



HAL
open science

How to give new value to moderately contaminated soil: assessment of wood energy production with short rotation coppice

Virginie Moreaux, Guillaume Hostyn, Jean-Marie Côme, Emma Lopez,
Vincent Huber, Séverin Poutrel, Gaylord Erwan Machinet, Xavier Marie,
Rebecca Dingkuhn, Claire Morvan, et al.

► **To cite this version:**

Virginie Moreaux, Guillaume Hostyn, Jean-Marie Côme, Emma Lopez, Vincent Huber, et al.. How to give new value to moderately contaminated soil: assessment of wood energy production with short rotation coppice. 11th Conference on Soils of Urban, Industrial, Traffic and Mining Areas, Sep 2022, Berlin (online), Germany. hal-04233787

HAL Id: hal-04233787

<https://hal.inrae.fr/hal-04233787v1>

Submitted on 9 Oct 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

How to give new value to moderately contaminated soil : assessment of wood energy production with short rotation coppice

Virginie MOREAUX^{1*}, Guillaume HOSTYN¹, Jean-Marie CÔME¹, Emma LOPEZ¹, Vincent HUBER¹, Séverin POUTREL¹, Gaylord-Erwan MACHINET³, Xavier MARIE⁴, Rebecca DINGKUHN⁴, Claire MORVAN⁴, Emmanuel VERNUS⁵, Axel BERNARD⁶, Christophe SCHWARTZ², Stéphanie OUVARD²

* More information: v.moreaux@groupeginger.com

Background and Objectives

An emblematic site:

- A 150 ha former iron and steel site being rehabilitated (SNM in Colombelles, suburb of Caen, France),
- Major constraints in relation to the establishment of productive plant cover (agronomic properties and soil pollution),
- Recommendations of good practices to avoid the costs of excavation and disposal to landfill, while improving the carbon footprint of development operations

Main objectives:

- Producing knowledge on the refunctionalization of moderately contaminated soil from an agronomic point of view, to produce wood biomass for energy purpose
- Restoring the fertility of the land with regard to needs of selected crops
- Producing, in quantity, healthy biomass with high energetic value and quality
- Contributing to soil management regarding pollution stabilization of Metallic Trace Elements (MTE) and through the potential degradation of organic pollutants as Polycyclic Aromatic Hydrocarbons (PAHs) and Total Hydrocarbons (THC).

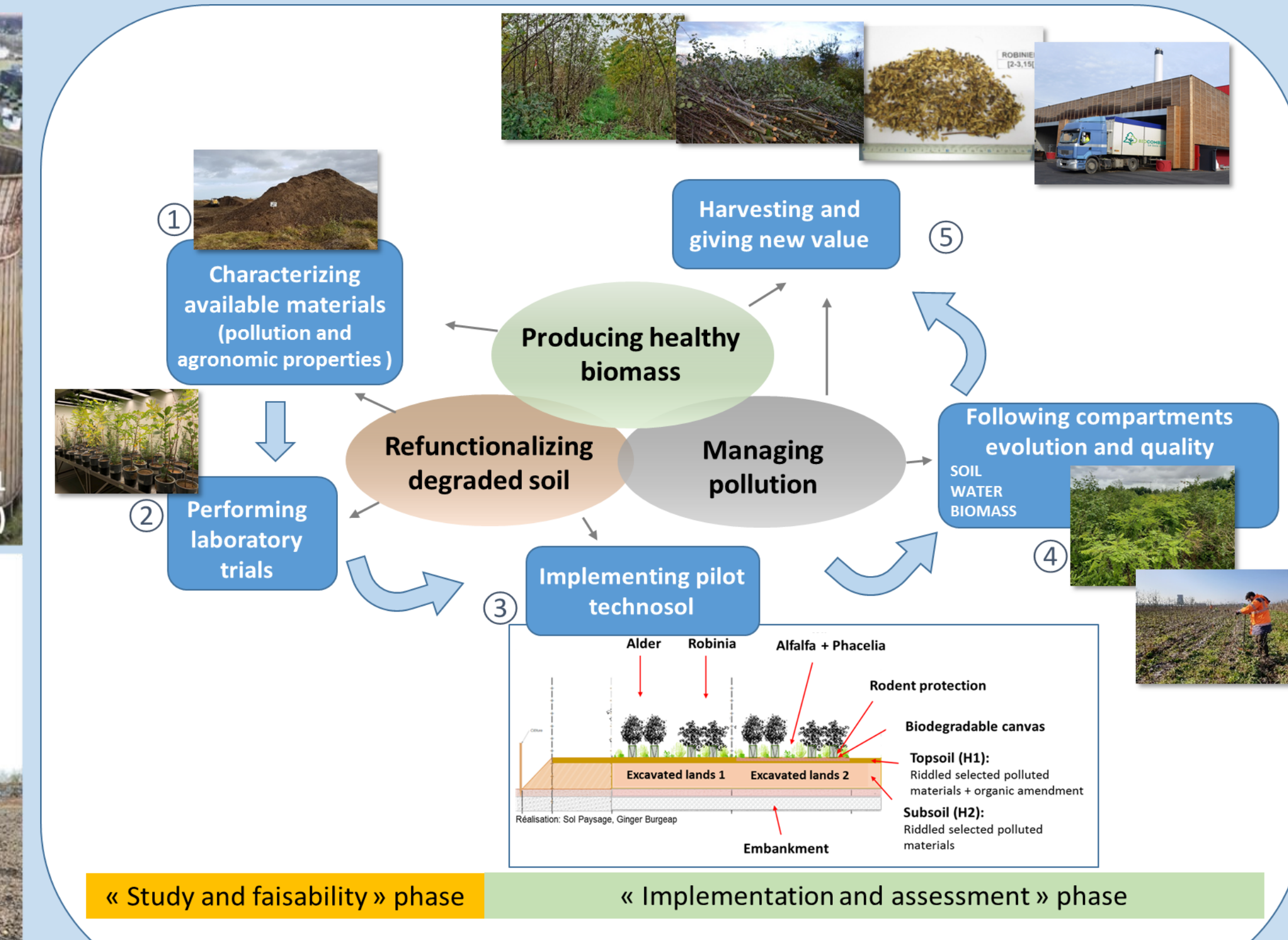


Material and Methods



Three measurements campaigns : Initial (t0), after one vegetation season (t1) and after two after vegetation season (t2)

A five steps project:



- Earth materials available on site impacted in MTE, PAHs and THC after 40mm screening (T8<=T6<T12)
- Surface horizon: incorporation of 10 cm of compost on 20 cm of soil in place
- Ground cover: Alfalfa (75%) and phacelia seedlings (25%)
- Planting black locusts and white alders

⇒ Proposing a methodology for stakeholders to understand the levers of actions around enhancing the energetic and economical outcomes of available brownfields awaiting for change and new use, while managing pollution

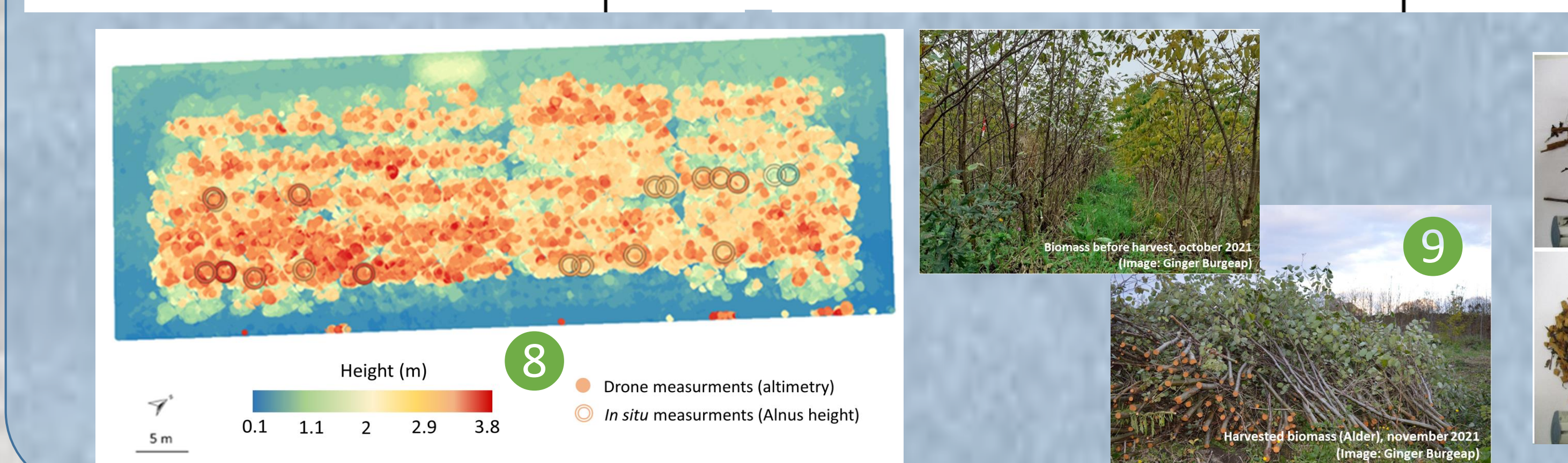
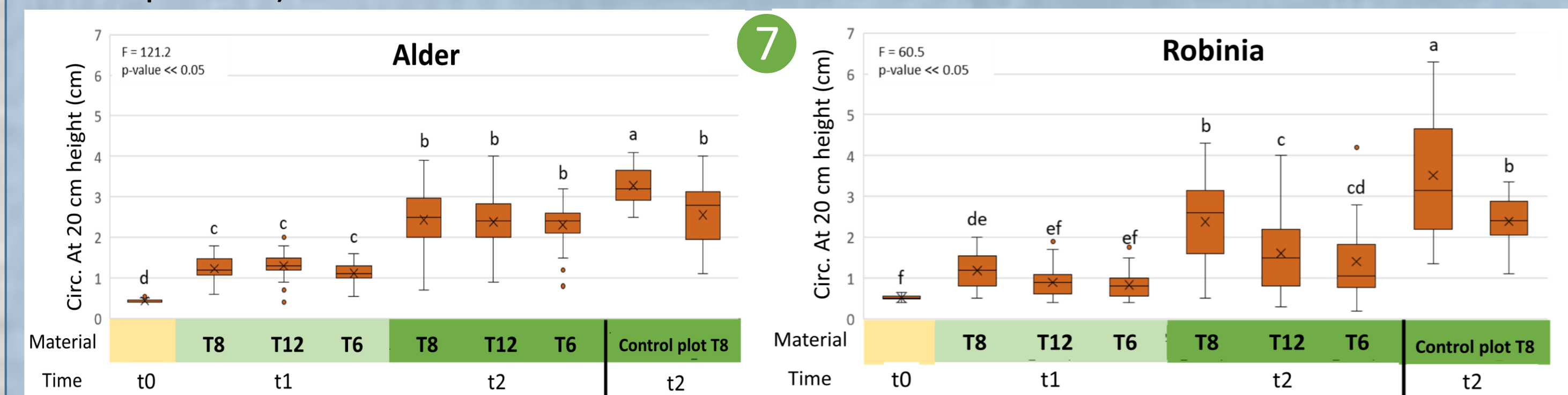
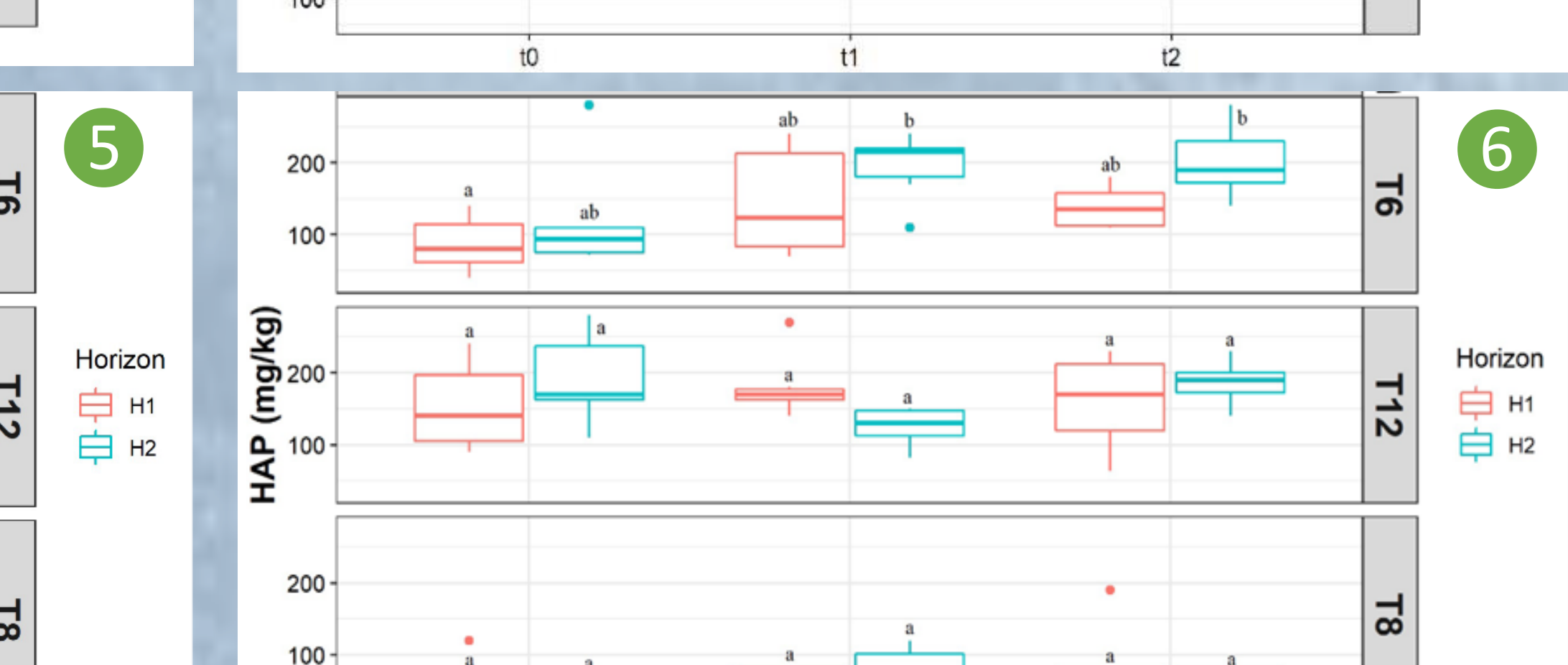
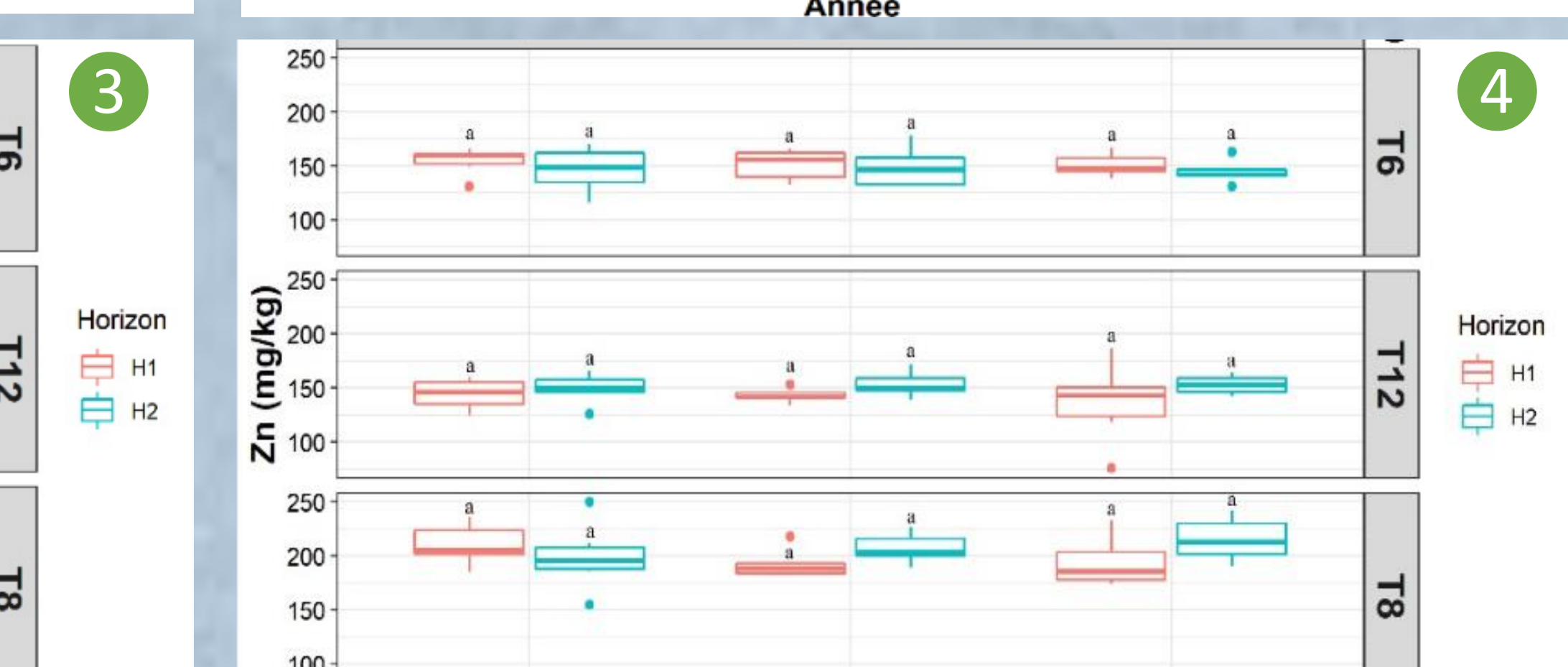
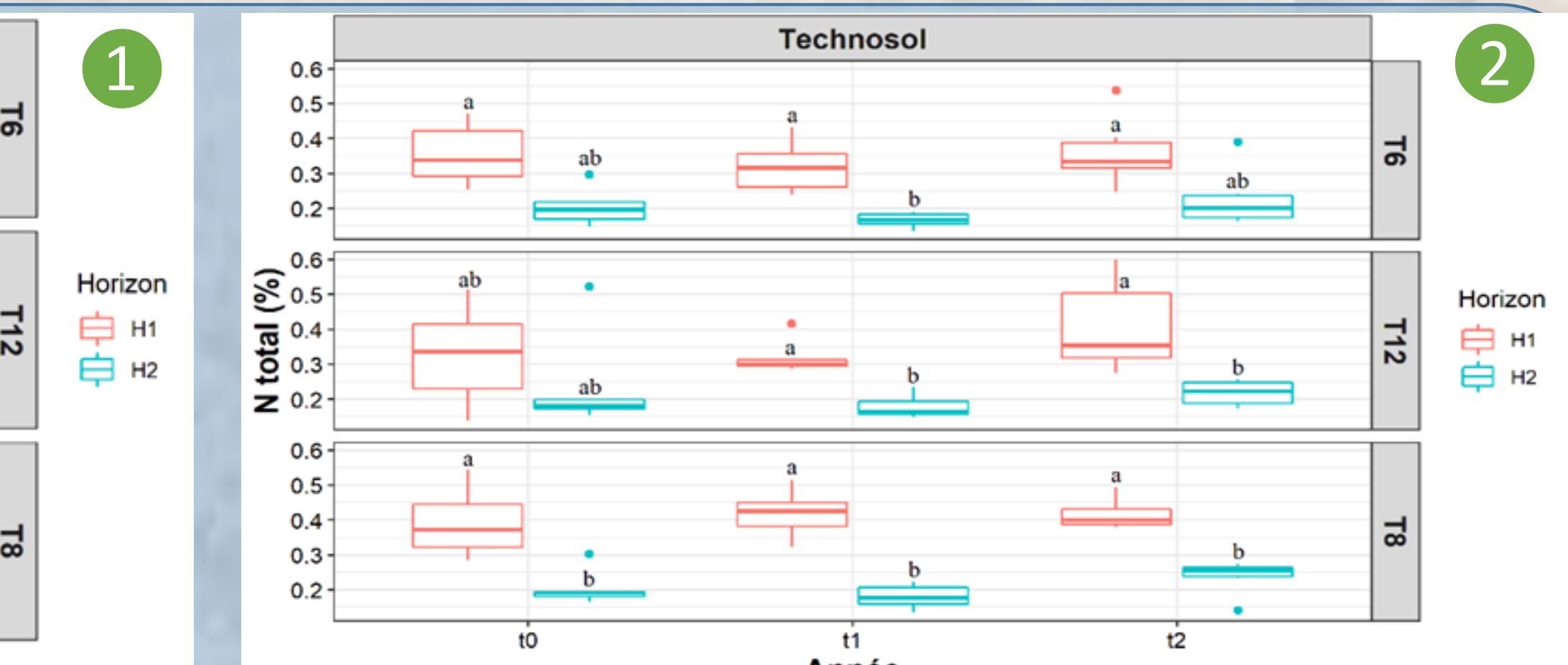
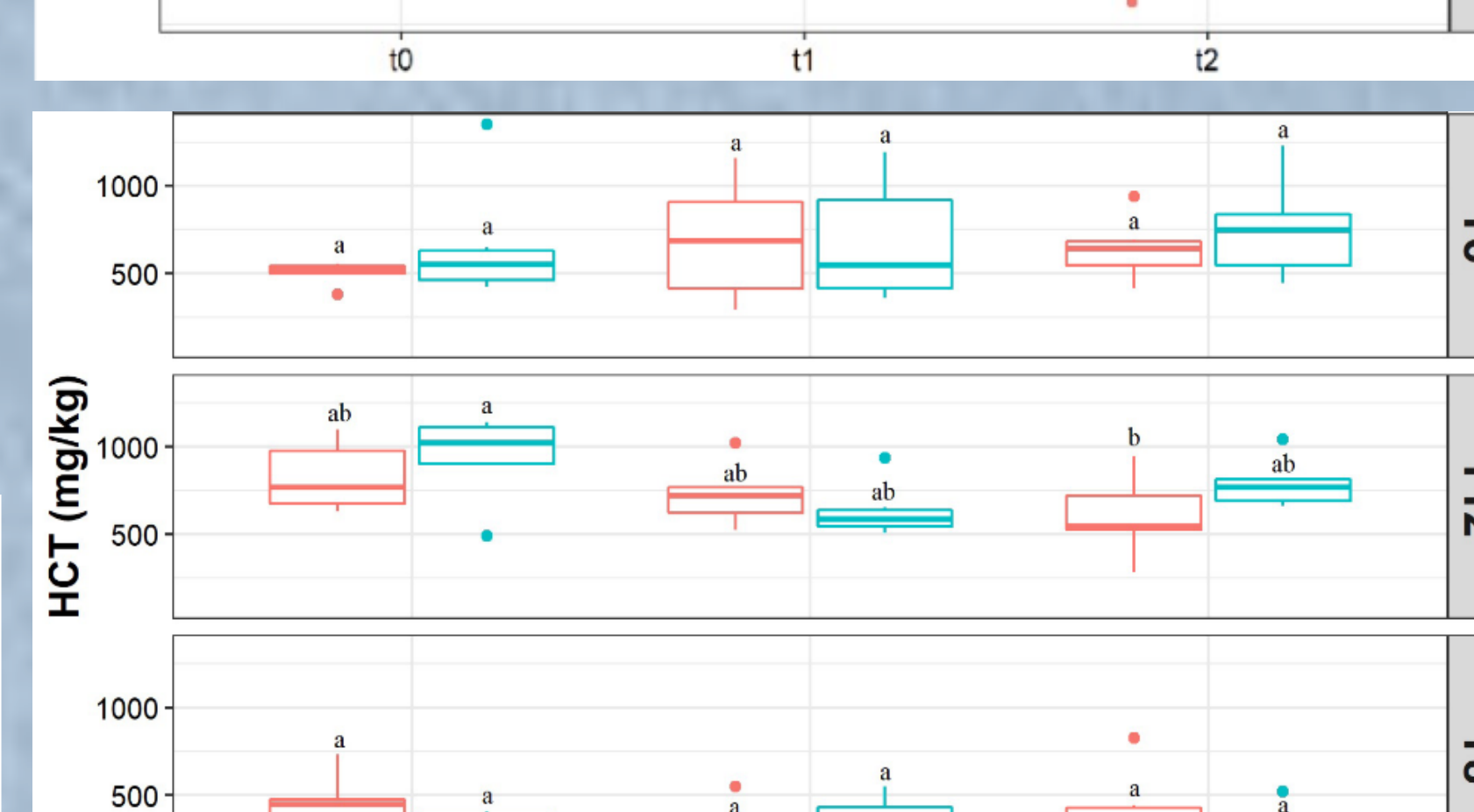
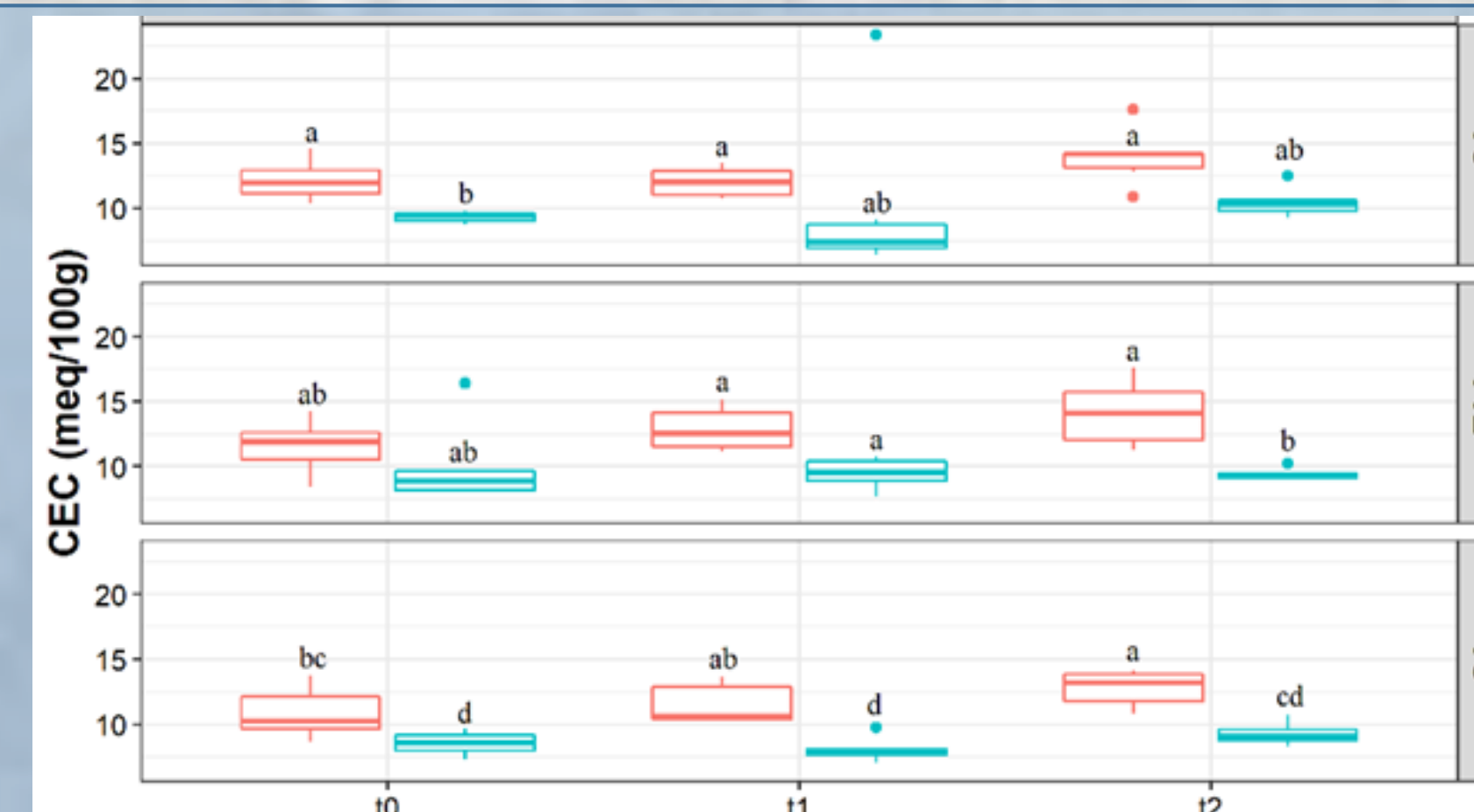
Results and discussion

Phytomangement solution of the moderately contaminated site:

- Agronomic parameters (1 2):
 - Significant impact of the organic amendment on agronomic parameters (CEC, N, P, K > in H1)
 - Apparent homogeneity and stability over time of parameters between the different initial materials (T8, T6, T12).
- Pollution parameters (3 4 5 6):
 - No significant differences observed along the soil profile (n=6 per barplot),
 - Heterogeneity of organic pollutants concentrations,
 - Stabilization of inorganic pollutant over time,
 - No significant evolution of organic pollutants : no highlighting of decomposition by natural and/or rhizodegradation (=> sample heterogeneity over time and long process expected),
 - No transfer observed in the soil water compartment.

Ecosystem productivity and quality:

- Plant growth and performance (7 8 9):
 - At the end of the experiment: 1.5 tonnes of raw material harvested (all leaves and woody species combined), i.e. 10 t_{VM}/ha, after two years of growth (=> lower than usually observed in short rotation coppice: climatic and competition issues)
 - Growth heterogeneity between species.: Alder biomass > Locust biomass (=> Climatic and competition issues)
 - Spatial heterogeneity in the development of the vegetation as a whole (=> slope, soil compaction)



Biomass quality:

- High biomass humidity requiring drying prior to its energy recovery
- Lower calorific value of dry biomass: 17.7 to 18.6 MJ/kg for each of the samples (NF EN ISO 18125) (Common value),
- Dry biomass contains 3-5% of mineral matter (ash content) (higher than the ash levels generally observed in biomass),
- Relatively low nitrogen and sulfur content favorable indicators of smoke quality of combustion with respect to the production of NO_x and SO_x (NF EN ISO 16948, 16994, internal methodology SOCOR PA334)
- Total content of regulated inorganic elements << regulated threshold (NF EN ISO 16967).
- The results of combustion tests (smoke and ash) are being analyzed.

Take home message

This demonstrator in real conditions reveals pollution control in the different compartments, without identifying transfer and highlighting the phytostabilization. It also testifies to a production model that does not deplete the resource, particularly soil nutrients. The results of the analyzes of the aerial biomass harvested point a potential recovery in energy wood production for a local supply chain, given their compliance with the thresholds of the French Biomass Decree (03/08/2018).

¹GINGER-BURGEAP, Département R&D, 19 rue de la Villette 69425 Lyon Cedex 03, France

²UNIVERSITE DE LORRAINE, INRAE, LSE, 54000 Nancy, France

³MICROHUMUS, 3, Allée de Chantilly - 54500 Vandœuvre-lès-Nancy, France

⁴SOL PAYSAGE – 8bis boulevard Dubreuil, 91400 Orsay, France

⁵PROVADEMSE – INSAValor, 66 boulevard Niels Bohr – CS52132, 69603 Villeurbanne, France

⁶NORMANDIE AMENAGEMENT – 1 avenue du Pays de Caen, BP04 14460 Colombelles, France