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# DataBaler N-Sensor Analytics User Guide





AGANALYST LTD



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# 1. N-Sensor Report Portal User Guide Introduction

#### 1.1 Summary

The DataBaler N-Sensor portal is an interactive dashboard developed by AgAnalyst. Its purpose is to help farmers and technicians optimise how they use their N-Sensor by producing analytics from the data that can be used to identify where the operation has gone to plan, and where improvements can be made. The data is uploaded to the system via AgAnalyst's SyncAgent software which runs on the tablet in the cab alongside the N-Sensor software.

## 1.2 Accessing the portal

Access to the N-Sensor Report Viewer is available by logging in to DataBaler



Once logged in, select the 'Reports' tab in the top left and the reports you have a subscription to are displayed.

Select 'NSensor' and the "Welcome to your N-Sensor data viewer" will appear. The N-Sensor Report Viewer has two viewing options; <u>Log Analytics</u> and <u>Log Summary view</u>.

Users also have access to a demo of DataBaler NUE Analytics. By selecting the NUE tab users can experiment changing the parameters to investigate the variability within the demo field. Once we have integrated your Nitrogen application data from your N-Sensor, we can then overlay your harvest data (yield, protein, moisture) to analyse your Nitrogen Use Efficiency and see where you can reduce Nitrogen applications without compromising yield or quality. We integrate with 90% of machinery – a number that is always increasing as we come across data from different machines. For more information on DataBaler NUE Analytics please contact joe.walters@aganalyst.co.uk.



# 2. Log Summary View

The Log Summary View provides an overview of all the fields where an N-Sensor has been used. All logfiles uploaded by the device selected will appear as red polygons and represent the extent of the data from that file. The date filter can be used to narrow down a selection to a certain time period, either to view jobs for a particular season, month or week.





Logfiles can be selected by either zooming on the map or selecting a logfile from the dropdown list, which will automatically zoom to its location. Clicking on a logfile provides basic job details to the left of the screen, as well as any notes relating to that file that have been left by your N-Sensor agent.

# 3. Log Analytics 3.1 Job selection pane



In the current version of the N-Sensor viewer, only one logfile can be selected at one time. The filter logic works from top to bottom, meaning that by picking a "Device name", the "Job Date", "Crop" and "Logfile name" lists are filtered to the relevant information that the device selected contains. As the user progresses down from "Device name" and selects an available "Job date", the subsequent filters are narrowed down to only show the available data (i.e., the "Crop" and "Logfile name" available for the parameters specified).

The filters do not propagate from bottom to top. I.e., if a "Crop" is selected, the "Job Date" and "Device name" lists do not get filtered by the selection.

Note that if changing to a different device, job date or crop, then a new logfile will need to be selected to view data. The 'Clear all filters' button can be used to reset the filters you have selected.



Once a logfile is selected, the data is automatically rendered on all the report visuals and numbers.

Filter Name	Explanation
Levice name	The device name filter allows users to filter the data for a particular device of all the ones they have access to. This device name is
All	defined when the user sets up SyncAgent.
♂ Job date     All   ∨	The job date filter allows users to narrow the data down to a particular day when a job was done. Dates that appear are restricted to those which that device has a job recorded to.
K Crop	The crop filter allows the selection of a crop name as entered when setting up the N-Sensor job.
Operation Mode All	Operation mode filter allows the selection of the operation mode as setup during the N-Sensor job (scanning, target rate, base rate etc.)
Log file name 00799_0_18_220825_14.log ~	The Logfile name filter is the only compulsory selection that the user must define. Only one logfile name can be viewed at a time.

#### 3.2 Job Summary

The Job Summary area provides basic details of the job from the machine: Area scanned and applied (has), job duration, start time and end time. Please note that if the data is appearing in American format (mm/dd/yyyy) and you wish to view it in UK format (dd/mm/yyyy) then you need to change the language settings in your browser from English (US) to English (UK).





The Job Summary also includes general metrics from the sensor: Average Biomass reading, Average Sensor N (crop Nitrogen), crop growth stage, fertilizer agent and agent content and the recommended application rate vs the applied rate, as well as calculating the estimated total product applied in the bottom right. The Area applied (has), Average biomass, recommended rate and applied rate will change depending on the selection of different layers and filters on the scatterplot, map and/or histograms.

The bottom left box represents the recommended rate data from the N-Sensor, which is how much the N-Sensor instructed the spreader to apply on average across the field. The as applied rate to the right is data taken from the spreader and is how much N was applied to the crop.

The colour of these boxes will change based on the accuracy of the application:

**Green** = <5% **Yellow** = 5-10%

**Red** = >10%

**Recommended rate**: This box is green because there is less than a 5% difference between 69.12 and the Reference rate which what is entered at the start of the operation during calibration (top centre of the screen in between the minimum and maximum rate)

As applied (App.) rate: This has less than a 5% difference to the recommended rate from the N-Sensor

## 3.3 Map Visual

The main visual on the Standard view is the map rendered on the right of the report which displays geospatial data stored in the logfile.





- Settings log: Selecting the Settings log will open a new pane to the left of the map (see right). This will display the main parameters from the N-Sensor settings for the current task. Each time the values are updated or changed in the sensor, a new log will be generated. It is therefore possible to have multiple logs in one file, as in the example to the right where the SN reference was altered from 0 (first set at 8:49:18 AM) to 95.4 at 8:50:04.
- Map Layer: Allows the user to select and toggle between the different available layers to be displayed on the map. The layer selected here is also displayed on the x-axis of the <u>scatterplot</u>. The layers available to view from an N-Sensor job are:
  - a. **Biomass Index:** Derived from the SN (see below)
  - b. Altitude: GPS altitude at each record
  - c. **N recommended**: The recommended Nitrogen application rate as suggested by the N-Sensor
  - d. **N as applied:** The as applied rate that Nitrogen was applied to the field as reported by the spreader/sprayer



- e. **Sensor N**: Sensor Nitrogen Value Crop Nitrogen Measurement from the N-Sensor in kg N/ha. For this value to be calculated accurately the crop and growth stage need to be identified correctly
- f. Green Biomass Index: Derived from the SN value
- g. Speed: Speed measured by the sensor
- 3. **Geometry type:** The geometries displayed on the map can either be represented as points or polygons filtered or polygons all
  - a. Points: The exact location at which the data was collected
  - b. **Polygons:** Polygons are reconstructed from the point data. The width and length of each polygon will be based on the distance travelled by the machine between each data point and the working width reported by the sensor. The Polygons filtered and Polygons all will only affect the N as applied maps, all other Map layers will remain the same regardless of which polygon type is selected
    - i. **Polygons all:** Selecting 'N as applied' in Map layer and 'Polygons all' in Geometry Type (left image below): Data with a value of 0 will appear as a transparent polygon with a black border and will also be excluded from all of the graphs. Polygons in red are values that we have identified as outliers that are 50 kg/n/ha above the max rate set. These are included in the scatterplot and as applied histogram, but not in the 'Application Rate v Spreader rate' graph below the map. They can be filtered out entirely by clicking and dragging over the areas not in red on the scatterplot, or by using the as applied filter in the top centre of the portal. As you can see from the example



below, these outliers (0 values and 50kg/n/ha above the max) are usually confined to areas where speed was significantly reduced (mostly in headlands or avoiding trees, telegraph poles etc.)

- ii. **Polygons filtered:** Selecting 'N as applied' in Map layer and 'Polygons filtered' in Geometry Type (right image below): 0 values and 50kg/n/ha above the max are filtered from the map, providing a clearer view of the N as applied data. Other map layers will not be affected if selected with Geometry Type set to 'Polygons filtered'.
- 4. **Legend mode:** This feature allows the user to toggle between two different modes of displaying the data spatially; dynamic and fixed
  - a. **Dynamic:** Calculated based on the specific data for that field and is adjusted based on the maximum and minimum values in the selected logfile. This helps to highlight variations and extremes within the data.
  - b. **Fix:** Constant across the datasets and has a pre-defined set of ranges to colour the map features. This is more appropriate to use when comparing more than one map as the legend is standardised. When printing a PDF, this is the recommended setting to have selected.
- 5. **Open legend:** This button displays the legend colour scale and ranges. Click the cross in the right-hand corner to hide it.
- 6. **Operation mode label:** This label indicates the operation mode the sensor was set for the job selected.



Left: Polygons all – 0 values and 50kg/n/ha above the max remain (N as applied only)

Right: Polygons filtered – 0 values and 50kg/n/ha above the max are filtered out (N as applied only)



## 3.4 Scatterplot

The scatterplot visual is automatically constructed by setting the X (bottom) axis variable from the selected layer on the map, and a Y (left) axis which the user defines from the dropdown menu on the top left of the scatterplot (these are the same layers available for selection in the map).

In this example we can compare the N recommendation from the N-Sensor (X axis) and the Biomass Index of the crop (Y axis). In this application the N recommendation has reached the full extent of the application settings reaching both the min and max fertiliser rate which correspond to the settings displayed at the top of the portal (50 and 120 kg/n/ha respectively). It also highlights a small area where the N Sensor biomass cut off has been applied in the bottom left of the graph.





The values of the scatterplot can be further selected by clicking and holding to draw a rectangle over an area of interest. This selection will be replicated to all the report visuals and numbers. To deselect, simply click again on the scatterplot and this will erase the selection. In the example below, the biomass cutoff in the scatterplot has been highlighted, selecting the corresponding points in the map enabling the user to identify exactly where this occurred in the field – in this example a very small area in the northwest corner of the field.





# 3.5 Histograms – Distribution of the data

In both histograms, selections and filtering of this data will also impact the data shown on the map, log summary and the scatterplot.

#### 3.5.1 Biomass Index Settings

The biomass settings show the settings taken from the logfile.

- 1. If calibrated correctly, there will be a crop Nitrogen (SN) reference value which represents the average SN value of the current calibration.
- 2. Cutoffs will only be available for selection from the dropdown menu if the sensor has been calibrated properly. These cutoffs can also be viewed in the <u>settings log</u>
- 3. The Relative cutoff (%) is the value taken from the N-Sensor and represents the percentage of the average GBI. If any part of the crop is measured to be below 20%, it will receive the minimum rate set at the start of the task
- 4. Create prescription map (see section 3.7)
- 5. The histogram shows the distribution of GBI values in the data. The colour for the bars on the histogram replicates the colours set in the legend mode of the map.



#### 3.5.2 Spreader Settings

The spreader settings graph can either display Recommended Rate (1) or Applied Rate (2) data. Task settings are displayed which allow the user to set a minimum and maximum rate using the filters. Like the biomass graph, there is a histogram which shows the distribution of the data and a filter.

In the example on the left below, we can see lots of high N as applied values (in red) distorting the distribution. These are noisy values that can be removed by either typing in a max value in the box (currently 859.37) or by adjusting the slider underneath. The image on the right shows the data being filtered to only display N as applied values below 170 kg/n/ha (all values above this are red as per the 'Polygons filtered' <u>Geometry type in the map visual</u>).







# 3.6 Comparison Graphs

The Application data (1) and Sensor N data comparison graphs can be used to identify differences between what the N-Sensor has either recommended to apply (1) or the amount of Nitrogen it has measured in the crop (2).





#### 3.6.1 Application Rate vs Spreader Rate Comparison Graph

By plotting the N-Sensor recommended rate (blue line) against the spreader as applied rate (green line) against time, the accuracy of the actual application can be assessed. In this example they are almost identical, indicating the spreader has done exactly what the N-Sensor instructed it to.



Where the two lines deviate, the area can be highlighted so only that area appears on the map, and then cross-referenced with other layers in the data to investigate why the spreader did not comply with the instructions from the N-Sensor.

The application factor (grey dashed line) displays how much the spreader should apply in relation to what the N-Sensor is instructing it to apply. For 100% it would apply what the N-Sensor recommends. This can be changed during job by the operator. If it stays as a flat line as is this case in this example, it has not been altered. The max rate (red line) and min rate (black line) correspond to the max and min rates set for the task. Again, these may also change depending on if they have been altered during the task, which they have not been in this example.



#### 3.6.2 Measured Nitrogen in the Crop Comparison Graph (Sensor N)

The Sensor N comparison graph displays the variability in Nitrogen that the N-Sensor has measured in the crop (yellow line), against the average Nitrogen reference rate which should be calibrated at the start of the job (red line).



In this example, there has been no calibration for the first part of the job. There is then a pause (either to refill the spreader, or operator having a break) for just over half an hour, when the sensor is then calibrated and a Sensor N reference value of 87.3 is calculated. There is another pause in the job just after 11am, where the Sensor N reference then drops slightly. These changes in the Sensor N reference will also be documented in the Settings Log pane.

### 3.7 Download as a .csv and PDF

The data can be downloaded as a .csv file which can be opened in Microsoft Excel. The map can also be downloaded as a PDF with any of the map layers selected. Basic job metrics will also be included in the PDF.





# 3.8 Prescription Maps

DataBaler can also create prescription maps downloadable in either PDF or shapefile format ready to be used on your next application. By clicking on the Create prescription button in the <u>Biomass</u> <u>histogram</u>, a new window will open where a custom prescription can be created.

Split the field into 4 zones based on their biomass index and choose a rate to see how much you will be applying where.

- 1. **Set zone max. values:** Set the maximum GBI for each of the four zones by either using the slider or entering a value into the textbox
- 2. Zone area (has): Calculates the size in hectares for each zone set
- 3. Set rate (units/ha): Set the rate at which product will be applied for each zone
- 4. Kg of product: Calculates the amount of product that will be used for each zone
- 5. Select format: Download the prescription as either a PDF or shapefile





# 4. Troubleshooting Examples

DataBaler is interactive and allows for easy selection of data in the graphs and field. This allows the user to identify where certain aspects of a job have not gone to plan and ensure operator or calibration errors can be rectified before the next task.

## 4.1 N-Sensor not controlling the Spreader

The settings log can be used to identify where and when calibration settings have been altered on the N-Sensor. In this example, the incorrect spreader (Hardi (B)) and working width (24m) have been set, either due to an operator error or a poor computer reset. The N-Sensor has therefore not controlled the spreader, as reflected in the Application Comparison graph where there is no red line. Once the settings log has been updated the next day at 7:37AM, both the spreader and N-Sensor begin to function normally, as seen by the variability in the right of the graph.

