GEAR User Manual

EUSPA European Union Agency for the Space Programme

ESSP

NAVIGATION MADE IN EUROPE

https://egnos-user-support.essp-sas.eu

The following document contains all the information required to utilise GEAR (eGnos dEmonstrator for AgRriculture), an interactive virtual demonstrator that people can be downloaded from the EGNOS User Support Website. GEAR allows farmers and any other user to discover in a friendly and entertaining way the benefits of EGNOS for machinery guidance in comparison with other GNSS solutions: Autonomous, Commercial SBAS, RTK or none GNSS at all. Users can drive a virtual tractor equipped with EGNOS and simulate the performance of several farming tasks, such as ploughing, sowing, spreading and spraying, under different weather conditions. Users shall show their driving skills with the assistance of EGNOS, avoiding both gaps and overlaps between passes, in order to optimize costs. Once the agricultural job is completed, a report is generated to analyse the economic savings and other benefits achieved by the user thanks to EGNOS.

Disclaimer: GEAR is designed for general awareness and promotion purposes only. The results of the analysis are estimated based on different input parameters and internal models and may vary from the farmer's real operation performance. For any further inquiry or clarification please contact the EGNOS Service Adoption team via the EGNOS Helpdesk mailbox: egnos-helpdesk@essp-sas.eu.

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For questions and further information

EGNOS HELPDESK

+34 911 236 555

egnos-helpdesk@essp-sas.eu

https://egnos-user-support.essp-sas.eu

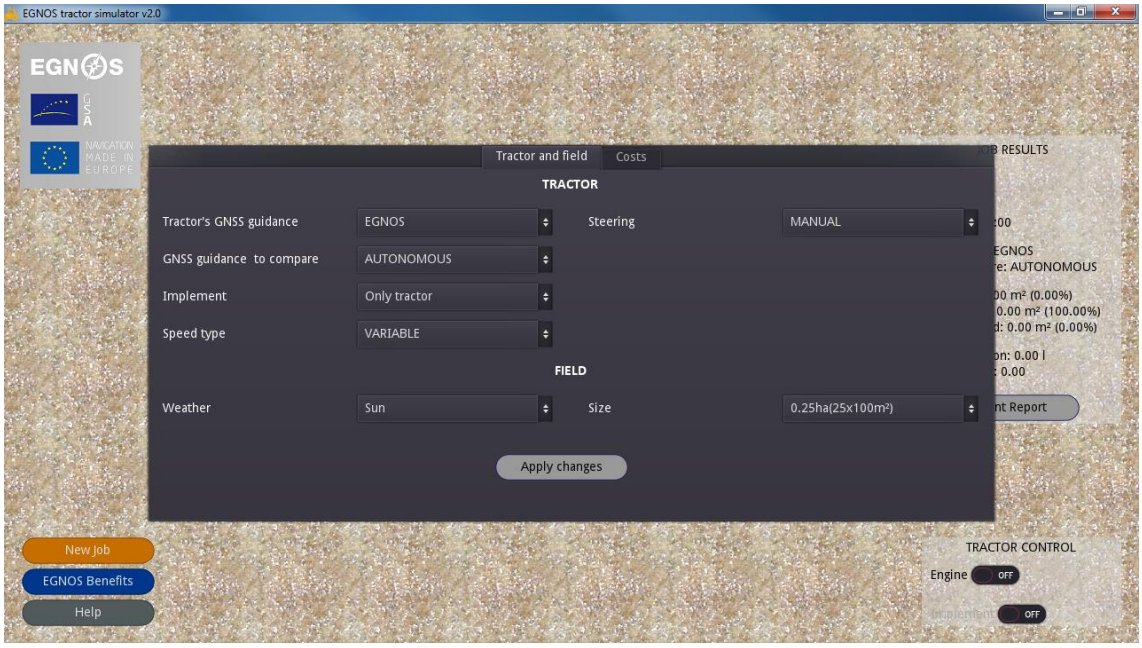
Contents

1 INSTALLATION

In order to execute GEAR, please follow the steps below:

1. Download from the EGNOS User Support Website the file “GEAR.zip” and unzip it in your local computer. You should have now two files:
2. GEAR.exe
3. GEAR.pck
4. Double-click on the file “GEAR.exe”.
5. GEAR starts charging showing the following screen:

6. GEAR is ready and shows the initial configuration screen:



Please note that for a proper performance of GEAR the following systems requirements are needed:

- RAM: 4 GB
- OS: Windows 7, Windows 8, Windows 10 (64-bit versions only)
- Video card:
  - Intel starting from Ivy Bridge
  - AMD starting from Northern Islands (HD 6000 series)
  - NVIDIA starting from Fermi (GT/GTX 500 series)

2 CONFIGURATION SCREEN

The Configuration Screen allows the user to set the parameters of a new job. For this reason, the Configuration Screen is launched in the following situations:

- Once GEAR is started.
- Whenever the user push the “New Job” button.

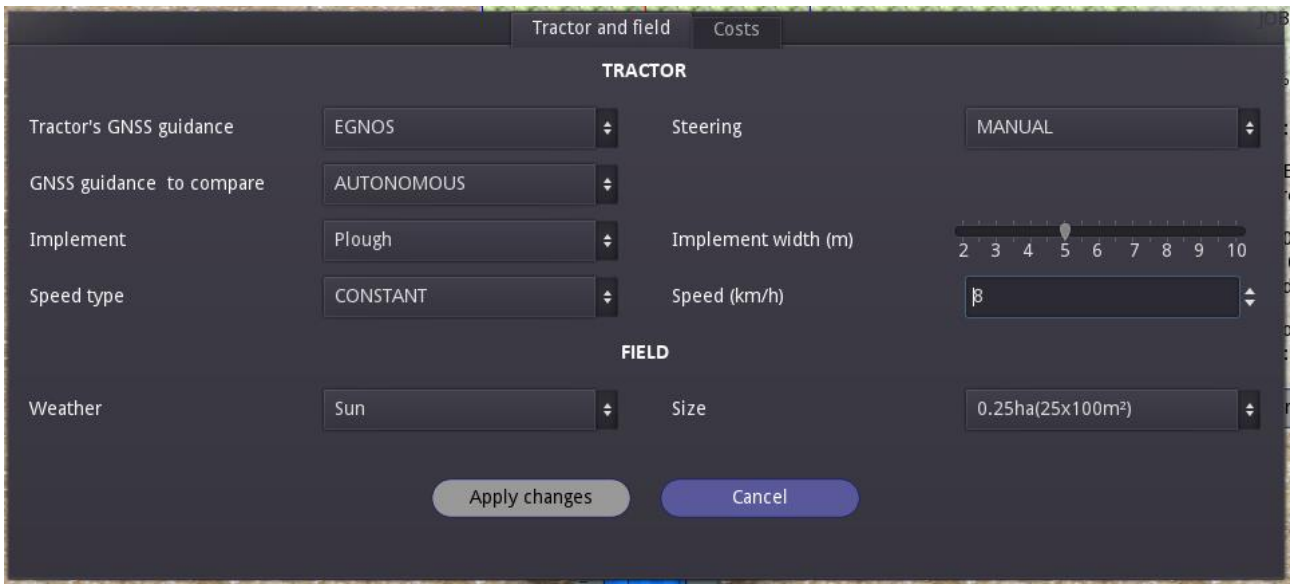
In this case, the Configuration Screen can be employed also to consult the parameters of the current job.

The Configuration Screen comprises two different tabs:

- Tractor and field
- Costs

2.1 TRACTOR AND FIELD

In this tab, the user configures the features of the GNSS solution to be employed in the tractor (both for application and comparison) as well as the environmental conditions of the job. The different configuration fields are explained below.



TRACTOR:

- Tractor's GNSS guidance: GNSS solution employed by the user during the job:
  - EGNOS
  - AUTONOMOUS
  - COMMERCIAL SBAS
  - RTK RADIO
  - RTK NTRIP
  - WITHOUT GUIDANCE
- Steering: if the user controls the steering wheel or the GNSS equipment does:
  - MANUAL
  - AUTOMATIC
- GNSS guidance to compare: GNSS solution that is simulated following the very same trajectory for the tractor in order to compare both results. Please note that one of both GNSS solution must be EGNOS and the menu obliges to do so hiding the other options:
  - EGNOS
  - AUTONOMOUS
  - COMMERCIAL SBAS
  - RTK RADIO
  - RTK NTRIP
- Implement: tool to be attached to the tractor to perform on type of job or other. The "Only Tractor" option does not include any GNSS capability, as it is intended just to allow the user to practice the tractor driving before starting any job.
  - Only tractor
  - Plough
  - Seeder
  - Sprayer
  - Spreader
- Implement width: from 2 meters to 10 meters in steps of 0.5 meters.
- Speed type:
  - VARIABLE: the user controls the speed all the time.
  - CONSTANT: the tractor follows a constant speed, but only during the passes inside the crops field.
    - Speed (km/h): between 0 km/h and 20 km/h in steps of 1 km/h

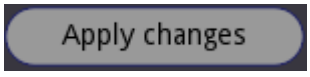
FIELD:

- Weather:

- Sun
- Rain
- Fog
- Night

- Size (of the crops field):
  - 0.25 ha (25x100 m^2)
  - 0.50 ha (50x100 m^2)

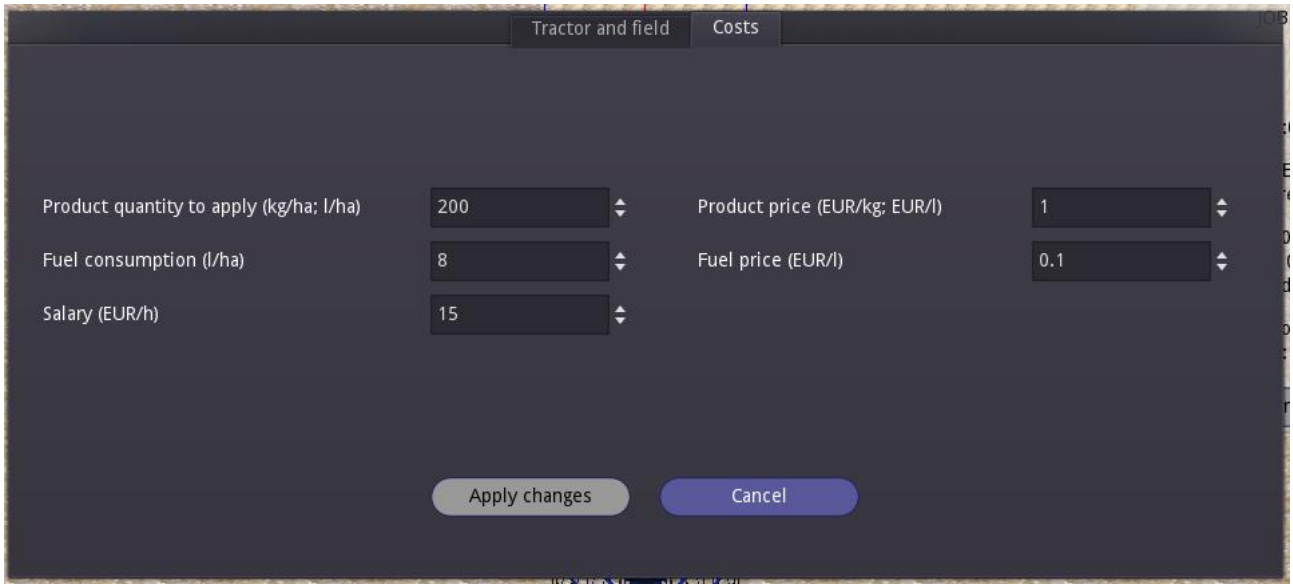
“Apply changes” button: to leave the “Configuration Screen” and start a new job with the parameters set.



“Cancel” button: lo leave the “Configuration Screen” and resume the current job.

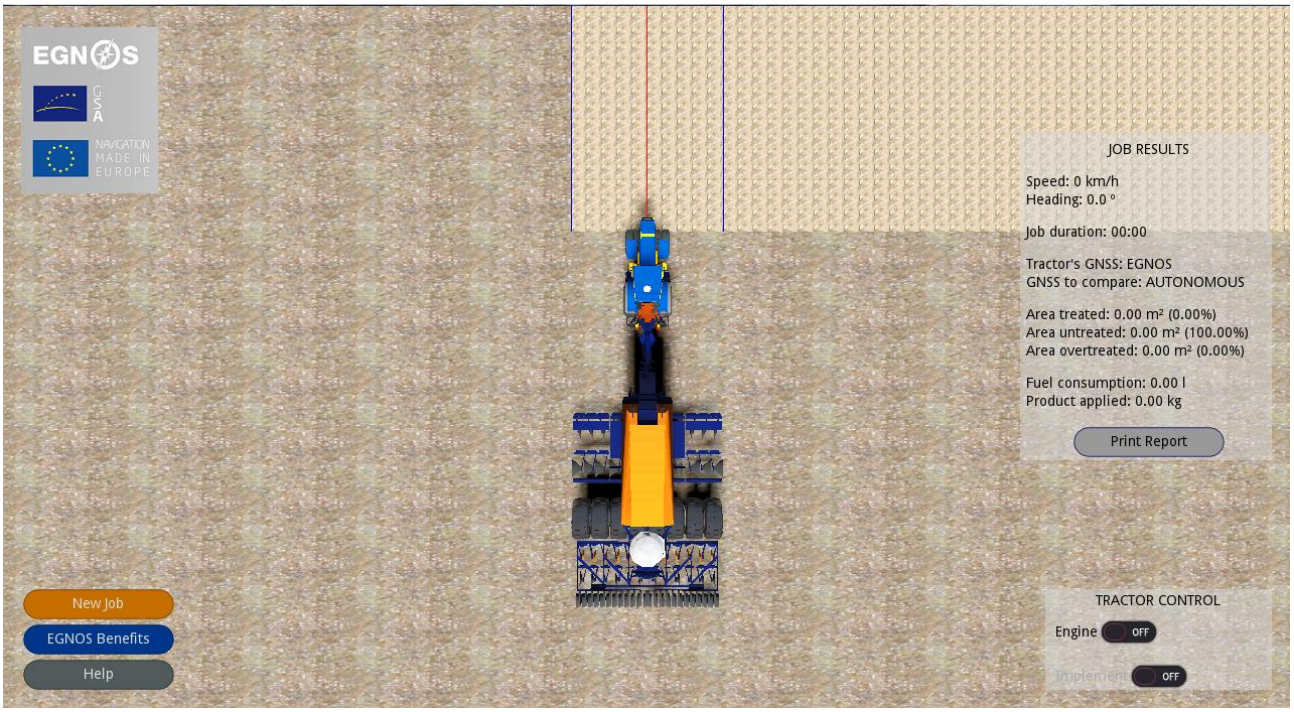
2.2 COSTS

In this tab, the user configures the costs related to input application, fuel consumption and salary. Please note that the product-related fields only appear if a suitable implement has been selected in the “Tractor and Field” tab, i.e. not for ploughing.



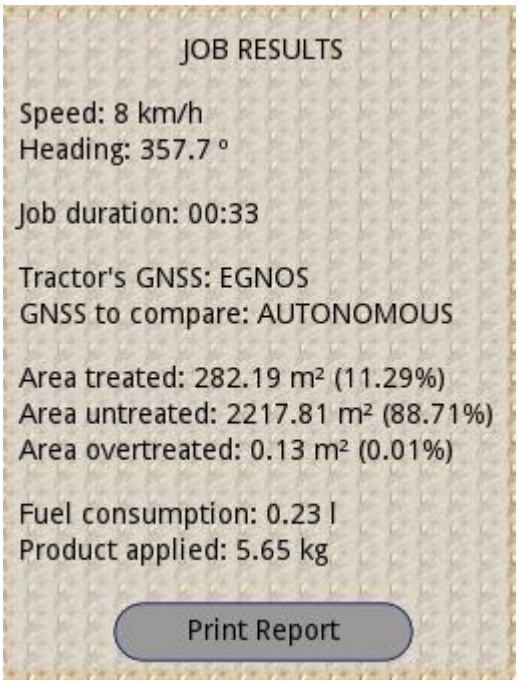
3 MAIN SCREEN

The Main Screen of the demonstrator allows the user to drive the tractor through the crops field with the selected implement to carry out the corresponding job.



3.1 JOB RESULTS PANEL

This panel, located on the right side of the Main Screen, shows the evolution of the job in real time.



- Speed: current speed of the tractor.
- Heading: current direction of the tractor, considering North=0º, East=90º, South=180º, West=270º.

- Job duration: time since the start of the job, i.e. the tractor's engine is on for the first time.

- Tractor's GNSS: as selected in the Configuration Screen.
- GNSS to compare: as selected in the Configuration Screen.

- Area treated: area of the crop field passed by the tractor with the implement activated.
- Area untreated: area of the crops fields not passed yet by the tractor or passed with the implement off.
- Area overtreated: area of the crops field passed by the tractor more than one time.

- Fuel consumption: fuel already consumed by the tractor.
- Product applied: amount of input already applied with the implement.

- "Print Report" button: to generate a report with the current status of the job. Please see section 4 for more information.

3.2 TRACTOR CONTROL PANEL

This panel, located on the lower right corner of the Main Screen, allows the user to see the status of both the engine and the implement of the tractor. The users can also modify directly the status of both elements with the mouse, clicking on the corresponding switches. Please note that the implement cannot be activated with the engine off, showing its letters in grey.

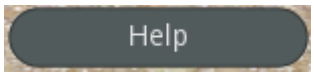
3.3 OTHER BUTTONS

These other buttons, located on the lower left corner of the Main Screen, have the following functionalities:

- "New Job" button: to access to the Configuration Screen. The user can there configure and start a new job or just consult the parameters of the current job.

- "EGNOS Benefits" button: to open a document explaining the multiple benefits of EGNOS, not only economic ones, for farming machinery guiding.

- "Help" button: to open the "GEAR User Manual"



3.4 TRACTOR DRIVING

In the Main Screen, the tractor and other features, such as the camera view, are controlled by means of the keyboard, using the following keys:

- Up arrow: speed up
- Down arrow: speed down
- Left arrow: turn left / move among pop-up options
- Right arrow: turn right / move among pop-up options
- Enter: press button in pop-up

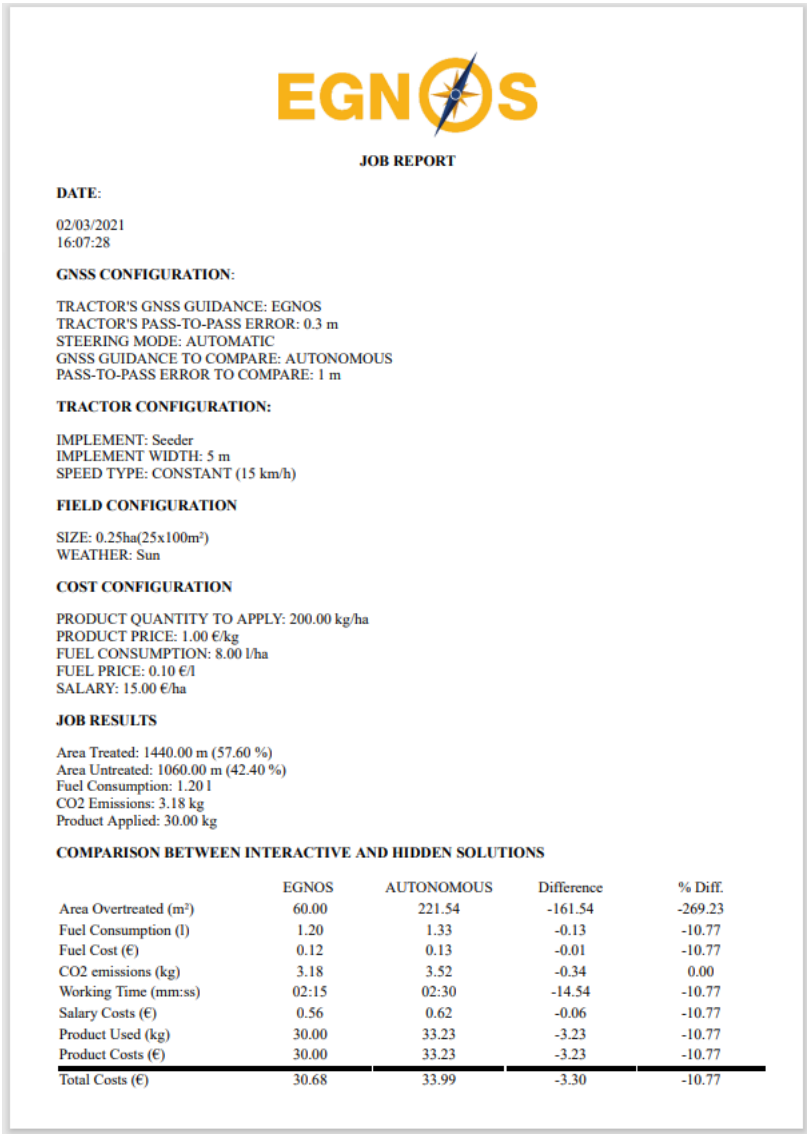
- W: switch the implement on/off
- E: turn the engine on/off
- D: turn the lights on/off

- T: top camera
- F: cabin camera
- C: rear camera
- D: turn the lights on/off

- R: recover the tractor (after rollover)
- Spacebar: handbrake

4 JOB REPORT

The job report provides all the information, both configuration and results, of the current status of the job. It is opened in the default web browser of the user's computer, in .html format, but it can be saved as .pdf using the "Print" option of the web browser. An example of a job report is shown below and its different sections are explained next.



JOB REPORT

DATE:

02/03/2021
16:07:28

GNSS CONFIGURATION:

TRACTOR'S GNSS GUIDANCE: EGNOS
TRACTOR'S PASS-TO-PASS ERROR: 0.3 m
STEERING MODE: AUTOMATIC
GNSS GUIDANCE TO COMPARE: AUTONOMOUS
PASS-TO-PASS ERROR TO COMPARE: 1 m

TRACTOR CONFIGURATION:

IMPLEMENT: Seeder
IMPLEMENT WIDTH: 5 m
SPEED TYPE: CONSTANT (15 km/h)

FIELD CONFIGURATION

SIZE: 0.25ha(25x100m²)
WEATHER: Sun

COST CONFIGURATION

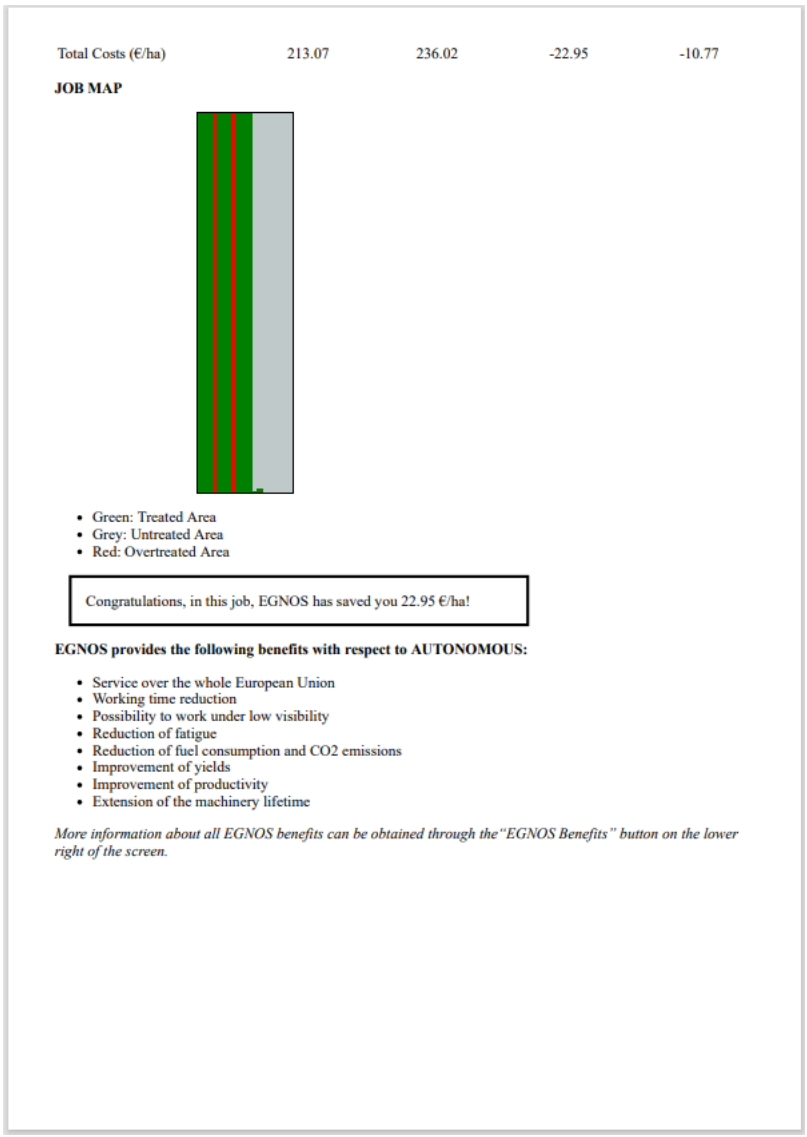
PRODUCT QUANTITY TO APPLY: 200.00 kg/ha
PRODUCT PRICE: 1.00 €/kg
FUEL CONSUMPTION: 8.00 l/ha
FUEL PRICE: 0.10 €/l
SALARY: 15.00 €/ha

JOB RESULTS

Area Treated: 1440.00 m (57.60 %)
Area Untreated: 1060.00 m (42.40 %)
Fuel Consumption: 1.20 l
CO2 Emissions: 3.18 kg
Product Applied: 30.00 kg

COMPARISON BETWEEN INTERACTIVE AND HIDDEN SOLUTIONS

	EGNOS	AUTONOMOUS	Difference	% Diff.
Area Overtreated (m²)	60.00	221.54	-161.54	-269.23
Fuel Consumption (l)	1.20	1.33	-0.13	-10.77
Fuel Cost (€)	0.12	0.13	-0.01	-10.77
CO2 emissions (kg)	3.18	3.52	-0.34	0.00
Working Time (mm:ss)	02:15	02:30	-14.54	-10.77
Salary Costs (€)	0.56	0.62	-0.06	-10.77
Product Used (kg)	30.00	33.23	-3.23	-10.77
Product Costs (€)	30.00	33.23	-3.23	-10.77
Total Costs (€)	30.68	33.99	-3.30	-10.77



Total Costs (€/ha) 213.07 236.02 -22.95 -10.77

JOB MAP

- Green: Treated Area
- Grey: Untreated Area
- Red: Overtreated Area

Congratulations, in this job, EGNOS has saved you 22.95 €/ha!

EGNOS provides the following benefits with respect to AUTONOMOUS:

- Service over the whole European Union
- Working time reduction
- Possibility to work under low visibility
- Reduction of fatigue
- Reduction of fuel consumption and CO2 emissions
- Improvement of yields
- Improvement of productivity
- Extension of the machinery lifetime

More information about all EGNOS benefits can be obtained through the "EGNOS Benefits" button on the lower right of the screen.

DATE: the date and time of the report generation.

- GNSS CONFIGURATION: the job's configuration parameters related to GNSS.
- TRACTOR CONFIGURATION: the job's configuration parameters related to the tractor.
- FIELD CONFIGURATION: the job's configuration parameters related to the field.
- COST CONFIGURATION: the job's configuration parameters related to the different costs.
- JOB RESULTS: current results obtained by the user in the job.
- COMPARISON BETWEEN INTERACTIVE AND HIDDEN SOLUTIONS: the area overtreated, i.e. treated more than one time, is considered as the source of additional costs that the farmer would like to avoid. It implies undesired increases of fuel consumption, working time and product used, which are translated into economic costs (euros). The meanings of the different columns are.
    - First column: parameters taken into account for comparison.
    - Second column: results of the tractor's GNSS guidance.

  - Third column: results of the GNSS guidance for comparison.
  - Fourth column: difference in absolute units between the second and third columns. Negative values imply savings with the tractor's GNSS guidance.
  - Fifth column: difference in percentage terms.

  The final costs per hectare are provided, so the farmer can extrapolate the results to the size of its own crops field.

- JOB MAP: map showing the different kind of areas of the job:
  - Green: treated area.
  - Grey: untreated area.
  - Red: overtreated area.
- CONCLUSION: summary of the EGNOS savings and other benefits obtained by the user in this job