

# International Conference on Enhanced-Efficiency Fertilizers

An IFA-New Ag International Event  
23-24 March 2010  
Hotel Hyatt Regency, Miami, FL, USA

**“N-SIGHT” TECHNIQUE: A VISUAL AND QUANTITATIVE  
ANALYSIS OF UREA HYDROLYSIS AND  
AMMONIA LOSS FROM SOIL**

**Brian WADE**

Agrotain International, Switzerland



## “N-sight” technique:

A visual and quantitative analysis of urea hydrolysis and ammonia loss from soil

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N-sight technique, Conference on Enhanced-Efficiency Fertilizers, Miami 2010

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## N-sight Development Team

### N-sight system development

- S. Blossfeld, Forschungszentrum Juelich, Juelich, Germany
- B. Wade, Agrotain International, Basel, Switzerland
- C. Watson, Agri-Food and Biosciences Institute, Belfast, UK
- R. Laughlin, Agri-Food and Biosciences Institute, Belfast, UK
- C. Krause, PreSens: Precision Sensing, Regensburg, Germany
- C. Siegrist, InteractiveThings, Bern, Switzerland



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## Urea application – deceptively simple



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## Volatilization is complex – and confusing

Many approaches to explain/predict volatilization:

$$EF_{NH_3} = (EF_{mean}) \times RF_{Agrotain} \times RF_{soil\ pH} \times RF_{soil\ placement} \times RF_{N\ rate} \times RF_{rainfall} \times RF_{temp}$$

### Complex?

- many (too many?) variables even with “simple” models

### Confusing?

- what drives volatilization? The urea or the conditions?

### Necessary!

- need guiding scientific principles to create reputable products
- are testing standards needed?



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## Goals of N-sight project

### Clarify

Understand dynamic complexity

Use real data – understand through visualization

### Communicate

Engage public on major N loss pathway from primary N source

### Inspire

Provide new leads for improving control

Using principles to make further advances

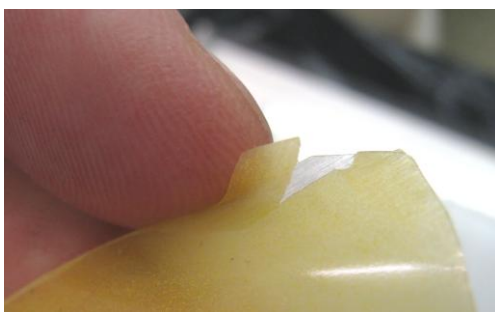


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## Optodes: innovative, dynamic solute sensing films

### The heart of N-sight system



Water and ion permeable films

Fast reaction times (<1 minute) due to thinness

Senses not alters soil conditions



Cut-to-size, easy to mount

Stable in soil for weeks

Re-usable (within limits)

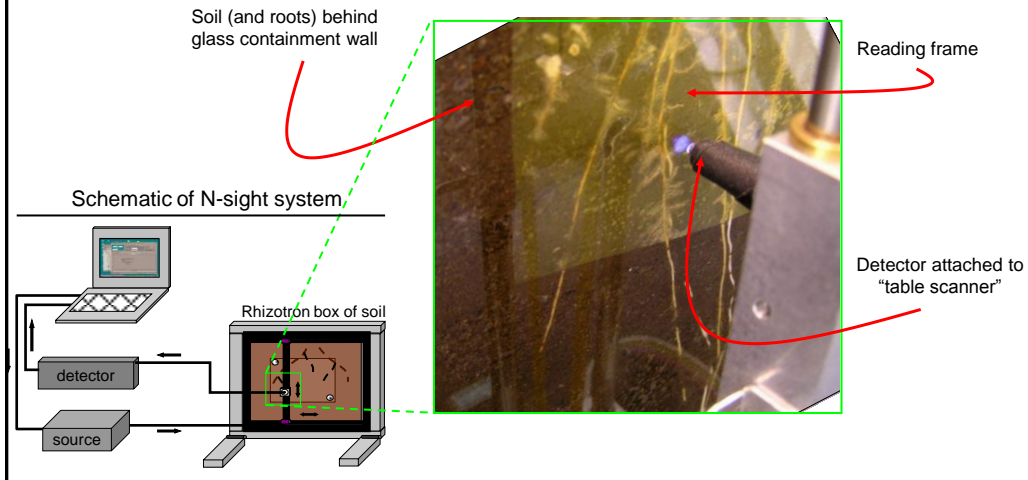


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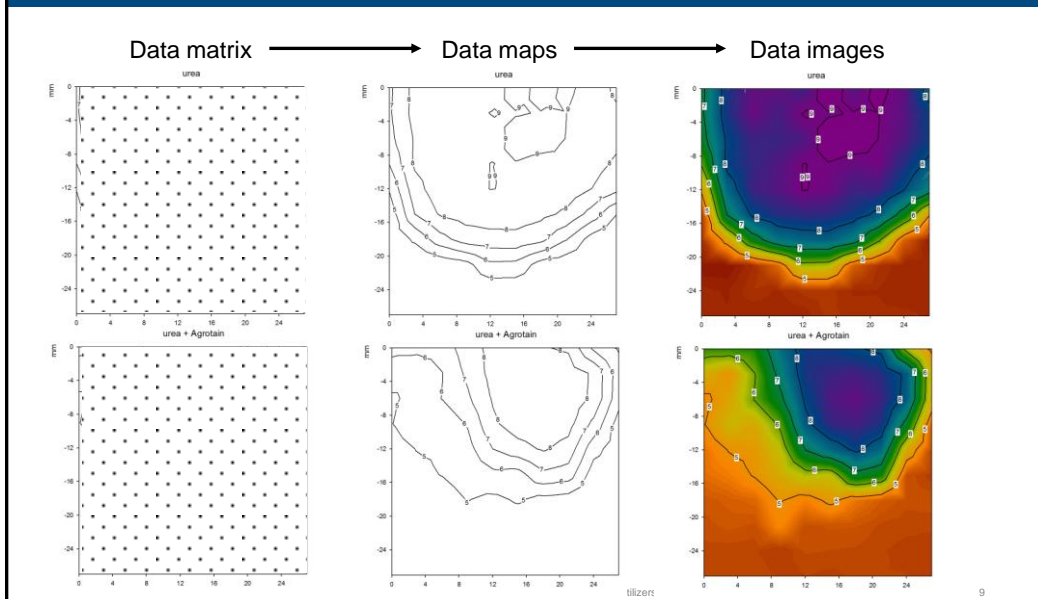
## Optodes in rhizotron boxes – the heart of N-sight

Optodes: in contact with soil without disturbing or altering processes



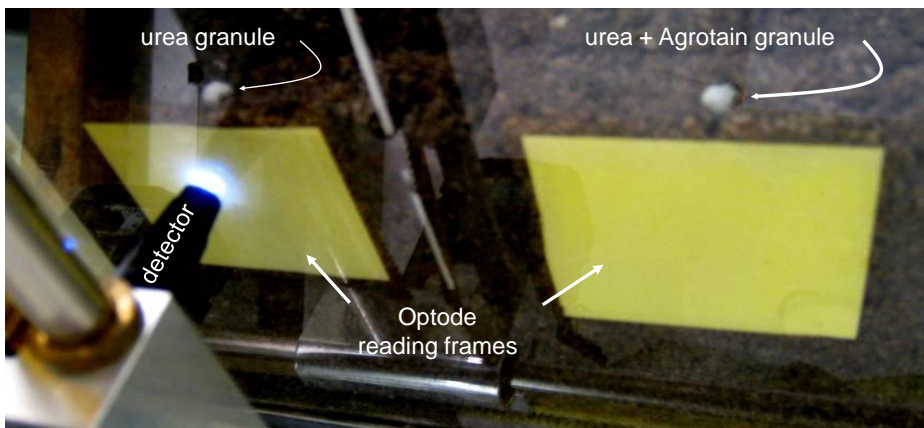
## N-sight operational demonstration

## Converting measurement data into intuitive images



## Research: Understanding Nitrogen Transformation

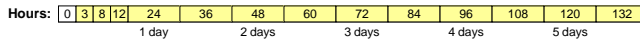
N-sight system analysis of soil with urea and Agrotain-treated urea



# Research: Understanding Nitrogen Transformation

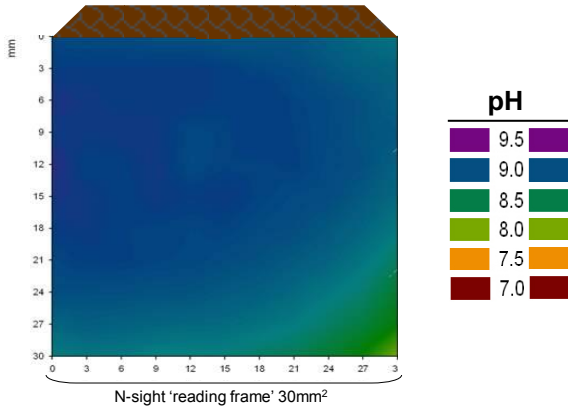
Sandy soil, 1 urea granule added to surface, 1.3in<sup>2</sup> reading frame, 5.5 day run time

[Click here once to start animation](#)



Press up arrow to replay

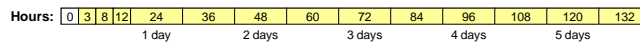
Normal urea



# Research: Understanding Nitrogen Transformation

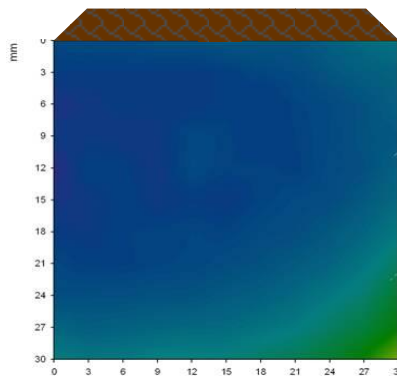
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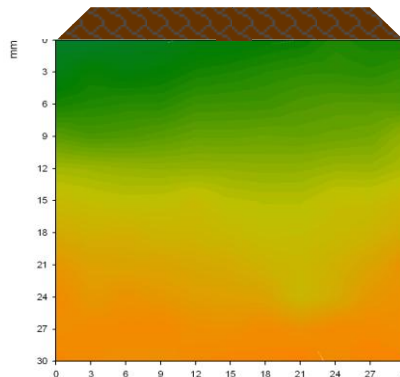
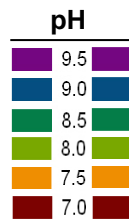


Press up arrow to replay

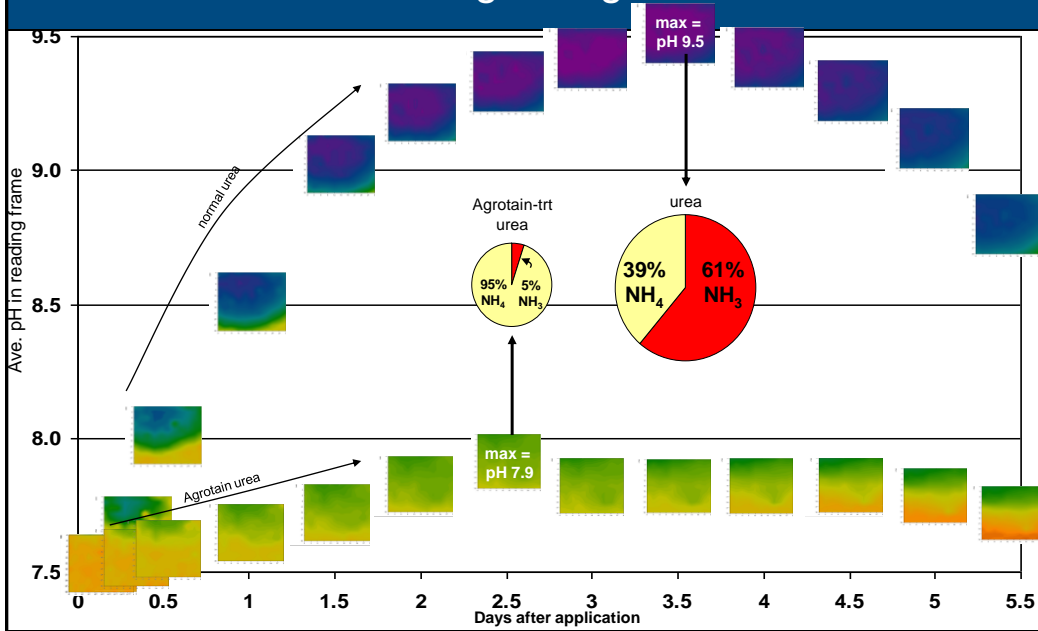
Normal urea



Treated urea



## Research: Understanding Nitrogen Transformation



## Standardized Interface to link soil and loss data

### Rhizotron boxes allow trapping NH<sub>3</sub> during experiments

Standard methods to trap NH<sub>3</sub> from headspace to acid

### Hydrolysis chemistry data linked with NH<sub>3</sub> loss data

Explore cause and effect

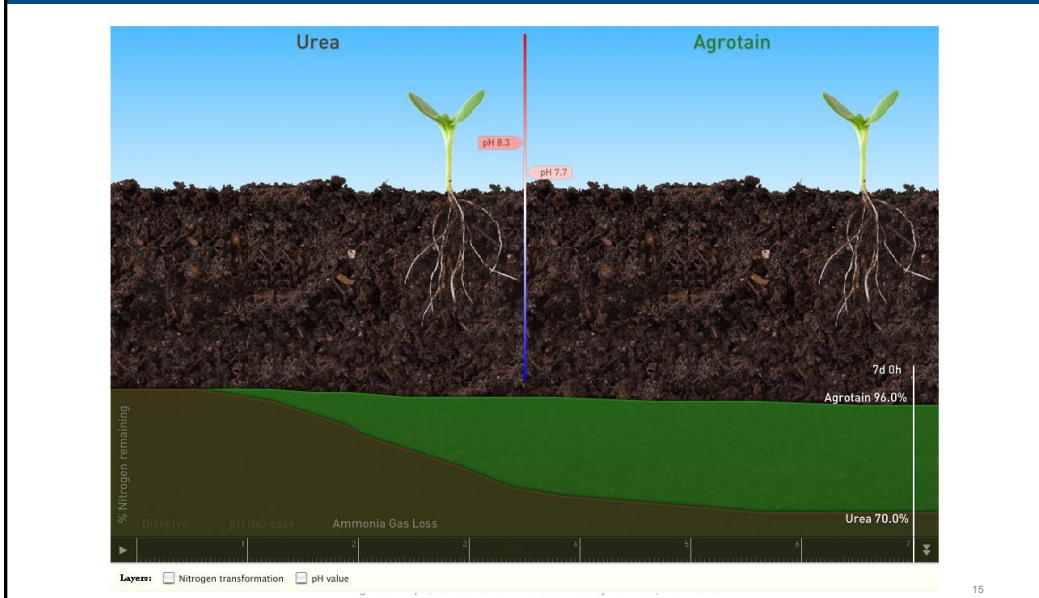
### Allow “layers” of data to be added to the interface

Interactivity increases the engagement with data

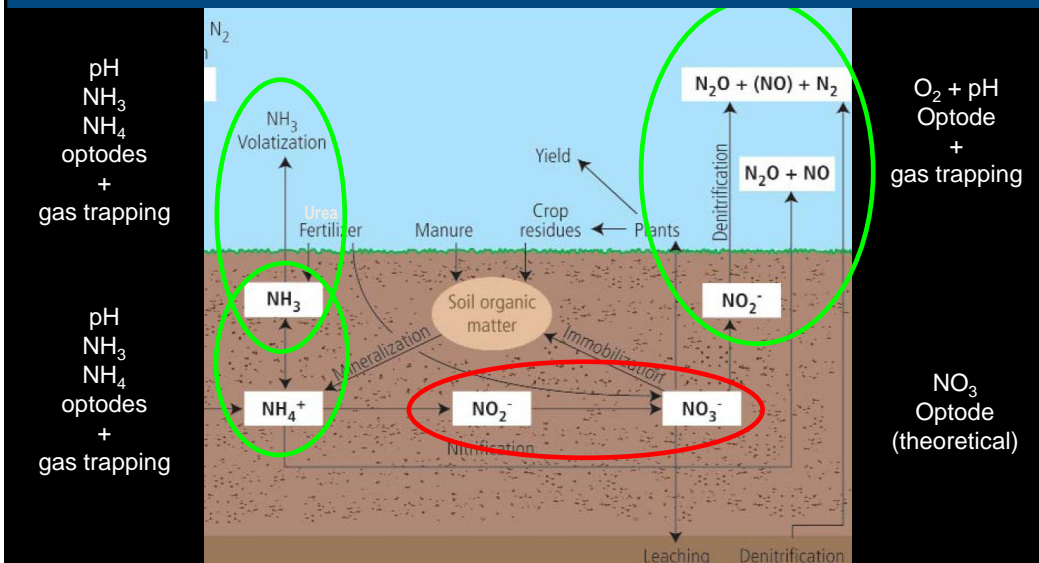
### Only and early prototype! Not user-ready...



## Standardized Interface to link soil and loss data



## Potential application for N-sight technique:



## Goals of N-sight project

### **Clarify**

Hydrolysis-induced chemistry drives volatilization  
NH<sub>4</sub>:NH<sub>3</sub> pool is the source, pH is the force  
other factors influence the two drivers

### **Communicate**

Intuitive, interactive data presentation interface

### **Inspire**

Role for optodes + trapping to clarify dynamics of N transformation