# USAGE REPORT

| | | | |
|---|---|---|---|
| **Vehicle:** | SRBC 17 | **Date:** | 24/06/2026 |
| **Location:** | La Crau | **Missions:** | 2 |

## Mission 1

| | |
|---|---|
| **Trial date** | 2026-06-24 |
| **Location** | La crau, Provence Alpes Côte d'Azur, France |
| **Operator** | Johan |
| **Start time** | 13:00 |
| **End time** | 14:59 |
| **Weather** | |
| **Precipitation type** | None |
| **Temperature** | 40 °C |
| **Sun position** | Zenith |
| **Terrain** | |
| **Slope** | 1 % |
| **Cross slope** | 2 % |
| **Soil** | |
| **Texture** | Silty loam |
| **Dominant particle size** | Sand 0.05-2 mm |
| **Moisture condition** | Dry (hard) |
| **Crop** | |
| **Species** | Pomme de terre douce |
| **Growth stage** | Early vegetative |
| **Weed pressure** | 0 % |
| **Planned operation** | Hoeing |
| **Adjacent environment** | |
| **Tall vegetation** | Yes |
| **Tall buildings** | No |
| **Metallic structures** | No |
| **Ditch or embankment** | Yes |
| **High voltage lines** | No |

| | |
|---|---|
| **Roads** | No |
| **No network zone** | No |
| **Robot configuration** | |
| **Robot weight** | 250 kg |
| **Robot width** | 0.64 m |
| *Tool* | |
| **Tool name** | Bineuse |
| **Tool type** | Mounted |
| **Tool weight** | 30 kg |
| **Tool length** | 1.0 m |
| **Tool width** | 0.6 m |
| **Tool height** | 0.6 m |
| **Tool total length** | 1.1 m |
| **Working depth** | 0.1 m |

*Figure 1.1: Mission presentation photo*

# Mission presentation

| Mission parameters | |
|---|---|
| **Task to perform** | Binage parcelle |
| **Trajectory** | Rectiligne, square turn |
| **Working speed** | 2 km/h |
| **Mission file** | Patate.json |

| Organization | |
|---|---|
| *Workforce* | |
| **Total number of employees** | 1 |
| *Surface* | |
| **Worked plot surface** | 0.022 ha |
| **Plot fragmentation** | Consolidated (<0.5 km) |

## Trajectory

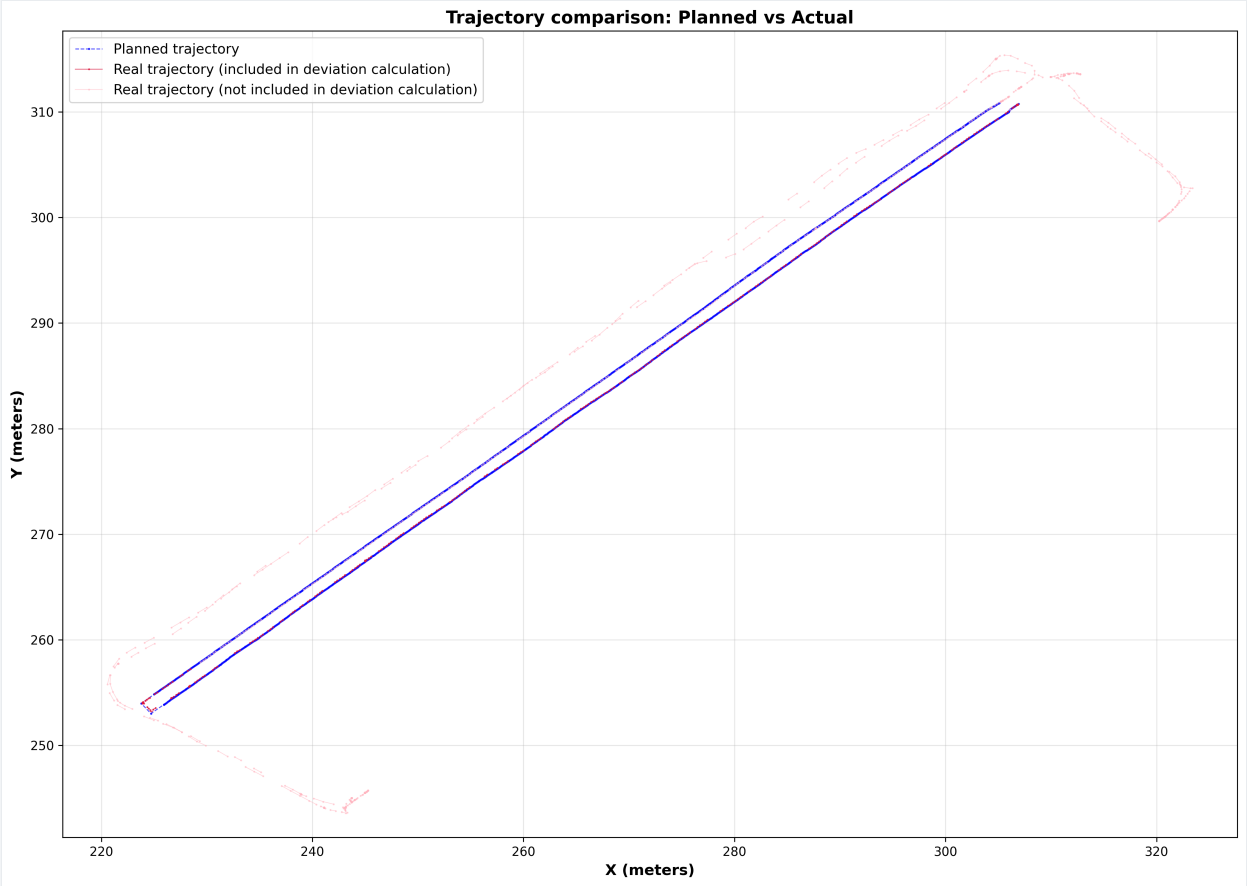



*Figure 1.1: Planned vs actual trajectory comparison*

# Agronomic Summary

| | |
|---|---|
| **Energy per hectare** | 8.24 kWh/ha |

| | |
|---|---|
| **Work rate** | 0.02 ha/h |
| **Autonomy per battery** | 0.31 ha/batterie |

**Time tracking**

| | |
|---|---|
| **Tool setup** | 5 min |
| **GPS connection wait** | 0 min |
| **Wi-Fi connection wait** | 0 min |
| **Supervision time** | 60 min |
| **Travel time** | 0 min |
| **Restart count** | 0 |
| **Stop count** | 0 |

**Work assessment**

| | |
|---|---|
| **Quality assessment** | Very satisfied |
| **Crop damage** | None |

**Before work**

**After work**

## Performance Indicators

### Agronomic [1]

| Indicator | Value | Unit |
|---|---|---|
| Crop species | Pomme de terre douce | |
| Growth stage | Early vegetative | |
| Soil texture | Silty loam | |
| Soil moisture | Dry (hard) | |
| Weed pressure | 0 | % |
| Planned operation | Hoeing | |
| Work quality assessment | Very satisfied | |

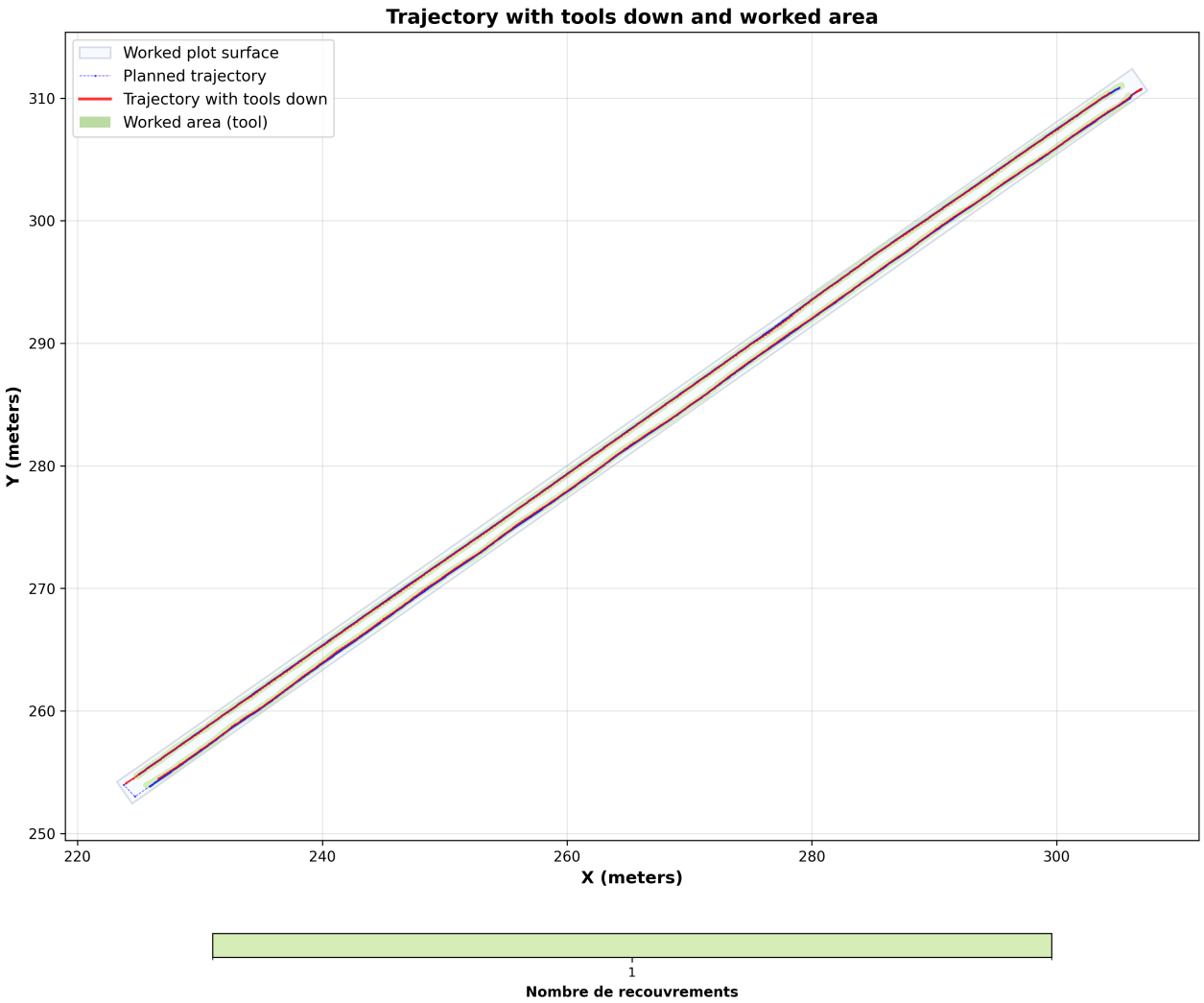
| Indicator | Value | Unit |
|---|---|---|
| Crop damage | None | |

## Energy [2]

| Indicator | Value | Unit |
|---|---|---|
| SOC at start | 70.23 | % |
| SOC at end | 62.39 | % |
| Total discharge [3]<br>*For a battery pack capacity of: 2.54 kWh* | 11.40 | % |
| Total energy consumed | 0.29 | kWh |
| Average power | 0.15 | kW |
| Energy per hectare | 8.24 | kWh/ha |
| Autonomy per battery<br>*Reference battery: 2.54 kWh* | 0.31 | ha/batterie |

## Work Rate [4]

| Indicator | Value | Unit |
|---|---|---|
| Work rate [5] | 0.02 | ha/h |
| Area covered [6] | 0.04 | ha |
| Worked plot surface [7] | 0.02 | ha |
| Worked area [8] | 0.01 | ha |
| Effective area [9] | 0.01 | ha |
| Coverage rate [10] | 0.00 | % |
| Average speed (km/h) | 0.87 | km/h |
| Max speed (km/h) | 3.60 | km/h |




## Economic [11]

| Indicator | Value | Unit |
|---|---|---|
| Electricity price | 0.19 | €/kWh |
| Labor cost per hour | 18.00 | €/h |
| Employees assigned | 0 | |
| Labor cost per hectare | 0.00 | €/ha |
| Energy cost | 0.06 | € |
| Energy cost per hectare | 1.56 | €/ha |
| Total cost | 0.06 | € |
| Total cost per hectare | 1.56 | €/ha |

## Environmental [12]

| Indicator | Value | Unit |
|---|---|---|
| Temperature | 40 | °C |

| Indicator | Value | Unit |
|---|---|---|
| Precipitation type | None | |
| $CO_2$ emissions [13]<br>*Emission factor applied: 317 g $CO_2$ per kWh.* | 0.09 | kg |
| Plot fragmentation | Consolidated (<0.5 km) | |

## Mission [14]

| Indicator | Value | Unit |
|---|---|---|
| Planned distance [15] | 201.12 | m |
| Performed distance [16] | 549.97 | m |
| Distance deviation | 348.85 | m |
| Performed distance (%) | 273.45 | % |
| Mean lateral deviation<br>*Without half-turn* | 4.63 | cm |
| Max lateral deviation<br>*Without half-turn* | 19.99 | cm |
| Mean lateral deviation (tool)<br>*Without half-turn, tool distance: 110 cm* | 12.05 | cm |
| Max lateral deviation (tool)<br>*Without half-turn, tool distance: 110 cm* | 19.79 | cm |
| Worked rows [17] | 2 | |

## Operational [18]

| Indicator | Value | Unit |
|---|---|---|
| Robot weight | 250.00 | kg |
| Tool weight | 30.00 | kg |
| Total weight | 280.00 | kg |
| Energy per kg per hectare | 0.03 | kWh/kg/ha |
| Mean torque at work (% of nominal) [19]<br>*Reference nominal torque: 2.39 N·m — Number of motors: 2.* | 31.16 | % |

## Safety [20]

| Indicator | Value | Unit |
|---|---|---|
| Geofencing exits | 5 | |
| Time outside geofencing (seconds) | 2244.43 | s |
| Time outside geofencing (hours) | 0.62 | h |
| Local emergency stops | 0 | |

| Indicator | Value | Unit |
|---|---|---|
| Remote emergency stops | 0 | |
| Bumper activations | 0 | |

## Reliability [21]

| Indicator | Value | Unit |
|---|---|---|
| Output errors | 0 | |
| Input errors | 0 | |
| Battery errors | 0 | |
| Motor errors | 1 | |
| Cylinder errors | 1 | |
| Total errors | 2 | |
| Output error time (seconds) | 0.00 | s |
| Input error time (seconds) | 0.00 | s |
| Battery error time (seconds) | 0.00 | s |
| Motor error time (seconds) | 0.31 | s |
| Cylinder error time (seconds) | 0.06 | s |
| Total error time (seconds) | 0.37 | s |
| Error rate per hour | 1.06 | /h |
| System availability | 99.99 | % |

## Localization [22]

| Indicator | Value | Unit |
|---|---|---|
| Localization errors | 2 | |
| Error time (seconds) | 53.53 | s |
| Error time (hours) | 0.01 | h |

## Time [23]

| Indicator | Value | Unit |
|---|---|---|
| Total duration | 6788.68 | s |
| Total duration (hours) | 1.89 | h |
| Active time | 1249.33 | s |
| Active time (hours) | 0.35 | h |
| Inactive time | 5539.35 | s |
| Inactive time (hours) | 1.54 | h |

| Indicator | Value | Unit |
|---|---|---|
| Active time (%) | 18.40 | % |
| Inactive time (%) | 81.60 | % |

# Mission 2

| | |
|---|---|
| **Trial date** | 2026-06-24 |
| **Location** | La crau, Provence Alpes Côte d'Azur, France |
| **Operator** | Johan |
| **Start time** | 15:00 |
| **End time** | 16:43 |
| **Weather** | |
| **Precipitation type** | None |
| **Temperature** | 40 °C |
| **Sun position** | Zenith |
| **Terrain** | |
| **Slope** | 1 % |
| **Cross slope** | 2 % |
| **Soil** | |
| **Texture** | Silty loam |
| **Dominant particle size** | Sand 0.05-2 mm |
| **Moisture condition** | Dry (hard) |
| **Crop** | |
| **Species** | Carotte |
| **Growth stage** | Bare soil |
| **Weed pressure** | 0 % |
| **Planned operation** | Sowing |
| **Adjacent environment** | |
| **Tall vegetation** | Yes |
| **Tall buildings** | No |
| **Metallic structures** | No |
| **Ditch or embankment** | Yes |
| **High voltage lines** | No |
| **Roads** | No |
| **No network zone** | No |
| **Robot configuration** | |
| **Robot weight** | 250 kg |
| **Robot width** | 0.64 m |

*Tool*

| | |
|---|---|
| **Tool name** | Semoir |
| **Tool type** | Mounted |
| **Tool weight** | 10 kg |
| **Tool length** | 1.0 m |
| **Tool width** | 0.2 m |
| **Tool height** | 0.6 m |
| **Tool total length** | 1.1 m |
| **Working depth** | 0.05 m |

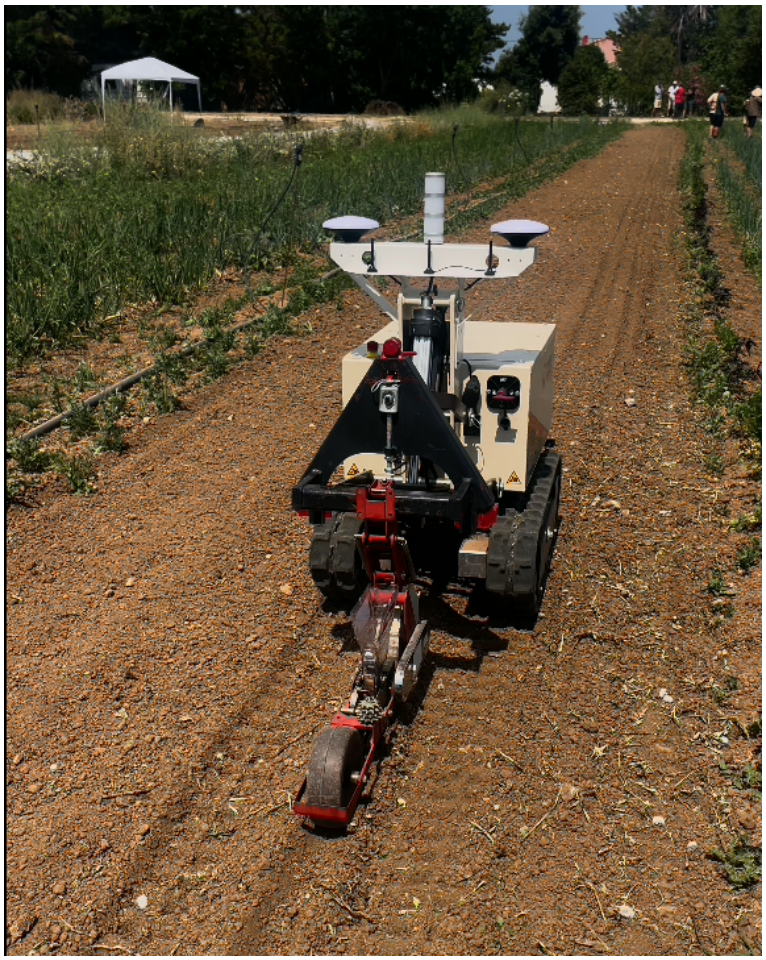


*Figure 2.1: Mission presentation photo*

## Mission presentation

**Mission parameters**

| | |
|---|---|
| **Task to perform** | Semis |
| **Trajectory** | Rectiligne, square turn |
| **Working speed** | 0.8 km/h |
| **Mission file** | Carottes.json |

### Organization

*Workforce*

| | |
|---|---|
| **Total number of employees** | 1 |

*Surface*

| | |
|---|---|
| **Worked plot surface** | 0.0141 ha |
| **Plot fragmentation** | Consolidated (<0.5 km) |

## Trajectory

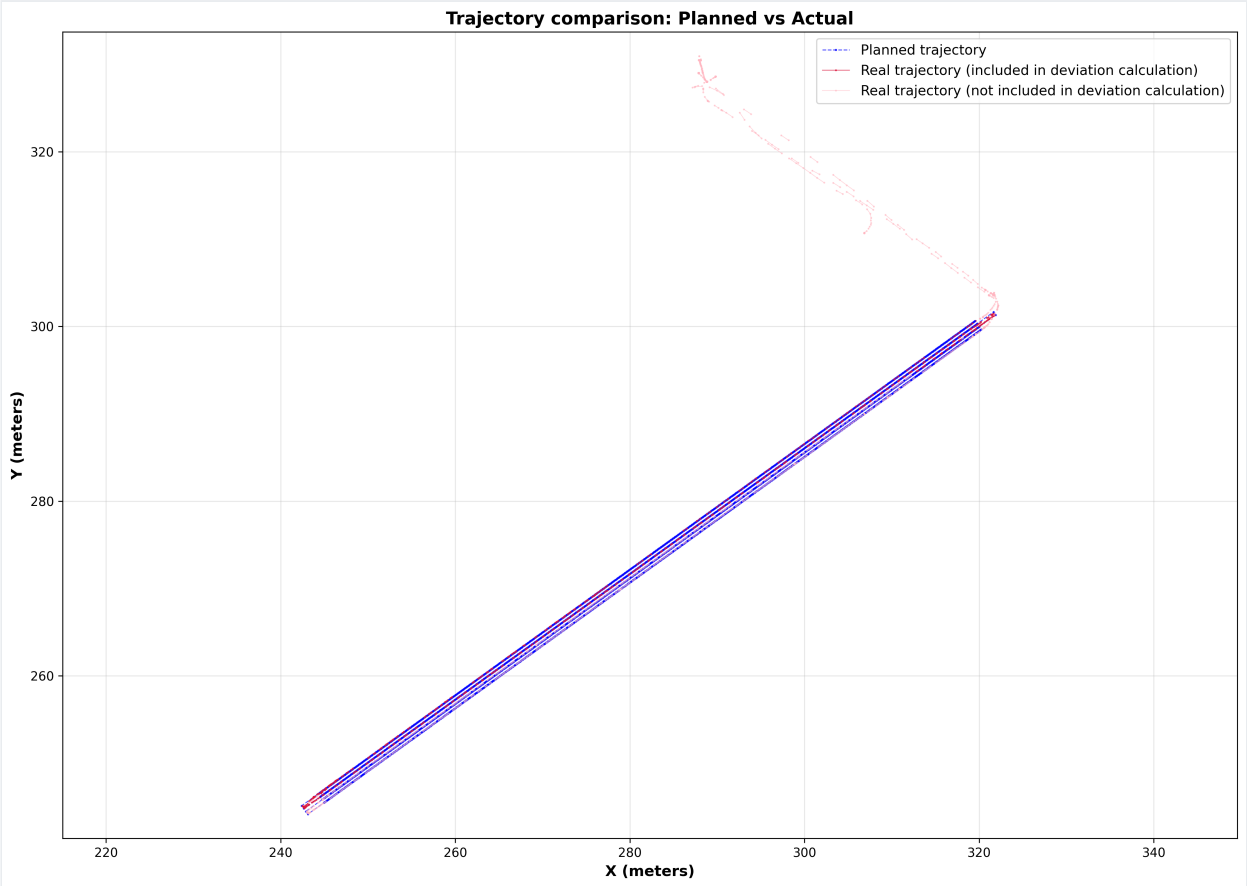



*Figure 2.1: Planned vs actual trajectory comparison*

# Agronomic Summary

| | |
|---|---|
| **Energy per hectare** | 9.92 kWh/ha |
| **Work rate** | 0.02 ha/h |
| **Autonomy per battery** | 0.26 ha/batterie |

### Time tracking

| | |
|---|---|
| **Tool setup** | 5 min |
| **GPS connection wait** | 0 min |
| **Wi-Fi connection wait** | 0 min |

| | |
|---|---|
| **Supervision time** | 60 min |
| **Travel time** | 0 min |
| **Restart count** | 0 |
| **Stop count** | 0 |

**Work assessment**

| | |
|---|---|
| **Quality assessment** | Very satisfied |
| **Crop damage** | None |

**Before work**

**After work**

After work

## Performance Indicators

### Agronomic [1]

| Indicator | Value | Unit |
|---|---|---|
| Crop species | Carotte | |
| Growth stage | Bare soil | |
| Soil texture | Silty loam | |
| Soil moisture | Dry (hard) | |
| Weed pressure | 0 | % |
| Planned operation | Sowing | |
| Work quality assessment | Very satisfied | |
| Crop damage | None | |

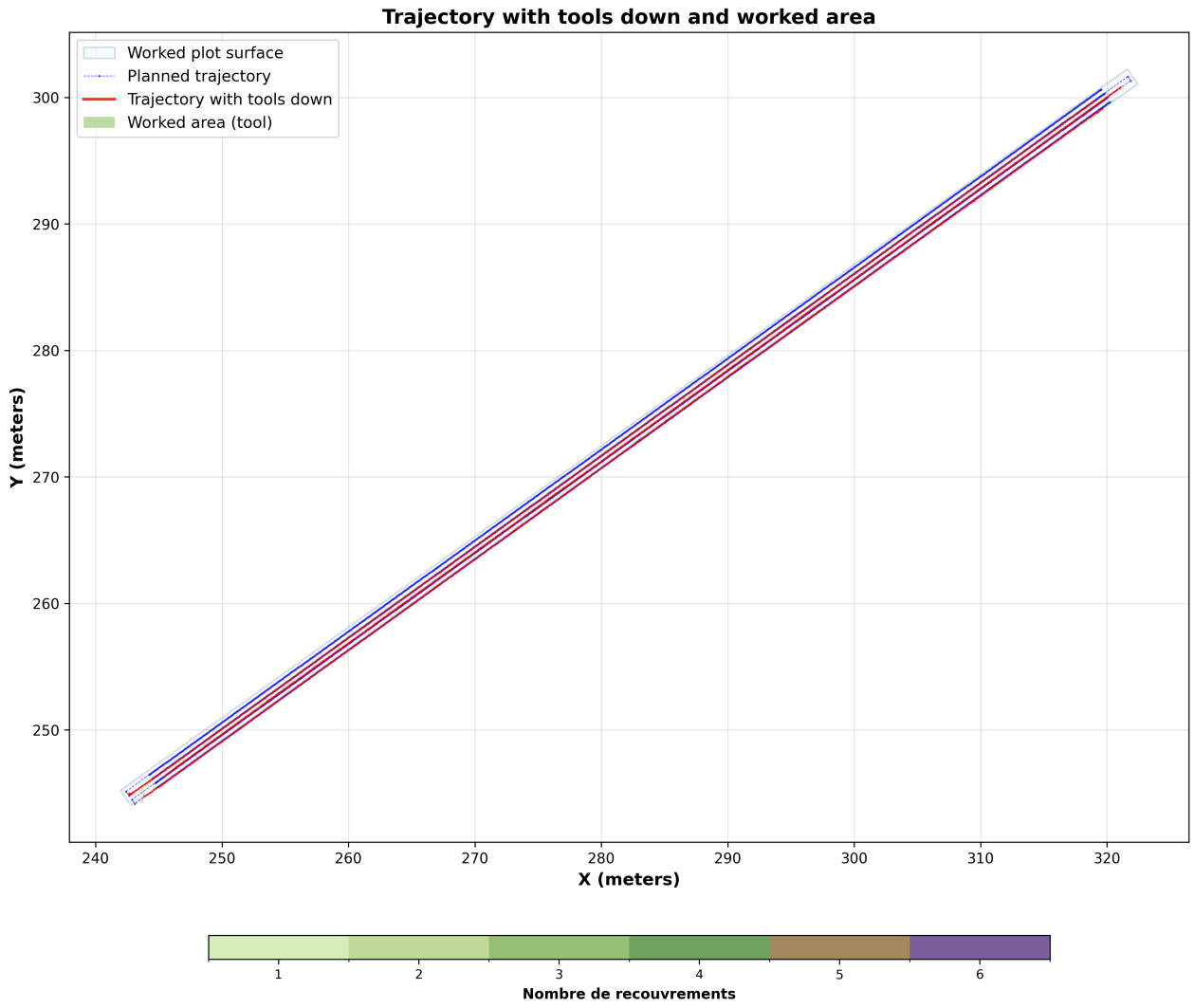
### Energy [2]

| Indicator | Value | Unit |
|---|---|---|
| SOC at start | 62.39 | % |
| SOC at end | 55.34 | % |

| Indicator | Value | Unit |
|---|---|---|
| Total discharge [3]<br>*For a battery pack capacity of: 2.54 kWh* | 13.64 | % |
| Total energy consumed | 0.35 | kWh |
| Average power | 0.20 | kW |
| Energy per hectare | 9.92 | kWh/ha |
| Autonomy per battery<br>*Reference battery: 2.54 kWh* | 0.26 | ha/batterie |

## Work Rate [4]

| Indicator | Value | Unit |
|---|---|---|
| Work rate [5] | 0.02 | ha/h |
| Area covered [6] | 0.03 | ha |
| Worked plot surface [7] | 0.01 | ha |
| Worked area [8] | 0.01 | ha |
| Effective area [9] | 0.01 | ha |
| Coverage rate [10] | 0.01 | % |
| Average speed (km/h) | 0.75 | km/h |
| Max speed (km/h) | 3.60 | km/h |




## Economic [11]

| Indicator | Value | Unit |
|---|---|---|
| Electricity price | 0.19 | €/kWh |
| Labor cost per hour | 18.00 | €/h |
| Employees assigned | 0 | |
| Labor cost per hectare | 0.00 | €/ha |
| Energy cost | 0.07 | € |
| Energy cost per hectare | 1.88 | €/ha |
| Total cost | 0.07 | € |
| Total cost per hectare | 1.88 | €/ha |

## Environmental [12]

| Indicator | Value | Unit |
|---|---|---|
| Temperature | 40 | °C |

| Indicator | Value | Unit |
|---|---|---|
| Precipitation type | None | |
| $CO_2$ emissions [13]<br>*Emission factor applied: 317 g $CO_2$ per kWh.* | 0.11 | kg |
| Plot fragmentation | Consolidated (<0.5 km) | |

## Mission [14]

| Indicator | Value | Unit |
|---|---|---|
| Planned distance [15] | 385.88 | m |
| Performed distance [16] | 546.76 | m |
| Distance deviation | 160.88 | m |
| Performed distance (%) | 141.69 | % |
| Mean lateral deviation<br>*Without half-turn* | 6.55 | cm |
| Max lateral deviation<br>*Without half-turn* | 19.98 | cm |
| Mean lateral deviation (tool)<br>*Without half-turn, tool distance: 110 cm* | 6.40 | cm |
| Max lateral deviation (tool)<br>*Without half-turn, tool distance: 110 cm* | 19.88 | cm |
| Worked rows [17] | 2 | |

## Operational [18]

| Indicator | Value | Unit |
|---|---|---|
| Robot weight | 250.00 | kg |
| Tool weight | 10.00 | kg |
| Total weight | 260.00 | kg |
| Energy per kg per hectare | 0.04 | kWh/kg/ha |
| Mean torque at work (% of nominal) [19]<br>*Reference nominal torque: 2.39 N·m — Number of motors: 2.* | 31.11 | % |

## Safety [20]

| Indicator | Value | Unit |
|---|---|---|
| Geofencing exits | 0 | |
| Time outside geofencing (seconds) | 0.00 | s |
| Time outside geofencing (hours) | 0.00 | h |
| Local emergency stops | 0 | |

| Indicator | Value | Unit |
|---|---|---|
| Remote emergency stops | 0 | |
| Bumper activations | 0 | |

## Reliability [21]

| Indicator | Value | Unit |
|---|---|---|
| Output errors | 0 | |
| Input errors | 0 | |
| Battery errors | 0 | |
| Motor errors | 3 | |
| Cylinder errors | 4 | |
| Total errors | 7 | |
| Output error time (seconds) | 0.00 | s |
| Input error time (seconds) | 0.00 | s |
| Battery error time (seconds) | 0.00 | s |
| Motor error time (seconds) | 1470.44 | s |
| Cylinder error time (seconds) | 1471.61 | s |
| Total error time (seconds) | 1472.45 | s |
| Error rate per hour | 4.08 | /h |
| System availability | 76.16 | % |

## Localization [22]

| Indicator | Value | Unit |
|---|---|---|
| Localization errors | 40 | |
| Error time (seconds) | 309.41 | s |
| Error time (hours) | 0.09 | h |

## Time [23]

| Indicator | Value | Unit |
|---|---|---|
| Total duration | 6175.21 | s |
| Total duration (hours) | 1.72 | h |
| Active time | 2720.39 | s |
| Active time (hours) | 0.76 | h |
| Inactive time | 3454.83 | s |
| Inactive time (hours) | 0.96 | h |

| Indicator | Value | Unit |
|---|---|---|
| Active time (%) | 44.05 | % |
| Inactive time (%) | 55.95 | % |

## Descriptions of indicators

Bracketed numbers refer to definitions, assumptions and sources listed below.

**[1]** Agronomic indicator: value from the recorded crop trial context.

**[2]** Energy indicator: derived from electrical measurements, consumption and SOC logged during the mission.

**[3]** Total discharge (%): energy consumed during the mission (change in cumulative energy, in kWh) divided by nominal battery pack capacity (kWh), multiplied by 100. This indicator does not use start or end SOC; reference pack capacity is stated in the note when known.

**[4]** Work-rate indicator: derived from worked areas, speeds and time on field.

**[5]** Work rate: amount of work completed per unit of time, in ha/h. Hourly rate = area covered (ha) ÷ total mission duration (h).

**[6]** Area covered: this is the area swept by the robot = cumulative odometric distance × robot width.

**[7]** Worked plot surface: area of the plot worked by the robot. It is modeled as an oriented bounding box (OBB) with a margin equal to half the robot width around the planned trajectory that was worked.

**[8]** Worked area: area processed by the implement (tool width × path length with implement lowered). Each pass counts; overlaps add up.

**[9]** Effective area: area worked by the implement excluding overlaps.

**[10]** Coverage rate: ratio of worked area to effective area. (worked area − effective area) / effective area × 100. A high value indicates many passes over the same zones.

**[11]** Economic indicator: computed from cost settings and mission energy/time aggregates.

**[12]** Environmental indicator: derived from weather context or consumption using the documented method.

**[13]** $CO_2$ emissions from grid electricity consumed during the mission (kWh × 0.317 kg/kWh). Source: French Ministry for Ecological Transition — Key Climate Figures (digital edition), chapter on GHG emissions from industry / electricity production (statistiques.developpement-durable.gouv.fr).

**[14]** Mission indicator: derived from actual path, plan and computed geometric deviations.

**[15]** Theoretical mission distance: cumulative length of the planned trajectory from the mission JSON file. Does not match the robot's actual path.

**[16]** Distance actually traveled by the robot. May include movement before the mission effectively starts and after it ends, depending on the recorded data.

**[17]** Number of distinct rows worked (tool lowered).

**[18]** Operational indicator: derived from kinematics, implement data or documented masses.

**[19]** Mean absolute motor torque only when the tool is lowered, as a percentage of the motors' nominal torque.

**[20]** Safety indicator: derived from safety-related events and durations.

**[21]** Reliability indicator: derived from fault codes and error time per subsystem.

**[22]** Localization indicator: derived from localization faults or downtime during the mission.

**[23]** Time indicator: derived from timestamps and activity states during the mission.