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

GENERAL INFORMATION					
Taxon name	*Scientific name of the propagated species*	*Croton macrostachyus*	**Name/s of propagator/**	*Name(s) of the person or people that carried out the propagation*	
Family	*Plant family of the propagated species*	Euphorbiaceae	**Organisation**	*Organisation(s) where the propagation was carried out*	
Origin of seeds	*Site(s) and country where seeds were collected*	Morogoro, Tanga, Kilimanjaro and Arusha	**Site and country**	*Site(s) and country where the propagation took place*	Morogoro, Tanga, Kilimanjaro and Arusha-Tanzania

SEED DESCRIPTION & PROCESSING		
Description of the seeds and the processing of the seeds before seed sowing.		
Time of year for seed collection	*List month/s of the year when seed collection is best*	November – February
Fruit/seed transport	*Describe how fruit/seeds have been*	• Harvest mature pods directly from the tree. • Store in cloth or jute sacks (well ventilated).

	stored during transport from the field to the nursery	• Avoid plastic bags (prevents moisture buildup). • Keep shaded during transport. • Deliver to nursery within 1–3 days.
Processing of fruits/seeds	*Describe how the fruits/seeds are processed in situ or in the nursery (seed extraction methods, seed cleaning, handling of fruits/seeds...)*	• Pods are dried under the sun for 3–7 days**.** • Pods split naturally when dry. • Manually extract seeds. • Remove debris and damaged/insect-attacked seeds. • Clean by sieving and hand sorting. • Shade-dry seeds to safe moisture content before storage
Method to assess seed viability	*Describe method used to estimate seed viability (e.g. floating test, cut test, tetrazolium test, X-ray test)*	1. **Cut test:** • Cut seeds longitudinally. • Viable seeds have firm, white/cream embryos. • Empty or darkened seeds are non-viable. 2. **Floating test:** • Place seeds in clean water. • Viable seeds often sink; empty seeds float. *(Note: Less reliable due to winged structure.)* 3. **Tetrazolium red test (more accurate):** • Seeds soaked and treated with Tetrazolium red solution. • Living tissues stain red.
% Estimated seed viability	*(Number of viable seeds) x 100 / (Total number of seed for which viability was estimated)*	Typical viability: 70–90% fresh seeds
Type of seed	*Choose one of these options: Orthodox, Intermediate, Recalcitrant or Unknown*	Intermediate between recalcitrant and orthodox
Seed size	*Include a measuring unit (e.g. mm, cm…)*	• Length: 5mm • Width: 3mm
Number of seeds per gram	*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)*	There are about 2500 seeds per kilogram

Seed storage	*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.*	• Storage facility: Cool dry room or refrigerator. • Temperature: 4–10°C • Moisture content: 8–10% • Container: Airtight jar or sealed foil packet. • Storage duration: Up to 1–2 years.

+ ***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.***

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GERMINATION			
Description of procedures, materials for seed germination and the germination success.			
Procedures	**Seed treatment**	*Describe treatment applied to the seed before sowing (e.g. mechanical scarification, chemical scarification, soaking, stratification, smoke treatment…). If applied, include the duration of the treatment.*	□ Hard seed coat requires scarification: • Mechanical scarification (nicking with knife or sandpaper). • Soak in hot water (pour hot water, allow to cool, soak 12–24 hours). □ Improves germination uniformity
	Seed sowing media	*Media composition: include percentages/ratio for the different components*	Recommended mixture: Tree Sees Production Station -Morogoro • **Top Black Forest soil – 63% (5)** • **Well decomposed Manure – 25% (2)** • **Rice husk – 12% (1)** **Ratio is 5:2:1** Well-drained and sterilized if possible.
	Container	*Describe size and material of the container in which seeds are sown*	• Direct sowing in nursery tubes preferred. • Tube size: 15–20 cm depth, 8–10 cm diameter. • Material: Black polyethylene nursery tubes.
	Seed spacing	*Describe the recommended spacing between the seeds when sown. Include a measuring unit (e.g.*	• In trays: 4–5 cm apart. • In tubes: 1 seed per tube.

		mm, cm…)	
	Seed depth	*Describe how deep the seeds are sown. Include a measuring unit (e.g. mm, cm…)*	• Sown at 2–3 cm depth**.** • Cover lightly with soil.
	Watering technique	*Describe watering tool, technique and frequency during sowing and germination*	• Fine rose watering can. • Water once daily or when soil surface dries. • Avoid waterlogging.
	Germination facilities	*Describe the facilities where the germination of seeds took place (e.g. close case, outdoor shaded area, heated bench, covered/bagged container...)*	• Outdoor nursery under 50% shade net**.** • Raised beds preferred.
	Environmental conditions	*Describe the environmental conditions where germination took place (temperature, humidity, and photoperiod)*	• Temperature: 22–32°C • Humidity: Moderate (50–70%) • Light: Partial shade.
Success	**Time of year for seed germination**	*List month/s of the year when seed germination is best*	1. **Northern & Eastern Zone** • October – December • March – May 2. **Central Zone** • November – April • May – October 3. **Southern & Western Zone** • November – April
	Duration until germination	*Average number of days/months/years until seeds germinated*	7–21 days after sowing (with scarification).
	% Germination success	*(Number of seeds germinated) x 100 / (Total number of seeds sowed)*	Is fair but sporadic. It attains 6% after two weeks and 40% after four weeks and continues
Materials		*List the materials needed for seed germination to help with the planning of this activity. E.g. trays, sieves, dibbers, labels, ruler…*	• Nursery tubes or trays • Sand, forest soil, compost • Watering can • Labels and marker • Knife/sandpaper (for scarification) • Shade net • Ruler

		• Sieve

+ ***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.***

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FIRST POTTING			
Description of procedures and materials for the cultivation of the plants and the success of the growing of the plants.			
Procedures	**Growing Media**	*Media composition: include percentages/ratio for the different components*	Recommended mixture: Tree Seed Production Station-Morogoro • Top Black Forest soil – 63% (5) • Well decomposed Manure – 25% (2) • Rice husk – 12% (1) **Ratio is 5:2:1**
	Container	*Describe size and material of the container in which plants are potted*	Black polyethylene bags of height 8–10 cm and diameter 101.4 mm or 4”
	Fertiliser	*If used, include: type (organic or inorganic); nutrient composition and its ratio; and application (added to soil, dissolved on water, foliar application)*	After transplanting: Type: • Organic compost preferred OR • NPK 15:15:15 Application: Mixed in soil or diluted liquid feed every 2–3 weeks
	Watering technique	*Describe watering tool, technique and frequency while growing the plants*	• Water 2–3 times per week depending on rainfall. • Ensure proper drainage.
	Plant growing facilities	*Describe the facilities where the plant growing took place (e.g. glasshouse, outdoors, shaded area...)*	• Outdoor nursery under shade during early stage. • Gradual hardening to full sunlight.
	Environmental conditions	*Describe the environmental conditions where the plant growing took place (temperature, humidity, light levels)*	• Temperature: 22–35°C • Moderate humidity • Full sun after hardening stage.
Success	**Number of days until first potting**	*Average number of days since the start of seeds sowing until first potting*	If started in trays: 21–30 days after germination (2–3 true leaves stage).
	Duration until established plants	*Average number of days/month/years for which the plant growth*	5–7 months in nursery before field planting.

		was monitored until the establishment of plants	
	% Plants established	*(Number of plants established) x 100 / (Total number of plants potted)*	Typical survival rate: 75–90%
	Health observations	*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….)*	• Damping-off during early germination. • Leaf-eating insects during seedling stage. • Yellowing leaves if nitrogen deficient. • Root rot in poorly drained soils.
Materials		*List material needed for potting to help with the planning of this activity. E.g. pots, dibbers, labels…*	• Poly pots (15–20 cm depth recommended) • Potting mix • Trowel • Labels • Watering can • Shade net

+ ***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.***