

Protocol: Root Ingrowth Core Preparation and Installation

This protocol outlines the procedure for studying root production using the ingrowth core method, covering soil preparation, fertilization, and field installation.

1. Soil Collection and Preparation

- **Collection:** Collect subsoil soil of similar type to the study site, but from a depth of **30-60 cm** to get soil without plant and root residues.
- **Cleaning:** Sieve the soil if necessary.
- **Drying:** Spread soil on the greenhouse floor to air-dry slightly. This makes handling easier and prevents clumping during packing.
- **Debris Removal:** If not sieved, manually pick out stones and any remaining large plant tissues.

2. Fertilization and Packing

- **Mixing:** Prepare a soluble fertilizer solution ca. 10 mg N/kg soil. Use approximately **30 ml** of solution for every **50 cores**.
- **Packing:** Weigh out approximately **0.83 kg** of soil per core to ensure uniform bulk density across all samples.
- **Timing:** Allow **4–6 hours** of labor to pack a full set of cores (e.g., 50+ units).

3. Field Installation

Installation is performed at a **30° angle** to better intercept horizontal root growth.

- **Drill holes:** Drill holes with electric drill and 30° triangular wooden board. Save the soil samples for afterwards refilling.



- **Placement:** Install cores at a depth range of **5–25 cm**. Hook the wire down to the soil to avoid potential influence on the following machinery process in the trials. Geometric Calculation of the starting point: Measuring **10 cm** along the core from the soil surface should result in a vertical depth of **5 cm**.
- **Efficiency:** Budget approximately **2.5 hours per block** (for 16 cores) for a group (3 people).
- **Refilling:** Immediately refill the gaps around the installed core using the soil saved during the drilling process.

4. Collect the ingrowth cores

- **Preparation:** One day prior to collection, visit the site to locate and mark all core positions to prevent delays on the day of collection.
- **Extraction Technique:** Use a kitchen knife to cut the soil carefully around the perimeter of the ingrowth core to loosen it. Gently pull the core out using the pre-installed wires. Then carefully cut off any "redundant roots" (roots hanging outside the mesh) so you only measure what grew *inside* the core volume.
- **Storage:** Field Storage: Place cores immediately into insulated boxes with ice packs.

Long-term Storage: Transfer samples to a freezer as soon as you return from the field to preserve the root architecture for washing.