



Knowledge grows

Improving nitrogen use efficiency and crop yield - examples from Europe

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Content of my presentation

- Development of nitrogen consumption, crop yields and nitrogen use efficiency (NUE) in Europe
- How did Europe improve NUE ?
- Measures to further improve NUE in crop production
- Summary

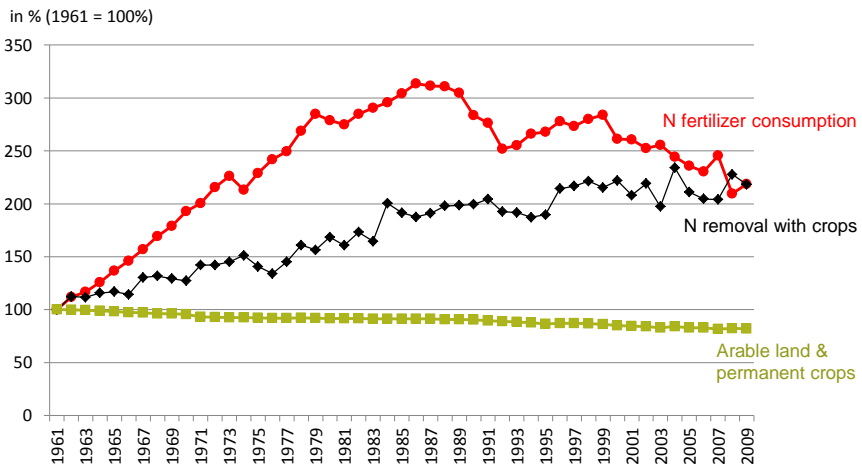


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Development of N fertilizer consumption, N removal with all crops, and cropping area (EU15, 1961 – 2009)

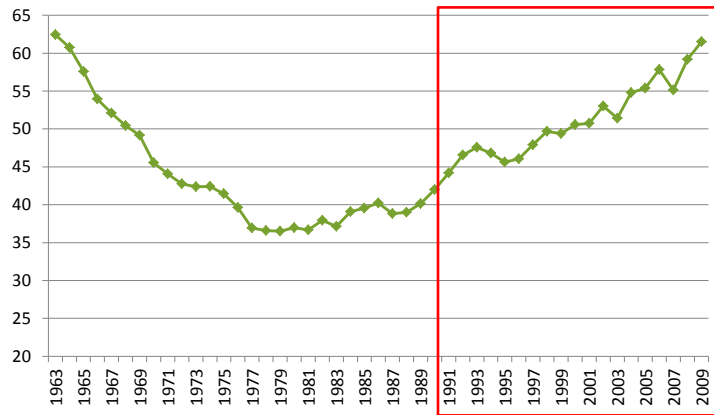


Data from IFA and FAO statistics



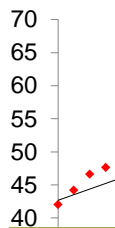
N fertilizer use efficiency (NUE) in EU15 is increasing since the end of the 1980s

in % (N removal / N fertilizer input * 100, 3yrs moving average)

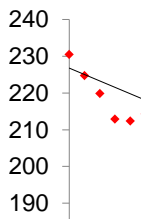


In Europe (EU 15) NUE has increased during the last 20 years while N₂O emissions from agricultural soils have decreased

NUE (%) *



N₂O emissions from ag. soils (Mio t CO₂eq)



The data confirm that increasing NUE is beneficial for the environment, in this case by decreasing N₂O emissions from soil.

Source: FAO, Fertilizers Europe, Yara
 * NUE = crop N removal / mineral N input * 100
 N import with feed is not considered

Source: United Nations Framework Convention
 on Climate Change (UNFCCC, 2011)



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Approach to improve Fertilizer use efficiency

1. Fertilizer planning including organic fertilizer (enforced by legislation)
2. Use organic fertilizer in the most efficient way
3. Focus on a balanced nutrition of all nutrients
4. Use the most efficient mineral fertilizer sources
5. Adjust fertilizer rate in season to actual crop demand



Fertilizer planning based on crop, soil, climate and available nutrient sources

Fertilizer planning

Planning year: 2006 Farm: YARA Field: Hanninghof 2 (5.00 ha)

Cropping Plan | Detailed Plan | Nutrient Demand | Fertiliser Plan | Nutrient budget | Documentation

Nutrient demand [Rotation]

Manure application in year 2006

Crop	Fertiliser	[t or [m ³]	Month	Application technique	Avail. N	Avail. NH ₄	N	P2O5	K2O	MgO	CaO
Winter Barley	Slurry Cows	20.0		Hose-towed	100%	52	38	124	20	-40	

Winter Barley
 Nutrient demand: N 169, P2O5 70, K2O 123, MgO 41, SO3 33, CaO -333
 J. Nutrients from soil: N 40, P2O5 21, K2O 70, MgO -1, SO3 31, CaO -40
 J. Nutrients from manure: N 52, P2O5 38, K2O 124, MgO 20, SO3 -40, CaO -40
 Fertiliser need: N 77, P2O5 11, K2O -72, MgO 22, SO3 1, CaO 373
 N dressings: 1, 0, 2, 35, 3, 42, 4, 0, 5, 0
Growing year 2006
 Fertiliser need: N 77, P2O5 11, K2O -72, MgO 22, SO3 1, CaO 373
Crop rotation 2006 - 2008
 Fertiliser need: N 351, P2O5 154, K2O 220, MgO 132, SO3 1039

Nutrients in kg/ha

Print

Farm: 1, Store in: 2...

Store	Available
Slurry Cows	1400



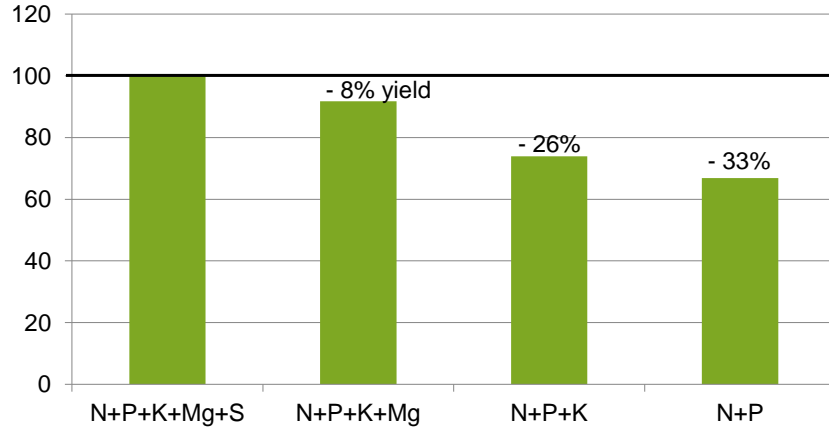
Use organic fertilizer in the most efficient way

- Consideration of all available organic nutrient sources (crop residues, manures, catch/cover crops, BNF)
- Reduction of losses through improved application technologies and immediate incorporation



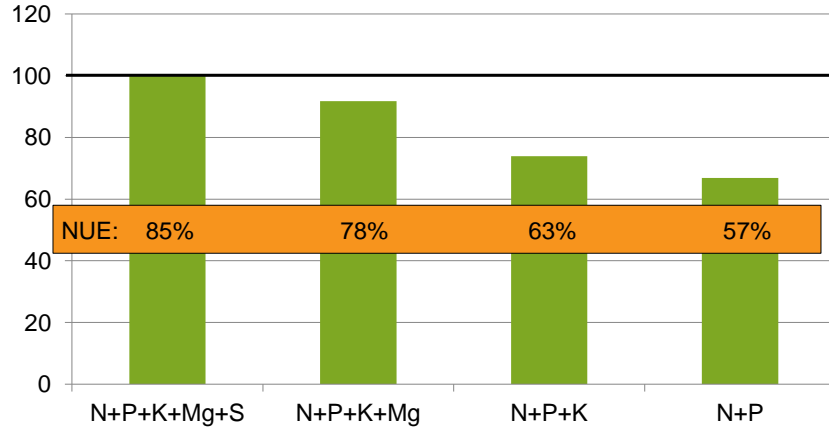
Optimum yield and high NUE can only be achieved with balanced supply of all plant nutrients

Yield in % (highest yield = 100%), field trial with winter wheat



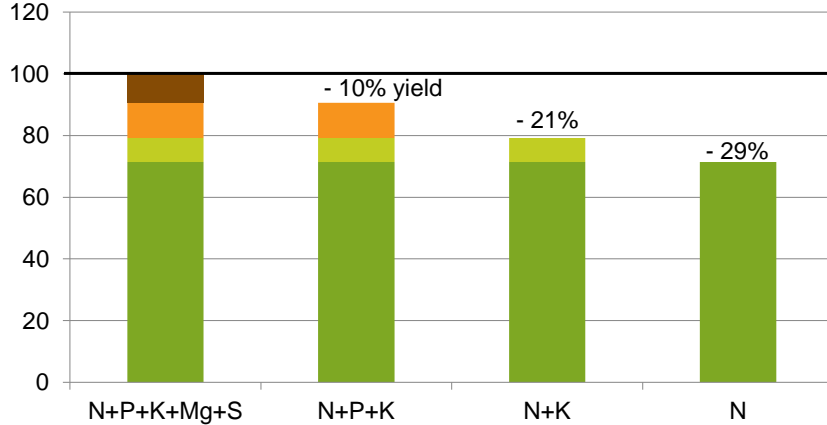
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Yield in % (highest yield = 100%)



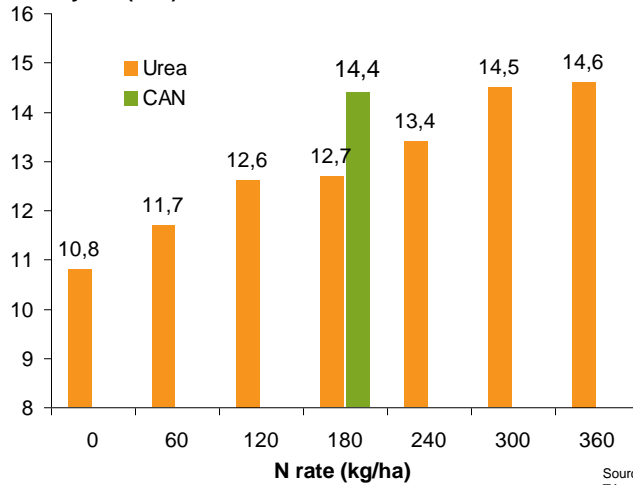
Balanced fertilization considering all plant nutrients gives highest yields and NUE

Yield in % (highest yield = 100%), field trial with potato (Hanninghof, Germany)



Higher fertilizer efficiency at optimum rates with YaraBela fertilizers (Corn, Spain)

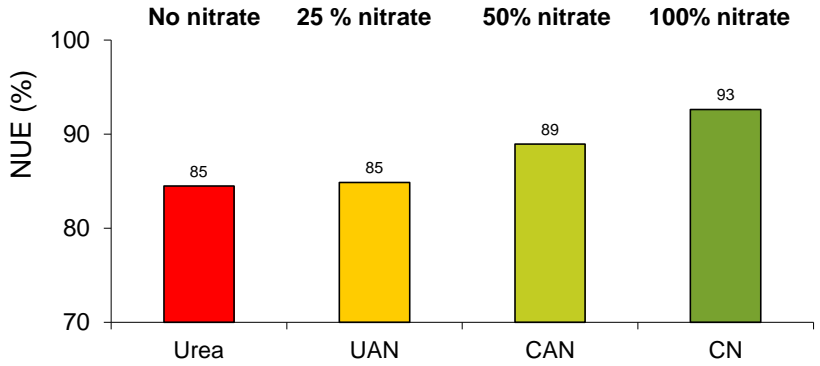
Grain yield (t/ha)



Source: ITGC (2004) - Instituto Técnico de Gestión del Cereal



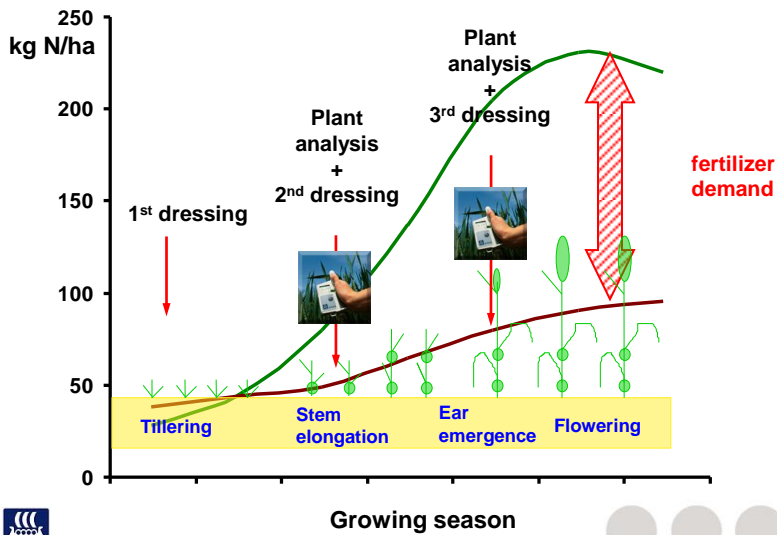
Nitrogen fertilizers that contain more nitrate have a better nitrogen use efficiency



Avg. of 15 field trials in UK with winter wheat at a N supply of (160 kg/ha)



Adjust fertilizer rate in season to actual crop demand (e.g. based on plant analysis)



Tools for Best Fertilizer Management

Fertilizer planners and crop monitoring tools are used to calculate the right nutrient requirement for each crop and each field



=> these tools helped to improve fertilizer management and nutrient use efficiency



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Precision farming is becoming a common practice in European crop production

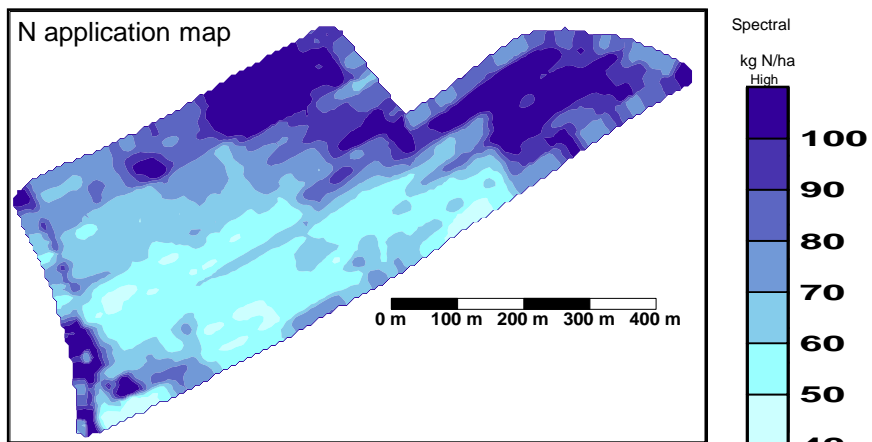
Example of a heterogeneous wheat field:



Therefore, the standard procedure requires additional fine-tuning every year and during the season.



N-Sensor[®] detects areas of different N supply and adjusts N fertilizer rates accordingly

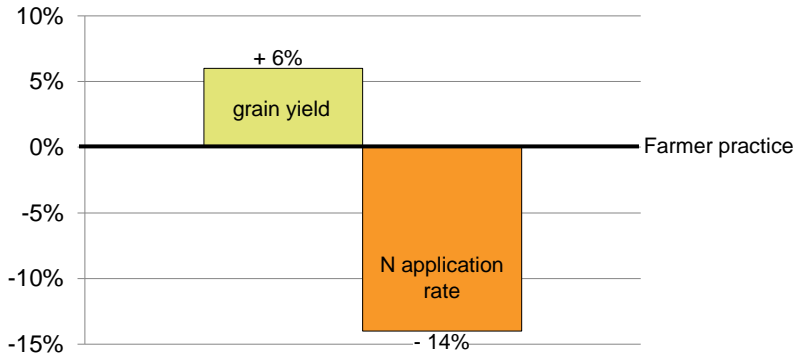


Winter Barley, N-Sensor measurement and N application on the 25th of May 1999
Source: AgriCon, Germany

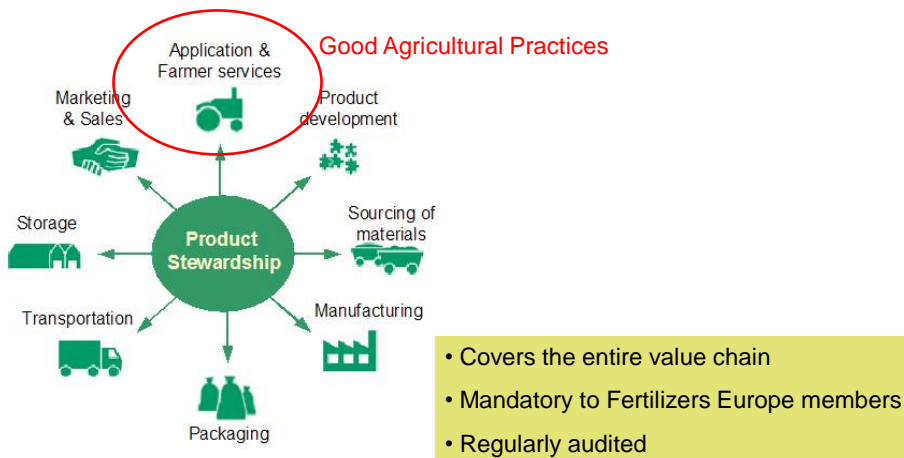


Variable rate N fertilization increases NUE

Average yield and N application rate of variable rate treatments as compared to farm practice (23 trials with winter wheat, 2001-2008)



Fertilizers Europe's Product Stewardship Program



Summary

- Mineral and organic nitrogen (N) fertilizer is applied to nourish the crop in order to produce optimum and economic yields.
- The more fertilizer N ends up in the harvested crop, the better for the farmer and for the environment.
- A range of measures (nutrient planning incl. organic sources, balanced nutrition, efficient N fertilizer, site and season specific adjustments) has already contributed to increasing NUE in European crop production, however, there is further scope for improvements.
- The European fertilizer industry supports farmers to increase their NUE by providing tools and services around the fertilizer products (stewardship).

