in concentrated sulfuric acid for 30 minutes, and rinse them with tap water several times; soak the seeds in tap water or in 0.02% fungicide solution overnight (for large volume of seeds)
- Sowing medium: Plastic trays with fine sand, or in 10.16 cm x 15.24 cm (industry specs) plastic bags with 1:1:1 ratio of sand, topsoil and dried organic matter.



15. Antsoan-dilaw – *Senna spectabilis* (DC.) Irwin and Barneby

- Place and date of collection:
 - Diadi, Nueva Vizcaya – Mar
 - Laguna – Jan-Dec
- Seed count: 46,628/kg
- Seed type: Orthodox
- Pretreatment: Soak in concentrated Sulfuric acid for 15 minutes and soak in tap water overnight
- Sowing medium: Plastic trays with four layers of moistened paper towels, or in seed boxes with fine sand



16. Mahogany – *Swietenia mahagoni* (L.) Jacq.

- Place and date of collection:

➢ Bangued, Abra	– Aug-Sept
➢ PFDPIN Proj., Ilocos Norte	– Dec-Jan
➢ Marcos, Nueva Era, Ilocos Norte	– Dec-Jan
➢ Caniaw Refo Proj., Ilocos Norte	– Dec-Jan
➢ Mangatarem, Pangasinan	– Dec
➢ Region 2 (Regionwide)	– Jan-Feb
➢ Norzagaray, Bulacan	– Mar
➢ Camiling, Tarlac	– Mar
➢ Masinloc, Zambales	– Jan
➢ Pilar, Bataan	– Dec-Jan
➢ Gapan, Nueva Ecija	– Mar
➢ Kinabuhayan, Dolores, Quezon	– Dec-Jan
➢ Quezon National Park, Quezon	– Dec-Jan
➢ Mt. Makiling, Laguna	– Dec-Jan
➢ Sooc, Camarines Sur; Albay	– Jan- Mar
➢ Leyte & Samar	– Jan-Mar
➢ Baluno Refo Proj., Zamboanga	– Jan-Mar
➢ Dipolog, Zamboanga del Norte	– Jan-Mar
➢ Malasag Refo Proj., Bukidnon	– Jan-Mar
➢ Impalutao Refo Proj., Bukidnon	– Dec-Mar
➢ Sumpong, Malaybay City	– Jan-Mar
➢ Sto. Tomas, Davao del Norte	– Feb-Mar
➢ Agusan	– Jan-Mar
➢ Lianga, Surigao del Sur	– Jan-Mar
- Seed count: 2,264/kg (medium sized); 2,933/kg (small sized)
- Seed type: Orthodox
- Pretreatment: None
- Sowing medium: Plastic trays with moistened paper towel or with fine sand; or in 10.16 cm x 15.24 cm (industry specs) plastic bags with 1:1:1 ratio of sand, dried organic matter & topsoil



17. Teak – *Tectona grandis* L. f.

- Place and date of collection:
 - Dinalupihan, Bataan – Aug-Sept
 - Mt. Makiling, Laguna – Aug- Sept
 - Sta. Monica, Puerto Princesa, Palawan – Sept-Oct
 - Camp 4 and Camp 7, Minglanilla, Cebu– Sept
 - Bagumbayan, Sultan Kudarat – Jan
 - Region 1 – June
- Seed count: 18-26 million/kg
- Seed type: Orthodox
- Pretreatment: None
- Sowing medium: Ordinary garden soil in seed boxes under the shade. Seeds covered thinly with fine soil



18. Firetree – *Delonix regia* (Hook.) Raf.

- Place and date of collection:
 - Cabarraguis, Quirino – Apr
 - Laguna; Batangas City – Dec-Jan
 - Pagbila, Quezon; Cavite – Dec-Feb
 - Region IV-B (Provincewide) – Oct-Dec
 - Legaspi – Oct-Dec
- Seed count: 1,347/kg
- Seed type: Orthodox
- Pretreatment: Cut the seed coat and soak the seeds in tap water, or in 0.02% fungicide solution overnight
- Sowing medium: 10.16 cm x 15.24 cm (industry specs) polyethylene bags with 1:1:1 ratio of sand, topsoil, and dried organic matter; or in plastic trays or seed boxes with fine sand



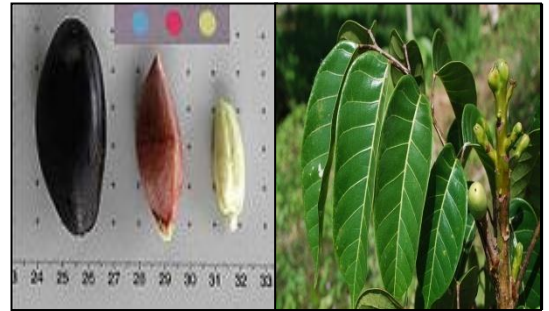
Reference:

Dayan, M. DP., R. S. Reaviles, and V. DP. Abarro. 2005. Forest tree Seeds: A phenological guidebook. Ecosystems Research and Development Bureau. Department of Environment and Natural Resources, College, Laguna 4031. 75 p.

D. PROPAGATION PROTOCOLS FOR SOME FRUIT TREES

1. Pili – *Canarium ovatum*

Pre-treatment: Seed nuts are used for planting. Before seed nuts are sown, the pulp is removed by soaking the fruits in clean water for not more than 48 hours. Seeds nuts are extracted by “slipping-off” or squeezing the soft, water-soaked pulp. Extracted nuts are air-dried and planted within a week after harvest as delayed planting often result to poor germination



2. Mango – *Mangifera indica*

Fruiting season peaks on April to May
Pre-treatment: Dehusk the seed to remove the seed cover that prevents the entry of water and oxygen needed in germination.
Sowing medium: best germinated in fine sand



3. Rambutan – *Nephelium sp.*

Fruiting season peaks on August – September
Pre-treatment: Seeds should be free of adhering aril and sown immediately after extraction
Sowing medium: sow seeds in sand or sandy soil in a vertical position with pointed ends down



4. Durian – *Durio sp.*

Pre-treatment: seeds extracted from pulp should be free from adhering aril and air-dried and coated with fungicide before planting. Extracted seeds should be planted immediately because they lose viability very rapidly.



5. Nangka – *Artocarpus heterophyllus*

Pre-treatment: After extraction from fruit, the outer covering of the seeds is removed as this lowers the germination. Large seeds should be selected for planting as these have higher chances of germination.
Sowing: Seeds should be sown immediately after extraction from the fruit. Sow seeds either horizontally or with their embryos pointing downward.



References:

- PCARRD. 1994. Philippine recommends for mango.
PCARRD. 1997. Philippine recommends for pili.
Coronel, R.E. 1986. Promising fruits of the Philippines. Second Edition. UPLB. College of Agriculture.