



Knowledge grows

**Data. Insights. Solutions. –  
crop nutrition on the spot**

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# Mechanistics of crop growth – natural parameters

Water



Temperature

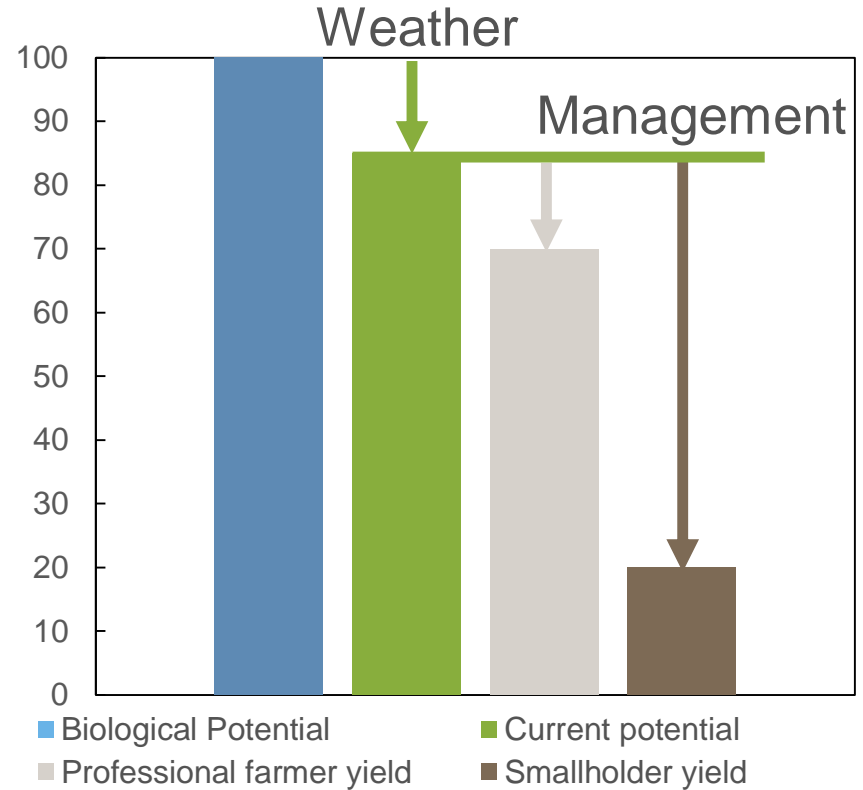
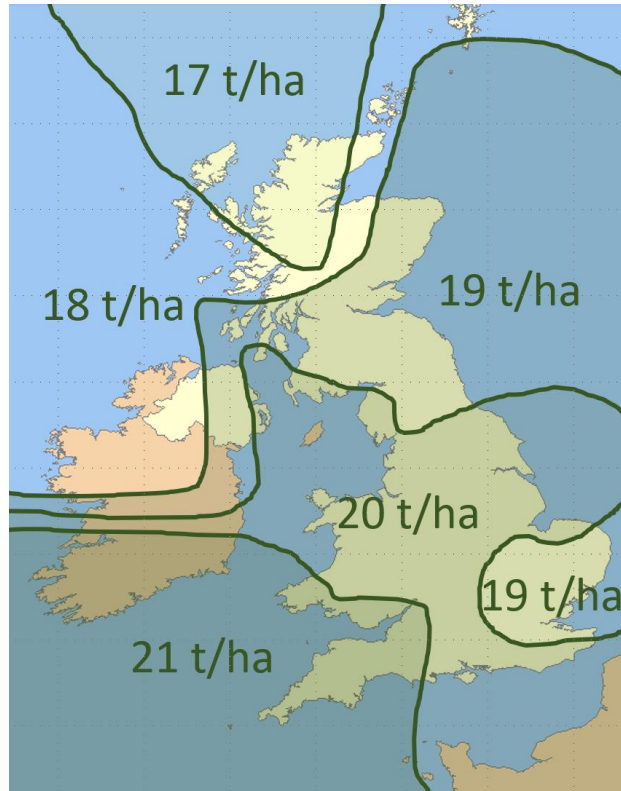


Radiation



Biological Potential

# Mechanistics of crop growth & yield gap



Ref: Own graph based on <http://www.yen.adas.co.uk/>

# Crop nutrition basics

Natural nutrients

Makro nutrients

Secondary nutrients

Micro nutrients





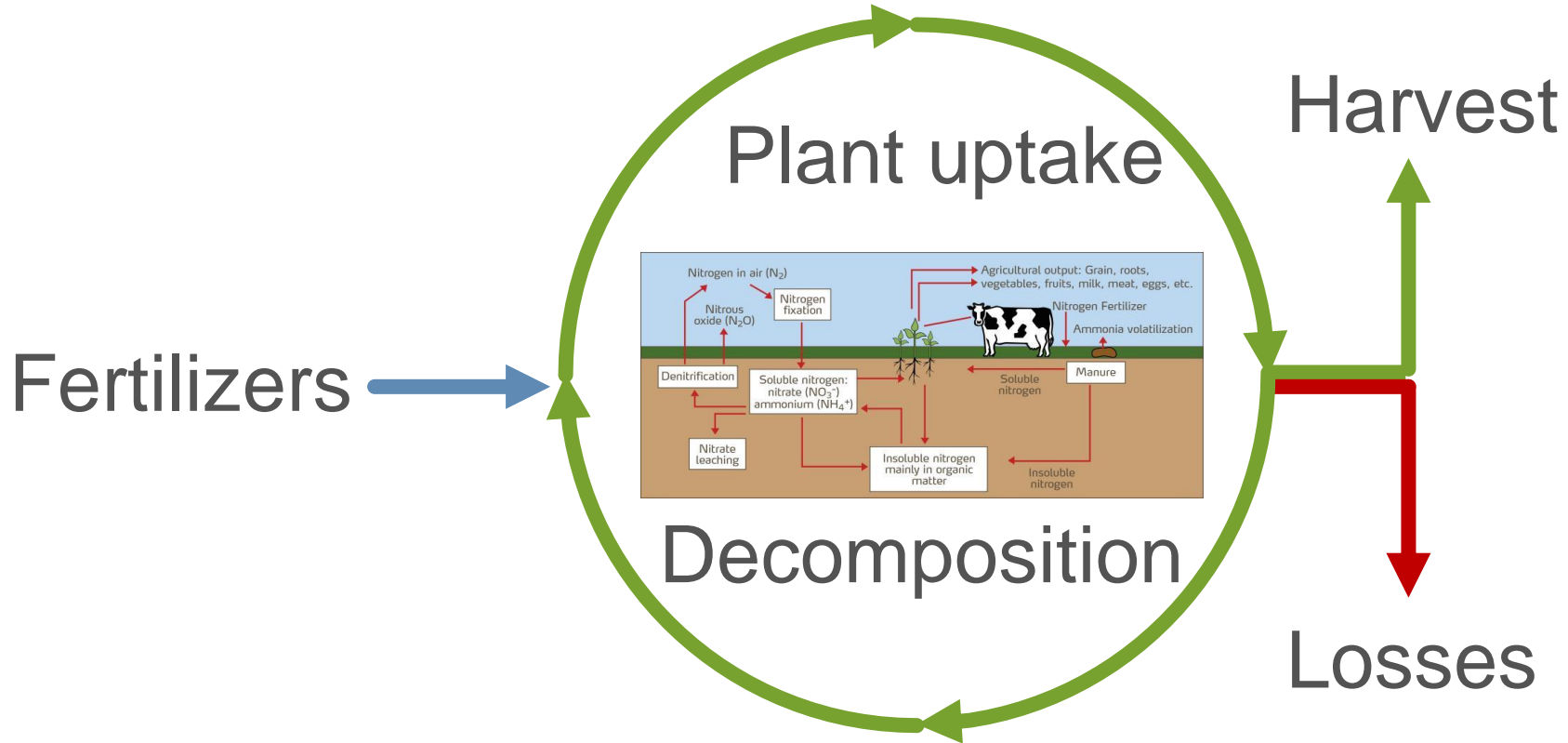
# Crop nutrition basics



# Crop nutrition basics



# Crop nutrition basics – the nitrogen cycle



# Agriculture is a logistical business!

- right product
- right rate
- right time
- right place



Ref: Roberts, International plant nutrition institute

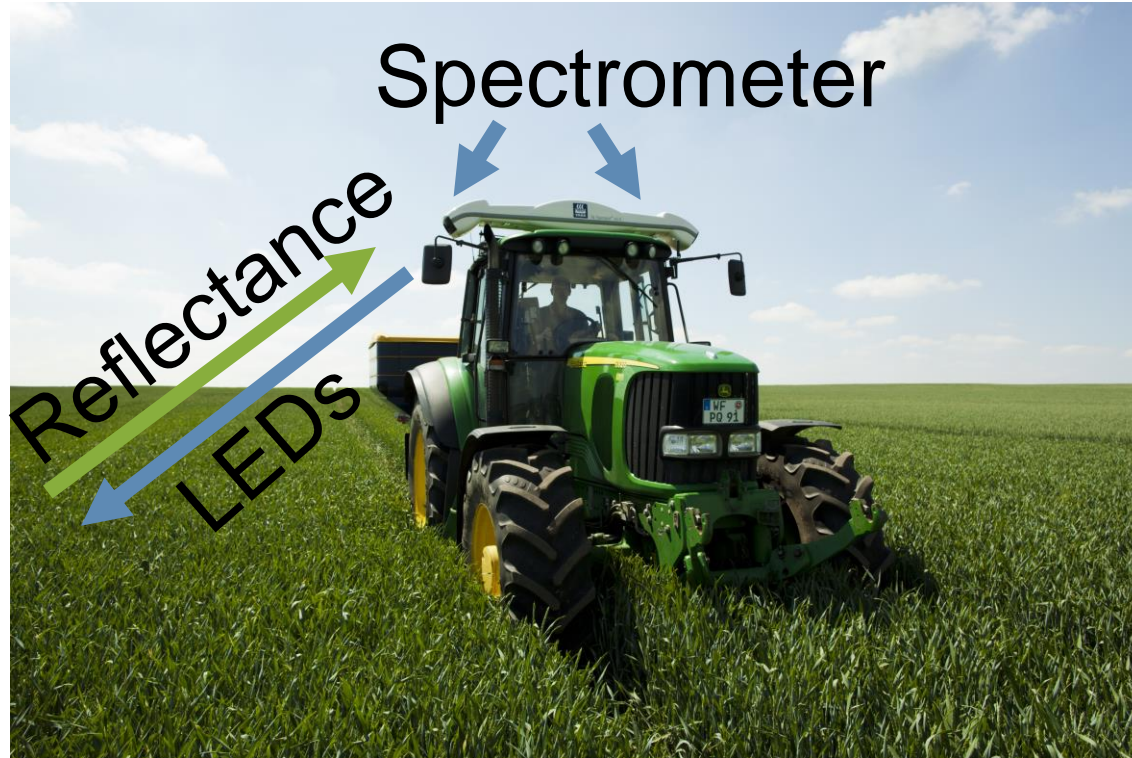


# Soils are heterogeneous & crops grow heterogeneous

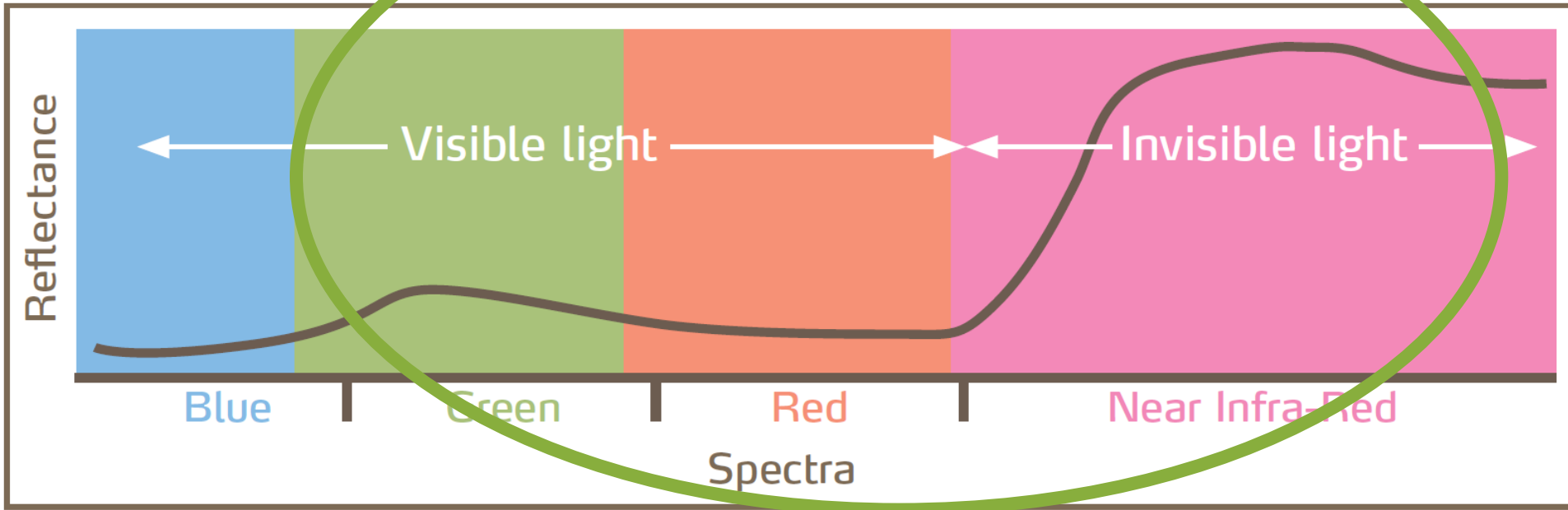


Ref: Atfarm Screenshot

# We need to adress heterogeneity!

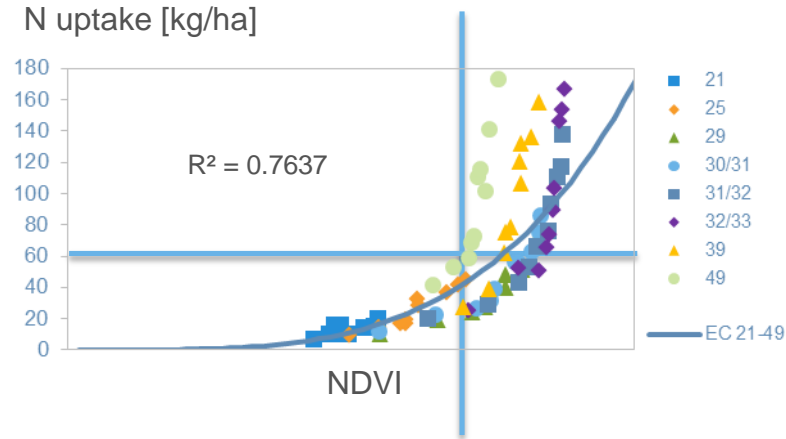


## Canopy reflectance

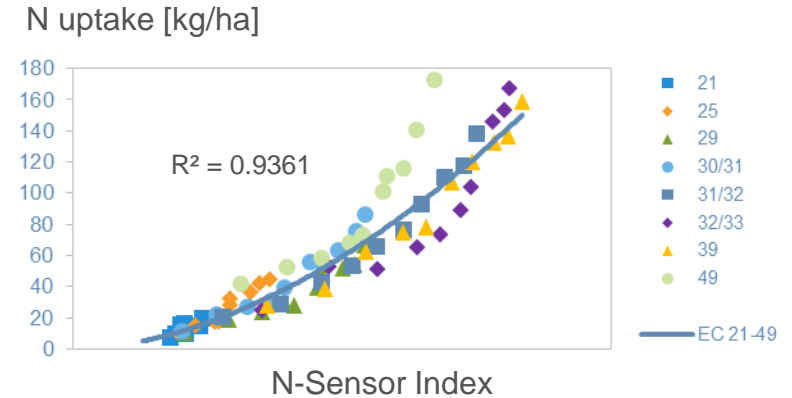


Area of N concentration / N uptake indices

# Robust vegetation index



✓ The NDVI is not useful for approximation of N uptake at later growth stages

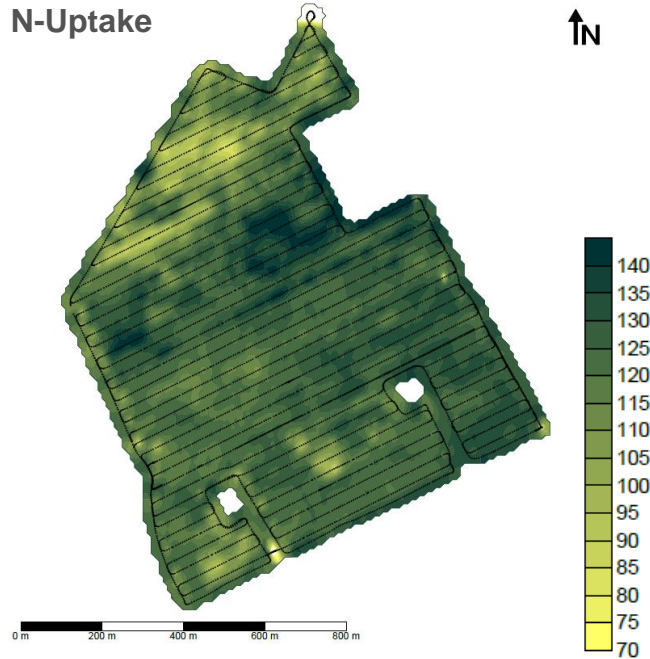


✓ The spectra used for the N-Sensor are more robust throughout the whole vegetation period

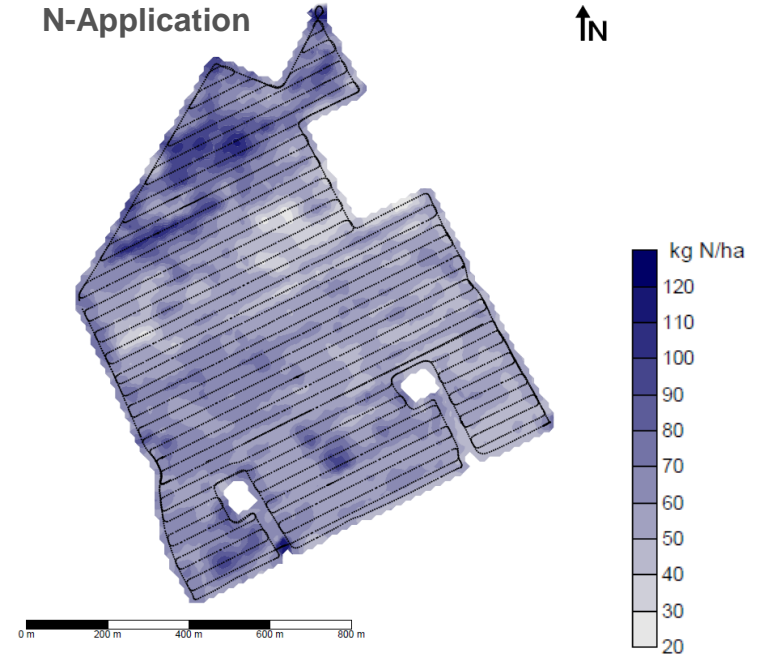


# Calculation of N uptake and application rate

N-Uptake



N-Application



The algorithms change based on crop & growth stage

Cool.....BUT!

# High acreage required for ROI – complicated setup



# Solution: Remote sensing data



## ESA Sentinel 2A/2B

Multispectral sensor platform dedicated to monitoring of soil, water and vegetation:

- Global revisit 5 days
- European revisit 3 days
- 10, 20 or 60m resolution



# Our aspiration: Crop Nutrition Management System

## Crop

Sensors and physical analysis



Leaf analysis



Water-Sensor



ImageIT



N-Tester



N-Sensor



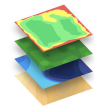
Atfarm

## Soil

Temperature & moisture Sensors, conductivity measurements and physical analysis



Soil analysis



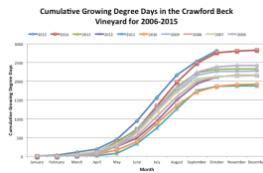
Soil maps



Soil sensor

## Weather

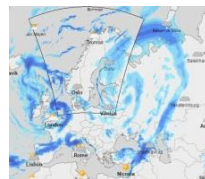
Past, current and future



Historical / modeling



Weather station



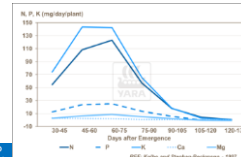
Forecast

## Agronomy knowledge

Nutrient planning Algorithms, Yield modeling, nutrient uptake, removal, guidelines etc.

	N	P <sub>2</sub> O <sub>5</sub> (% P)	K <sub>2</sub> O (% K)	MgO (% Mg)	CaO (% Ca)
Orange	2.55 (0.45)	0.15 (0.33)	0.15 (0.33)	0.15 (0.33)	0.15 (0.33)
Mandarin	3.05 (0.75)	0.15 (0.33)	0.15 (0.33)	0.15 (0.33)	0.15 (0.33)
Lemon and Lime	3.25 (0.82)	0.15 (0.33)	0.15 (0.33)	0.15 (0.33)	0.15 (0.33)
Grapefruit	2.12 (0.36)	0.15 (0.33)	0.15 (0.33)	0.15 (0.33)	0.15 (0.33)

REF: IFU (after Kien, 1980; Chapman, 1940; Malvar, 1980)



Uptake

Removal

## Product portfolio



## Application system

Spreader / sprayer / irrigation



Irrigation

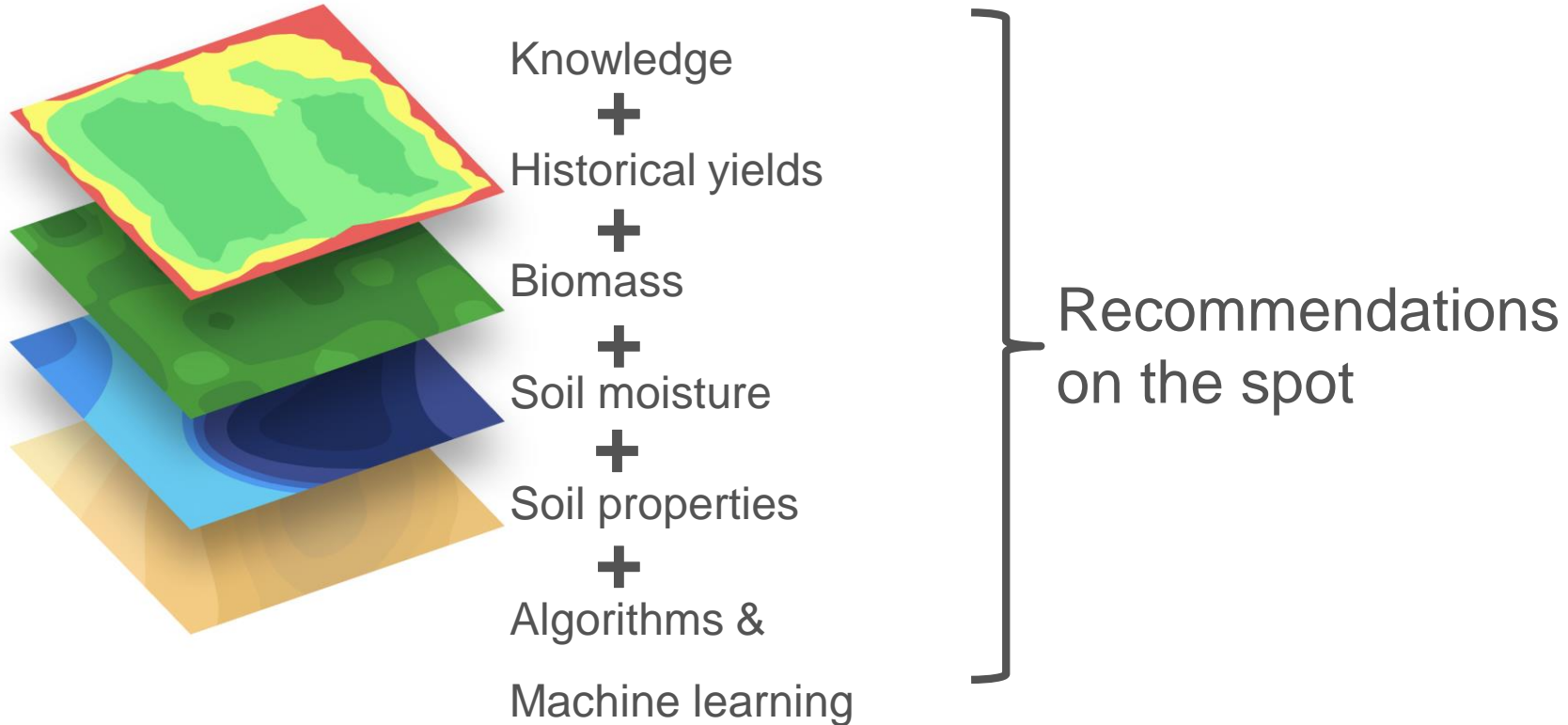


Sprayer



Spreader

# To apply our knowledge we need to know where?







Knowledge grows

[www.at.farm](http://www.at.farm)  
[www.yara.com](http://www.yara.com)