



MEMORANDUM

FOR : The Regional Directors
Regions 2, 3, 4A, 5, 6, 9, 12, 13, NCR and NIR

FROM : The Director

SUBJECT : **FMB TECHNICAL BULLETIN NO. 22-E, PLANT PROPAGATION:
BASIC PRINCIPLES AND TECHNIQUES**

DATE : AUG 17 2016

I. This Technical Bulletin

This Technical Bulletin covers the basic principles of plant propagation and can serve as a general reference. Plant propagation has been labeled as both an art and a science, and nursery managers and growers must learn both facets to ensure that seedling production is successful.

II. Users of the Technical Bulletin

The users of the Technical Bulletin are the Nursery Managers, Growers, Assistant Growers and readers who plan to start and operate a nursery for native plants as well as exotic plants in the tropics.

III. Introduction

Seeds are the product of sexual propagation and represent an entire embryonic plant that is covered by protective tissue. Seeds are considered dormant until they are exposed to favorable environmental factors such as moisture, warm temperatures, and light that encourage germination. There are many important factors that propagators must consider about seeds before germination.

There are two main ways to handle young plants. Traditionally, growers would "open sow" seeds in flats and achieve clumps or rows of seedlings. These seedlings would then be transplanted by hand into final containers. Not only did this method require a large amount of labor, but it results in slower growing plants and are more susceptible to disease and poor cultural practices.

Another disadvantage is the difficulty of transplanting. Seedlings germinate and begin to grow roots that are intertwined with each other. It is impossible not to

significantly damage the root systems when they are pulled apart during the transplanting process.

IV. Seed Quality

The issue of seed quality plays a major role in the success of a germinating seed. Growers should purchase seed from a reputable seed supplier, and all seed purchased should be labeled as certified with a seed lot number and germination percentage on the package. It is recommended that seed purchases be made from large seed suppliers that have their own testing labs for vigor and viability.



Poor germination due to poor seed quality (left photo); better seed quality means plenty of well-spaced, healthy seedlings emerging (right photo).

Seeds should be stored at a temperature between 4 to 16°C, with a relative humidity between 20 to 40%. These ranges would ensure that seeds do not lose their vigor and viability. Most growers store seeds in a cool chamber such as a refrigerator with low relative humidity. Properly stored seeds should have moisture content between 5 to 8%.

V. What happens when a seed germinates?

The seed first takes in a lot of water, and becomes larger. Then the cells in the growing points of its *embryo* become very active, using chemical energy released by the breakdown of stored substances. The root starts to elongate, and breaks through the seed coat. The shoot enlarges, and emerges through the covering material. Seed leaves and foliage leaves expand, and the seedling begins to produce its own sugars.

Germination is one of the critical stages in the life of a plant. It involves:

- a. going from a resting stage to one of very active growth;
- b. the delicate seedling root emerging from the seed and becoming established in the soil;
- c. the young shoot growing above ground and expanding leaves; and
- d. the germinating seedling not succumbing to various diseases or pests.

9

VI. Environment for germinating seeds

For seeds to germinate and grow well, their propagation conditions need to be favourable in respect of **temperature, light, moisture** and **aeration**. Generally, they also need to be sheltered from wind and heavy rainfall, and sometimes they may require extra protection from diseases and pests.

The average temperatures in the tropics normally allow germination to occur without supplementary heating, unlike in cooler parts of the world.

The germination and early growth of seedlings depend on substances stored in the seed. Only a little light is needed when there are no expanded leaves for photosynthesis. A few species with light-sensitive seeds will generally not germinate unless some light reaches the embryo, penetrating through the covering materials and the seed coat.

All other kinds of trees will germinate in the dark, but do need some light as soon as they emerge, or the seedlings will become elongated and weak.



Elongated (stretched) seedlings due to low light.

It is quite a skilled job to provide enough moisture and air to the germinating seeds. The main keys to success are using a good germination medium and watering very carefully.

A sheltered place such as a germination house is important for germinating seeds because shelter will tend to reduce too much air movement around the germinating seeds, tending to dry them out and the risks of damage and loss during storms or prolonged droughts.

VII. Substrate

The type of substrate or medium used for germination is important to seedling establishment. In general, a substrate should be light and porous to provide adequate oxygen, yet retain moisture and allow for proper drainage and permits the roots to grow

and branch easily in it, while being firm enough to support the growing seedlings. Most germination mixes contain a blend of coconut peat, raw rice hull, sawdust and sometimes porous soil. The germination mix should be free of weed seeds and pests (insects and disease organisms), low in nutrients, and have a pH between 5.4 to 6.4.

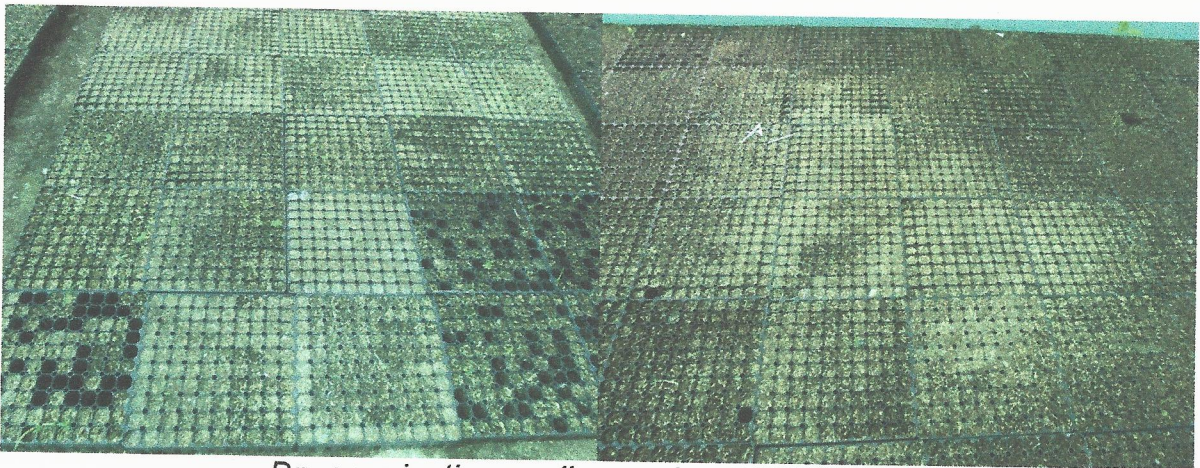
VIII. Watering

Seeds have to be watered very carefully because:

- a. **too much water** can knock them down or wash them away, waterlog them or make them susceptible to damping-off or other germination diseases; but
- b. **too little moisture** can dry them up before the seedling root system has become established.

Do not water if the medium is moist and the seeds already contain enough water for germination from initial watering.

Water the medium using fine droplets if the seeds are dry or the germination medium is not moist enough.



Dry germinating medium and uneven moisture

Afterwards, check regularly, and water sparingly as needed. With seed trays, consider restricting their drying by covering them loosely with clear or white polythene sheeting until the seedlings emerge.

IX. Container Trays

Plugs have become the chosen method for the production of young plants from seed. Basically, a plug is a seedling that is produced in its own individual container or cell. A plug tray contains many cells (49 to 100) and these trays are commercially produced by specialists. Plugs have many advantages: less labor inputs, faster growing times, less root shock and plant stress, and uniform growth of plants in the final container.

Be sure to move the seedlings out of the germination house as soon as they germinate so they do not elongate due to low light conditions. The result would be tall, spindly, weak and unusable plants.

X. Temperature of the propagation medium

The temperature of the propagation medium be high, and a general range for floricultural crops would be 68 to 86°F. Most seeds will germinate at 75°F, but one should always check the germination requirements of specific seed. Not only do specific species require an optimum germination temperature, but some seeds may or may not require light. If seeds are to be covered, a general rule of thumb is to cover the seed by a layer of loose propagation substrate (coco peat or grounded corn cob can be used) as thick as 1/4 the length of the seed. Along with a light covering of mix or a mix component, some growers will cover the flats with white or black plastic to keep moisture levels high and prevent rapid drying of the germination substrate.

The plastic is then removed after the seedling protrudes from the substrate surface. A plug is a containerized seedling. When propagation substrate components are combined, a lightweight porous moisture holding soilless mix is produced.

XI. When should seeds be sown?

For moist, non-storing seeds, they should be sown as soon as they have been cleaned. For dry, storable seeds, they can be dried and kept in good storage conditions until a date when they will produce planting stock of the right size.

In the Philippines, seeds should not be sown during rainy season because this is usually the time for outplanting. Sowing dates often vary between 3 and 6 months before planting dates, depending whether the seeds are slow or quick germinators, and how rapidly the young nursery trees grow to a suitable size.

XII. Fertilization

After the seedling has developed its first true leaves, a mild fertilizer solution can be applied. Nitrogen concentrations of 50 to 75 ppm are recommended. As a general rule of thumb is when leaves begin to touch one another, usually 2 to 3 weeks after germination, the plants are ready to be transferred to the growing areas (shadehouses).

XIII. Other factors that can affect success with germination?

- a. Frequent checks, careful handling and early weeding are all important.
- b. In many tree species, the seedlings can grow vigorously when the medium is inoculated with the fungi that form ectomycorrhizas with their roots.
- c. Keep simple records of the methods you used for each species, the germination dates and percentage of germination. Then before sowing them next time, you can check that against the number of established seedlings you obtained, and see how successful it was.

FOR INFORMATION AND GUIDANCE.

RICARDO L. CALDERON, CESO III