



## Cost of the different options available to the farmers - current status and prospects

Joachim Lammel, Yara International ASA



### Content

- **The concept of an ideal fertilizer**
- Current status on enhanced efficiency fertilizers
- Prospects for enhanced efficiency fertilizers



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## The “ideal fertilizer”

The ideal fertilizer should have at least the following characteristics:

- it only needs one single application throughout the entire growing season to supply the necessary amount of nutrients for optimum plant growth
- it has a high maximum percentage recovery in order to achieve a higher return to the production input, and
- it has minimum detrimental effects on soil, water and atmospheric environments

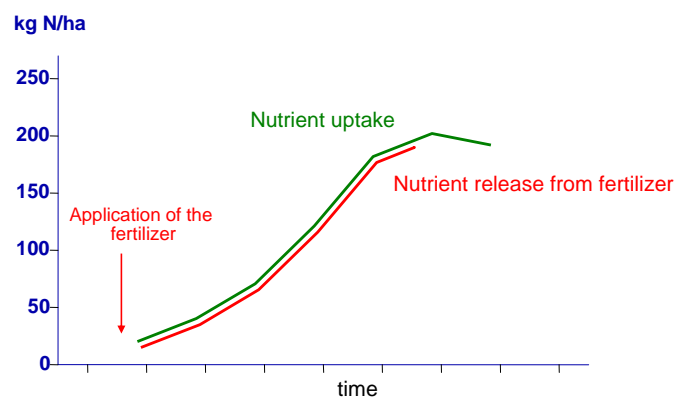
(according to Shoji and Gandeza (1992) cited in Trenkel 1997).



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## The “ideal fertilizer”: the nutrient release is synchronized with the crop’s nutrient demand



- The nutrient release pattern should match exactly the nutrient uptake curve of the crop.
- Any excess nutrients shall remain in the soil for the next crop.



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## The “ideal fertilizer” is still a matter of intensive research

- A Patent search with the keywords slow and controlled release fertiliser, urease and nitrification inhibitors, for the period from 1963 to 1999 revealed 1404 hits.
- The majority of patents are on coated and slow release fertilizers including urea-formaldehyde and urea condensate products.
- The fertilizer concepts can be summarized into 4 main product groups.
  1. coated fertilizers (controlled release),
  2. slow release fertilizers
  3. nitrification inhibitors,
  4. urease inhibitors
- The existing products are still only an approximation to the “ideal fertilizer”



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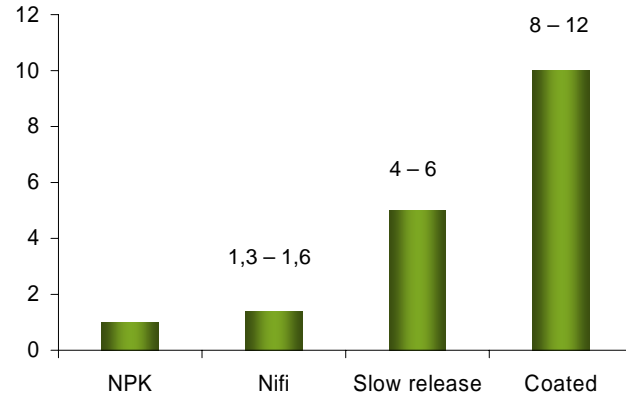


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The prices for enhanced efficiency fertilizers are substantially higher than for standard fertilizers

Relative fertilizer prices (NPK = 1)



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Farmers that grow high value crops can potentially pay for the enhanced efficiency products

	High-value crop (Melons) US \$ / ha	Low-value crop (Wheat*) US \$ / ha
Production cost	12100	750
Yield value	13750	780
Profit	1650	30
<b>Value of 5 % yield increase</b>	<b>687</b>	<b>39</b>

\* Yield: 6 t/ha, no subsidies considered

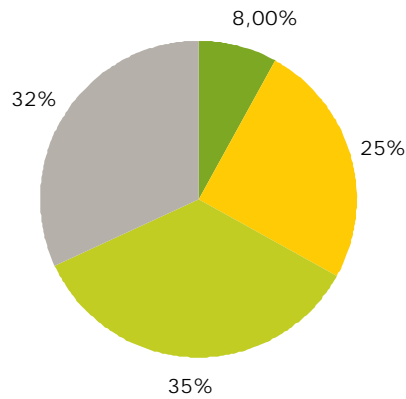


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## Market segments of controlled and slow release products in Europe (1998)

- Agriculture
- Home and Garden
- Turf and Public Green
- Nurseries



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## Summary: Current status of enhanced efficiency fertilizers

- Enhanced efficiency products are not new. They exist in the market since decades and their use has grown over time.
- Their total market share of the global fertilizer market is still quite low.
- The reason for the low market share is the fact that they are much more expensive than conventional fertilizers
- Only high value crop segments are able to cover the additional cost for that type of products.
- The current main markets are therefore professional horticulture, turf & public green and home & garden.
- Enhanced efficiency products provide a solution for the market segments in which they are sold today.



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- **Prospects for enhanced efficiency fertilizers**



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## Two main strategies exist to improve Nutrient Use Efficiency (NUE)

Product strategy	Fertilizer management strategy
Enhanced efficiency fertilizers	Enhanced efficiency fertilization
<b>Primary focus</b> product features <ul style="list-style-type: none"> <li>• coated fertilizers</li> <li>• slow release fertilizers</li> <li>• nitrification inhibitors</li> <li>• urease inhibitors</li> </ul>	Product features <ul style="list-style-type: none"> <li>• fast acting, water soluble fertilizers</li> </ul>
Management strategy <ul style="list-style-type: none"> <li>• reduced number of applications</li> <li>• yield expectation determines N rate</li> </ul>	<b>Primary focus</b> nutrient management <ul style="list-style-type: none"> <li>• split N application</li> <li>• N rate based on plant analysis</li> <li>• variable N rate (time &amp; space, precision farming)</li> </ul>



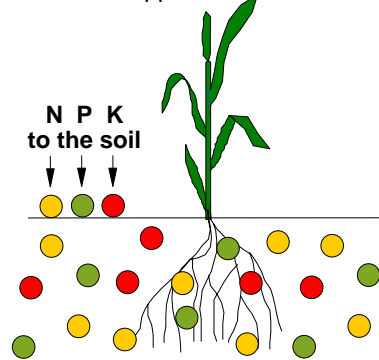
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## Alternative concepts: Soil maintenance vs. Plant nutrition

- Principle

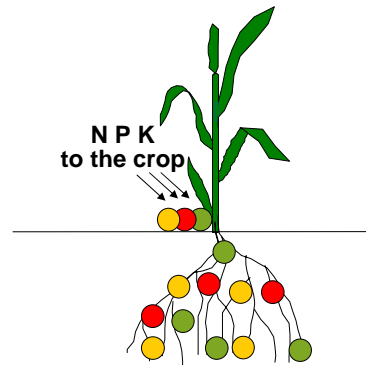
The crop absorbs nutrients from the soil. A recommended soil nutrient content shall be maintained through fertilizer application.



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- Principle

The nutritional status of the crop determines the fertilizer application rate and timing.



## Advantages and disadvantages of both strategies

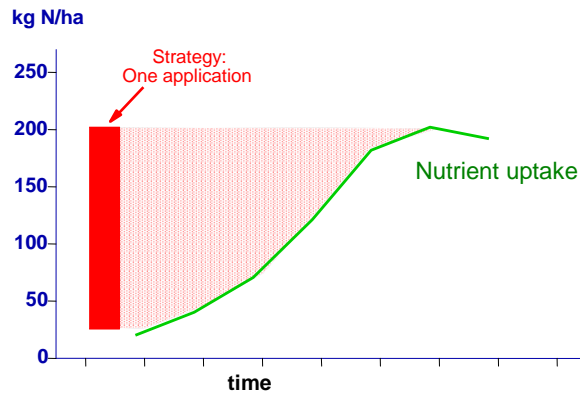
Product strategy	Fertilizer management strategy
Enhanced efficiency fertilizers	Enhanced efficiency fertilization
<b>Advantages</b> <ul style="list-style-type: none"> <li>• convenience for the farmer</li> <li>• cost saving in fertilizer application</li> </ul>	<b>Advantages</b> <ul style="list-style-type: none"> <li>• the possibility to adjust the fertilizer rate during the growing season</li> <li>• crop nutrition management</li> <li>• lower cost of fertilizer</li> </ul>
<b>Disadvantages</b> <ul style="list-style-type: none"> <li>• higher cost of fertilizer</li> <li>• yield expectation is uncertain = N rate may not be correct</li> </ul>	<b>Disadvantages</b> <ul style="list-style-type: none"> <li>• data acquisition for split application</li> <li>• cost of the split application</li> </ul>



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## Fertilizer strategy with only one N dressing



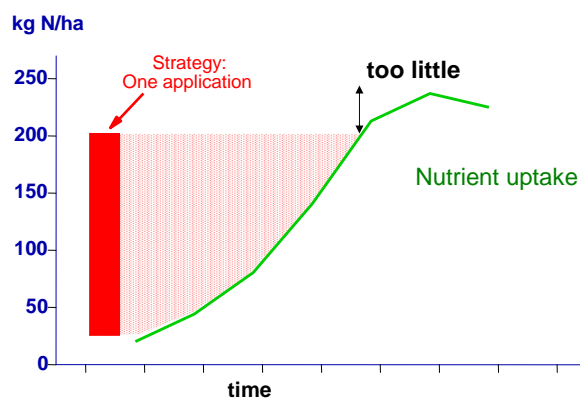
- In a strategy with only one fertilizer application the fertilizer rate has to be decided at the beginning of the growing season
- Long time span between fertilizer application and nutrient uptake



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## Fertilizer strategy with only one N dressing



- If the rate was too low it can be adjusted with a top dressing of fertilizer

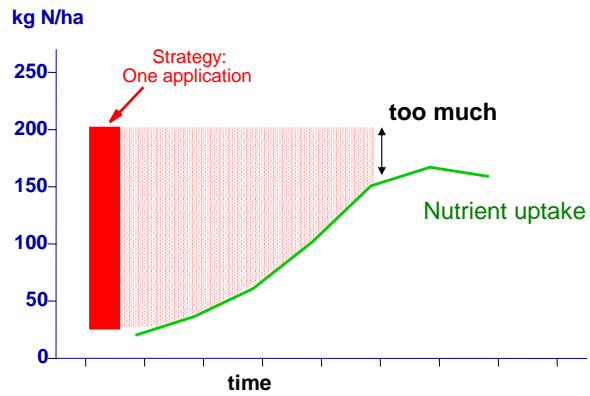


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## Fertilizer strategy with only one N dressing



- If the rate was too high the N use efficiency will be reduced

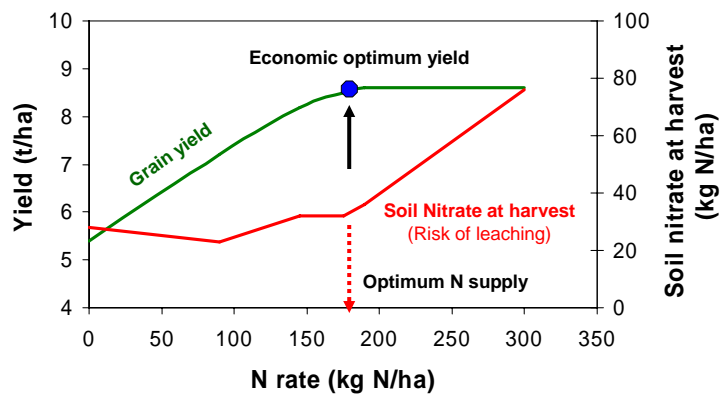


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## Nitrate leaching after harvest depend on the right nitrogen rate not on the N form

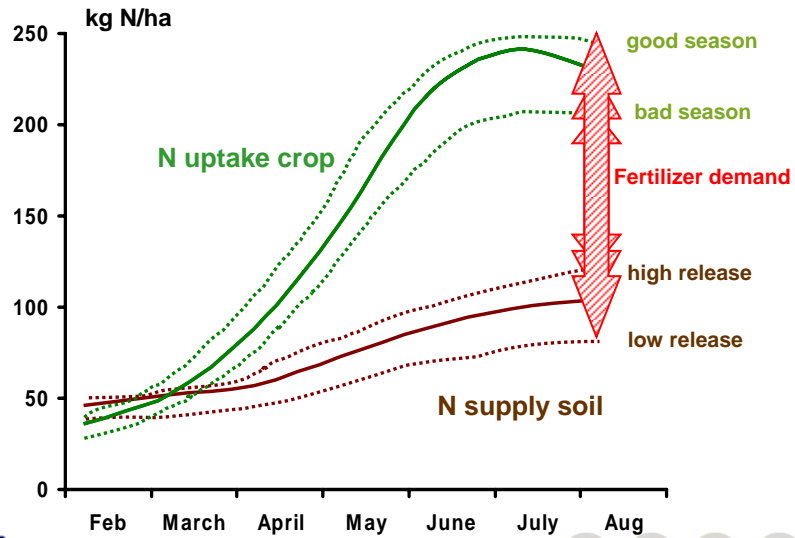
- No increase of soil nitrogen from zero to optimum N application rate



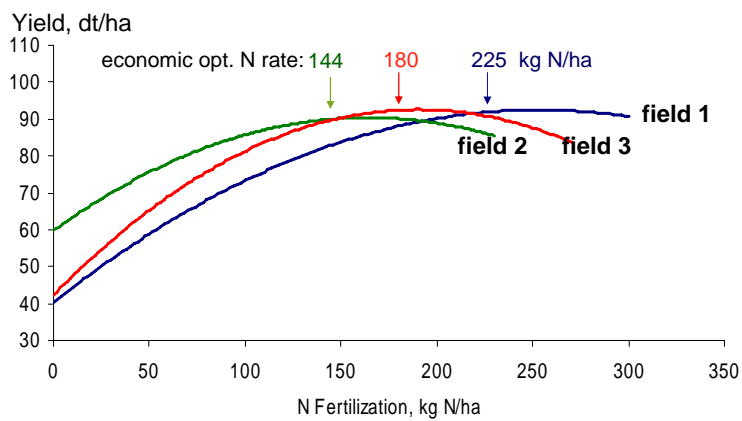
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The nitrogen fertilizer demand is not fix. It is calculated from crop N demand minus N supply from the soil



Yield response of winter wheat to increasing N rates on different fields

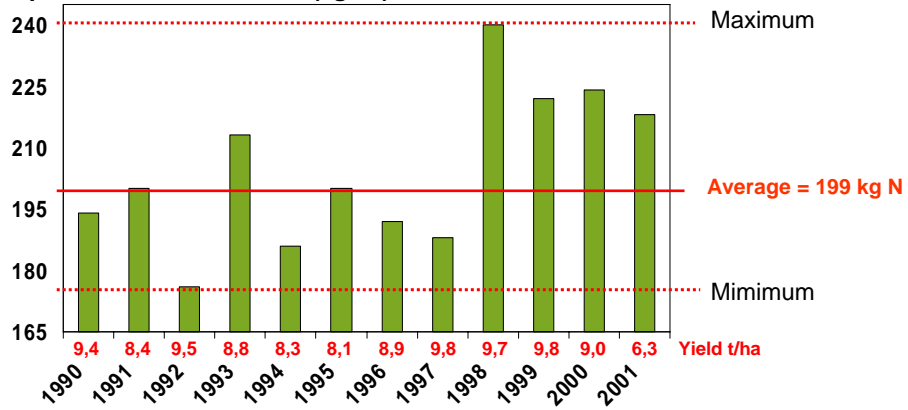


- The same yield can be obtained at different N rates

Even on the same field, with the same crop the optimum N fertilizer rate varies from year to year

Crop: Winter wheat (longterm trial, Rothamsted, UK)

Optimum N Fertilizer Rate (kg/ha)

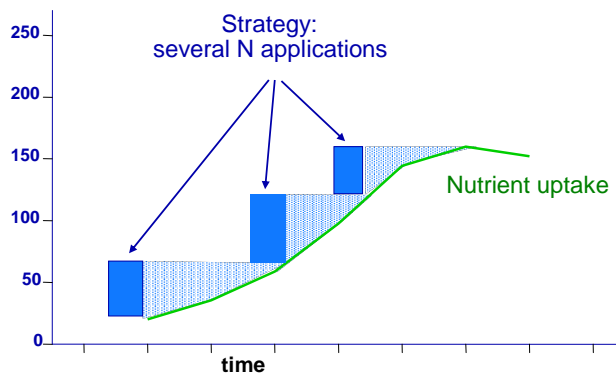


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Enhanced efficiency fertilization concept  
Fertilizer application in several N dressings

kg N/ha



- N fertilizer application close to N uptake of the crop increase the nitrogen fertilizer use efficiency
- Short time span between fertilizer application and nutrient uptake

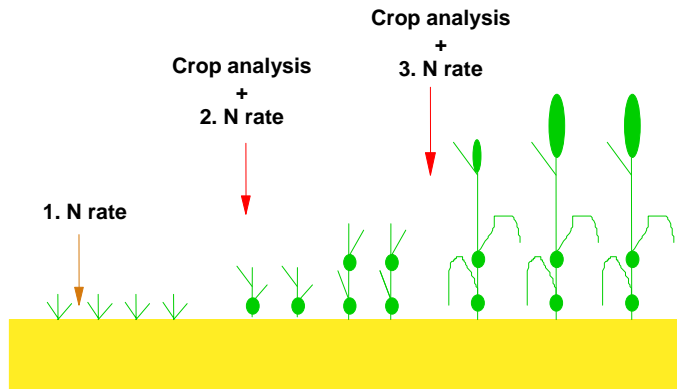


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## With split N application it is possible to adjust the fertilizer rate during the growth period

- Flexible decision about the amount of N fertilizer during the growing season
- Methods of plant analysis provide fertilizer recommendations based on the actual N status of the crop
- The N supply from the soil directly affects the N status of the crop

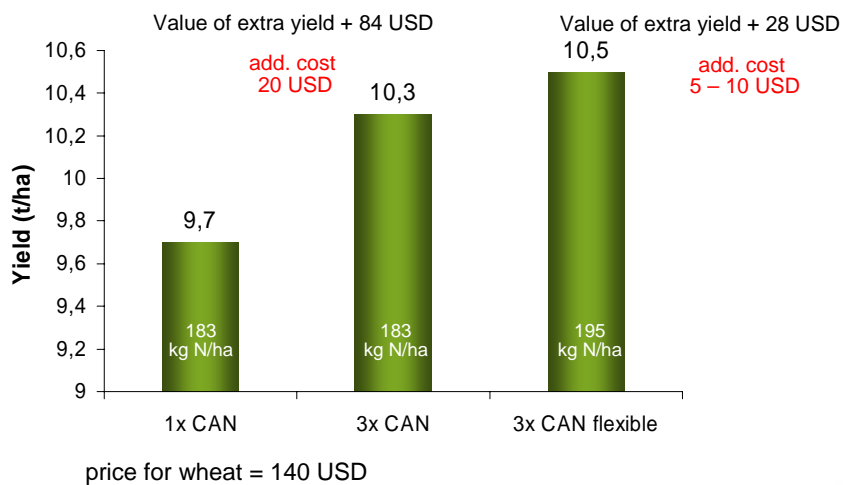


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## Yield of winter wheat at different N fertilizer strategies

Average of 16 trials with winter wheat 2004,



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## Summary

### Prospects on enhanced efficiency fertilizers

- In order to increase the fertilizer use efficiency it is either possible
  - to use enhanced efficiency fertilizers or
  - to go for split application of soluble fertilizers (enhanced efficiency fertilization).
- The cost of split application provide the frame for any additional price a farmer may be prepared to pay for enhanced efficiency products.
- In mechanised agriculture the cost of fertilizer spreading is quite low which makes split application very competitive
- A split application strategy makes it more easy to apply the right amount of fertilizer



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