

## Seed Propagation Protocol Form

### SEED PROPAGATION PROTOCOL

**This form collates the information about the best method for seed propagation and growing up of the target species.**

Authorship (*people that contributed propagation information*): Tanzania Forest Service Agency

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Logo/s of the affiliated organisation(s):



*This propagation protocol is subject to change and updates when new information on the propagation of the species becomes available. If there any comments or changes you would like to make, please send the information to [africa@bgci.org](mailto:africa@bgci.org)*

#### GENERAL INFORMATION

<b>Taxon name</b>	<i>Scientific name of the propagated species</i>	<i>Cephalosphaera usambarensis</i>	<b>Name/s of propagator/</b>	<i>Name(s) of the person or people that carried out the propagation</i>	
<b>Family</b>	<i>Plant family of the propagated species</i>	Myristicaceae	<b>Organisation</b>	<i>Organisation(s) where the propagation was carried out</i>	
<b>Origin of seeds</b>	<i>Site(s) and country where seeds were collected</i>	<ul style="list-style-type: none"> <li>• East Usambara Mountains – Tanzania</li> <li>• West Usambara Mountains – Tanzania</li> </ul>	<b>Site and country</b>	<i>Site(s) and country where the propagation took place</i>	Lushoto, Tanzania

#### SEED DESCRIPTION & PROCESSING

**Description of the seeds and the processing of the seeds before seed sowing.**

<b>Time of year for seed collection</b>	<i>List month/s of the year when seed collection is best</i>	<p>June – September</p> <ul style="list-style-type: none"> <li>• Fruits should be collected when they naturally split open and expose the seed, indicating full physiological maturity.</li> <li>• Seed collection should preferably be undertaken directly from the tree or immediately after natural fruit fall to minimize insect damage and fungal infection.</li> </ul>
<b>Fruit/seed transport</b>	<i>Describe how fruit/seeds have been stored during transport from the field to the nursery</i>	<ul style="list-style-type: none"> <li>• Collect fruits directly from tree or recently fallen fruits.</li> <li>• Place in breathable cloth/jute bags or baskets.</li> <li>• Avoid plastic bags (prevents sweating and fungal growth).</li> <li>• Keep shaded and cool during transport.</li> <li>• Deliver to nursery within 1–2 days.</li> <li>• As the seeds are recalcitrant, prolonged exposure to direct sunlight and drying conditions should be avoided during transport.</li> <li>• Seeds should be handled carefully to avoid mechanical damage to the seed coat and embryo.</li> </ul>
<b>Processing of fruits/seeds</b>	<i>Describe how the fruits/seeds are processed in situ or in the nursery (seed extraction methods, seed cleaning, handling of fruits/seeds...)</i>	<ul style="list-style-type: none"> <li>• If fruits are fleshy: soak in water for 12–24 hours to soften pulp.</li> <li>• Manually remove pulp by rubbing over a sieve.</li> <li>• Wash seeds thoroughly.</li> <li>• Shade-dry seeds for 1–3 days.</li> <li>• If fruits are dry capsules: air-dry until they split naturally and extract seeds manually.</li> <li>• Remove damaged or insect-infested seeds.</li> <li>• Fruits of <i>Cephalosphaera usambarensis</i> are large, yellow-green and fleshy, usually splitting into two valves at maturity to release a single seed.</li> <li>• Seeds are covered by a thin cream-coloured aril that should be removed before sowing to reduce fungal contamination and facilitate handling.</li> <li>• Excessive drying during processing should be avoided because seed viability declines rapidly when moisture content is reduced.</li> </ul>
<b>Method to assess seed viability</b>	<i>Describe method used to estimate seed viability (e.g. floating test, cut test, tetrazolium test, X-ray test)</i>	<ul style="list-style-type: none"> <li>• 1. Cut test: Cut seeds longitudinally. Viable seeds have firm, white/cream embryos. <ul style="list-style-type: none"> <li>• Empty or darkened seeds are non-viable.</li> </ul> </li> <li>• 2. Floating test: <ul style="list-style-type: none"> <li>• Place seeds in clean water.</li> <li>• Viable seeds often sink; empty seeds float.</li> </ul> </li> <li>• 3. Tetrazolium red test (more accurate): <ul style="list-style-type: none"> <li>• Seeds soaked and treated with Tetrazolium red solution.</li> <li>• Living tissues stain red.</li> <li>• Viable seeds should contain a healthy cream-coloured endosperm with no evidence of insect damage, mould growth or tissue discoloration.</li> </ul> </li> </ul>
<b>% Estimated seed viability</b>	<i>(Number of viable seeds) x 100 / (Total number of seed for</i>	<p>Typical fresh seed viability: 60–80%</p>

	<i>which viability was estimated)</i>	<ul style="list-style-type: none"> <li>Freshly collected seeds can attain viability levels above 80% when collected from healthy mature trees and processed promptly.</li> </ul>
<b>Type of seed</b>	<i>Choose one of these options: Orthodox, Intermediate, Recalcitrant or Unknown</i>	<p>Intermediate to Recalcitrant</p> <ul style="list-style-type: none"> <li>The seeds are generally classified as recalcitrant because they cannot withstand substantial moisture loss or prolonged storage.</li> </ul>
<b>Seed size</b>	<i>Include a measuring unit (e.g. mm, cm...)</i>	<ul style="list-style-type: none"> <li>Length: 5 cm</li> <li>Width: 3 cm</li> <li>Seeds are egg-shaped and among the largest indigenous tree seeds found in Tanzania.</li> </ul>
<b>Number of seeds per gram</b>	<i>Count a reasonable number of seeds and weigh them. Then, divide the number of seeds by their weight (e.g. 100 seeds / 5 g = 20 seeds/g)</i>	Approximately 135 seeds per kilogram (equivalent to about 0.135 seeds per gram).
<b>Seed storage</b>	<i>If seeds have been stored before germination, mention storage facilities (seed bank, fridge, freezer), and describe conditions (humidity, temperature), type of container, and storage time length.</i>	<p>The seed is recalcitrant and should be packed in small quantities (less than 10 kg) in cotton bags or in gunny bags made of sisal or jute fibre. Alternatively, they can be kept in wire mesh trays under shade. Both methods provide good ventilation. Seed should be sown within six weeks after collection.</p> <ul style="list-style-type: none"> <li>Seeds cannot tolerate desiccation below approximately 25% moisture content.</li> <li>Seeds should never be stored in sealed plastic containers because restricted aeration encourages fungal growth and accelerates deterioration.</li> <li>Storage under cool, shaded and well-ventilated conditions is recommended.</li> <li>Seeds should not be stored at freezing temperatures.</li> <li>Viability declines rapidly after six weeks; therefore immediate sowing following extraction is strongly recommended for maximum germination success.</li> </ul>

+ **Add photographs of the fruit and seeds. Make sure to include a detailed description of the photo, such as the growth stage, date, activity or process.**

## SEED PROPAGATION PROTOCOL

### GERMINATION

#### Description of procedures, materials for seed germination and the germination success.

<b>Procedures</b>	<b>Seed treatment</b>	<p><i>Describe treatment applied to the seed before sowing (e.g. mechanical scarification, chemical scarification, soaking,</i></p>	<p>Pre-treatment is not necessary, but the germination is shortened by warm stratification in moistened forest litter under shade for three weeks.</p> <ul style="list-style-type: none"> <li>Freshly extracted seeds should be sown immediately whenever possible because the</li> </ul>
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	<i>stratification, smoke treatment...).</i> <i>If applied, include the duration of the treatment.</i>	seeds are recalcitrant and lose viability rapidly during storage. <ul style="list-style-type: none"> <li>• Remove the thin cream-coloured aril before sowing to reduce fungal infection and improve handling.</li> </ul>
<b>Seed sowing media</b>	<i>Media composition: include percentages/ratio for the different components</i>	Recommended mixture: Tree Seed Production – Morogoro <ul style="list-style-type: none"> <li>• Top Black Forest soil – 63% (5)</li> <li>• Well decomposed Manure – 25% (2)</li> <li>• Rice husk – 12% (1) Ratio = 5:2:1. Well-drained and sterilized if possible.</li> <li>• The growing medium should remain moist throughout the germination period but should never become waterlogged.</li> </ul>
<b>Container</b>	<i>Describe size and material of the container in which seeds are sown</i>	<ul style="list-style-type: none"> <li>• Seed trays for initial germination.</li> <li>• Nursery tubes (after pricking out).</li> <li>• Tube size: 12–15 cm depth, 6–8 cm diameter.</li> <li>• Material: Black polyethylene tubes or rigid plastic pots.</li> <li>• Because of the relatively large seed size (approximately 5 × 3 cm), raised seedbeds or deep germination trays are recommended for better root development.</li> </ul>
<b>Seed spacing</b>	<i>Describe the recommended spacing between the seeds when sown. Include a measuring unit (e.g. mm, cm...)</i>	In trays: 1–2 cm apart (small seeds). <ul style="list-style-type: none"> <li>• For this large-seeded species, sow seeds 5–10 cm apart to reduce root competition and facilitate pricking out.</li> </ul>
<b>Seed depth</b>	<i>Describe how deep the seeds are sown. Include a measuring unit (e.g. mm, cm...)</i>	<ul style="list-style-type: none"> <li>• Sown at 0.5–1 cm depth.</li> <li>• Light covering with fine soil.</li> <li>• Large seeds may be sown slightly deeper (1–2 cm) and lightly covered with fine forest soil or leaf mould.</li> </ul>
<b>Watering technique</b>	<i>Describe watering tool, technique and frequency during sowing and germination</i>	<ul style="list-style-type: none"> <li>• Fine rose watering can or mist sprayer.</li> <li>• Water lightly once daily.</li> <li>• Avoid waterlogging. <ul style="list-style-type: none"> <li>• Maintain consistently moist soil because recalcitrant seeds are highly sensitive to desiccation.</li> </ul> </li> </ul>
<b>Germination facilities</b>	<i>Describe the facilities where the germination of seeds took place (e.g. close case, outdoor shaded area, heated bench, covered/bagged container...)</i>	<ul style="list-style-type: none"> <li>• Shaded nursery (50–70% shade).</li> <li>• Raised seedbeds preferred.</li> <li>• Covered germination beds may be used to maintain humidity. <ul style="list-style-type: none"> <li>• Germination under forest-like shaded conditions closely resembles the natural habitat of the species and improves seedling establishment.</li> </ul> </li> </ul>
<b>Environmental conditions</b>	<i>Describe the environmental conditions where germination took place (temperature,</i>	<ul style="list-style-type: none"> <li>• Temperature: 18–25°C (cool moist forest conditions).</li> <li>• Humidity: High (60–80%).</li> <li>• Light: Partial shade.</li> </ul>

		<i>humidity, and photoperiod)</i>	<ul style="list-style-type: none"> <li>• Good air circulation should be maintained while avoiding excessive drying of the germination medium.</li> </ul>
<b>Success</b>	<b>Time of year for seed germination</b>	<i>List month/s of the year when seed germination is best</i>	<ol style="list-style-type: none"> <li>1. Northern &amp; Eastern Zone <ul style="list-style-type: none"> <li>• October – December</li> <li>• March – May</li> </ul> </li> <li>2. Central Zone <ul style="list-style-type: none"> <li>• November – April</li> </ul> </li> <li>3. Southern &amp; Western Zone <ul style="list-style-type: none"> <li>• May – October</li> <li>• November – April. <ul style="list-style-type: none"> <li>• Germination should preferably begin immediately after seed collection during the rainy season to maximize viability.</li> </ul> </li> </ul> </li> </ol>
	<b>Duration until germination</b>	<i>Average number of days/months/years until seeds germinated</i>	<p>21–45 days after sowing.</p> <ul style="list-style-type: none"> <li>• Germination begins with the emergence of a thick whitish radicle.</li> <li>• Germination is hypogeal, with the cotyledons remaining below the soil surface.</li> </ul>
	<b>% Germination success</b>	<i>(Number of seeds germinated) x 100 / (Total number of seeds sowed)</i>	<p>Germination is very good and uniform. It reaches <b>90% after six weeks</b> and <b>97% after seven weeks</b> from sowing.</p> <ul style="list-style-type: none"> <li>• Uniform germination is achieved when freshly collected seeds are used and adequate moisture is maintained throughout the germination period.</li> </ul>
<b>Materials</b>		<i>List the materials needed for seed germination to help with the planning of this activity. E.g. trays, sieves, dibbers, labels, ruler...</i>	<p>Seed trays.</p> <ul style="list-style-type: none"> <li>• Fine sand.</li> <li>• Forest soil.</li> <li>• Compost.</li> <li>• Sieve.</li> <li>• Watering can.</li> <li>• Labels and permanent marker.</li> <li>• Shade net.</li> <li>• Dibber.</li> <li>• Forest litter for warm stratification</li> <li>• Raised germination beds.</li> <li>• Cotton bags, sisal bags or wire mesh trays for temporary seed storage before sowing.</li> <li>• Measuring ruler for recording germination progress.</li> </ul>

+ *Add photographs of the germination process. Make sure to include a detailed description of the photo, such as the growth stage, date, activity or process.*

# SEED PROPAGATION PROTOCOL

## FIRST POTTING

**Description of procedures and materials for the cultivation of the plants and the success of the growing of the plants.**

<b>Procedure</b> <b>s</b>	<b>Growing Media</b>	<i>Media composition: include percentages/ratio for the different components</i>	<p>Recommended mixture: Tree Seed Production Station-Morogoro</p> <ul style="list-style-type: none"> <li>• Top Black Forest soil – 63% (5)</li> <li>• Well decomposed Manure – 25% (2)</li> <li>• Rice husk – 12% (1)</li> </ul> <p><b>Ratio is 5:2:1</b></p>
	<b>Container</b>	<i>Describe size and material of the container in which plants are potted</i>	<ul style="list-style-type: none"> <li>• Tube size: 12–15 cm depth, 6–8 cm diameter</li> <li>• Material: Black polyethylene tubes or rigid plastic pots.</li> </ul>
	<b>Fertiliser</b>	<i>If used, include: type (organic or inorganic); nutrient composition and its ratio; and application (added to soil, dissolved on water, foliar application)</i>	<ul style="list-style-type: none"> <li>• Prefer organic compost.</li> <li>• Optional light inorganic fertilizer (e.g., NPK 10:10:10).</li> <li>• Application: Mixed in potting soil or diluted liquid feed after 3–4 weeks.</li> </ul>
	<b>Watering technique</b>	<i>Describe watering tool, technique and frequency while growing the plants</i>	<ul style="list-style-type: none"> <li>• Water 2–3 times per week depending on rainfall.</li> <li>• Maintain moist but well-drained soil.</li> </ul>
	<b>Plant growing facilities</b>	<i>Describe the facilities where the plant growing took place (e.g. glasshouse, outdoors, shaded area...)</i>	<ul style="list-style-type: none"> <li>• Outdoor nursery under shade net.</li> <li>• Gradual hardening before field planting.</li> </ul>
	<b>Environmental conditions</b>	<i>Describe the environmental conditions where the plant growing took place (temperature, humidity, light levels)</i>	<ul style="list-style-type: none"> <li>• Temperature: 18–28°C</li> <li>• Moderate to high humidity</li> <li>• Partial shade initially, gradual exposure to sun.</li> </ul>
<b>Success</b>	<b>Number of days until first potting</b>	<i>Average number of days since the start of seeds sowing until first potting</i>	30–45 days after germination (2–3 true leaves stage).
	<b>Duration until established plants</b>	<i>Average number of days/month/years for which the plant growth was monitored until the establishment of plants</i>	6–9 months in nursery before out-planting.

	<b>% Plants established</b>	<i>(Number of plants established) x 100 / (Total number of plants potted)</i>	Typical survival rate: 70–85%
	<b>Health observations</b>	<i>Record any signs of pest or disease, nutrient deficiency, damage... and the stage when they were observed (e.g. during germination, growing of seedlings, growing of plants....)</i>	<ul style="list-style-type: none"> <li>• Damping-off during early germination.</li> <li>• Leaf spot in high humidity.</li> <li>• Occasional insect feeding during seedling stage.</li> <li>• Slow growth if soil drainage is poor.</li> </ul>
<b>Materials</b>		<i>List material needed for potting to help with the planning of this activity. E.g. pots, dibbers, labels...</i>	<ul style="list-style-type: none"> <li>• Poly pots (15–20 cm deep)</li> <li>• Potting mix</li> <li>• Trowel</li> <li>• Watering can</li> <li>• Labels</li> <li>• Shade net</li> </ul>

+ *Add photographs of the pricking out, potting, and the growing of plants. Make sure to include a detailed description of the photo, such as the growth stage, date, activity or process.*

