Precision Farming:

How to preserve the groundwater from nitrogen that can't be consumed by the crop?

The facts:

In the Champagne-Ardenne region, 1/3 of the cultivated area is used to grow cereal crops and the underground water is regularly polluted by more than 100 mg/L of nitrogen.

The problem:

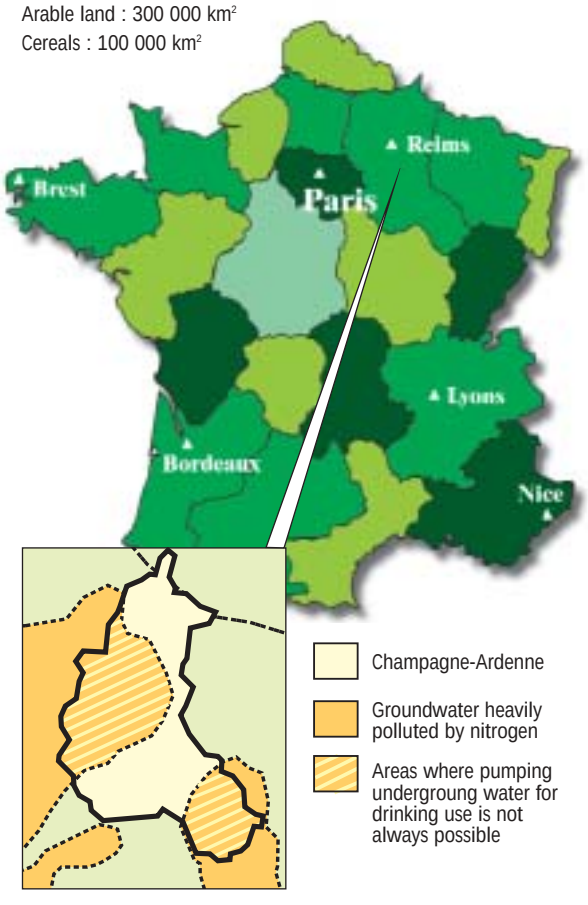
Everywhere cereals are cultivated, one of the most important environmental issue is the pollution of the groundwater by leach able nitrogen. How could one reduce the amount of fertilizer runoff while maintaining the yield ?

One possible answer is « Precision Farming », which aims to manage crop variability by tailoring fertilizer inputs to crop needs, which is linked to the observed yield. Cereal yields can vary greatly in different areas of the same field : one part may yield just 5 t/ha while others produce 10 t/ha or more. With yield mapping and variable rate fertilizer application, each site in a field is treated uniquely according to its needs.

Combine harvester equipped with a Global Positioning System and a yield monitor. This equipement is already financially within reach of the average farmer

The Champagne-Ardenne region is located in the North-East of France

France : 547 000 km²
Arable land : 300 000 km²
Cereals : 100 000 km²



Implementing Precision Farming, a three steps process:

1 - To record while harvesting the yield distribution. A GPS equipment allows a position accuracy lower than 1 m.

2 - To draw a precise yield map of the field.

3 - To make use of the results above as an input to control the amount of fertilizer dispensed by the sprayer.

French selection for the Stockholm Junior Water Prize 2005: Lycée Roosevelt, Reims

Organizer: Feee Paris. Under the ægis of the french ministery for environment and sustainable development, with the support of « Hydroplus », the water business magazine. **Partner** : Agence de l'Eau Seine Normandie.
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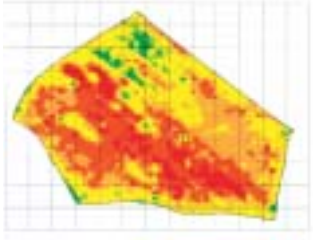
Precision Farming:

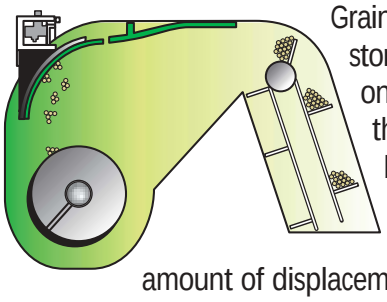
How to adjust the amount of fertilizer to the crop demand?

Yield map



- less than 6t/ha
- from 6t/ha to 9t/ha
- from 9t/ha to 12t/ha
- from 9t/ha to 12t/ha

The yield monitor

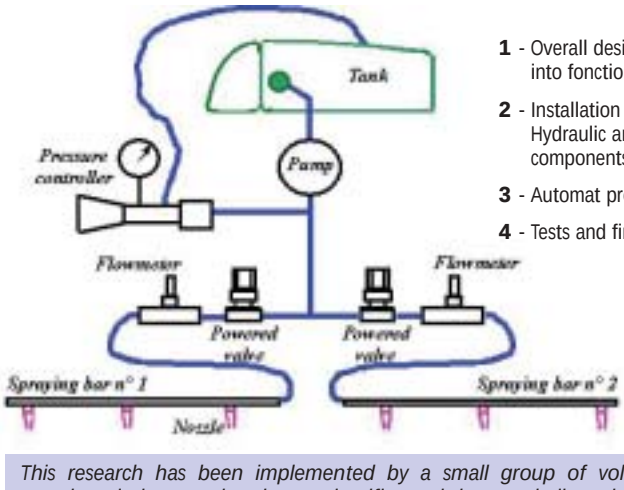


Grain mass flow is measured just before the grain enters the storage space. In the clean grain elevator, when the grain on the elevator paddles arrives at the highest point, it is thrown on an impact curved plate. That plate moves backwards because of the impacts. The displacement of the impact plate is indirectly related to the amount of grain flowing through the clean grain elevator. The amount of displacement of the impact plate that occurs when grain hits the impact plate is used to calculate the yield on a specific area. This measurement is recorded by the computer in the combine harvester every second along with the GPS data, which is used to prepare a yield map.

The sprayer

While spraying fertilizer, the GPS receiver equipped device identifies its position within the field and controls the amount of fertilizer to spray thanks to the data sent by the in-cab computer, bringing significant environmental benefits without diminishing the profitability.

« Space and Environment » workshop activities: Conception development and construction of a fully operational automat-controlled sprayer



1 - Overall design, segmentation into fonctional modules

2 - Installation on a rack: Hydraulic and Electric components

3 - Automat programming

4 - Tests and finalization

This research has been implemented by a small group of volunteers, working together during a « hands-on scientific workshop » dedicated to environmental issues, using information given by farmers, agricultural research institutes, farmers cooperatives and farm machinery distributors.

Demos at various science related events, exhibitions, scientific contests…

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