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manual

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FOREST & LANDSCAPE

Dansk Ornitologisk Forening

Burung INDONESIA

Manual

Tree Nursery Establishment for Small Holder Farmers

FACULTY OF LIFE SCIENCES
UNIVERSITY OF COPENHAGEN

Title
Manual: Tree Nursery Establishment for Small Holder Farmers

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1. REASONS FOR ESTABLISHING YOUR OWN NURSERY?

- You can select your own tree species
- You can control the quality & quantity of plants
- You can take care of the plants
- The nursery will be used as a centre of excellence for education and social interaction
- The nursery can be located close to planting site
- The cost is very limited

2. WHERE SHOULD THE NURSERY BE ESTABLISHED?

- On flat land with good drainage
- The area should be shaded and protected
- Close to source of water
- Good and easy access

3. HOW MANY SEEDLINGS SHALL BE PRODUCED?

- For your own needs: You need to consider the size and use of your land.
- For commercial use: You need to know the demand for seedlings and which species are required by your neighbouring villages
- The size of the nursery will depend on the 2 factors above

4. HOW DO YOU ESTABLISH A SMALL NURSERY?

4.1. How do you design a farmer nursery?

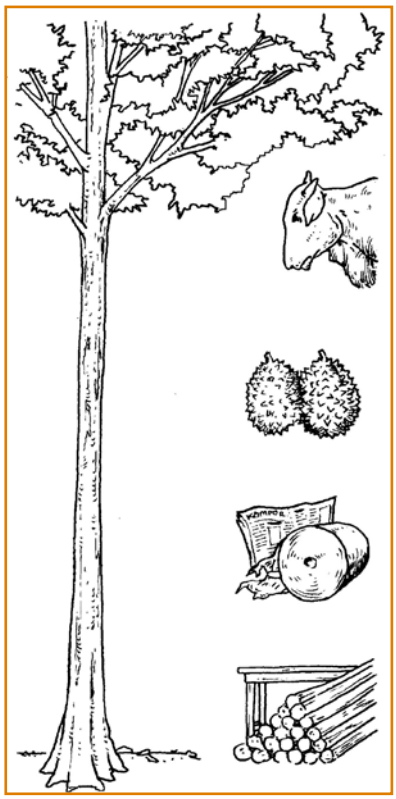
1. Protected and shaded area
2. Sowing beds
3. Nursery beds
4. Media processing
5. Space for filling the poly bag
6. Source of water
7. Storage
8. Fence
9. Shelter
10. Toilet
11. Name board

4.2. Equipment & material

- Spade and pitchfork
- Sieve (1,5 cm)
- Ladle for filling in media
- Watering can
- Water hose (rubber pipe)
- Wheelbarrow
- Scissors cut
- Poly bags
- Media
- Shadings (made from aren leaves or alang-alang) or shading nets
- Seeds

5. SPECIES SELECTION AND SEED HANDLING

5.1. Tree species selection



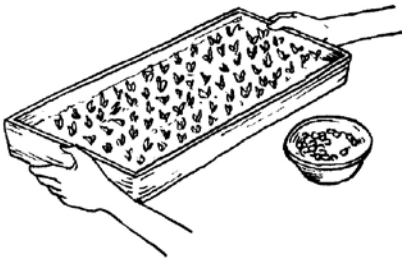
Which species you prefer depend on where you want to grow (planting site) and which end product you want

- Timber production?
- Fruit production?
- Food production?
- Degraded land rehabilitation?
- Watershed rehabilitation, etc

5.2. How many seeds will be required

Number of seeds and number of kilos required is determined by :

1. Number of seedlings needed
2. How many seeds per kilogram
3. Seed viability or germination percentage
4. Percentage of seedling survival (during transfer into poly bag)
5. Percentage of seedling survival at the nursery



Number of seedlings needed in the field is defined by the following factors :

- Size of land (planting area)
- Tree spacing and planting design
- Percentage of seedlings survival during transportation to the field
- Percentage of seedlings survival in the field

An example of calculation

1. Numer of seedlings needed per hectare:

If the spacing is 5 m x 5 m, then the number of seedlings needed per ha is:

10000/(5x5) = 400 seedlings

2. Number of seedlings needed for particular planting area:

If the spacing is 5 m x 2 m and the size of land is 5 ha,

then the number of seedlings needed is:

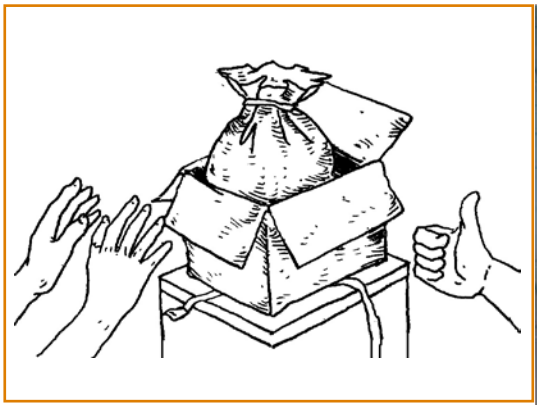
5 x 10000/(5x2) = 5000 seedlings

5.3. Seed Collection

- Get the seeds from nearby tree stands which look healthy: straight stem, good branch and canopy.
- Collect the seed by climbing or shaking the tree or branch.
- If seed is collected from the ground, make sure the seeds are not infected by diseases.
- Never collect seeds from isolated single trees. You should collect seed from minimum 25 trees.
- Collect the mature seeds or fruits, which is indicated by colour and shape of fruits. You can also check the seeds by cutting or opening the fruits.

5.4. Seed storage

- You can only store orthodox seeds like legume seeds, teak seeds etc.
- Semi recalcitrant seeds can only be stored for a certain period of time. For example, seeds of mahogony or suren can be stored up to 3-6 months.
- Recalcitrant seeds can only be stored for short period after collection.
- The seeds should be stored in dry conditions with max 12% moisture content inside the dry and steril containers in the cool and dry room.
- The recommended containers are: botol, cane containers, wooden boxes, gunny sacks. Plastic containers are not recommended.



5.5. Seed pretreatment

- Fruits with seed: remove and clean the fruit in order to avoid attack from fungi.
  The seeds should be sown directly in poly bags or in sowing beds.

- The legume seeds are normally released easily when mature.
  The seed pretreatment can be done by soaking in cold or hot water for 24 hours.

- Seeds with hard seed coat.
  The seed pretreatment can be done through soaking – drying – soaking over 2-3 days.

6. NURSERY MANAGEMENT AND MAINTENANCE

6.1. Prepare the sowing beds

- The seeds should be sown in sowing beds.
- The sowing beds can be made from unused containers, bamboo, wooden boxes or directly on the ground.
- The sterile media consists of compost and sand (1:1).
- The thickness of the media is 6 – 10 cm.
- Make small holes under the container in order to have good drainage.

6.2. Seed sowing

- Watering the media (not too wet)
- The seed sowing should be done in the morning or evening
- Sowing the seeds over the media (not over lapping)
- Cover with mixed media (compost and sand) 1 cm
- Watering the sowing bed in the morning or afternoon as necessary (not too wet)
- Place the sowing beds on the shaded and protected area
- The big seeds can be directly sown in poly bags.
  For example: mahogony or candlenut seed.

6.3. Pest and desease control

- Pest: rats, birds, insects
- Disease: fungi
- How to control:

1. Place the beds in safe areas

2. The media, water and seeds should be clean from any pest and disease

3. Spray the media and seeds with insecticides if required

4. Remove the attached seedlings.

6.4. Transfer the seedling to poly bags

- The transfer will be done when the seedlings have two leaves fully open
- If the transfer is delayed, the rooting structure will be effected
- Use a piece of wooden stick to remove the seedlings and place the seedlings on wet containers (could be banana leaves or plastic containers)

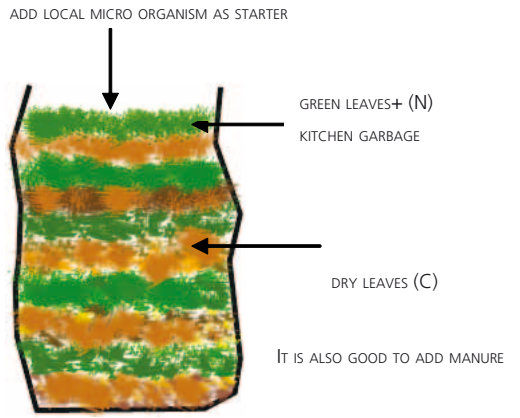
6.5. Prepare the mixed media

- Function of media is to assist the growth of seedlings. Media should support a healthy root system with enough oxygen, nutrient and water.
- Type of proper mixed media is: forest soil, top soil from garden, powder coconut belts, rice husk, compost
- Composition of forest soil (humus) – powder coconut belts/rice husk) is 2:1

AN EXAMPLE OF MAKING MEDIA COMPOST

COMPOST CAN BE MADE IN BRICK BOXES, BASKETS OR SIMILAR CONTAINERS

MAKING COMPOST INSIDE A SACK



TIED

REVERSE SIDE

MAKING COMPOST ON SPARE LAND
COMPOSTER MADE FROM BAMBOO
PLACE THE BROWN LEAVES – THE GREEN LEAVES – THE BROWN LEAVES ON EACH LAYER AND ADD Local Micro Organism
THERE IS NO SMELL and this will even IMPROVE THE SOIL CONDITION

6.6. Type of containers recommended

- Poly bag (10 x 15/17 cm)
- Poly tube
- Plastic container

6.7. Fill the mixed media in the container

- Spray the mixed media with water (not too wet)
- Fill the container with mixed media by using hand or special tools made from wood
- Make sure the container is full but not too tight

6.8. Placement of seedlings in nursery

6.9. Nursery maintenance

- Watering
- Weeding
- Fertilizing (if required)
- Pest and disease control
- Light control
- Seedlings grading
- Seedlings transport
- Aclimatization
- Planting

6.10. When will the seedling be ready for planting

- Height of seedlings average 30 – 60 cm
- The seedlings vigour is good
- The seedlings should be healthy with good root development

7. ANNUAL WORK PLAN FOR NURSERY ESTABLISHMENT

SPECIES	KEG	JAN	FEB	MAR	APR	MEI	JUN	JUL	AGS	SEP	OKT	NOP	DES
Jati	A						XXXX						
	B							XXXX	XXXX				
	C									XXXX	XXXX	XXXX	XXXX
	D	XXXX											XXXX
Suren	A			XXXX	XXXX	XXXX	XXXX						
	B												
	C							XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
	D	XXXX									XXXX	XXXX	XXXX

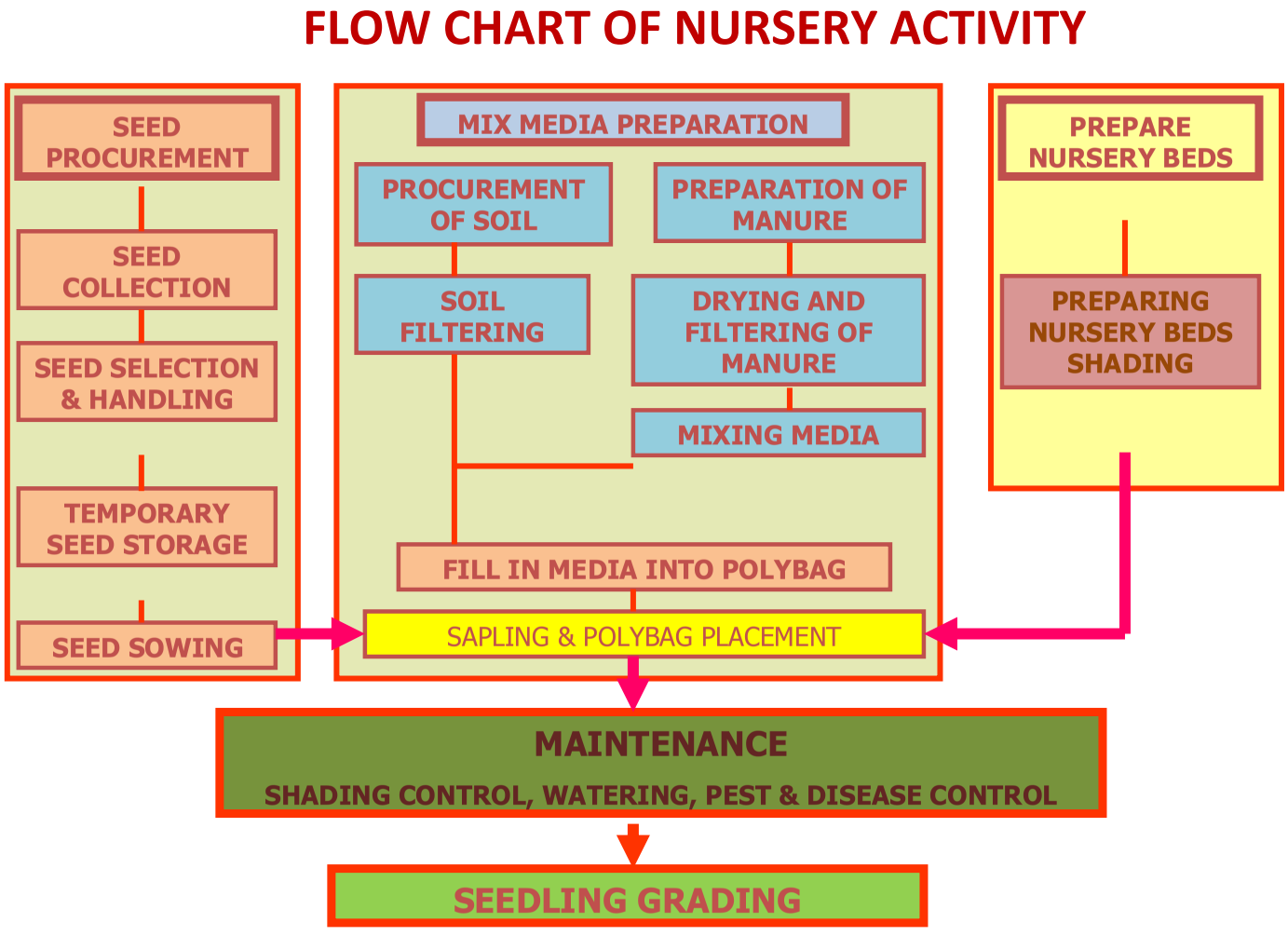
Remark:

A = Exploration of seed collection
B = Seed collection and seed sowing
C = nursery period
D = seedlings ready for planting

The plan should refer to specific condition:

- Tree species
- Planting site
- Local climate
- etc

8. FLOW CHART OF NURSERY ACTIVITY



APPENDIX 1. MANUAL ON NURSERY ESTABLISHMENT FOR SOME TREE SPECIES

Teak (*Tectona grandis*)

1. Soak the seeds for 1 day, then put the seeds into the gonnie container and place it in a dark and humid room for 5 days. Keep the container and seeds moist. Spray with water if necessary.
2. Prepare the sowing beds.
3. Spray the media in the sowing beds with water as recquired (not too wet).
4. Sow the seeds on the media then cover with sand. The seed must not be sown too close.
5. Check moisture conditions of sowing medium every day. Keep in mind the seeds need dry and wet periods in turn. Therefore it is necessary to regulate the media to keep it dry occasionally to encourage germination.
6. Prepare the media for seedlings in polybag only when seeds have germinated
7. Use polybag size 10 x 20 or larger polybag if the seedlings are kept in the seed bed for a longer time.
8. Note that when the time comes to move seedlings from sowing beds (after sufficient number of leaves have emerged). Water media in polybag and make holes deep enough for the seedlings.
   NB:
   Teak seed germination is often gradual, so wait until there are sufficient number of seedlings before moving. Seeds that have not germinated after 3 months are not necessarily bad seed. If there are still a lot of seeds that have not germinated then let the seeds remain in the sowing bed and continue treatment. Teak seeds can stay dormant for up to 1 year.
9. Move seedlings to prepared polybags.

Gmelina/White Beech (*Gmelina arborea*)

1. Soak Gmelina seeds for one day.
2. Prepare sowing bed.
3. Water media until it becomes sufficiently wet.
4. Sow seeds in tub but not too closely.
5. Check moisture content of sowing medium every day. If less humid spray.
6. While waiting for the seeds to germinate you can prepare the media in polybag.
7. Use polibag size 10 x 20 or larger polybag if the seedlings are relatively larger.
8. Note the size of seed in existing sowing beds. When you are ready to plant (the leaves have emerged and seedlings 2-3 cm in height. Water media in polybag and make holes suitable for the seedlings.
9. Move seedlings from the tub to the prepared polybags.

White albizia (*Paraserianthes falcataria*)

1. Prepare completed polybag with media.
2. Soak the seeds in cold water as necessary.
3. Let stand for 24 hours.
4. Make a 1-2 cm deep plant hole in the polybag.
5. Sow one seed per polybag.
6. Wait 3-4 days before replacement of dead seed.
7. Maintain the seedlings until ready to be moved to the field.

Timor white gum (*Eucalyptus urophylla*)

1. Prepare sand media in sowing tub (bed). Do not forget to make some small holes in the bottom of the sowing tub for drainage.
2. Water media.
3. Mix eucalypt seeds with fine sand and sow evenly on the sowing bed.
4. Cover evenly with sand.
5 Observe every day. When media becomes dry spray with water.
   Do not pour water directly on the surface like a shotgun but water gently by pouring water slowly from one corner of the box. Let the water flow from one corner to the other parts. Very gentle watering is required for eucalyptus seed in order not scattered seed.
5. Wait for seeds to germinate.
6. Prepare the media, fill into the polybags.
7. When seedlings reach 3-5 cm height (usually 5-7 days after sowing), transfer carefully to polybag. Make sure that the media on sowing bed is wet as it will be easier to remove the seedlings.

Black wattle (*Acacia mangium*)

1. Soak the acacia seeds in hot water. Let stand for one night.
2. Prepare sandy media for sowing. Do not forget to make holes in the bottom of the sowing tub for drainage.
3. Sow Acacia seeds evenly on the media. The seed should be well covered with sand.
4. The next step as for Eucalyptus

NB
Sowing can be done in plastic tubs or other containers filled with sand. When using a plastic tub, make sure that it is large enough to sow all the seed needed and with sufficient room between seeds. Make holes in the bottom of the plastic tubs and containers to drain excess water. Place the sowing bed container in the shade. Sowing beds can also be made directly on the soil of sand-sized beds, 40 cm x 100 cm for example. Note that enough beds must be prepared to sow seeds so that the seedlings will not be too close. This way the seedlings will be much easier to replant in a polybag.

Transfer of seedlings

- Remove seedlings to a protected place
- Move the seedlings from their sowing beds into the polybag, which has been prepared with a hole deep enough for planting. Be sure that the seedlings are standing firm and upright after transfer.
- Make sure that the entire seedling is transferred to the polybag.
- Spray polybag media and the seedling roots, with the sowing media still attached, before placing the seedling in the polybag
- Take care of the seedlings in the polybags until the seedlings are 20-30 cm in height and ready to move into the field. This will depend on the type of plant, usually after 2-3 months the plants will be strong enough to move into the field. In dry areas seedlings should be larger before they are strong enough to survive in the field
- Occasionally it is necessary to remove the polybags in order to break the roots that penetrate the polybag and also to have the seedlings strong enough before transfer to the field.

APPENDIX 2. SEED PRETREATMENT OF SOME TREE AND FRUIT SPECIES

Botanical name	Common/ local name	Treatment	No. days germination	Number of seeds per kg
Acacia auriculiformis	Acacia	Immerse for 30 seconds to 1 minute in boiling water, soak overnight in cool water. Immerse in hot water for 3–10 minutes and soak overnight in the tap water	3 – 8	7,400–8,000
Acacia mangium	Sabah acacia	Immerse for 30 seconds in boiling water and soak overnight in cold water	3 – 6	40,000–70,000
Albizia lebbeck	Indian walnut, Siris	Immerse in boiling water for 2 minutes and soak overnight in tap water. Immerse in hot water and soak for 24 hours	3 – 4	6,000–16,000
Anacardium occidentale	Cashew nut tree	Cut-off forehead to reduce distortion of seed linos	12	200–900
Annona muricata	Soursop	Soak overnight	2 – 3	1,750
Artocarpus heterophyllus	Jack fruit	Remove seed jacket and soak for 24 hours in cool water	3 – 5	45–90
Azadirachta indica	Neem tree	Soak in water 3–6 days	3 – 5	4,000–6,000
Carica papaya	Papaya	Remove qelatinous material, clean and air-dry	7	47,000–76,000
Coffee spp.	Coffee	Remove parchment and soak for 24 hours in cold water	30	2,000
Delonix regia	Flamboyan	Immerse in boiling water for 10 seconds. Soak in cold/tepid water for 24 hours	12 – 20	1,600–9,300
Durian zibethinus	Durian	Remove and wash aril		45
Leucaena leucacephala	Ipil-ipil	Soak in tap water for 36 hours. Immerse in hot water for 24–72 hours	5 – 12	13,000
Mangifera indica	Mangga	Remove off husk to improve quality and uniformity of seedlings	6 – 9	40
Pterocarpus macrocarpus	Nara	Soak in hot water (50 °C) for 10 minutes. Soak in hot water for 12 hours	4 – 15	1,500–2,000
Swietenia macrophylla	Mahogony	Soak in hot water (50 °C) for 5 minutes. Break off seed wings	14 – 28	2,300
Tamarindus indica	Asam-tamarind	Soak seeds for 5–6 days Soak in hot water for 24 hours	13	1,000–2,600
Tectona grandis	Jati-teak	Soak seeds in running water for 24 hours, sun-dry for 1–2 days	14 – 68	1,000

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