



## Innovative tool to reduce the arduousness of technical planting operations: the redesigned planting pickaxe

### Introduction

In the context of climate change, planting appears to be a major tool for guaranteeing the adaptation and sustainability of forests. In recent years, planting has undergone a major boom with the introduction of the economic relaunch plan. However, the various players involved, particularly forestry operators, have expressed difficulties with these operations. These operations are acknowledged to be arduous and give rise to work-related illnesses and accidents, such as musculoskeletal disorders. Frontal bending is the main biomechanical stress to which operators are subjected.

The aim of the PIF project was to develop plantation management methods that meet the social and environmental expectations expressed by stakeholders. One of the aims of the project was to determine the various characteristics of the planting tool that would improve ergonomics and optimise the efficiency of the actions carried out by the operator.

### Methodology and results

Three tools were selected and two series of tests were carried out with two different teams of workers in contrasting soil and climate conditions. The tool characteristics evaluated were: the length of the handle and its composition, the weight of the tool, the width of the pick and the width of the axe. The workers highlighted the need for a light, easy-to-handle pickaxe with a wide blade (necessary for stripping and making manual pot planting), as well as a long axe and a wooden handle. They also expressed the desire to be able to test other tools with longer handles. The aim of the second test was to determine the effect of the length of the tool handle on the operators' frontal flexion. Workers were asked to plant first with a conventional tool with a handle measuring one metre and then with a longer handle measuring one metre and thirty centimetres. Four experienced workers had to strip the soil using the tool's pick to gain access to the soil (stripping phase) and then split the soil with the axe and pick to create the location for the seedling (planting phase). Frontal flexion was measured by filming the operations during these two phases, and the videos were processed using Kinovéa software. The angular kinematics data showed that the length of the tool handle had an effect on the planter's posture, and that a longer handle would allow the planter to straighten up and reduce biomechanical stress.

There were differences between individuals, which can be explained in part by the size of the individuals, but also by the techniques and postures adopted. However, the number of workers tested was not sufficient to carry out statistical tests and therefore to establish the significance of the results.

## Lessons learned

This work enabled us to identify a type of pickaxe that would optimise the planting of forest plants. The length and width of the pane and the axe were reworked to improve seedling placement and limit the number of pickaxe strokes. The length and material of the handle will be adapted to the user. The length of the handle and the material of the handle will have to be adapted to the user. It is important to note that the prototypes created during the PIF project were a great success with the operators, some of whom have continued to work with them. The various results suggest that workers need to have a range of different tools at their disposal, rather than a single tool, in order to adapt to the different sites and conditions they encounter. It would also be useful to continue testing these tools on a wider panel of operators, and also in contrasting soil and climate conditions, in order to be able to statistically determine the benefits and limitations of the tool, and also to refine the recommendations according to operator profiles.



*Figure 1. Planter using a pickaxe on a worksite: slot planting of a calocedar root ball on prepared ground.  
Sylvain Gaudin © CNPF*

The information presented in this factsheet was developed by the FOREST4EU partner, drawing on the innovations and knowledge generated by the indicated operational group with their explicit authorization.

## Further information

<https://renfor.hub.inrae.fr/projets/pif#:~:text=Le%20projet%20C2%AB%20Plantations%20Innovantes%20en,exprim%C3%A9es%20par%20les%20diff%C3%A9rents%20acteurs.>



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