Seed Division Pinjore

The mandate of the Seed Division Pinjore in the Haryana Forest Department includes the following core functions:

- Systematic quality seed collection from designated superior trees and reserve forests to maintain genetic purity and high germination potential.
- Seed processing activities such as cleaning, drying, grading, and packaging to ensure seed viability, uniformity, and protection during storage and transportation.
- Establishment and management of Clonal Seed Orchards (CSOs), Seedling Seed Production Areas (SSPAs), and Clonal Multiplication Areas (CMAs) to produce high-quality, genetically superior planting material for forestry and agroforestry programs.
- Supply and distribution of processed seeds and clonal planting material to various forest divisions, nurseries, and agroforestry projects across Haryana to support afforestation, reforestation, and restoration efforts.
- Production of clonal eucalyptus and other priority clones in mist chambers at the special range in Seonthi, Kurukshetra, for large-scale multiplication and supply.
- Supporting forest and farm-based forestry initiatives through scientific seed and clonal propagation techniques aligned with sustainable forest management and conservation goals.

Overall, the division plays a vital role in strengthening forest regeneration, biodiversity conservation, and eco-restoration by providing high-quality planting materials and technical support to forestry operations in Haryana.

Jurisdiction and Ranges

- The division administers four ranges:
    1. Seed Range Pinjore,
    2. Seed Range Karnal,
    3. Seed Range Hisar, and
    4. Mist Chamber Range Seonthi (Kurukshetra) for clonal eucalyptus production.
- Seed Range Pinjore includes Meerpur RF and Manakpur RF situated in Yamunanagar district for key seed sources and field operations.

- Seed Range Karnal covers Sekhpura RF as a designated seed source area and nursery support landscape.
- Seed Range Hisar covers Bithmara RF for seed collection and allied seed operations in western Haryana.

Seonthi clonal programme

- A Special Range at Seonthi, Kurukshetra is dedicated to the production of clonal eucalyptus and allied clones in a controlled propagation setup.
- Clones such as C-7, C-32, C-71, C-83, C-288, P-23, P-32, 271, and 413 are raised in 35 mist chambers at Seonthi for large-scale multiplication and distribution.
- Clonal planting stock from Seonthi is supplied to the Forest Department and for agroforestry deployment to enhance farm forestry productivity and livelihoods.

Key seed sources and operations

- Systematic seed collection is undertaken from designated Reserve Forests and superior mother stands to maintain genetic quality and high germination standards.
- Seeds and clonal stock undergo processing, grading, viability assurance, and timely dispatch to nurseries and plantation sites to support afforestation and restoration programmes.

Support to forestry and agroforestry

- The division underpins state plantations, eco-restoration, and farm forestry, ensuring timely supply of certified seed and clonal stock to meet annual targets.
- Operations are aligned with departmental tendering and seasonal work cycles for seed collection and nursery scheduling led by the DFO Seed, Pinjore.

Seed Collection and Storage:

Seed Collection is the primary step for achieving a successful and good plantation goal. Various factors and aspects must be taken care of during this process.

Key considerations in seed collection:

- Collect only from healthy, mature trees and representative populations.
- Follow legal and ethical guidelines, including permits, quotas, and protections for endangered species.

- Ensure genetic diversity by sampling across different stands and habitats.
- Maintain seed quality through proper collection timing, handling, cleaning, and storage.
- Document provenance (location, parent tree characteristics, altitude, etc.) to maintain traceability.

A seed source is a designated location from which seeds are collected for planting. This can be a specific tree, a stand of trees, a seed orchard, or even a farm with trees scattered throughout. These sources are chosen based on the desired genetic quality and characteristics of the resulting plants.

Types of Seed Sources:

- **Seed Trees:** Individual trees selected for seed collection.
- **Seed Stands:** Groups of trees managed for seed production, often with superior characteristics.
- **Seed Production Areas:** Planted areas specifically designed to produce high-quality seed.
- **Seed Orchards:** Carefully managed plantations of selected and bred trees designed for maximum seed production.
- **Farmland Seed Sources:** Scattered trees, shelterbelts, or small woodlots on farmland.
- **Plantation Seed Sources:** Plantations established for purposes other than seed production, but which can also be a source of seeds.

Methods of Seed Collection:

Collecting seeds from Forest trees for reforestation and conservation requires careful consideration of the species, the desired genetic diversity, and practical constraints. Several methods are employed, ranging from simple ground collection to specialized techniques involving climbing and machinery.

I. Collection from the ground

- **Natural Seed fall**: This method relies on collecting seeds and fruits that have naturally fallen from the tree after ripening.
    - **Advantages:** Requires less skill and labour, suitable for large-fruited species like Jamun, Neem, Arjun, Reetha and some tropical varieties such as Tectona and Gmelina.

- **Procedure:**
    - Clear the ground beneath the tree of debris, or spread sheets (plastic, canvas, etc.) to catch the falling seeds.
    - Gather seeds with a rake or by folding the sheets daily to minimize losses from insects, rodents, fungi, and premature germination.
    - Sieve the collected material to extract the seeds from any litter.
- **Disadvantages:** Risk of collecting immature, empty, or unsound seeds; difficulty in identifying the mother tree in dense stands.

- **Animal Caches:** Squirrels, for instance, gather cones and fruits as food supplies, and these caches can sometimes be a source of seeds.
    - **Caution:** Inspect seeds collected from caches for damage or infestation by fungi.

II. Collection from standing trees

- **Manual Collection (Ground Level):** Suitable for shrubs and low-branched trees where fruits can be picked by hand directly from branches or using long-handled tools.
    - **Tools:** Pole and hook, rakes, saws, chisels, hooks, pruning shears, etc.
- **Shaking the Tree:** Can induce seedfall for easily detached fruits, especially if natural shedding is not concentrated enough.
    - **Manual Shaking:** Shake the trunk or lower branches of small trees. Use long poles, hooks, or ropes for higher branches.
    - **Mechanical Shaking:** Specialized machinery designed for fruit and nut orchards can be adapted for some forest tree species, particularly in seed orchards or stands.
- **Pruning Branches:** When fruits are out of reach, branches can be pruned using pole implements.
    - Procedure:
        - Select branches with good-looking pods/fruits.
        - Position ground sheets to catch falling material.
        - Cut branches using pole saws or other tools, remove fruits, and extract the seeds.
- **Climbing:** For tall trees, climbing may be the only practical method.

- Unaided Climbing: Dangerous, and not recommended as it can lead to choosing trees based on ease of climbing rather than seed quality.
- Climbing Irons/Spurs: Light, inexpensive, and suitable for inaccessible areas.
    - Note: Can damage the bark, especially on thin-barked species.
- Ladders: Provide safe access for heights of 8-40 meters, available in various materials and designs.
    - Types: Sectional ladders (one- or two-legged), extending ladders mounted on vehicles, etc.
- Ropes and Hoisting Equipment: A rope or rope ladder can be suspended from a stout branch to provide access to the crown. Hoisting equipment with a block and tackle can lift the collector using a bosun's chair or saddle.
- Within the Crown: Once in the crown, collect fruits/seeds by hand or with pruning tools, using safety gear like safety belts, straps, and lines.

- **Throwing a Rope with Weighted End:** This destructive method is a last resort to reach high branches, potentially breaking them.
    - Limitations: Damages the tree, not recommended for species that take two years to mature their seeds, and safety precautions are essential.

III. Collection from felled trees

- Synchronized with Commercial Fellings: Seeds can be collected from felled trees during normal felling operations that coincide with the ripening season.
    - Procedure: Wait until felling is complete, then collect seeds/fruits from the felled crowns using hand-picking or tools like rakes, hooks, or machetes.
    - Note: Ensure selection of superior mother trees if phenotypic quality is a priority.
- Felling for Seed Collection: Selected individual trees can be felled specifically for seed collection, especially in areas without commercial felling or for research purposes.
    - Disadvantage: Results in the loss of the tree as a future seed source and timber waste.

General considerations

- Timing: Collect seeds when they are mature and before natural dispersal begins. This interval varies greatly by species and local conditions.
- Safety: Always prioritize safety, especially when climbing or using tools. Utilize appropriate safety equipment and follow guidelines.
- Genetic Diversity: Collect from multiple, preferably unrelated, trees spaced adequately apart to ensure genetic diversity in the collected seedlot.
- Seed Handling: Proper handling, including transport and storage, is crucial for maintaining seed viability and quality.
- Documentation: Maintain meticulous records of seed collection, including species, location, date, and collector's name.

Quality Testing and Handling Protocols at Seed Processing and Laboratory Safety Precaution/Preventive Measures

Handling of Seed is done at various stages of collection processing testing, storage etc. Which requires careful handling at all the stages? There are certain natural enemies of the seed like insects and other pathogens. Which reduce both quality and quantity of seeds? Seeds need to be adequately treated with chemicals to reduce the damage from pest/pathogens. Although there are virtually no major threats during the handling of seed, however adequate care should be taken when collecting the seeds from trees and when using chemicals for seed treatments for storage of testing.

1. **Seed Collection**

   Seed Collection is often the most labour and cost intensive part of all the seed handling operations and one may be tempted to cut down labour cost and choose the cheapest possible method.

   Safety precaution should be enforced particularly in relation to the following points.

   1. Use of ground operated equipment.
   2. Collection from tress near transmission lines should be avoided.
   3. Danger of falling objects.
   4. Maintenance and careful use of climbing equipment.
   5. Personal fitness.
   6. Personal clothing (fight-fitting)
   7. Tree defects (approach, weak branches, diseased trees)
   8. Use of safety equipment (belt, rope, gloves) when climbing.

2. **Seed Processing**

   Dry fruit parts, resin and dust released during processing of dry fruits easily catch fire and therefore pose a fire hazard. Use of artificial heat or other electric appliances during extraction increase the danger. Dust may catch fire when coming into direct contact with glow wires or the like. Therefore heat source should be safety shielded and dust removed regularly during processing. Water and fire extinguishers should be readily available at the seed processing in the lab. Infested seed should be removed and disposed off. Some fruits and seed have poisonous pulp, fatal to humans and livestock. Removed pulp and water used for extraction must be discharged and disposed off safety.

3. **Handling insecticide/fungicides.**

   Use of insecticide/ fungicides in seed handling should be limited to the absolutely necessary condition. Mostly they are used in small amounts for treating the seed, before storage. Where insecticide/fungicides are used, they must be handled with due respect and the seed handler must comply with the safety precautions prescribed by the manufacturer. Some general rules and precautions are listed as under.

   1. Read instructions from the manufactured carefully and handle the remedy accordingly.
   2. Use the concentration prescribed by the manufacturer.
   3. Never experiment by mixing different chemicals.
   4. Prepare prescribed pesticide mixtures in a well-ventilated place.
   5. Use marks and protective glasses when applying toxic fumigants and sprays.
   6. Check and repair any leak from containers and equipment.
   7. Do not leave pesticide unattended.
   8. Wash hands thoroughly with detergent.

4. **Acid treatment of seeds for scarifications.**

   1. Use acid only in a well- ventilated place as evaporated gases can cause serious irritation when inhaled. Avoid inhaling the gas when opening bottle.
   2. Always use safety glasses protective clothing such as apron etc.
   3. Never pour water into undiluted acid.
   4. Store the acid locked up in a safe place when not in use.
   5. Always have plenty of water. Preferably a water tap with easy reach during any handling of acid.

5. The waste material (twigs, dead/diseased seed, cones, etc.) after extraction and cleaning of seeds and the seed which has become non-viable or has got spoil due to

insects/pathogens and lost its germination capacity should not be kept in laboratory as it invites more pathogen attack due to its poor quality and health. Such seed should be deposed off either burning or dumping in a pit in the ground and covering with soil, both safe distances away from the place of work.

Seed viability testing methods

- Cutting Test: This simple method involves slicing open seeds with a knife or scalpel to visually inspect the embryo and endosperm. Healthy seeds will typically have a well-developed, normal-colored embryo. While quick, it is not always reliable in distinguishing between recently deceased or injured seeds that may still appear normal.
- Topographical Tetrazolium Test (TZ Test): This biochemical test utilizes 2,3,5-triphenyl tetrazolium chloride (TTC) to stain living seed tissues red, revealing their viability. The seed is typically soaked, cut or punctured, exposed to the TTC solution, and then evaluated based on the staining pattern of the embryo. This test can quickly determine viability, even in dormant seeds, making it useful for species with slow germination or deep dormancy. However, it requires experience to interpret the staining patterns accurately.
- Excised Embryo Test: Seeds are soaked, and their embryos are carefully removed and placed on a moist substrate in a controlled environment to promote growth. This test assesses both viability and embryo dormancy. The embryos are monitored for development and classified as viable or non-viable. It provides a direct measure of embryo viability but requires skilled technicians and is limited to certain species.
- Hydrogen Peroxide Test: Seeds are soaked in hydrogen peroxide, which stimulates germination, and their radicle tips are exposed. The seeds are incubated, and radicle growth is monitored to determine viability. It is a quicker method than standard germination tests but may be less reliable.

Germination percentage refers to the number of seeds in a sample that successfully germinate and develop into normal seedlings under favourable conditions within a specific timeframe. It is calculated by dividing the number of germinated seeds by the total number of seeds tested and multiplying by 100. For example, if 8 out of 10 seeds sprout, the germination rate is 80%.

Viability in refers to the capacity of a seed to germinate and produce a normal seedling under suitable conditions, assuming dormancy is broken. It essentially signifies whether a seed is alive and possesses the potential to sprout, even if it might be dormant and not germinate immediately.

Orthodox seeds

- Definition: Orthodox seeds are those that can be dried to low moisture content (typically 5-7%) without damaging their viability.
- Desiccation Tolerance: They are desiccation-tolerant, meaning they can survive significant dehydration and remain viable.
- Storage Potential: Orthodox seeds can be stored for extended periods, even decades or centuries, under dry and cold conditions (e.g., -18°C or cooler in conventional seed banks). Longevity is enhanced by lower moisture content and temperature.
- Examples: Many annual and biennial crops like rice, wheat, corn, sorghum, as well as temperate species and trees like pine, spruce, and teak. Examples include most Amla, guava, Khair, Jacaranda etc.

Recalcitrant seeds

- Definition: Recalcitrant seeds are sensitive to desiccation and lose viability when their moisture content drops below a relatively high threshold (e.g., 20-30%). They are also termed desiccation-sensitive.
- Desiccation Sensitivity: They cannot withstand the drying process necessary for conventional seed storage and are prone to damage or death if moisture content falls too low.
- Storage Potential: Recalcitrant seeds are short-lived and cannot be stored for long periods in conventional seed banks. Their viability is best maintained under specific, often humid, and not freezing conditions
- Challenges: The high moisture content also increases vulnerability to fungal and insect damage. Freezing temperatures can be lethal due to ice crystal formation within the cells.
- Examples: Many tropical trees and some temperate species Mango, Jamun, Kusum, Jackfruit, Sita Ashok etc.