# **Protocol B – Biochar Grow‑Bag Container Trial (Fall 2025)**

## **1 Study Objective**

Using portable containers instead of in‑ground plots, test whether a **2 % w/w pine‑biochar amendment**:

* raises soil pH ≥ 0.3 units,
* increases cation‑exchange capacity (CEC) ≥ 10 cmol c kg⁻¹,
* lowers cumulative NO₃⁻ leaching ≥ 25 %, and
* improves fresh biomass yield ≥ 15 %

relative to a compost‑only control during a 10‑week crop cycle.

## **2 Experimental Design**

| **Item** | **Specification** |
| --- | --- |
| **Experimental units** | Eight **25 L fabric grow‑bags** (Ø 30 cm × 35 cm H) filled with loam + compost (12 kg dry mix). |
| **Treatments** | 4 Grow‑bags with 2 % w/w pine biochar (*B1–B4*) vs. 4 Control grow‑bags (compost only, *C1–C4*). |
| **Randomisation** | Assign treatment labels randomly at Day 0. **Rotate bag positions clockwise** weekly to minimise micro‑site light & airflow gradients. |
| **Buffering** | Leave ≥ 15 cm gap between bags; place on plastic trays to collect leachate. |

## **3 Crop & Management**

* **Crop mix:** 4 bush‑bean plants + 8 lettuce seedlings per bag (uniform density).
* **Watering:** Irrigate to field capacity (~1.5 L per bag) when soil‑moisture probe reads <15 % v/v.
* **Fertiliser:** None beyond initial compost; avoids confounding nutrient inputs.

## **4 Sampling Schedule**

| **Week** | **Activity** |
| --- | --- |
| **Day 0 (Aug 2–3)** | • Composite baseline soil sample from each bag: pH, EC, OM, CEC, NO₃⁻, Pb.• Mix biochar into B‑bags (rinsed to EC < 2 dS m⁻¹).• Sow crops; record wet weight of media. |
| 1, 3, 5, 7, 9 | • pH & EC (1:1 slurry).• Soil‑moisture probe (10 cm depth). |
| After each deep irrigation or ≥ 0.5″ rain | • Collect tray leachate; measure volume & NO₃⁻ with Merck strip + smartphone RGB photo. |
| **Week 5** | • Calibrate RGB–NO₃⁻ curve using 5–50 mg L⁻¹ KNO₃ standards. |
| **Week 10 (Nov 3–5)** | • Harvest above‑ground biomass → fresh mass; dry 60 °C 48 h → dry mass.• Post‑harvest composite soil sample: pH, CEC, NO₃⁻. |

## **5 Analytical Methods**

* **pH & EC:** Apera PH60S; 1:1 soil:H₂O slurry.
* **CEC:** NH₄OAc extraction (commercial lab).
* **NO₃⁻ leachate:** Merck MQuant 1.10020 strips; RGB analysis via smartphone + Python script.
* **Biomass:** Fresh kg bag⁻¹; dry g bag⁻¹.

## **7 Safety & Ergonomics**

| **Hazard** | **Control** |
| --- | --- |
| Biochar dust | N95 respirator; mist char with water while mixing. |
| Heavy lifting (wet bags ≈ 15 kg) | Lift with bent knees; move on a dolly if possible. |
| Dilute acid/base in RGB calibration | Gloves, goggles; neutralise waste with NaHCO₃. |

## **8 Data Management**

* Raw .csv logs, RGB scripts, and protocol stored in GitHub repo **Biochar\_Garden\_Project**; DOI via Zenodo.
* Version tags: v0.1 (baseline), v0.2 (mid‑season), v1.0 (final dataset).

*Revision 1 | 21 May 2025*