

### INTEGRATION OF SLURRY ANALYSIS ON JOSKIN TANKERS

A cooperation between **JOSKIN** and **JOHN DEERE**



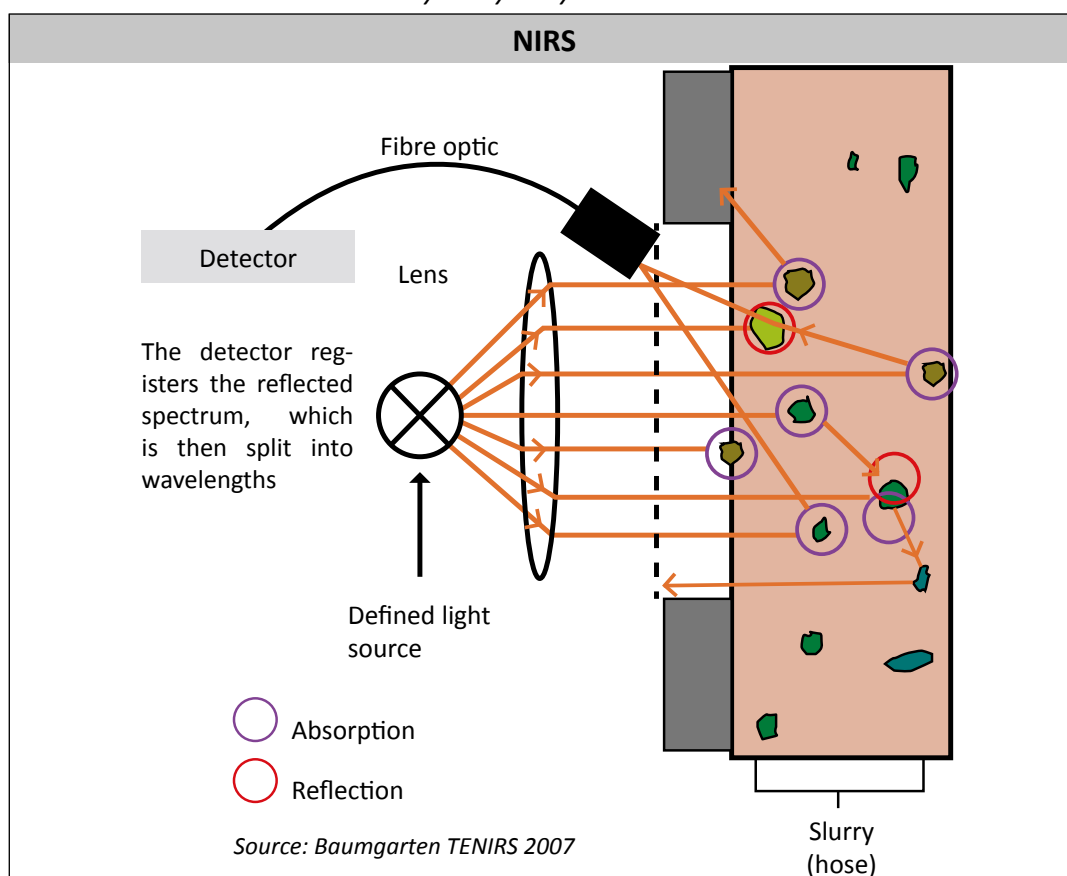
#### What is the usefulness of a precise spreading analysis system?

- **Higher crop outputs** while meeting the strictest spreading standards.
- **More precise** spreading with a better use of the slurry nutrients.
- Optimization of the **mineral balance** (on the parcel level and site-specific with GPS).
- Higher **capacity** to spread more slurry on **shorter periods**.
- Better **documentation and information** for **precision agriculture** (traceability).
- **Information** on the real N-P-K contents of the slurry directly available.
- Lower crop costs given the savings on chemical fertilizers per kg of crop products or fodder.
- **Faster, easier and better sampling and registration** of the slurry transport.
- **Ecological interest**: possibility to regulate according to a set value of nitrogen and a limit value of phosphorus to prevent water pollution.

### Used technology: near infrared reflection

High variability of the nutrient contents of the slurry

*Slurry analysis by NIRS sensor*



### Near infrared reflection technology

Thanks to a infrared lens, an analysis of the main components of the slurry is carried out at the tanker outlet. The following elements are taken into account: total nitrogen (N), phosphorus (P), potassium (K), ammoniacal nitrogen (NH<sub>4</sub>) and dry matter. The NIR sensor sends a spectrum that will be reflected by the slurry components. This reflection is then split into different wavelengths, depending on the nutrient contents.

The speed amounts to 17 analyses per second with an accuracy range of 0.72%!

### What is precisely the NIR technology?

The ratio between the absorbed or reflected NIR light varies according to the ingredients present in the slurry. For each of them, there is a specific wavelength with which this effect is best to be seen.

### Which type of light source is used?

The detector of the HarvestLab™ sensor unit gathers the reflected NIR light, which is produced by the light source of the sensor. The light is visible but the detector only looks at the reflected NIR energy. The integrated microcomputer analyses the reflected radiation for ingredient-specific wavelengths.

### System components:

In collaboration with John Deere, JOSKIN proposes a real time technology to analyze the slurry composition (NPK). JOSKIN integrates this ISOBUS connected system on its tankers fitted with a DPA.

The ISOBUS protocol is used to transfer data between the Harvestlab™ (NIR computer), the MCS computer and the Joskin ECU.

### The system includes the following elements:

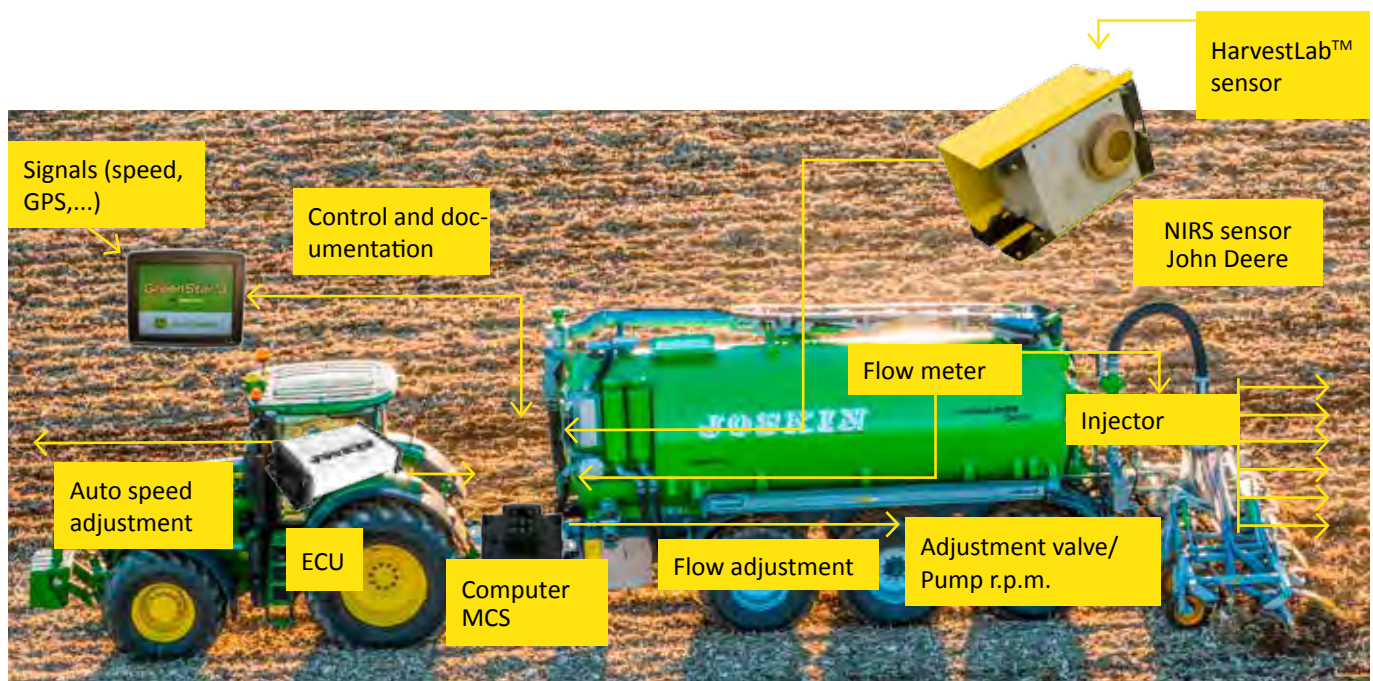
- **Harvestlab:** an electronic system measuring the nutrients contained in the slurry, developed by Zeiss and John Deere (NIR);
- **MCS:** the John Deere computer;
- **ECU:** the Joskin computer that combines the data of driving speed, spreading flow and working width;
- a **Greenstar 3** 2630 terminal (compulsory for the MCS display);
- a satellite receiver (**GPS**).

### Working Principle:

The quantity of ingredients (nitrogen, phosphorus, ammoniacal nitrogen, dry matter and potassium) is measured in the hose, immediately before spreading. There is indeed variations of nutrients between the different storage tanks between storage and transport, as well as between the individual tank loads. Knowing the exact quantity of ingredients allows to avoid an over or under application rate and to therefore reduce the costs of an extra fertilizer and of twice the work and time.

The on-board measuring equipment has the great advantage that the slurry ingredients are only measured just before they are applied on the ground, which prevents any disturbing influence. However, the John Deere Manure Sensing can only measure the slurry ingredients that flow past the sensor, not those that are actually absorbed by the plant.

The information gathered by the sensor are sent to the MCS computer that combines these data with the data of the flow meter and NIR sensor.





### Integration on John Deere tractor fitted with TIA:

The TIA, which is proposed on John Deere tractors (6R-7R-8R), allows to automatically manager the driving speed of the tractor. A target value, defined by the user, is assigned to the nitrogen and maximum value to the phosphorus. The NIR integration on John Deere tractors allows to use the automatic speed regulation technology according to these objectives.



*Data from the MCS computer*



*Data from the JOSKIN ECU*

The ISOBUS control screen in the cabin allows to see the data gathered by the sensor, the assigned objectives and the set driving speed to meet the objectives.

### Applications on tractor without TIA:

In this case, the use can either:

- set spreading objectives (set level of nitrogen and desired maximum level of phosphorus) that the MCS uses to send the regulation instructions in  $m^3/min$  to the ECU. The data from the NIR sensor and JOSKIN ECU are constantly combined to regulate the spread slurry volume. A GPS antenna allows to map the spread values;
- use the DPA and the data of the nutritional values of the spread material to set a clear data base with GPS positioning. The user will exploit this information for mapping purposes.



### GPS record

Maps can be made from the records and reports of the GPS sensor. An optimal traceability is reached and allows to see in a glance the contents of the spread material on every area. These reports will allow to manager in the best possible way the possible addition of mineral fertilizers.

The data will be exported on a USB stick to be then imported on the website myjohndeere.com. They are available for free and can be consulted and printed.



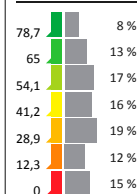
JOHN DEERE



#### DONNÉES AGRONOMIQUES

**MOYENNE**  
45,28 kg/ha  
**SURFACE TRAVAILLÉE**  
18,54 ha  
**TOTAL PLANTÉ**  
839,68 kg

#### LÉGENDE



### GreenStar™ 3 integration

- Working and target application rate maps.
- Easy documentation for compliance.

### Time savings

- No sample packaging or sending.




### Control ease

- No laboratory skills required.





### Functions and possibilities:

<i>Site-specific spreading</i>	<i>Automation tractor - implement</i>	<i>Documentation and registration</i>
<ul style="list-style-type: none"> <li>• Emission according to the current contents of N, P or K (kg/ha)</li> <li>• Max. value for 2nd nutrient (adjustment on N, max. limit for P)</li> </ul> 	<ul style="list-style-type: none"> <li>• Auto. speed adjustment (with John Deere 6R-7R-8R)</li> <li>• Manual adjustment of the speed for other tractors/self-propelled machines</li> </ul> 	<ul style="list-style-type: none"> <li>• Site-specific registration of all nutrients</li> <li>• Use of task maps possible for variable emissions (GPS)</li> </ul> 

### Advantages of the slurry tests:

- Precise and site-specific optimization of the nutrient balance.
- Automatic adjustment of the quantity based on the nutrient or volume.
- Application of nutrients based on the target value per kg per hectare through adjustment of the speed.
- Complete variability between the tank loads and slurry basins.
- Maximization of the harvesting potential of plants:
  1. over or under application rate avoided;
  2. application of the exact quantity of N, P, K in [kg/ha].
- Reduction of the costs or higher surface covered.
- Installation working at optimal speed.
- Measurement on the spreading area.