

# “AUTOPE” Project – Automation and mechanization to reduce arduous work in market gardening, fruit growing, viticulture, nurseries, medicinal and aromatic plant production



santé  
famille  
retraite  
services



# Action 1: Inventory of physical assistance and mechanization devices

# Reminder

## Operational objectives of the action:

- Inventory of physical assistance programs and agricultural technologies

Adapting these systems to different types of operations or areas of activity

Demonstration or presentation day for equipment (experimental sites)

## 2 sub-actions:

- Action 1.1: Inventory of physical assistance and mechanization devices
- Action 1.2: Development of a guide by sector and type of farm

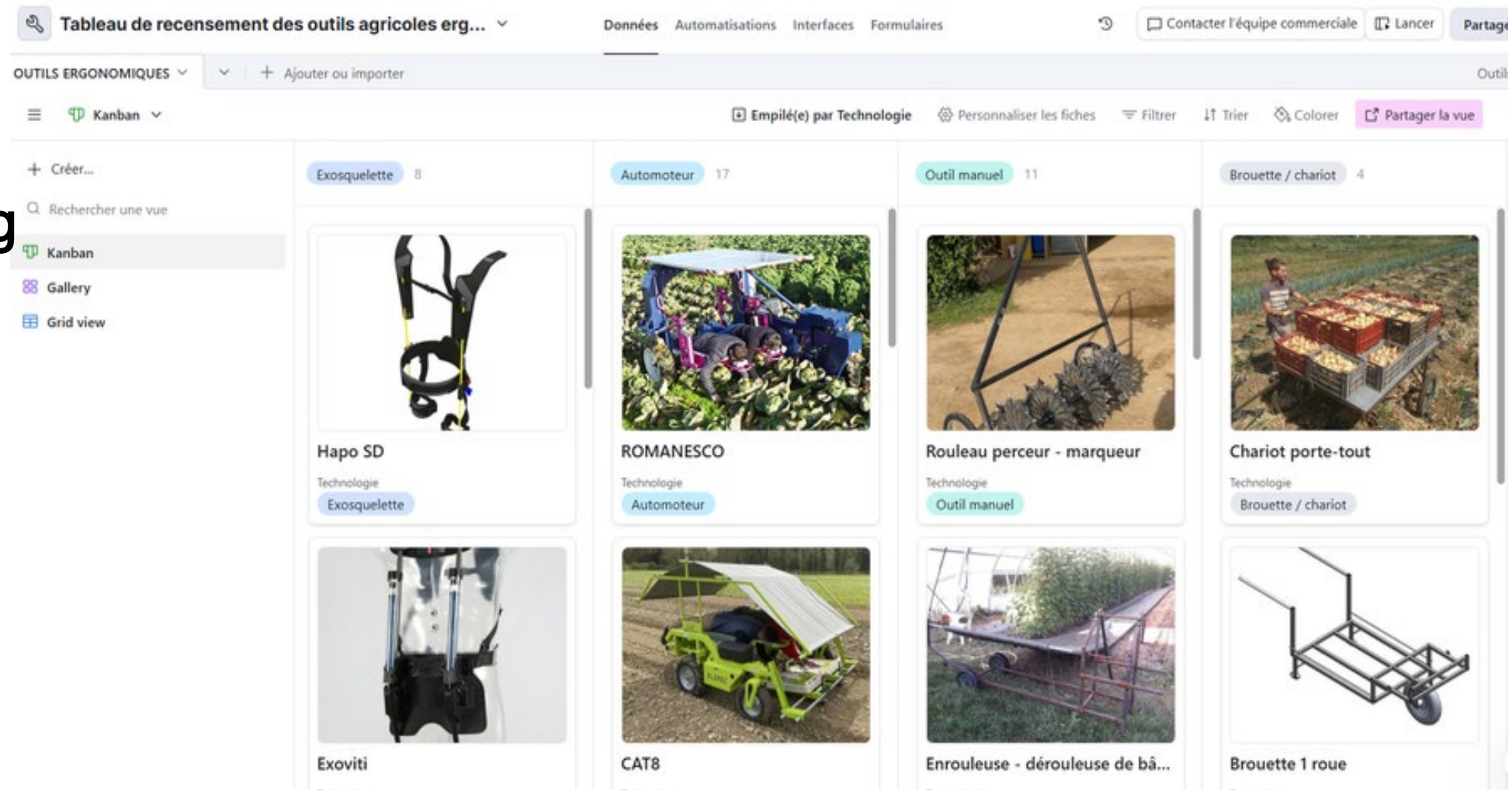
# AIRTABLE

Table listing the monitoring devices for AUTOPE equipment.xlsx

This led to the development of the Airtable spreadsheet:

<https://airtable.com/appIfOhW6W4F9oGtH/shrQPUXW1pchZWPhl>

Objective: to continue monitoring and amending it each year



# Action 2: Ergonomic study of working postures



# Reminder

## Operational objectives of the action:

- Development of a questionnaire on the perception of the arduousness of different work positions based on a grid of indicators qualifying the degree of arduousness of tasks in agricultural production as said by farmers, used for the evaluation in work situations of physical assistance devices and testing of exoskeletons in production (horticulture, kiwi orchards, chestnuts, market gardening, viticulture).
- Gathering information from experimenters and operators in companies

Analysis of work postures with or without physical assistance devices

## 3 sub-actions:

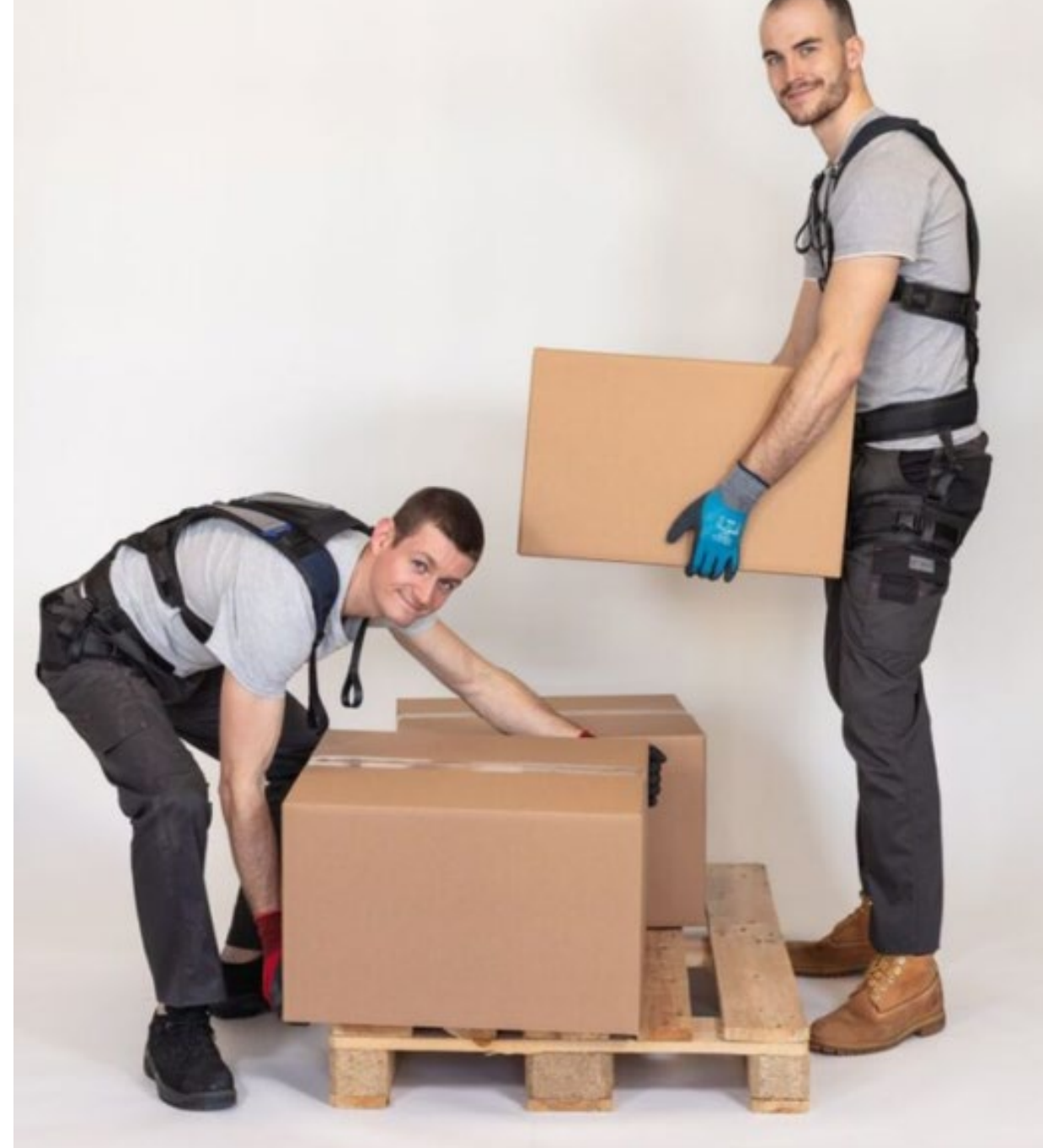
- Action 2.1: Ergonomic assessments of certain farming operations
- Action 2.2: Development of an ergonomic monitoring methodology
- Action 2.3: Ergonomic assessment of workstations



Plum' (HMT)



Biscoe



Liftsuit (auxivo)

# Action 3: Analysis of working times (site output) and economic study (depreciation)

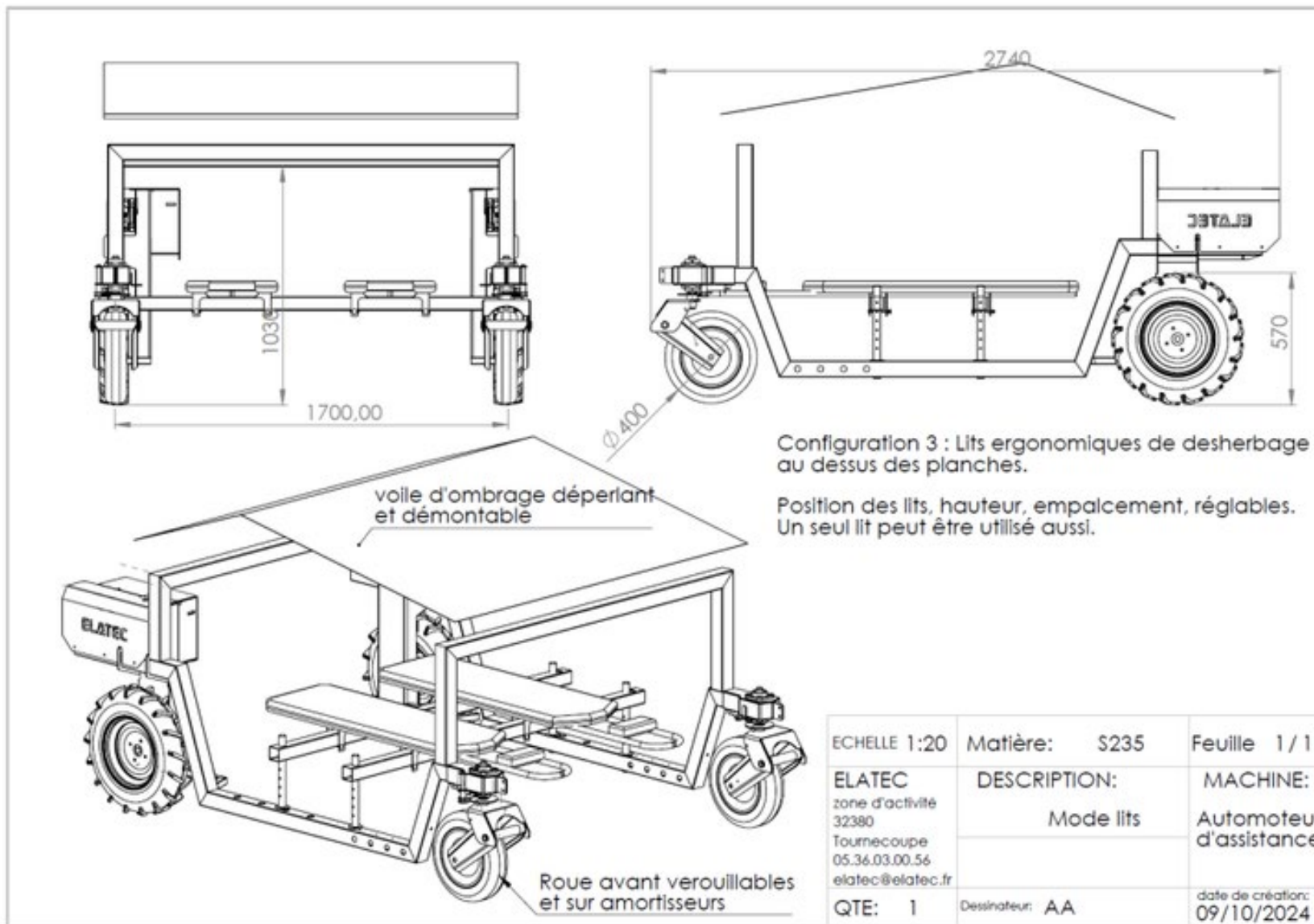
# Reminder

## Operational objectives of the action:

- Analysis of work times with and without physical assistance devices
- To measure the agronomic and economic impact of the different tools used on the vigor, production and economic yield of the orchard
- Economic study: investment, amortization period, labor time savings, calculation of production costs
- Socio-technical study: to evaluate and qualify the relevance of physical assistance devices in the details of work on farms: impact on well-being and the arduousness of tasks, work performance, and clarification of the limits of their use for the management of associated risks (weakness, overload, stress, ..).

# modular straddle

- Elatecstraddletractor: plantingseatmode, weedingbed market gardening □ planting, manual weeding, harvesting

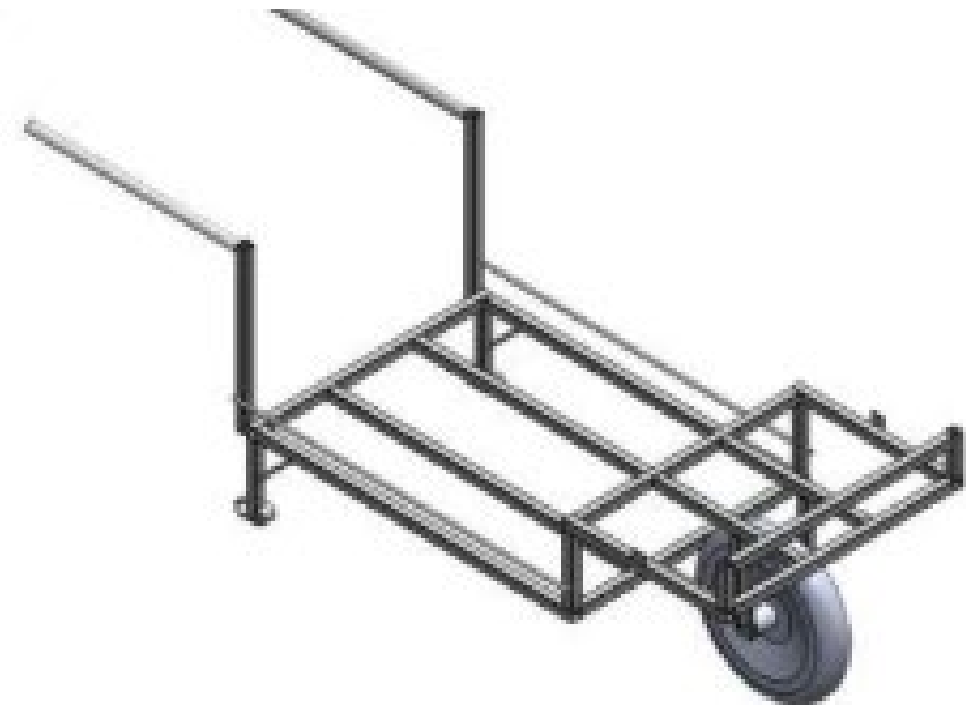


## 3 possibilities:

- "Sliding butt" seat mode
- Weed bed mode
- Swivel seat mode

# wheelbarrows

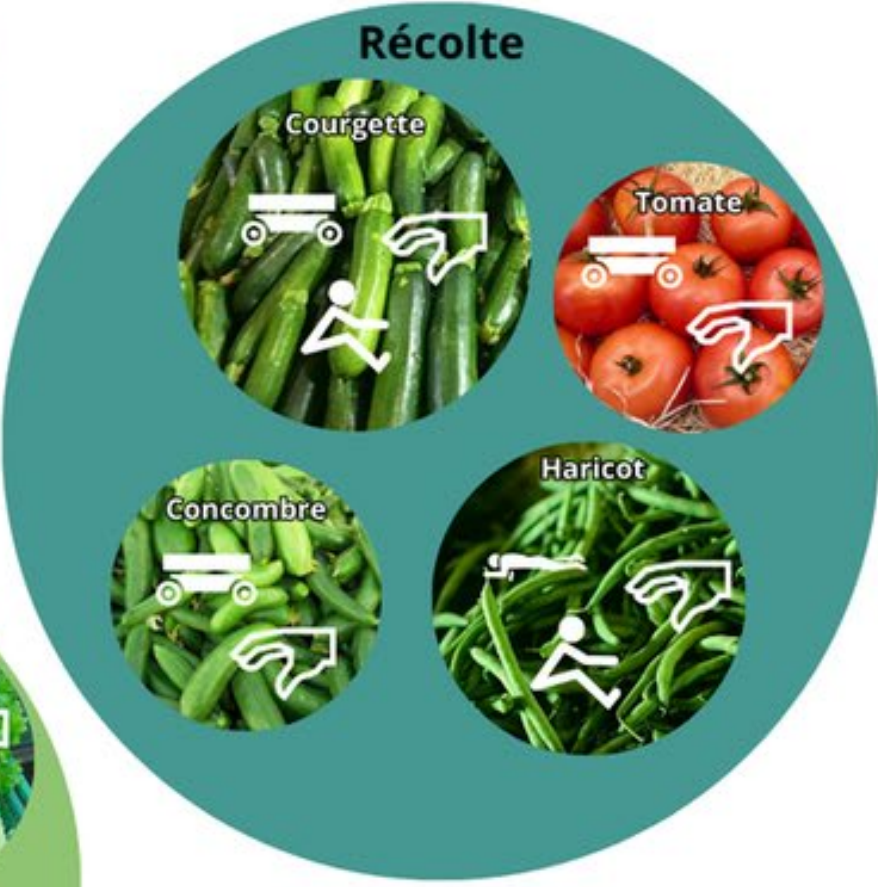
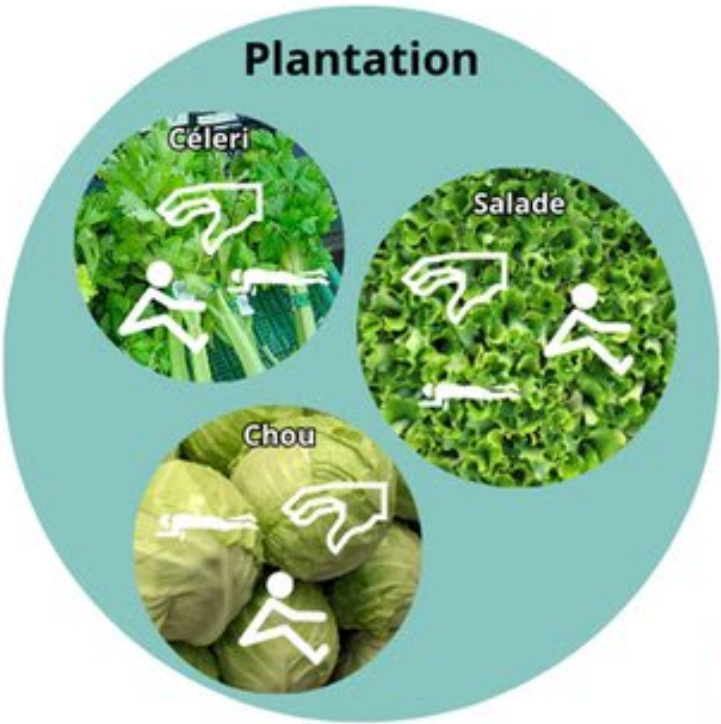
- Load-carrying trolleys, electric or not: Elate or Atelier paysan market gardening  harvest



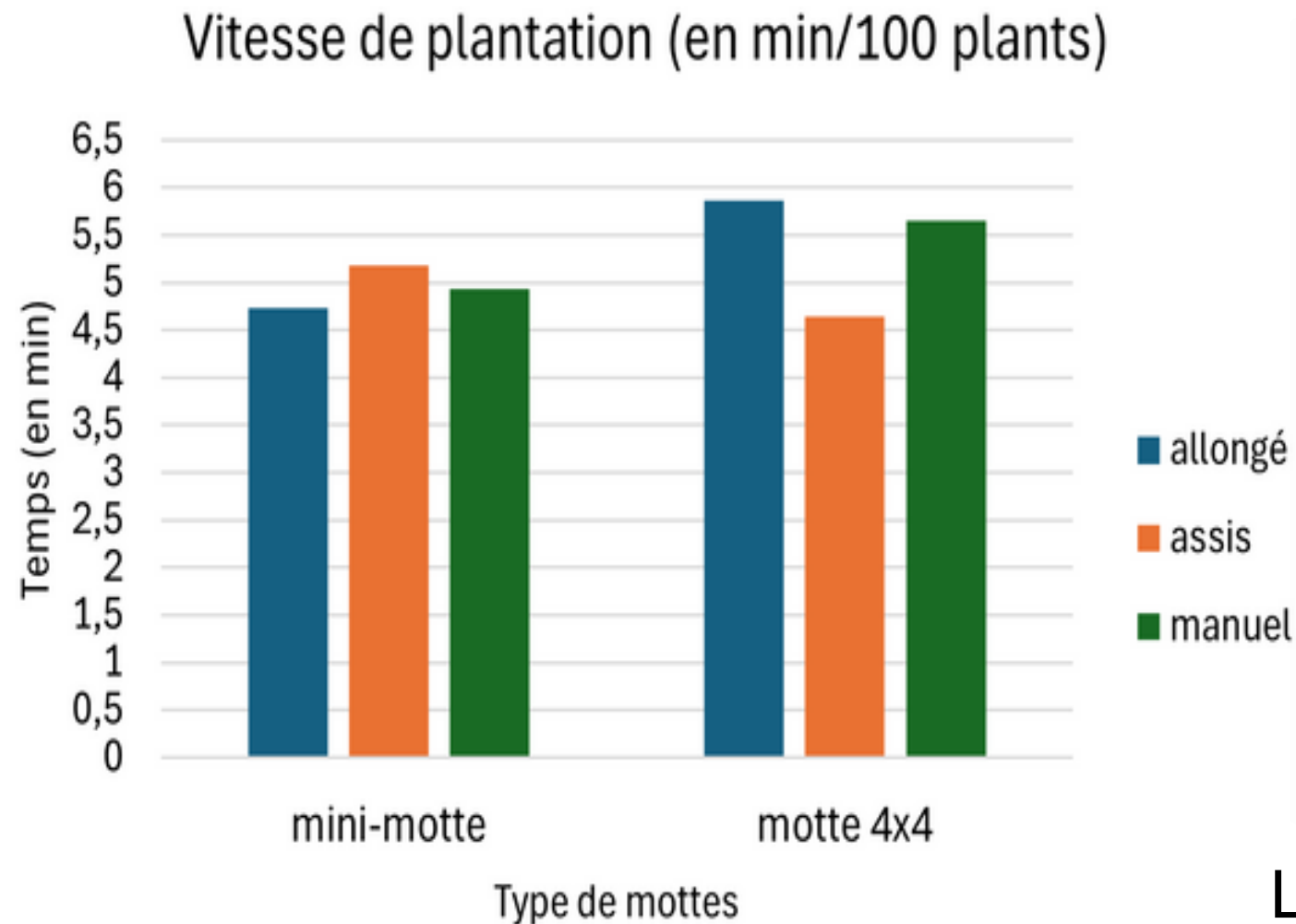
# Materials & Methods

## Positions

-  Manuel
-  Chariot
-  Sat
-  Layer



# Technical and economic results



Vitesse au plateau	Allongé	Assis	Manuel
Mini-mottes (240 mottes)	4min 43s	5min 10s	4min 56s
Mottes 4x4 (150 mottes)	5min 51s	4min 38s	5min 39s

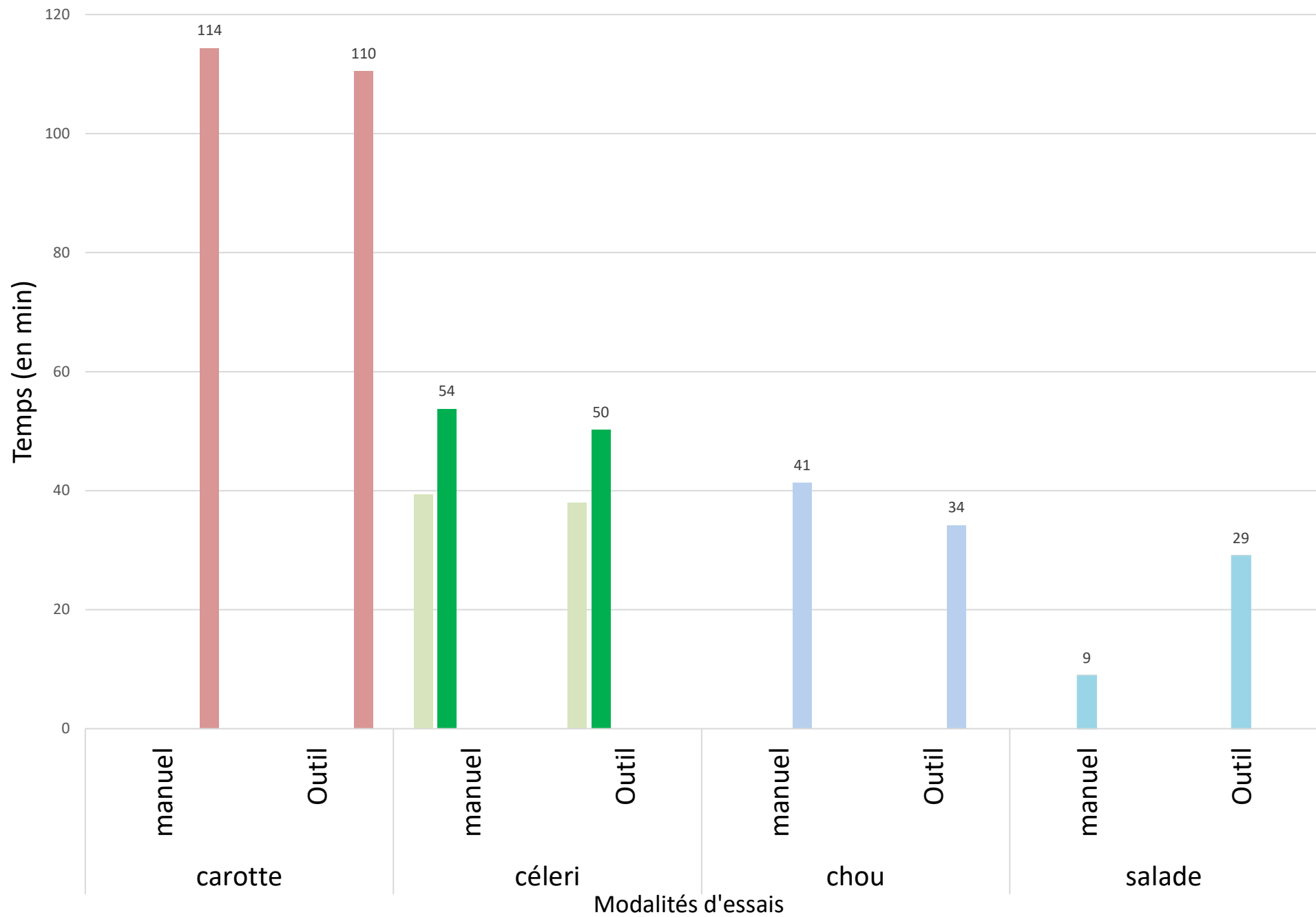
Little or no time saved at planting

The planting site was not long enough.

Significant variability between operators and soil preparation conditions

# Technical and economic results

Temps de désherbage (en min/100m<sup>2</sup>)



Significant variability between operators (MO vs. trainee!)

Row +/- dirty Heterogeneity trial grassing between rows

Carrot in 4 rows. Advancement by making 2 rows/operator -> start&stop

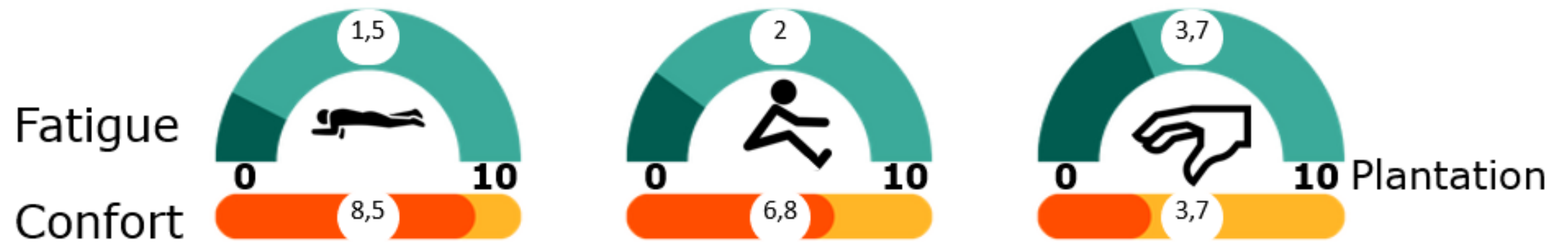
Comparison with continuous feed and 1 row/operator

# Technical and economic results

Moyenne réduite Rdt/opérateur	Culture	Tomate	Concombre	Haricot	Courgette
Méthode					
Manuel		67,6 kg/h	180,2 kg/h	4,2 kg/h	136,0 kg/h
Chariot		77,3 kg/h	229,2 kg/h		131,5 kg/h
Outils (assis)				3,9 kg/h	122,8 kg/h
Outils (couché)				3,6 kg/h	
Outils (couché CL)				4,3 kg/h	
Références (BTM Rhône)		90 kg/h		12 kg/h	60 kg/h
Références (CTIFL (projet MIPS))		120 kg/h		7,3 kg/h	120 kg/h




# Rating of hardship criteria

## ◦ Preliminary results



This needs to be considered with a longer construction project, particularly regarding the reclining position.



Number of trials			
Plantation	5	5	5
Weed control	15		11

# 1st results – EMA / producer planting bed

## • Positive points

Silence  
battery charge  
  
headrest  
Bed cutout at shoulder level  
Bed can be tilted



10 trays/hour/person

Bed tilt  
Comfortable cushion  
Easy position change between each platform  
Easy to change position



16 trays/hour/person

## • Negative points

Missing tray holder  
Forward speed not maintained as soon as on a slope

Noisy, exhaust  
1 tractor driver, therefore 4 people  
Lack of head support = neck tension

Tight at 3  
Elbow hits the bed

# 1st results – EMA / producer planting bed



# 1st results – EMA / producer planting bed



Headrest. Bed cutout at shoulder level.

# 1st results – EMA / producer planting bed



# 1st results – EMA / producer planting bed

## • Positive points

Silence, battery charging

3 people  
Anticipation possible, + visibility

10 trays/hour/person

2 people on the footrest  
+ 1 in the middle

More comfortable because it's closer to the ground  
Legs better positioned  
Less tight  
Improved visibility on wheel adjustment

12 trays/hour/person

## • Negative points

Missing tray holder  
Forward speed not maintained as soon as on a slope

Reduced wheel visibility for adjusting driving  
Back pulled back, hunched position  
= amplify with different morphologies

Twist for those in the footwell



# 1st results – EMA seated



# 1st results – EMA seated footbridge



# 1st results – EMA seated footbridge



# Ctifl test visit 08 -07 -2025



- Mechanical weeding of basil

Sowing basil seeds in a 1.6m bed with 4 rows

2 tools tested: the Kult guided hoe attached to

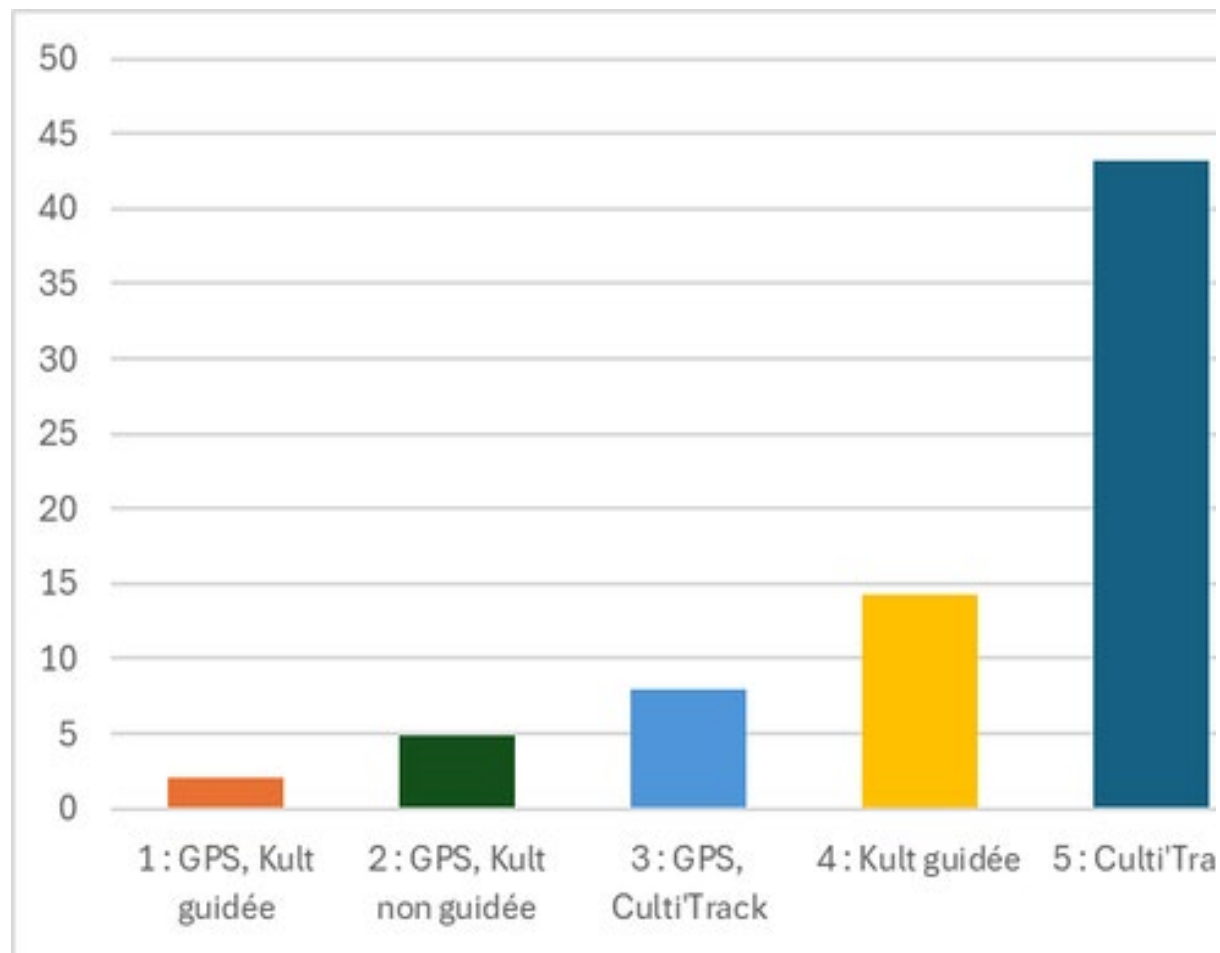
the tractor, and the Culti'track from Terrateck

(a selfpropelled tool carrier, does not require a tractor)

modality	1	2	3	4	5
Semis GPS	YES	YES	YES	NON	NON
weeding	tractor + guided cultivator	tractor and hoeing machine jammed (no one is guiding the hoeing machine)	Culti'Track	tractor and guided hoe	Culti'Track

# • Mechanical weeding of basil

## Crop destruction rate



Percentage of crop beds destroyed by the weeding tool.

GPS sowing (moda 1, 2, 3): significantly lower destruction rate

Moda 1 and 2: Kult hoeing attached to the tractor + GPS: less than 5% crop destruction.

(if guided by an operator: 2% destruction; without a guide: 4.9%) mode 3: when used with the Culti'Track: 7.9% destruction

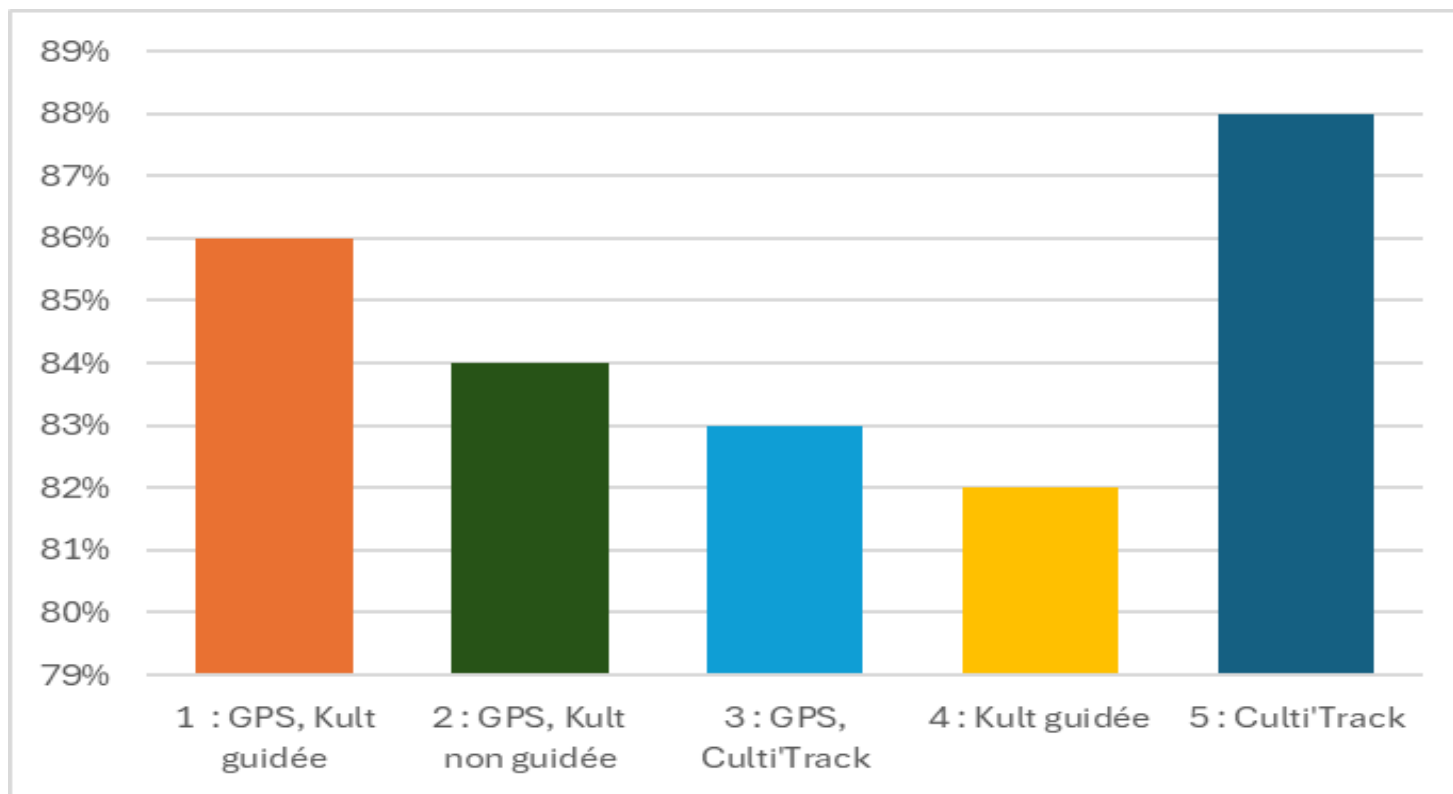
Seeding without GPS (modes 4 and 5):

- guided hoeing machine 14% destruction
- Cultitrack :43% de destruction

/!\ Kult hoeing machine already known to operators (no adaptation time needed) unlike the Cultitrack (discovery of the tool and first use)

# • Mechanical weeding of basil

## Weeds



Reduction in the number of weeds compared to the pre-hoeing assessment [?] 82% to 88% fewer weeds after hoeing

Similar results between the methods [?] No differences in effectiveness depending on the weeding tools used.

Reduction (%) in the number of weeds compared to the pre-hoeing count

- Manual weeding of basil: Glider 500 Terrateck weeding bed



- Manual weeding of basil: Glider 500 Terratec weeding bed

Trials: 10 microplots (4m x 1.6m)

Half weeded by hand, half weeded with a weeding bed

Benefits	Disadvantages
Comfortable, pain-free position	Sweating at the headrest (forehead)
Easy to use (steering controls at foot level + remote control)	Forward speed + lower
Possibility of installing shade	It's not possible to help the other person if the soiling is uneven.
	Wet ground: risk of slipping (difficult steering)

manual weeding:  
 - heavy (mud) shoes  
 - impossible to get down on the ground

# • Pellenc cultivation weeding hoe



Benefits	Disadvantages
Effective	Adaptation time (handling, organization, battery management)
Time saving	Vibrations (arm pain upon first use)

Testing other blade models: gain in precision?