Basics for Nurseries

I. Production Systems

A. Introduction

This course is not intended to cover all aspects of nursery establishment and management. However, a few nursery problems involve seeds and seed management practices. The type of nursery system, size of the nursery, and location are important for seeds. It was once believed that all seedling production and planting in the Tropics had to be done in containers. This is not true; in general, however, bare-root production systems predominate in the Temperate Zones and container production systems predominate in the Tropics.

B. Objectives

1. Recognize different nursery systems and the conditions most favorable for each.
2. Learn the relationship of nursery systems to national seed program management.
3. Review basic seed technology for sowing in each system.

C. Key Points

The following points are essential in understanding seed basics for nurseries:

1. Bare-root systems are more common in Temperate Zones; container systems are more common in the Tropics.
2. Bare-root production is possible in the Tropics with some pines and for stump production of selected species.
3. In container systems, large seeds are usually sown directly in containers, whereas small seeds are sown in germination beds or trays and transplanted (pricked out).
4. Tray mobility is an advantage in caring for and protecting young seedlings.
5. In small nurseries, seed treatments for germination are usually done by hand.

D. Core Material

1. Type of Nursery

a. **Bare-root systems**

(1) Are suitable in countries with large-scale planting programs.

(2) Can produce seedlings or stumps.

(3) Require same-day planting in tropical environments when seedlings are lifted; thus, distribution of seedlings to many planting locations may not be feasible.

(4) Used with *Pinus caribaea* in Venezuela and stump plantings of *Gmelina, Dalbergia sissoo,* and *Cassia siamea.*

b. **Container production systems**

(1) Are usually preferred in most tropical locations because

(a) They can be small, labor-intensive operations.

(b) Containerized seedlings can stand the harsh environments during transport to the planting sites.

(2) System options are:

(a) A large centralized nursery with 0.5 to 1.0 million seedling production

(b) Numerous small nurseries with 10,000 to 100,000 seedlings each

(3) Containers can also be used for "wildings," natural seedlings that are dug up and transplanted. Wildings are useful for species with recalcitrant seeds that cannot be collected and delivered alive to nurseries for planting (e.g., *Shorea* spp. in Asia).

(4) Movement of a large number of seedlings at a time is difficult because of container **bulk,** but the system is suitable for many small nurseries in dispersed locations.

c. **Seed program considerations**

(1) If most production is in a large, centrally located nursery, seed cleaning and storage should be located nearby.

(2) If most production is in small, dispersed nurseries, cleaning and short-term storage should be in a regional center. Long-term storage should still be at a "national" seed center.

(3) In small nurseries, much seed collecting, extracting, and cleaning are done locally. This centralization decreases the need for mechanical operations and favors the use of labor-intensive manual methods.

(4) Localized collection forces the use of local seed sources.

(5) When seedlings of tropical recalcitrants are grown, small local nurseries must be used to avoid losing seed viability during long transport.

(6) In most successful reforestation programs, a combination of approaches **will** probably evolve, depending on species, transportation systems, personnel, and politics.

2. Bare-Root Production

a. **Small seeds** — For small seeds, such as

those of *Pinus,* mechanized sowing and culture are typical.

b. Large seeds — For large seeds, such as those of *Quercus, Juglans,* and *Melia,* sowing by hand in furrows across the beds is typical.

c. Covering

(1) Small seeds—Press into the soil surface and cover with a light mulch (2 to 3 mm).

(2) Large seeds — Place on their sides, press into the soil, and cover with 5 mm of soil (or not more than three times the seed diameter). Add mulch if moisture conditions require it. Some species, such as *Swietenia macrophylla,* should not be pressed into the soil because pressing can cause J-root formation.

3. Container Production

Seeds can be sown directly into containers or sown into seedbeds or seed trays and transplanted later (pricking out).

a. **Sowing into containers**

(1) Sowing into containers is good for the root systems because damage or distortion from transplanting is avoided.

(2) Sowing directly into containers is used for:

(a) Large seeds that can be handled individually

(b) Seedlots with expected high germination

(3) Suggested sowing rates are shown in table 28 [table 16 in Student Outline].

(4) "Doubles" are pricked out to fill in blanks.

(5) Only one seedling should be grown per container.

(6) Seed needs are calculated as follows. If the following conditions exist: the goal is 4,000 seedlings, seeds per kilogram are 3,500, germination is 70 percent, plant survival is 85 percent, and plantable seedlings are 80 percent, then 5,882 containers are needed. (Four thousand seedlings divided by 0.8 times 0.85 equals 5,882 containers). With 70-percent germination, 2 seeds per container are sown (5,882 containers times 2 seeds per container divided by 3,500 kg equals 3.4 kg of seeds needed).

b. **Sowing into seedbeds or seed trays**

(1) Sowing into seedbeds or seed trays concentrates germination in small areas, allowing better protection and care.

(2) This method is used for:

(a) Seedlots with expected germination of less than 40 percent

(b) Seedlots with slow germination

(c) Species that produce several seedlings from one seed unit

(d) Very small seeds that are hard to handle

(e) Scarce or expensive seedlots

(3) Seed tray mobility can be an advantage because it allows trays to be moved in and out of shade or protected from heavy rains. Trays can be made cheaply from local materials.

(4) The steps in sowing into seedbeds or seed trays are:

(a) Use a sand:topsoil mix of 1:1 for slow germinators and growers. They need nutrients from the soil for 4 to 8 weeks.

(b) Use pure sand for *Pinus, Eucalyptus,* etc., that germinate quickly and are pricked out after only a few days.

(c) Press seeds into the soil and barely cover with washed sand; then mulch lightly with pine needles, rice husks, and water. (Washed sand will not crust when it dries.)

(d) Monitor closely to maintain proper moisture level.

(5) There are other considerations when using seedbeds.

(a) Seedbeds must be well drained, and the soil mix should be at least half sand.

(b) Small seeds are broadcast, pressed lightly into the soil, and

Table *28.—Suggested sowing rates for seedling production in containers (Napier and Robbins 1989) [table 16 in Student Outline]*

Expected germination	Seeds per container
Percent	*Number*
80	1 or 2*
60-79	2
40-59	3
<40	use seedbeds

*Sow half the containers with one seed and half the containers with two seeds.

covered lightly with sand and mulch.

(c) If rodents are a problem, the beds are covered with wire mesh.

(d) For very small seeds (e.g., *Eucalyptus* and *Anthocephalus),* the seeds are mixed with fine sand and shaken from a salt shaker to distribute them evenly in the beds.

(6) Rates for sowing in seedbeds:

(a) Desired densities are 2,000 seedlings per square meter for seedbeds and 4,000 seedlings per square meter for seed trays.

(b) If there are 100,000 seeds per kilogram and if the expected germination is 40 percent, then 1 g of seeds should produce 40 seedlings. In seedbeds, 2,000 divided by 40 equals 50 g of seeds to be sown per square meter of seedbed. This rate is doubled (100 g) for sowing in seed trays.

D. Sources

For additional information, see Lantz 1985, Liegel and Venator 1987, Napier and Robbins 1989, Willan 1985.