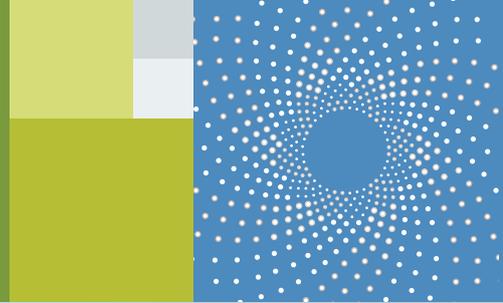


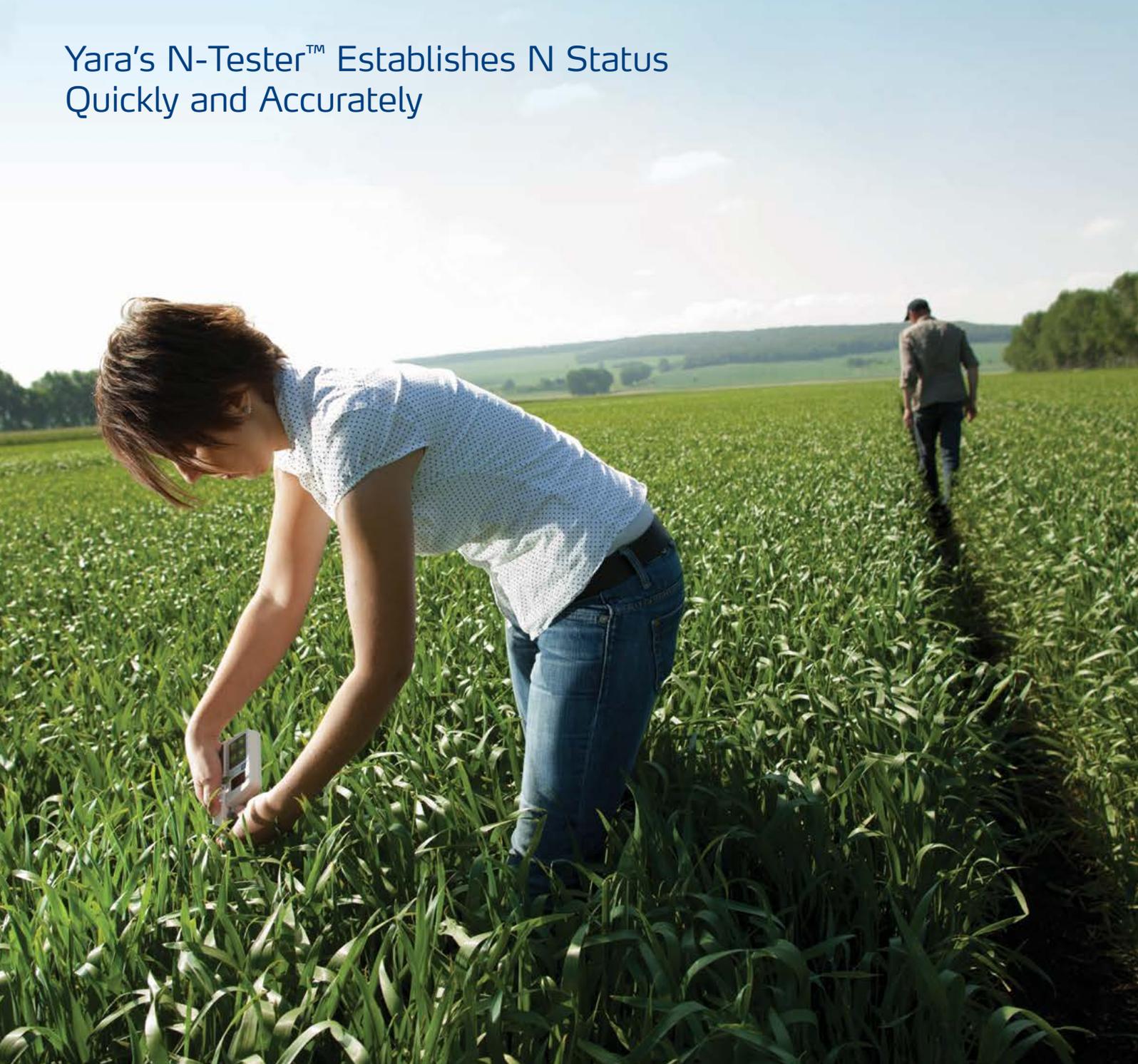


Knowledge grows

# Precision Farming in Practice



Yara's N-Tester™ Establishes N Status  
Quickly and Accurately



# Yara N-Tester™

## What is N-Tester?

N-Tester™ is a hand held tool which enables quick and easy non-destructive measurements to be taken in a growing crop to establish its nitrogen status. This enables both more timely nitrogen applications as well as fast and accurate field specific nitrogen recommendations to help fine-tune final dressings towards the end of the growing season. This can result in more accurate nitrogen management, improving profitability and nitrogen use efficiency whilst minimizing environmental impact.

The nitrogen fertilizer demand is never constant and can vary considerably from year to year and field to field. This has been demonstrated by recent Yara trial work showing that optimum nitrogen rates have varied from under 100kgN/ha to over 300kgN/ha.

Two of the main influencing factors of nitrogen fertilizer demand in a cereal crop is the amount of nitrogen that is supplied by the soil and the efficiency of uptake, neither of which can be accurately measured directly.

With the N-Tester it is possible to identify the nitrogen status of plants directly in the field, easily, safely and quickly. A plant analysis with the

N-Tester gives valuable information about the current nutritional status of the plant, helping to identify the amount of both soil nitrogen and fertilizer nitrogen the crop has been able to pick up.

The nutritional status of the plants determines both the timing and later in the season, the amount of fertilizer required.

## N-Tester operation modes

The N-Tester can be used as a tool for identifying the optimum timing of nitrogen, by monitoring the nitrogen status of the plant on a regular basis using the 'Relative' calibration, as well as fine-tuning final dressings in cereals using the 'Absolute' calibration.

## N-Tester for Nitrogen Timing

The nutritional status of crops determines the timing of nitrogen application as regular measurements can track the change in nitrogen status of the crop over time. Whilst nitrogen levels remain stable or increasing, additional nitrogen is not required, however once the values start to drop, nitrogen timing can be targeted to better match crop demand.





For this approach, rather than taking the typical ‘W’ pattern through a field, a small, repeatable area that is representative should be chosen to take the 30 samples. Also, rather than selecting the crop in the options on the screen, scroll down and select ‘(with reference)’. A field name can then be entered, after which the samples can be taken, ensuring the youngest fully emerged leaf is chosen each time.

The three digit values produced can then be entered into a spreadsheet to track the nitrogen status of the crop over time. As the value starts to drop below the target level, additional nitrogen applications can be better timed to ensure the crop is never too under or over fed.

This method also helps to identify the impact of weather conditions on the uptake and usage of nitrogen in the plants. If dry conditions persist following an application of nitrogen to a field, regular N-Tester measurements can help to identify whether this nitrogen has been taken up by the plant, or if it is still in the soil, and therefore likely to become available following moisture.

This approach is likely to lead to an increase in number of applications during a season, but by splitting the N-fertilization into more dressings, it is possible to optimise the nitrogen

rate according to the plants needs on any field in any year.

### N-Tester for Yield

In cereals the N-Tester measurement can be used to calculate the optimum nitrogen rate for the final timing around flag leaf emergence. By choosing the crop type plus variety on the screen and entering the field name, 30 samples can be taken, again from the youngest fully emerged leaf, to provide a three digit value as well as a nitrogen recommendation.

Current research conducted by Yara UK is looking at calibrating the N-Tester for use early in the season as a tool for recommending nitrogen application rates at GS 31/32 as well as the final dressing.

Optimum nitrogen rates can only be calculated from nitrogen response trials at the end of the season, and are therefore a retrospective assessment. Trials over the years have shown the benefit of using N-Tester to better match nitrogen rates to the season (Table 1).

N-Tester recommendations are based on variety specific calibrations to achieve optimum yield. Where a milling wheat is grown a further 40-60kgN/ha should be applied for quality.

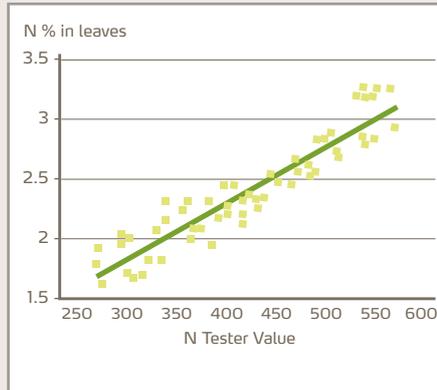
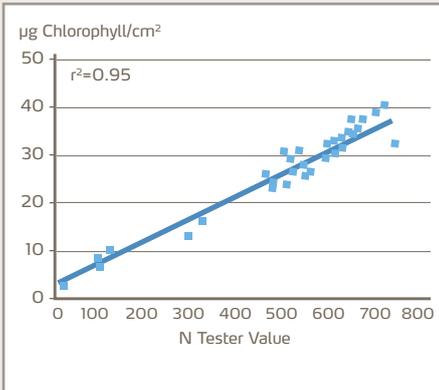
### Performance of N-Tester recommendation compared to economic optimum yield

232 trials, winter wheat, 1993 - 2010	Calc. economic optimum yield*	N-Tester relative yield*
1993 <b>15 trials</b>	100	99
1994 <b>10 trials</b>	100	99
1995 <b>10 trials</b>	100	97
1996 <b>10 trials</b>	100	100
1997 <b>12 trials</b>	100	97
1998 <b>15 trials</b>	100	100
1999 <b>13 trials</b>	100	99
2000 <b>14 trials</b>	100	98
2001 <b>7 trials</b>	100	100
2002 <b>9 trials</b>	100	98
2003 <b>7 trials</b>	100	96
2004 <b>16 trials</b>	100	97
2005 <b>13 trials</b>	100	99
2006 <b>16 trials</b>	100	98
2007 <b>13 trials</b>	100	100
2008 <b>19 trials</b>	100	97
2009 <b>18 trials</b>	100	98
2010 <b>15 trials</b>	100	98

## How does the N-Tester work?

N-Tester operates by measuring the chlorophyll content of the leaf, as this is directly related to the nitrogen status of the plant. The measurement point should be in the middle of the youngest, fully developed leaf.

### Graphs to show the correlation between the N-Tester reading and Chlorophyll and %N in leaves.



Thirty random measurements from across the field, taken using the usual 'W' pattern, give an average value that is used to indicate how much nitrogen the crop requires. Deriving a fertilizer recommendation is only possible if no other nutrient is limiting crop growth.

The N-Tester™ measurements are strongly influenced by crop variety and growth stage. For this reason the N-Tester™ measurements must be calibrated to take account of this variation.

As all varieties are slightly different in terms of their inherent colour, Yara calibrates the N-Tester annually on a large number of variety trials across Europe, and these correction values are built into the software on the N-Tester. Software updates are periodically released, as well as the annual updates to include newly released varieties, which can be downloaded directly onto the N-Tester using the USB cable supplied and the N-Tester loader software.

## N-Tester Ensures Your Economic Success

Applying the correct level of nitrogen to a cereal crop can have a significant benefit both on yield and on grain quality. Ensuring that the protein content of grain meets grain buyers' specifications can have a significant impact on crop profitability. Trials have shown that by using N-Tester large increases in grain protein content can be achieved.

### Trials in the UK

In more than 140 field trials on cereals:

- Increased protein content of 0,5%
- Additional yield lead to an increased gross margin of more than £20/ha

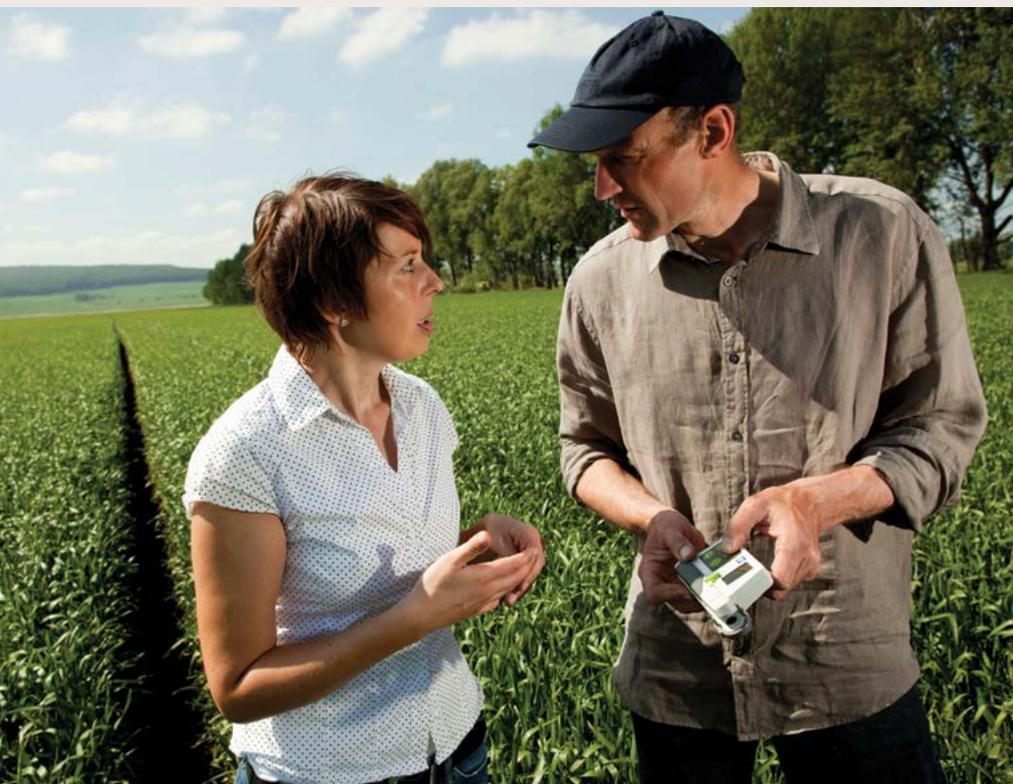
### Trials in France

In more than 240 field trials on cereals:

- Increased protein content of 0,3%
- Increased yield of 0.12 t/ha
- Additional yield led to an increased gross margin of more than 18 €/ha (cost of application deducted)

## An Environmentally Friendly Tool

A nitrogen fertilizer strategy based on the current need of nitrogen by plants not only ensures optimal yields, but also leads to a better utilization of fertilizer nitrogen and therefore reduces the amount of nitrogen that could potentially be available to leach. For this reason the N-Tester is recognised as an official building block of an environmentally sound agriculture by many official advisory services throughout Europe.



## N-Tester and the optimal application of YaraBela™

N-Tester™ used at GS37 onwards will provide a nitrogen recommendation for the crop as well as a fertilizer recommendation. At this point the choice of fertilizer is then crucial.

YaraBela is the range of ammonium nitrate-based fertilizers developed by Yara to feed the crop with a highly available nitrogen form. It is immediately and fully plant available because it can be easily taken up by the plant regardless the weather and soil conditions.

The N-Tester helps to fine tune the application of YaraBela at the right growth stage and in quantities that are environmentally sustainable, following the 'Just-in-Time' plant nutrition strategy supported by Yara.

### The 'Just-in-Time' Concept

When it comes to application of products, the 'Just-in-Time' concept expresses Yara's belief that applying the right amount of the correct product, at the time needed by the developing crop, brings the best results for growers and profits to our customers.

Whenever the 'Just-in-Time' approach is applied, sustainability and profitability will always be linked.

'Just-in-Time' application of fertilizers means:

- **Providing the required nutrients**
  - At the time of crop demand
  - In an adequate ratio
  - In a highly plant available form
- **Employing the best available delivery system**
  - Solid or liquid application
- **Using tools like the N-Tester to determine the current nutrient requirement, by considering:**
  - Nutrient supply by the soil
  - Crop development stage
- **Advantages**
  - To allow a better fine tuning in terms of crop requirement
  - To achieve a high nutrient efficiency
  - To make the most of the crop's potential in terms of yield and quality



### Testimonial

Based in Steeple Aston, 15 miles north of Oxford in the UK, Clarke Farming Partnership rears its own British lamb, provides farm management and contract farming services and offers professional advice to farms and estates in the Midlands, South & West of England.

Seeing the rising price of premiums for milling wheat in 2000, Mr Clarke decided to invest in the crop and has gradually increased its hectareage across managed and contract farms to just over 1,000 ha in 2015.

*"I knew I had to increase the nitrogen content of the grain to meet the premiums and I've always thought that working out what fertilizer to apply and when was too much like guesswork. We work hard to avoid being a day late when applying a fungicide, for example, but when it comes to fertilizer, we think 'OK, we'll go for mid April' kind of attitude. I wanted to get more scientific about the timings and amounts to apply."*

Mr Clarke was already aware of the N-Tester and in 2014, became involved with the agronomy team at Yara UK to put in place an N-Tester Trial on milling wheat on a 40 ha field on one of the company's managed farms. Kicking off in April, the trial resulted in a 0.6% increase in the protein content of the milling wheat crop which is significant given current premiums for a min 12.5% spec contract.



*"Any lift in percentage protein is good," Mr Clarke continues, "but when you get a lift of 0.6% above the minimum specification, it can be worth £20/tonne to the farm business. That's significant."*

*"Premiums have gone up a lot for 2015 because of the very poor French harvest, and more people are growing milling wheat as well, so it's even more important for us to get better at managing grain protein content and the timing and amount of fertilizer applied."*

*"I'm using the N-Tester in the same way, but I'm more confident with it this year. It's a good management tool that really improves the accuracy of your nitrogen timings and amounts and I would certainly recommend it. I'm a fan!"* concluded Mr Clarke.

In 2015, the Clarke Farm Partnership is using the Yara N-Tester on 600Ha - or 60% - of its total milling wheat hectareage.

Our thanks to Sam Clarke, BScAg, BASIS, FACTS, ICM, IPM, MBPR & NRoSO qualified farmer and crop consultant, Clarke Farming Partnership, May 2015.

Yara UK Limited  
Harvest House  
Europarc  
Grimsby  
NE Lincolnshire  
DN37 9TZ

© 2015 Yara. All rights reserved.

Yara UK Limited  
April 2015

## About Yara

Yara's knowledge, products and solutions grow farmers and industrial customers' businesses profitably and responsibly, while nurturing and protecting the earth's resources, food and environment.

Our fertilizers, crop nutrition programmes and technologies increase yields, improve produce quality, and reduce environmental impact from agricultural practices. Our industrial and environmental solutions reduce emissions and improve air quality from industry and transportation, and serve as key ingredients in the production of a wide range of goods.

Founded in 1905 to solve emerging famine in Europe, Yara today has a global presence with more than 12,000 employees and sales to more than 150 countries. [www.yara.com](http://www.yara.com)



 @Yara\_UK

 Yara UK

 01472 889250

 [agronomy.uk@yara.com](mailto:agronomy.uk@yara.com)

 [www.yara.co.uk](http://www.yara.co.uk)