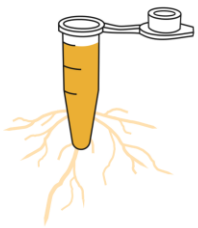

CARROT

***C**ollecting and **A**nalyzing **R**hizodeposits: **R**eviewing and **O**ptimizing **T**ool*

Version: 2026-02-25

User manual - version R Shiny

1 Aims & purpose

CARROT is a decision support tool aiming to guide a user towards the protocol of rhizodeposits collection and analysis best suited for his/her own objectives and constraints. The tool enables to move along a complex decision tree in order to identify options for successive protocol steps that are recommended, alternative or incompatible with the set of choices progressively selected by the user. *CARROT* does not intend to create a complete, operational protocol of rhizodeposit collection & analysis, but rather aims to orientate the user towards the best methods by giving him/her synthetic information.

This document provides practical information about the way to use this tool. A scientific article describing the origin and the associated principles of this tool is referred at the end of this document.

2 How to start *CARROT*

CARROT has been written as an R Shiny application, and can be either:

i) launched online without any installation at the GitHub Page https://frees86.github.io/carrot/

ii) used as an R program by executing the file "app.R" in an R console, available on https://github.com/frees86/carrot

➔ *Note that the file "app.R" needs to be located in the same folder as the folder 'source' containing the supporting tables. Alternatively, writing an explicit path to load the source files in the R script might be necessary.*

3 How to use *CARROT*

After launching the program, the first step is to select one of the five groups of instructions from which to start:

1. Scientific questions & objectives
2. Growth conditions
3. Sampling method
4. Sample treatment
5. Sample analysis

Note: It is recommended to start by "Scientific questions & objectives" and to follow the logical order of these successive groups of instructions. However, the user can choose to go through these groups of instructions in any order, knowing that this order has consequences on the evaluation of the compatibility of successive options to one another.

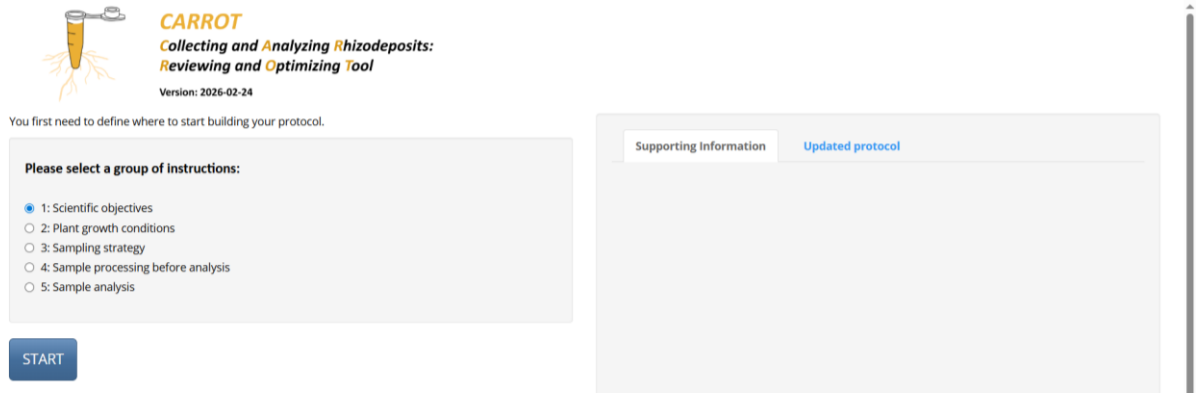

Fig. 1: Starting page of CARROT

The next step is to select one of the possible options corresponding to the first instruction. For this instruction and all subsequent ones, a Supporting Information table is displayed on the right panel and aims to provide relevant, synthetic information to support the decision. Additional information is also usually provided in the companion scientific article.

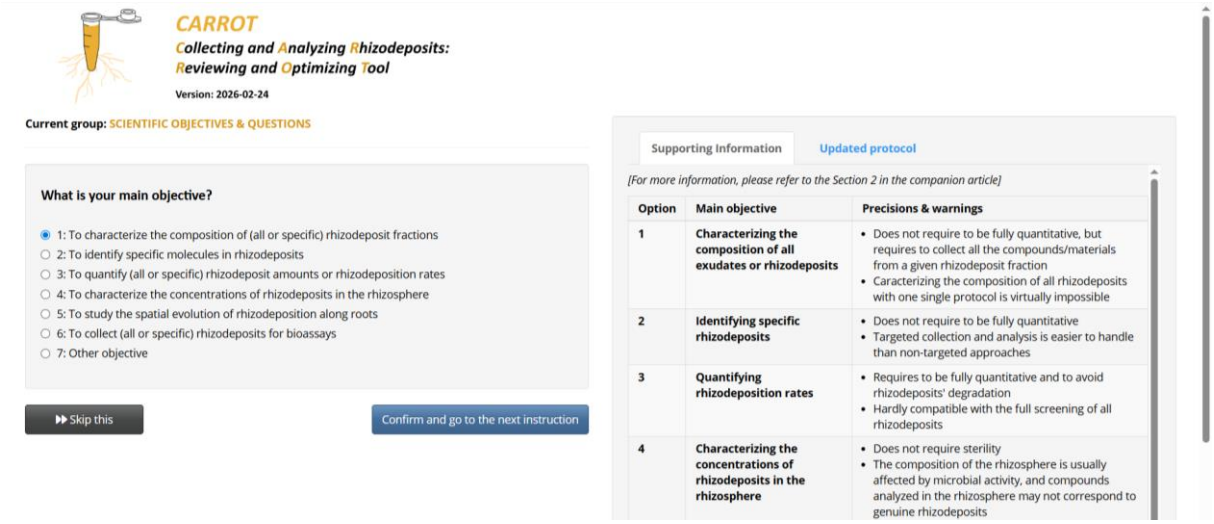

Fig. 2: A decision can be supported by a synthetic table summarizing information about the different options

Once a first option has been selected and the instruction for a new protocol step is considered, a compatibility test is activated, and automatically labels each option as "Recommended", "Possible" or "Incompatible", based on previous choices. The reason for which a given option is deemed incompatible can be further explored by ticking the box "*Show details about incompatible options*" displayed above the instruction.

Note: If all possible options of a given instruction are deemed incompatible with previous choices, the instruction will be skipped and the program will automatically display the next instruction without notice.

Note: Depending on your progression within a given group of instructions, you can click on "Go back" to move back to the previous instruction of the current group of instruction, or click on "Skip this" to move directly to the next instruction without deciding - this may be used in particular to avoid a step to influence the compatibility suggested for the options of the next instructions The decision to skip instruction will appear in the final results (see below).

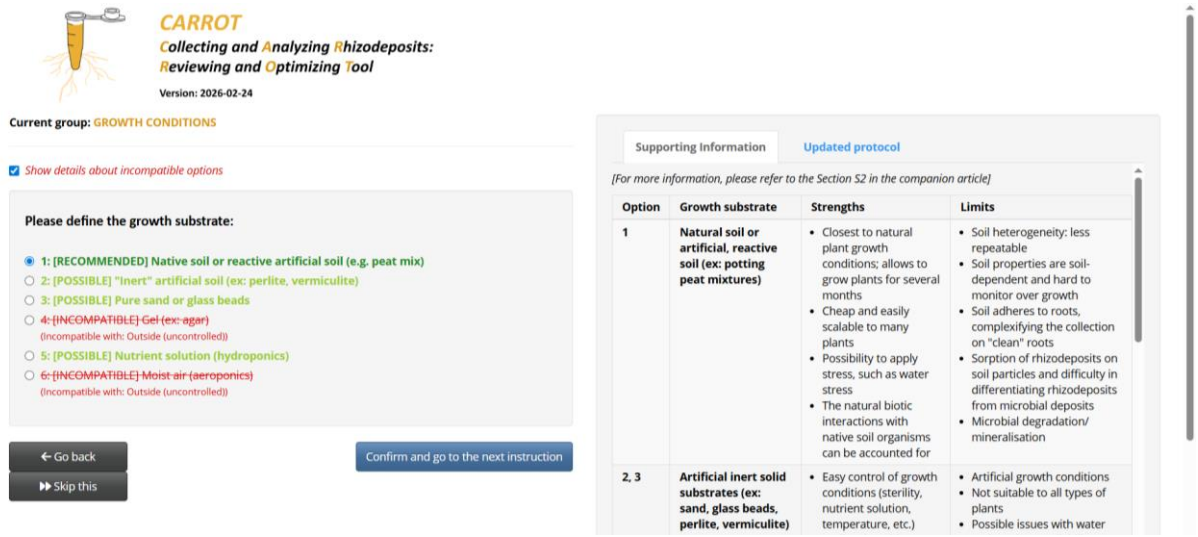

Fig. 3: When options have been deemed incompatible with previous choices, details can be obtained by checking the box "Show details about incompatible options".

Once all possible instructions within one group of instructions have been covered, a new group of instructions can be selected, and the selection procedure can continue. Note that a group of instructions can be revisited later on. In such case, a warning is displayed to confirm the choice, and, when confirmed, the previous choices related to this group of instruction will be overwritten.

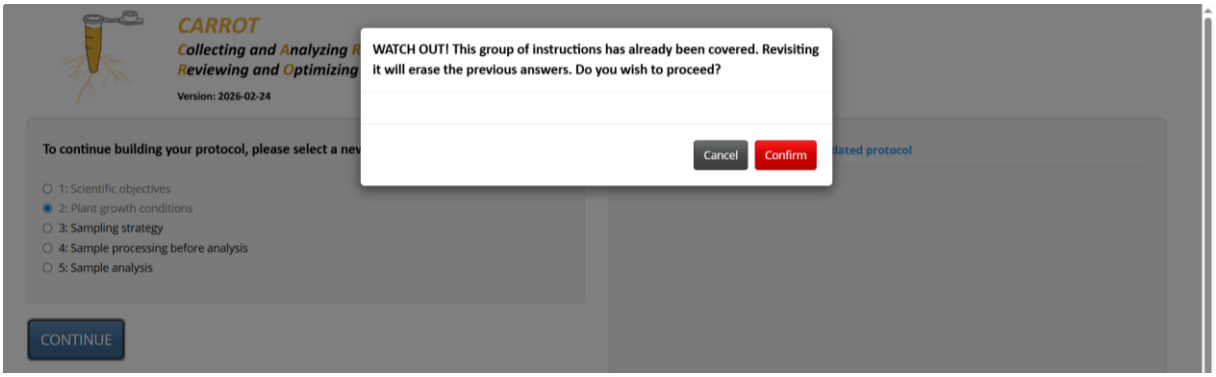

Fig. 4: Selecting an incompatible option remains possible, but raises a warning message.

Once all possible options within each group of instructions - or at any moment within the protocol construction, the user can access and download the resulting protocol corresponding to the selected choices by moving to the tab "Updated protocol". There the user can either:

i) **download the protocol as a CSV file or an Excel file** summarizing the instruction and corresponding choice in each group, as well as detailing the compatibility test for each option,

ii) **download a text file** summarizing the main steps of the protocol.

At this stage, the user can leave or continue the program. Two options are available:

i) **RE-START:** All previous answers will be erased and the program will reinitialize at the starting page.

ii) **RESUME:** The user can reconsider one of the previously visited groups of instruction. If so, the answers corresponding to this group of instructions will be erased, but other previous answers will be kept and will influence the compatibility of options of the revisited group.

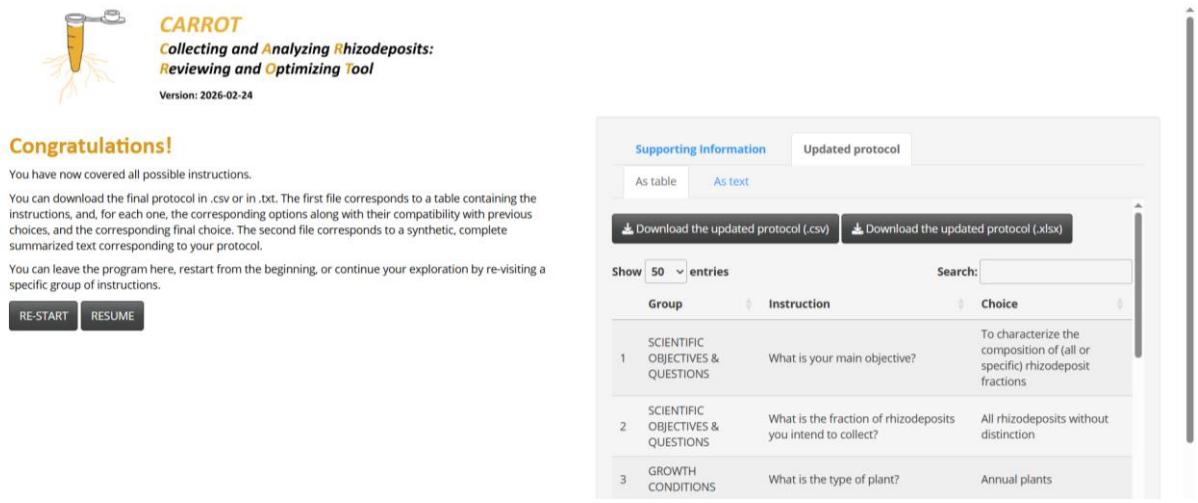

Fig. 5: The results can be checked and downloaded at any time by reaching the tab "Updated protocol" on the right.

4 Troubleshooting

To report bugs, persisting issues or possible improvements, please contact Frédéric Rees (frederic.rees@inrae.fr).

5 Credits

This works originates from discussions held within the French network *RhizosPHARE* and the previous project *PHARE* (2021-2022) funded by INRAE.

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6 Reference

The decision support tool *CARROT* is associated to the following scientific article:

> Frédéric Rees, Virginie Lauvergeat, Gabin Piton, Aude Tixier, Sylvain Chéreau, Sylvie Dinant, Barbara Pawlak, François Perreau, Emmanuelle Personeni, Jean-Bernard Pouvreau, Anouk Zancarini, Jean-Benoît Peltier, and Agnès Attard (2026). **Unlocking research on rhizodeposition: a step-by-step guide for producing, sampling and analyzing rhizodeposits**. Currently under reviewed by the *Peer Community In Plants*.