Knowledge grows

Fertilizer Industry Handbook 2022

December 2022

Cautionary note

This presentation contains forward-looking information and statements relating to the business, financial performance and results of Yara and/or industry and markets in which it operates. Forward-looking statements are statements that are not historical facts and may be identified by words such as "aims", "anticipates", "believes", "estimates", "expects", "foresees", "intends", "plans", "predicts", "projects", "targets", and similar expressions. Such forward-looking statements are based on current expectations, estimates and projections, reflect current views with respect to future events, and are subject to risks, uncertainties and assumptions. Forward-looking statements are not guarantees of future performance, and risks, uncertainties and other important factors could cause the actual business, financial performance, results or the industry and markets in which Yara operates to differ materially from the statements expressed or implied in this presentation by such forward-looking statements. No representation is made that any of these forward-looking statements or forecasts will come to pass or that any forecasted results will be achieved, and you are cautioned not to place any undue reliance on any forward-looking statements.

This presentation includes market and industry data and forecasts which were obtained from internal surveys, estimates, experts and studies, where appropriate, as well as external market research, publicly available information and industry publications. There are limitations with respect to the availability, accuracy, completeness and comparability of any such market and industry data and forecasts, and no representation is made in relation to such data, which are included herein for information purposes only. Accordingly, undue reliance should not be placed on any of the industry or market data contained in this presentation

List of contents

What is fertilizer?

Fertilizers are plant nutrients, required for crops to grow

Crops need energy (light), CO_2, water and minerals to grow

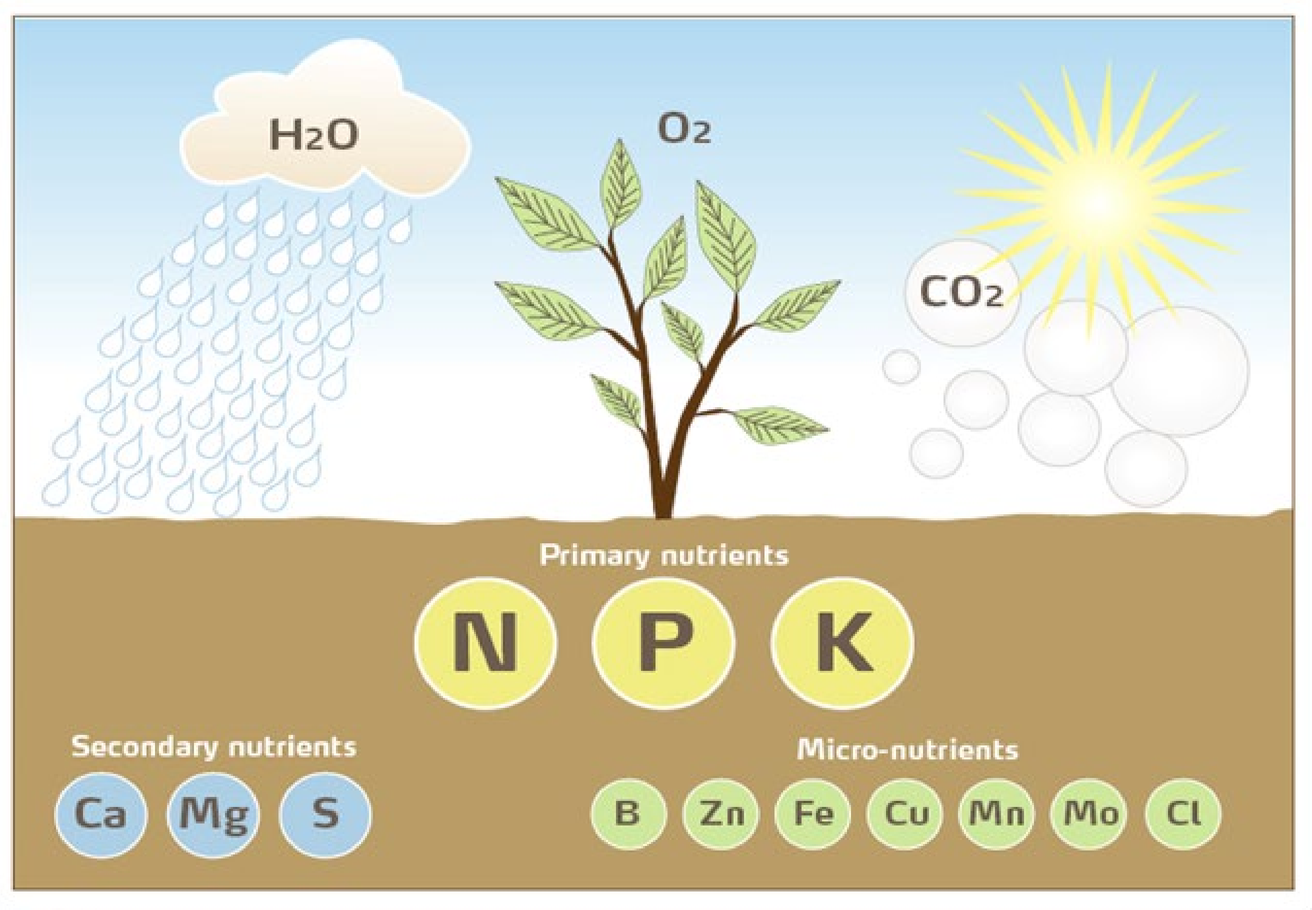
The carbon in crops originates from CO_2 absorbed through the leaves

Crops absorb water and plant nutrients from the soil

Plant nutrients are building blocks of crop material. Without nutrients, the crops can not grow

Mineral fertilizers provide plant nutrients for crops

Three main nutrients: Nitrogen, Phosphorus and Potassium are primary nutrients



Mineral fertilizers are produced from natural elements, into a form which makes them easily available for plants

Nitrogen (N)	Nitrogen originates from the air (78% of the earth's atmosphere is nitrogen). The most common process in nitrogen fertilizer manufacturing is to create ammonia from a mixture of nitrogen from the air and hydrogen from natural gas
Phosphate (P)	Phosphate is sourced from insoluble calcium phosphate rocks. Rock phosphate is made available for the plant usually through a chemical process to create plant-friendly fertilizers
Potash (K)	Potassium is sourced from old sea and lake beds formed millions of years ago. Since potassium sources are often located far below the soil surface (1-2km depth), plant roots are unable to reach them naturally

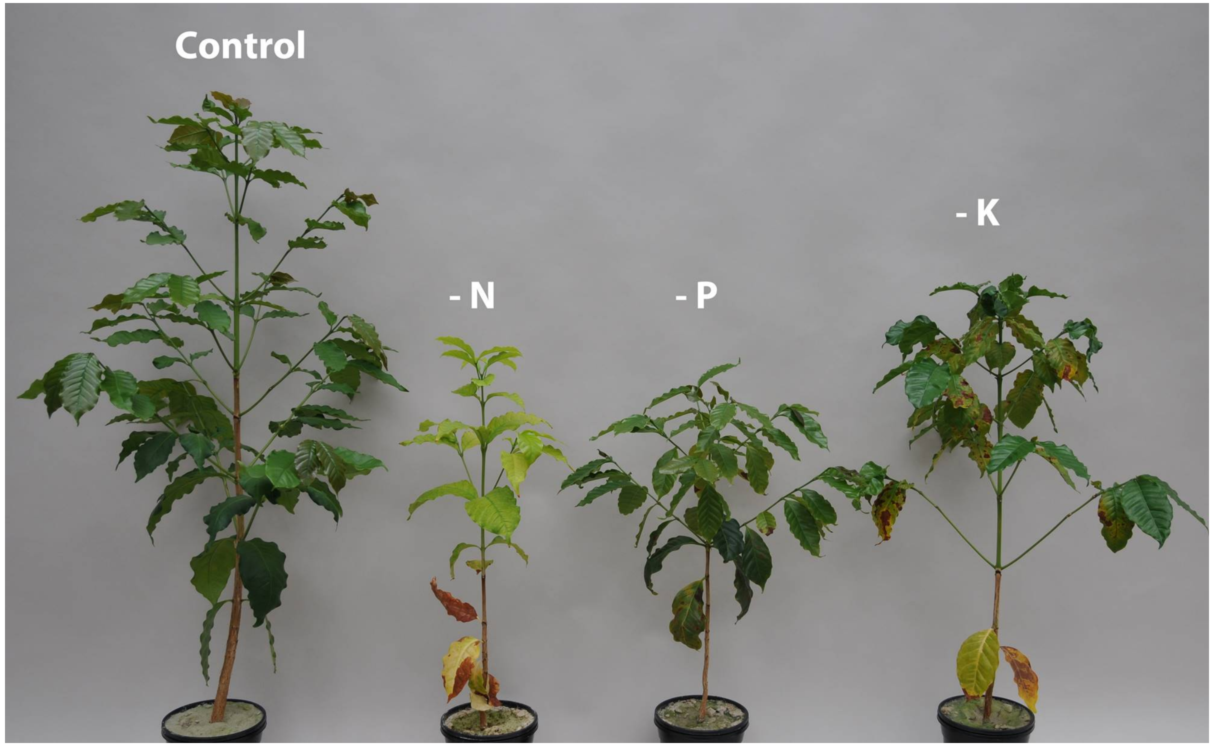
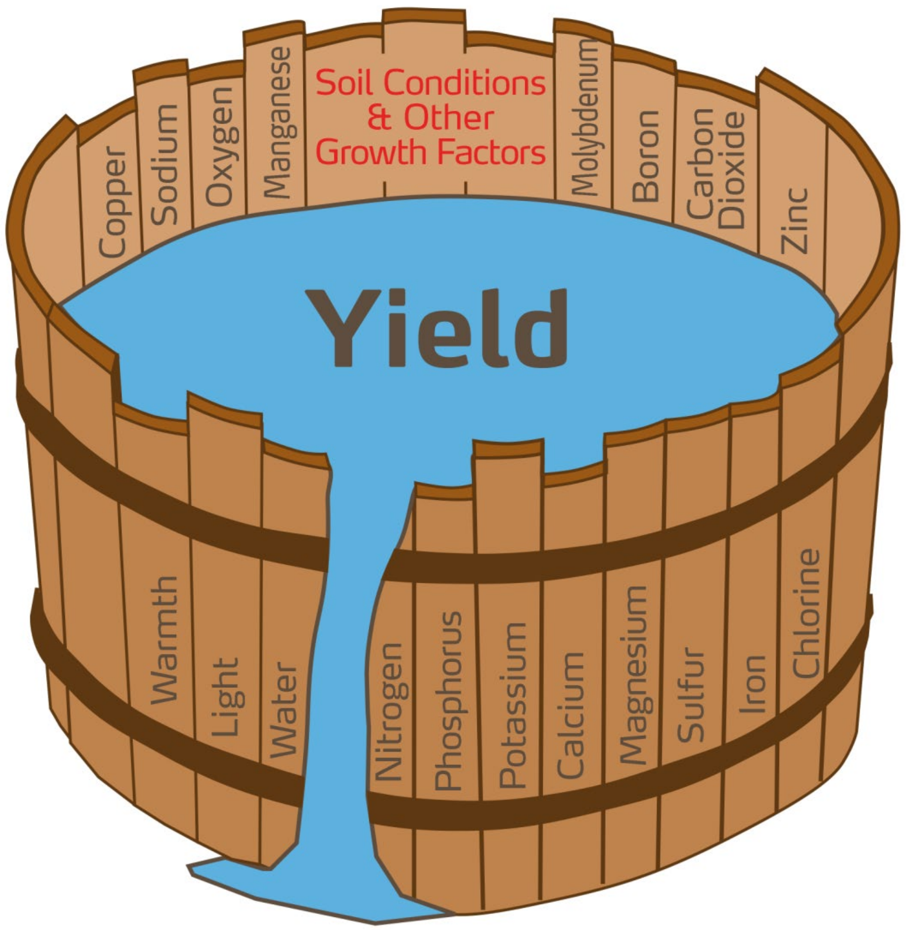


Illustration: lack of either N, P or K typically leads to plant deficiencies including reduced crop growth, reduced crop quality and/or lower resistance to drought and diseases

Principle of crop nutrition: crop growth is limited by the most deficient nutrient

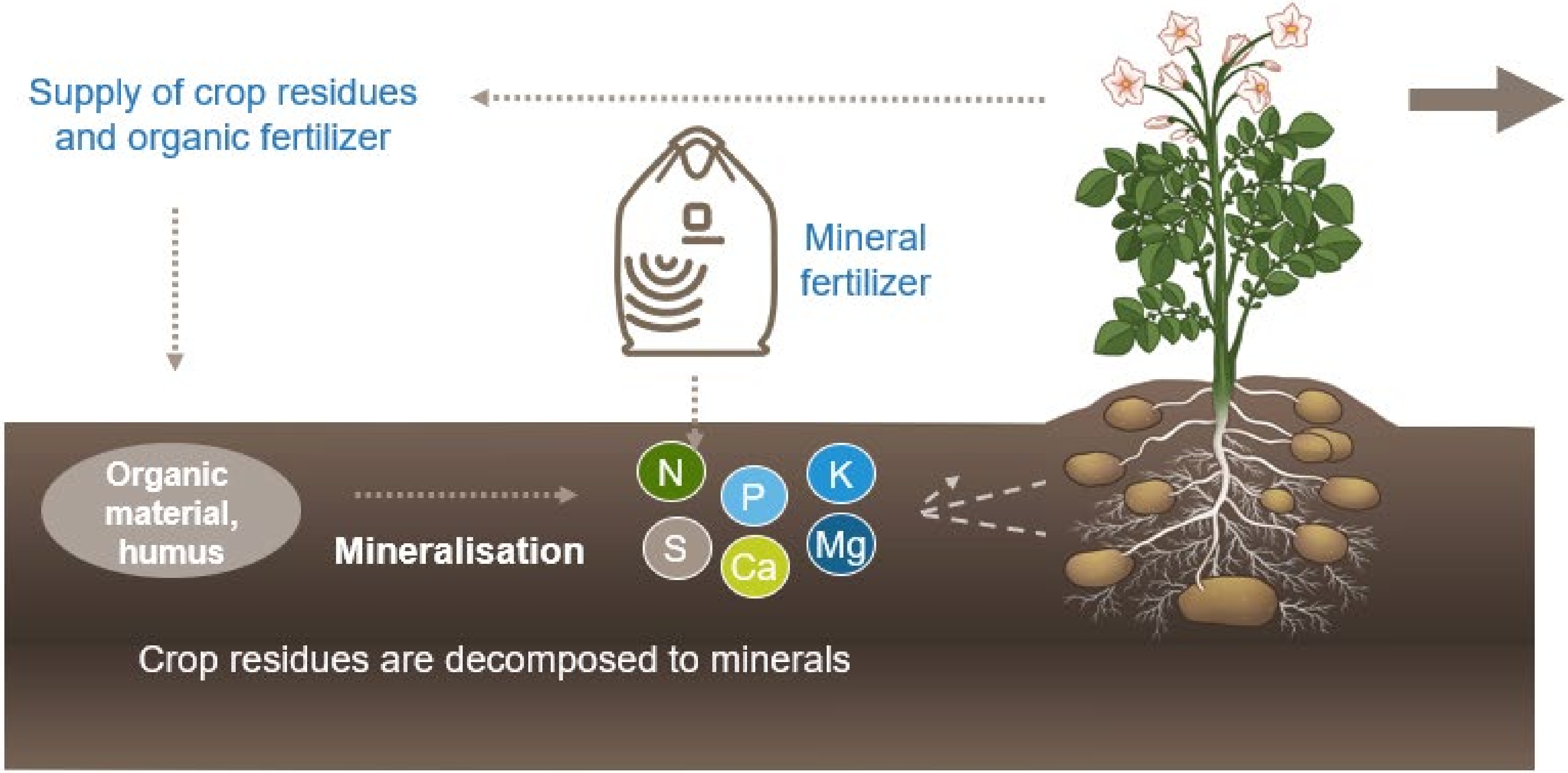
- Law of the Minimum” (Liebig, 1843): “Crop yields are proportional to the amount of the most limiting nutrient.”
- Plant nutrients have specific and essential functions in crop metabolisms
- They cannot replace each other, and lack of any one nutrient limits crop growth
- It is therefore essential to focus on balanced nutrition of all plant nutrients



JUSTUS VON LIEBIG 1803 - 1873

Why mineral fertilizer?

Mineral fertilizers replace nutrients removed from the soil with the harvest



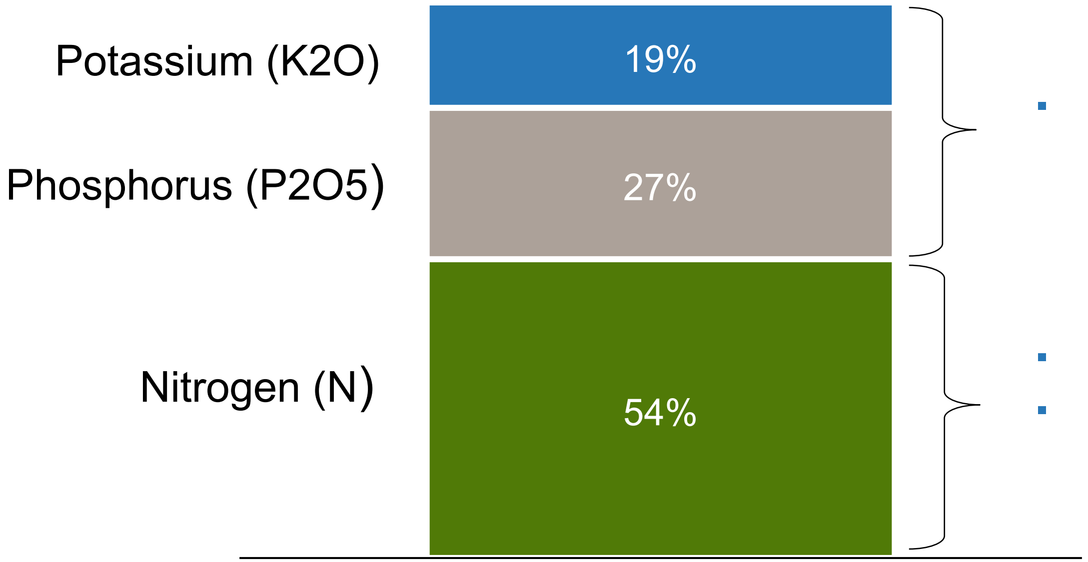
- Export of nutrients with the harvest
- Growing demand for food & feed

Mineral and organic fertilizers supply the same inorganic molecules to crops, but have different characteristics

Characteristics	Mineral fertilizer	Organic fertilizer
Nutrient source	Nitrogen from the air, Phosphate and Potassium from deposits / mines	Crop residues and animal manures, other organic material
Nutrient concentration	High nutrient concentration Low logistical cost	Low nutrient concentration Large volumes to transport and store
Nutrient availability	Immediately available for the crop	Variable, organic material needs to be decomposed to release nutrients
Quality	Traceable and consistent	Often inconsistent Dependent on source

Mineral and organic fertilizers are not mutually exclusive. When using the right source, at the right rate and time and in the right place, both can improve farmers' livelihoods, support soil health on the farm and protect the environment.

Nitrogen – the most important nutrient



Total ~230 million tons nutrients

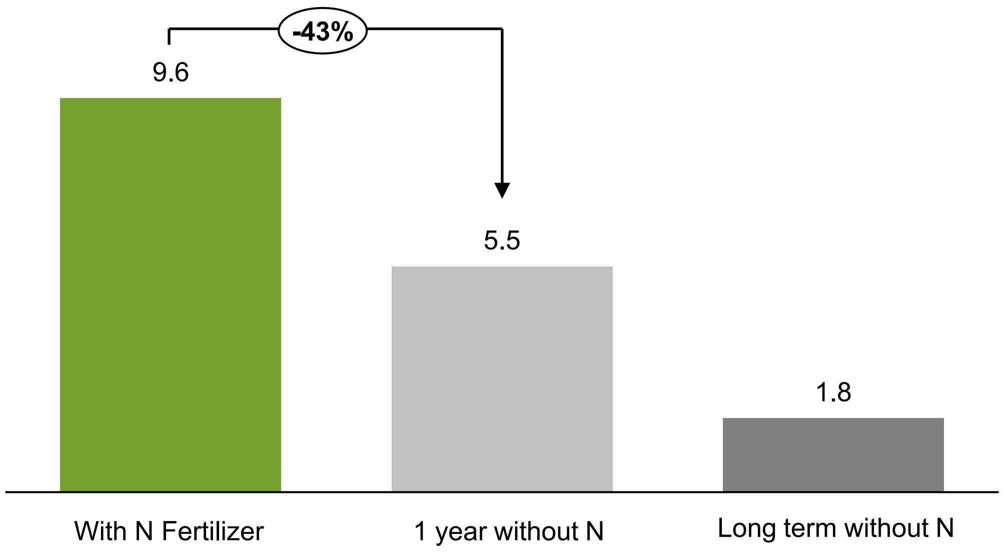
Nutrient characteristics

Primary benefit	Application	Industry structure
▪ Improve crop quality	▪ Application can be varied	▪ Fewer suppliers, production discipline
▪ Increase crop size ▪ Most important and commonly lacking nutrient	▪ Annual application critical	▪ Fragmented industry ▪ More dynamic prices, but stable volume

Regular nitrogen application is required in order to maintain yields

Annual N-application is critical for yield

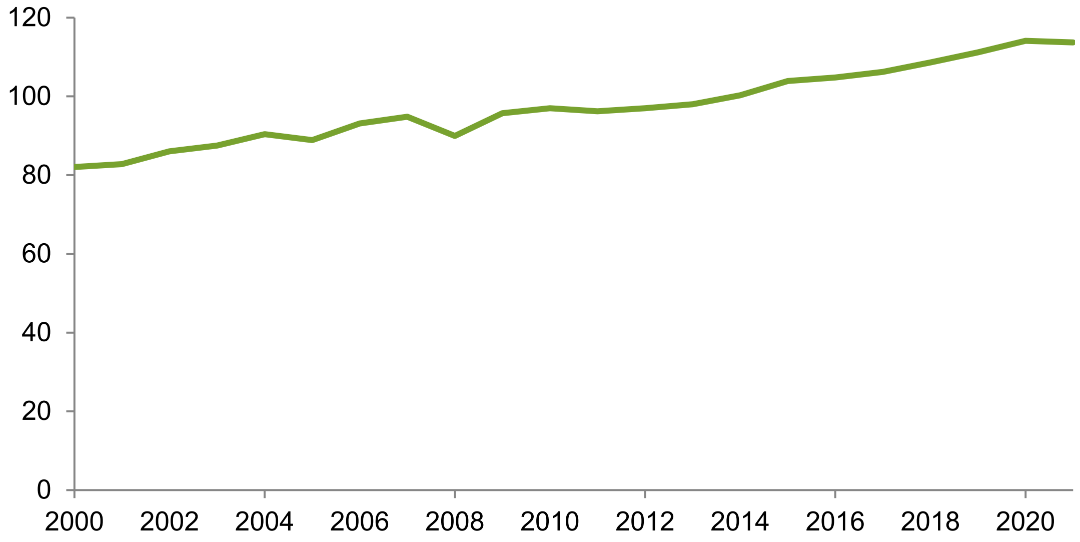
Grain yield from Nitrogen fertilizer
Ton per hectare



Source: Broadbalk long term trial Rothamsted UK

Stable global nitrogen consumption pattern

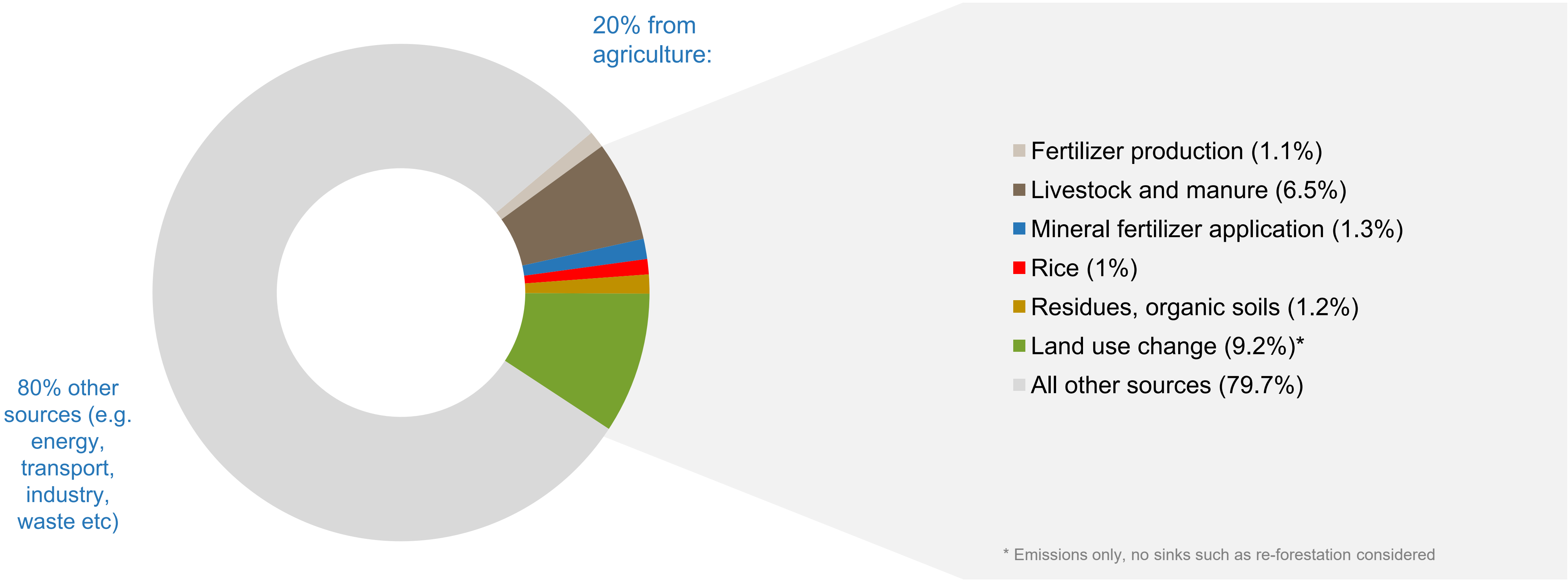
Million tonnes of nitrogen (ex China)



Source: IFA, October 2022

Fertilizer CO_2 footprint

Ag sector represents 20% of global greenhouse gas emissions



Source: FAOSTAT (2020)
* Calculated based on IFA and FE for 2015; not disaggregated from industry in FAOSTAT

Fertilizer reduces the carbon footprint of farming

Fertilizer - an efficient solar energy catalyst

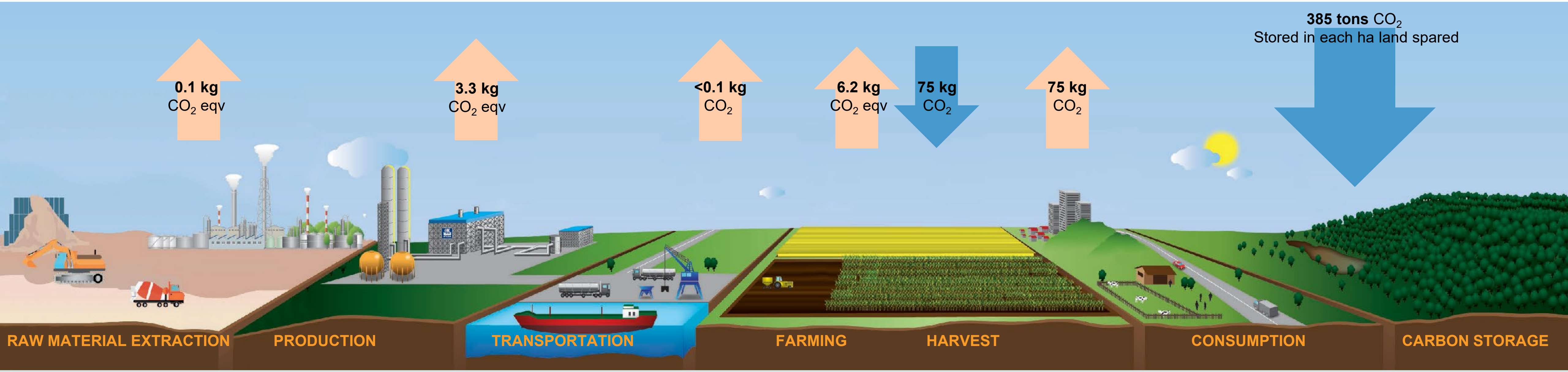
- Production is a marginal part of the carbon footprint; efficient application is more important
- Huge positive effects of fertilizer use, since higher yields enable lower land area use

Production

- Yara's production is more energy-efficient than the competitor's average

Application

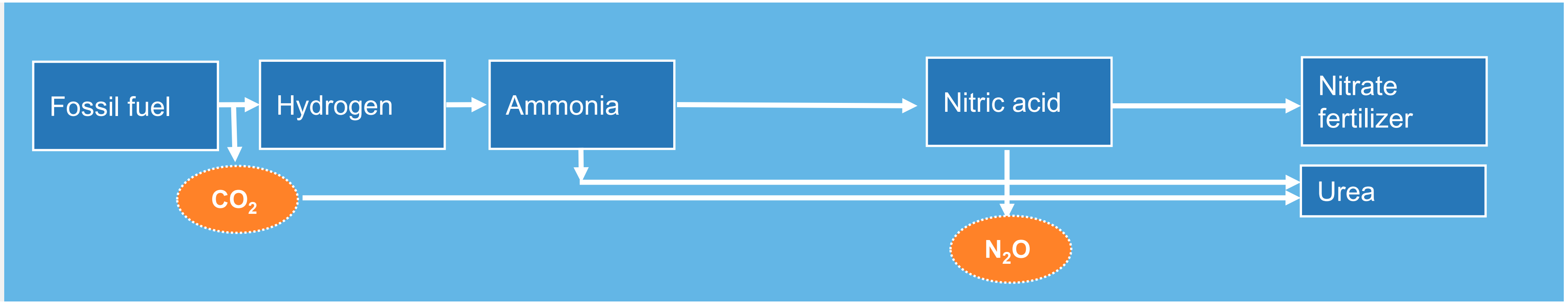
- Higher efficiency with nitrates
- Precision farming tools



Numbers show emissions as CO2eqv per kg Nitrogen in fertilizer product for Calcium Ammonium Nitrate 27%

Emissions occur mainly in the ammonia production step, catalyst technology invented by Yara has almost eliminated N_2O emissions

Standard fertilizer production



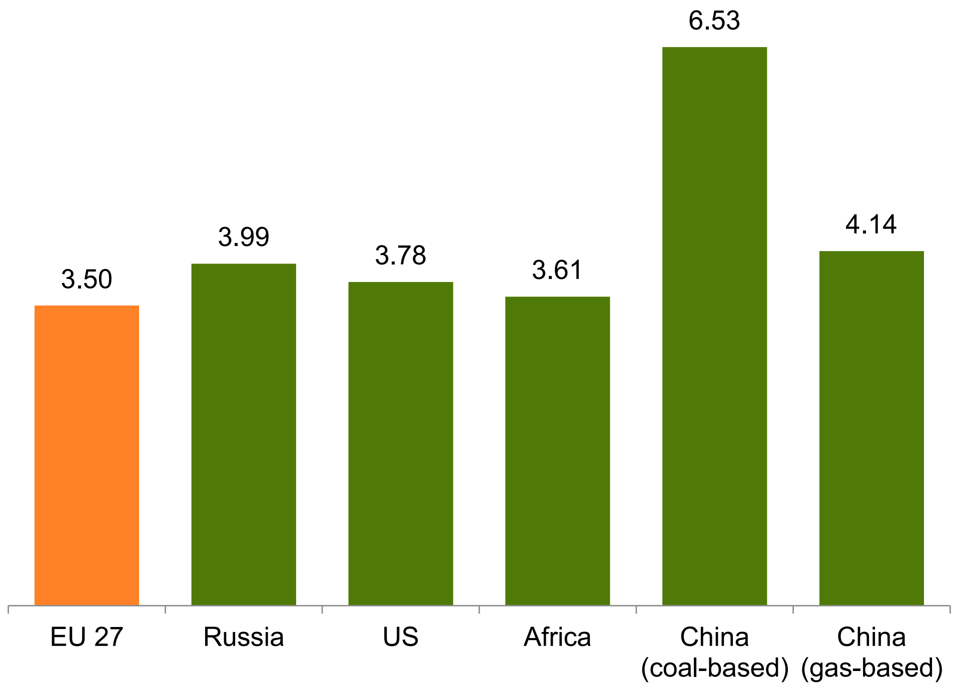
Emissions	1.8-.2.4 mt CO_2 per mt ammonia *)	0.03 -0.2 mt CO_2e per**) tonne nitric acid
Decarbonization routes	• Carbon capture and storage (blue ammonia) • Replace fossil fuel with hydrogen from electrolysis (green ammonia)	• Catalyst abatement technology

*) Source: IFA
**) Source BT Large Volume Inorganic Chemicals Ammonia, Acids and Fertilizers (2007) new plants

Carbon footprint of fertilizer production differs by region - Europe is the most efficient

Urea

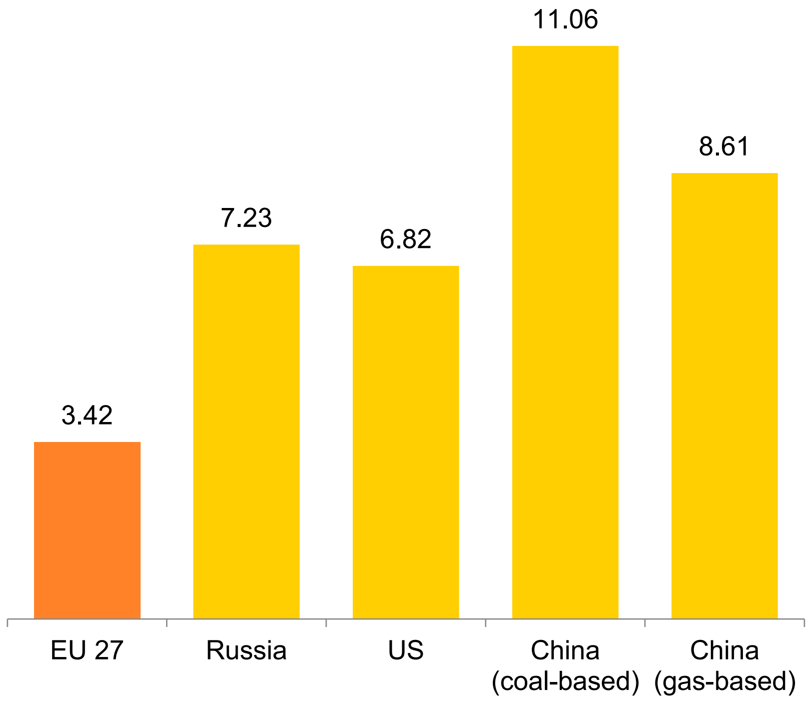
kg CO_2 equivalents per kg urea nitrogen



Source: Fertilizers Europe (2016) for production in 2014

Ammonium nitrate

kg CO_2 equivalents per kg AN nitrogen



Source: Fertilizers Europe (2016) for production of granulated AN in 2014

More than half of total GHG emissions from fertilizer take place in the field

Share of total emissions:

Fertilizer production:

20-50%

Share of total emissions

Main source: CO_2 and N_2O emissions from the ammonia and nitric acid production process

Major sources of variation: energy source, fertilizer product type

Fertilizer use:

50-80%

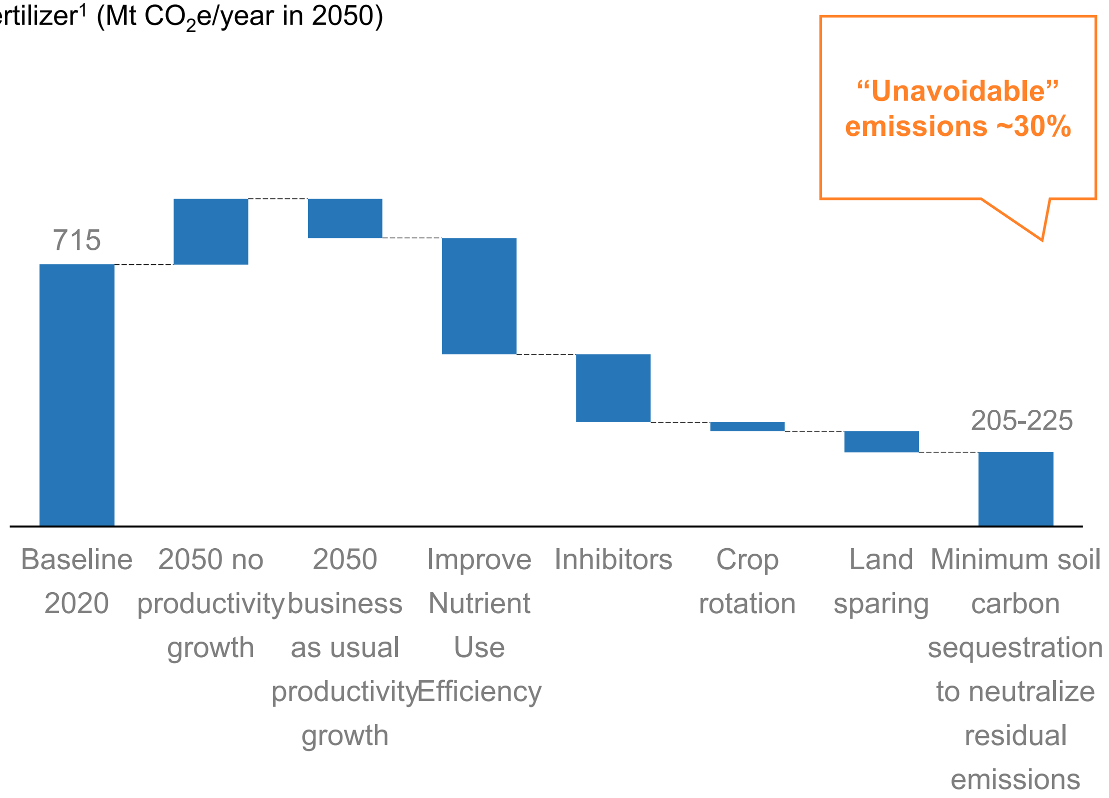
Share of total emissions

Main source: microbiological processes in soil (nitrification and denitrification)

Major sources of variation: application rate, method and timing, soil and climatic conditions, crop type and rotation

Industry scenario: emission reductions from application

Greenhouse gas emissions from mineral nitrogen fertilizer[1] (Mt CO_2e/year in 2050)

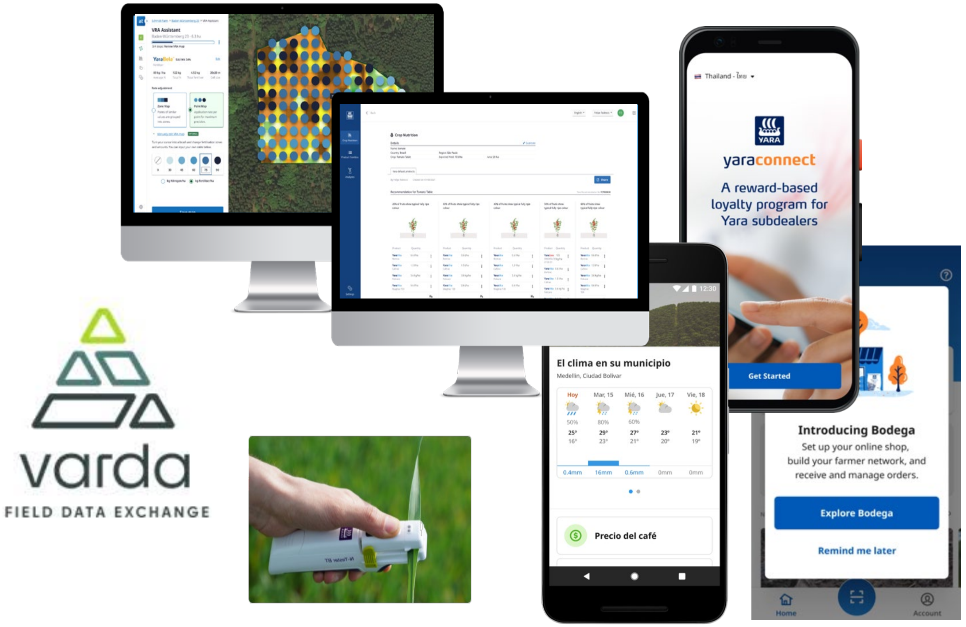


Source: IFA 2022, Systemiq

1) Not showing the uncertainty ranges in the results

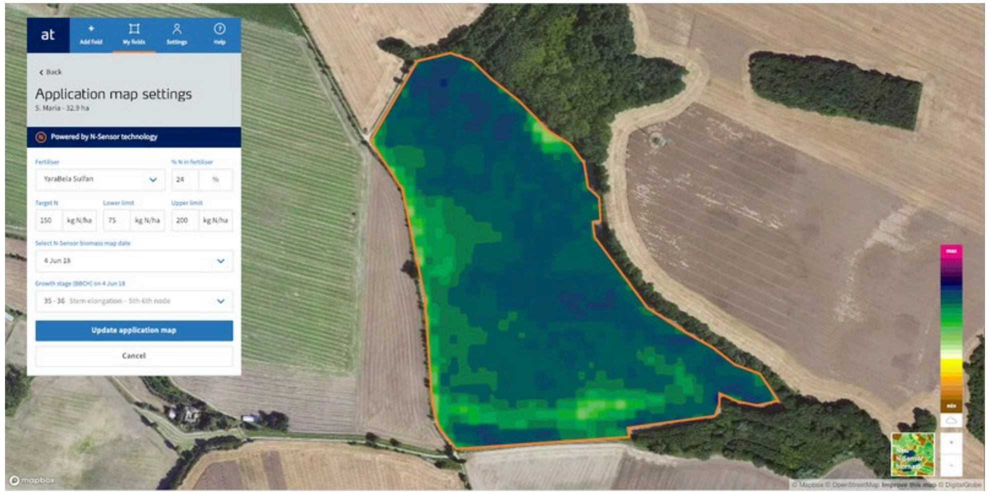
Digital solutions enable optimized application, improving food production per hectare and reducing emissions

A wide range of digital solutions at Yara



Example: Yara AtFarm

- Atfarm uses state-of-the-art satellite imagery combined with Yara's expertise and products to create variable rate fertilizer application maps.
- Proof points; up to 6% yield gain, up to -12% fertilizer use[1], up to -20% carbon emissions from fertilizer[1]



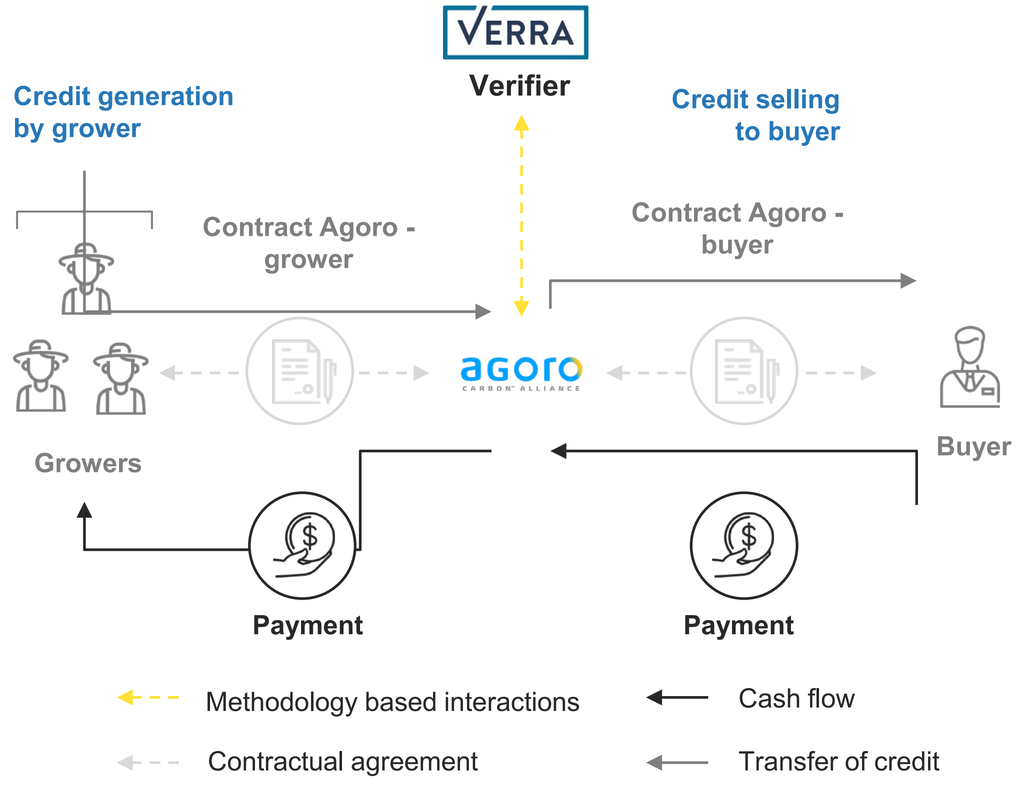
1) By using best practices and solutions that exist today, farmers* can already in average reduce nutrient losses by 20%, increase yields and incomes by 5-7% and reduce their carbon footprint related to mineral fertilization up to 20%**
*Assumption are built with major crops in major EU countries (e.g. cereals)
**CFP considers mineral fertilizers produced with BAT-Best Available Technology, as mineral fertilizers without BAT may have around +30-40% carbon footprint. It does not consider the potential of using carbon sequestration farming practices

Carbon marketplaces such as Agoro enable global farm decarbonization

Agoro: decarbonization cycle

1. Sign up farmers and collect data through a digital farmer enrollment process
2. Advise farmers on how to maximize carbon reduction leveraging in-house agronomists and external partners
3. Quantify the carbon reduction using soil samples, 3rd party data and powerful models
4. Generate independently verified carbon credits
5. Monetize the carbon reduction either through carbon credits or insets to food value chain buyers

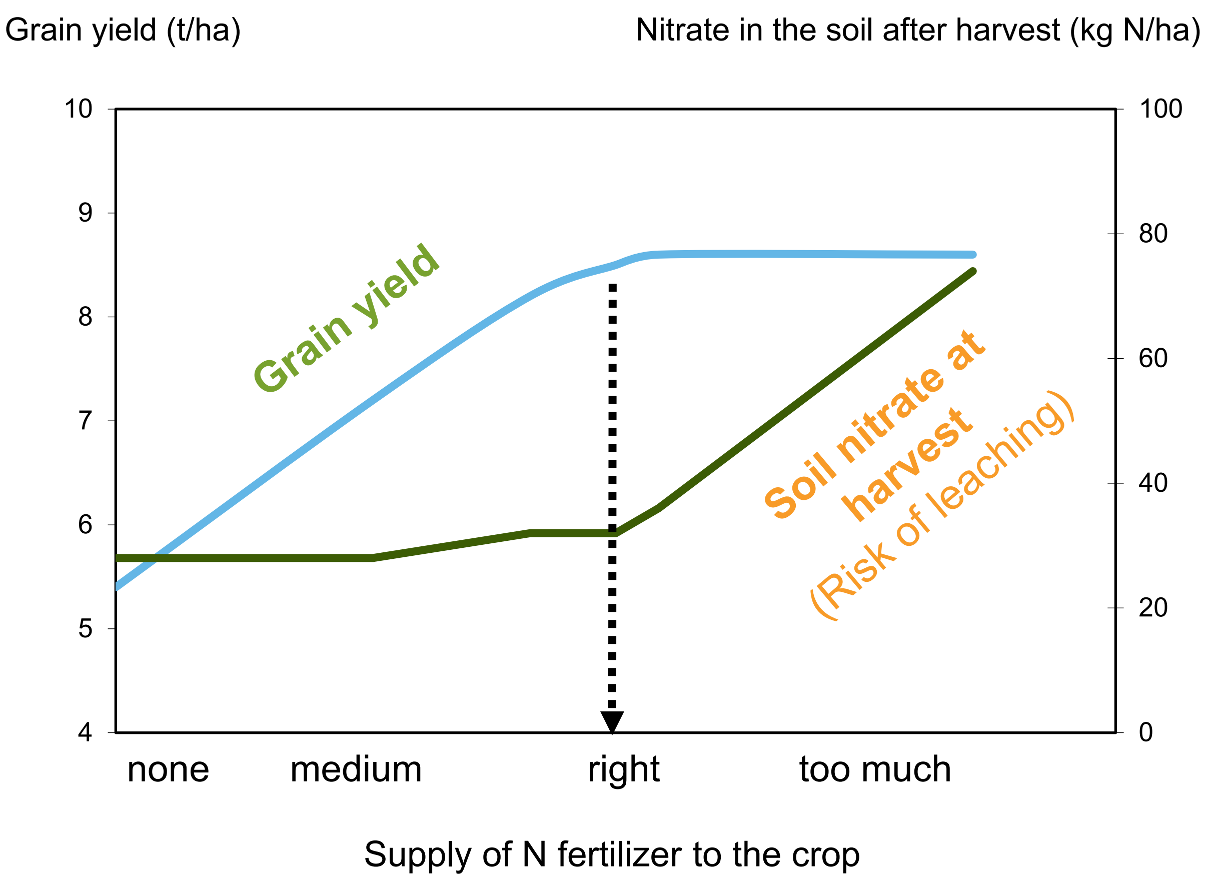
Business model



Other environmental topics

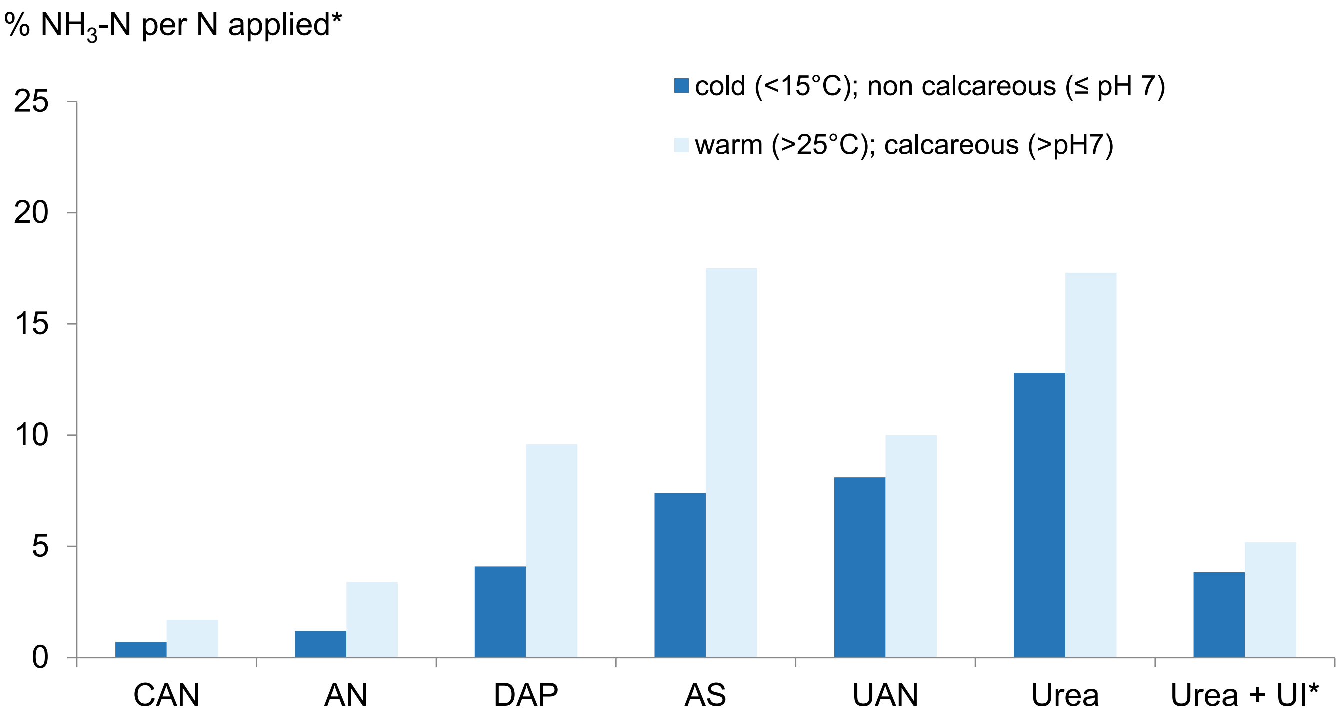
Leaching: The right nitrogen fertilizer rate is key to avoid nitrate leaching

- Leaching of nitrate into groundwater affects water quality and can contribute to eutrophication
- Oversupply of organic and mineral nitrogen fertilizer is the main driver for nitrate leaching
- Nitrogen fertilizer application according to crop demand does not increase the risk of nitrate leaching
- The risk of nitrate leaching increases only when too much N fertilizer has been applied



Ammonia volatilization: Choosing the right nitrogen fertilizer is key to avoiding ammonia volatilization losses

- Volatilization of ammonia gas affects air quality and induces soil acidification
- The use of organic or urea-based nitrogen fertilizer is the main driver for ammonia losses
- Nitrate-based N fertilizer or immediate incorporation of urea into the soil avoids volatilization losses
- Urease inhibitor is a chemical compound which delays the conversion of urea to ammonium



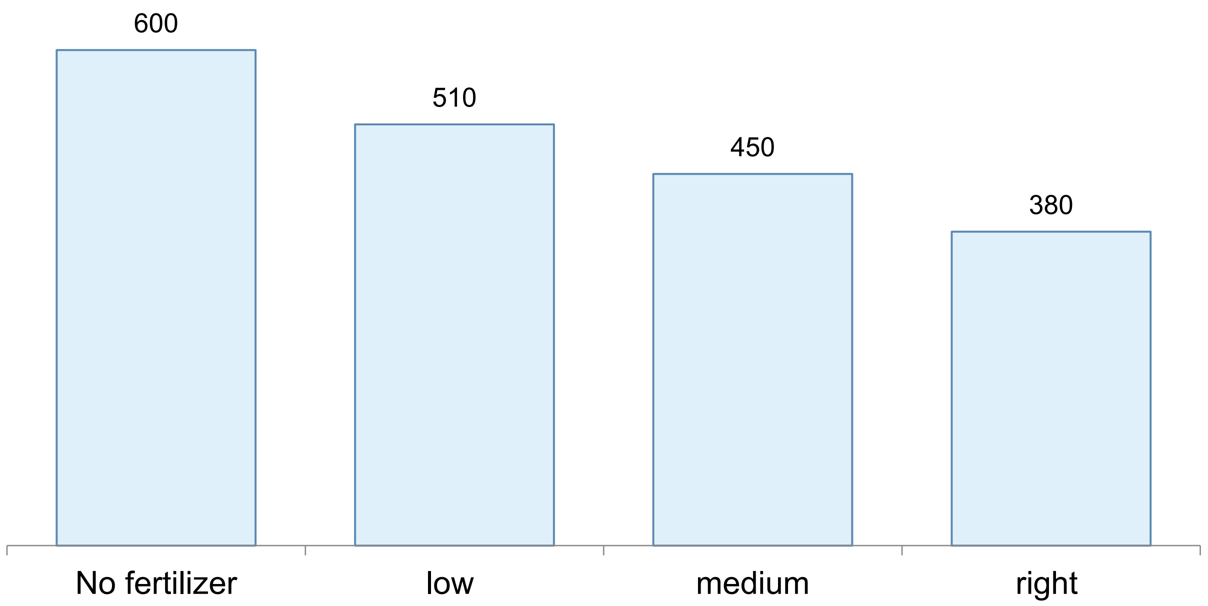
* Urea + Urease Inhibitor (Urea + UI) assuming 70% reduction of ammonia emissions

NH_3-N per N applied is the amount of nitrogen as ammonia (NH_3) released per tonne of nitrogen applied
Source: http://www.eea.europa.eu/publications/emep-eea-guidebook-2016

Water: Good crop nutrition enables increased water efficiency: “more crop per drop”

- Water is a key input for crop growth
- About 70% of global water consumption is for agriculture
- Optimized crop nutrition improves water use efficiency, mainly because a well-nourished crop creates a soil cover which reduce evaporation of water from the soil

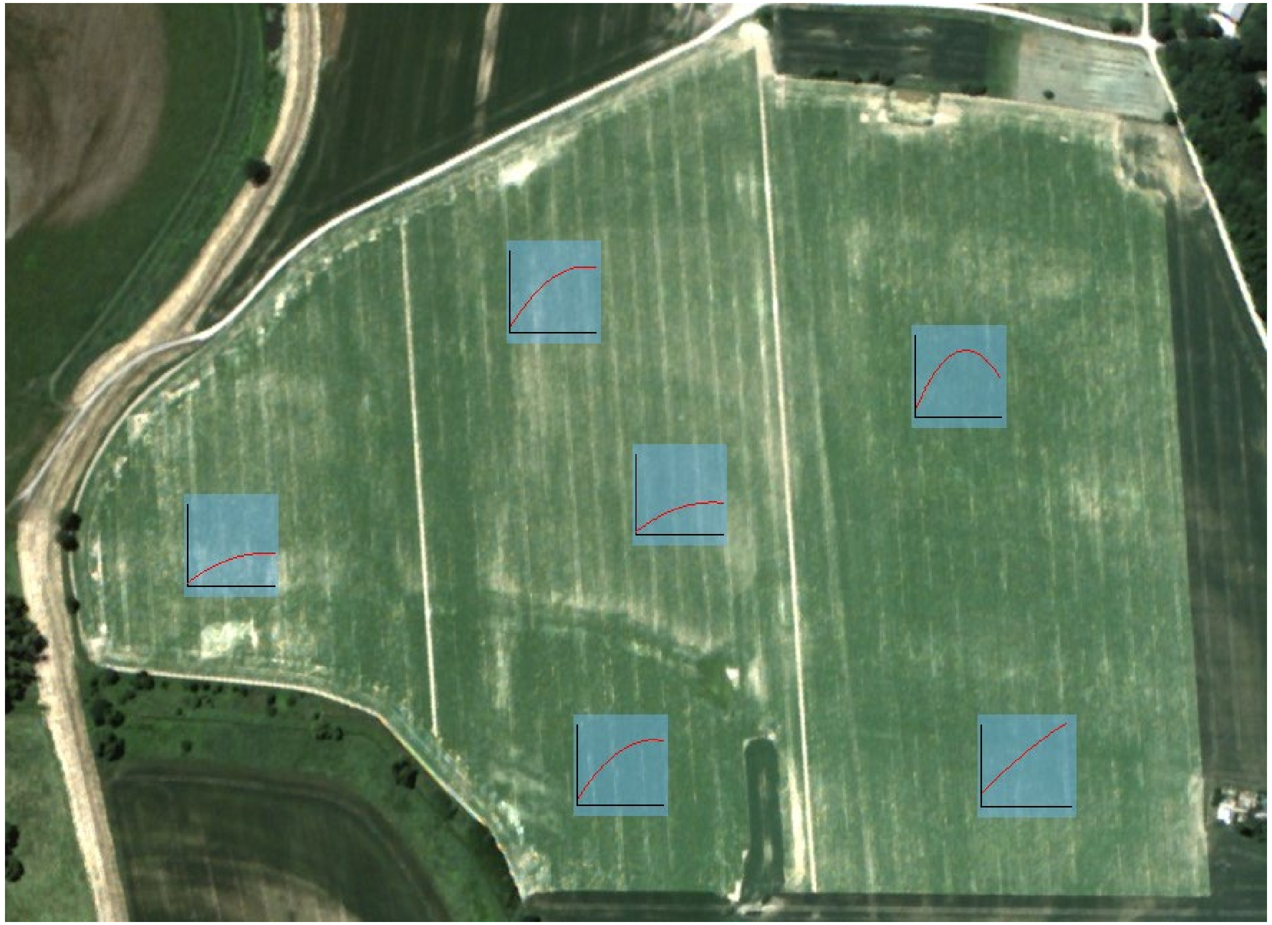
Water requirement (liter per kg of wheat grain)



Supply of fertilizer to the crop

Precision farming

Precision farming: applying the right nutrients in the right quantity at the right time



- Growth conditions within fields are heterogeneous, affecting the crop yield and fertilizer demand
- Estimation of the nitrogen status of crops is a requirement to respond to this heterogeneity
- Digital tools enable growers to estimate the nitrogen status of crops and use this information to determine how much fertilizer to apply and when to apply it

---

- **Benefits of precision farming** include higher yields, improved crop quality, lower emissions and other environmental impacts and cost savings for the farmer

Digital crop sensing tools enable variable rate nitrogen application

N-Tester BT

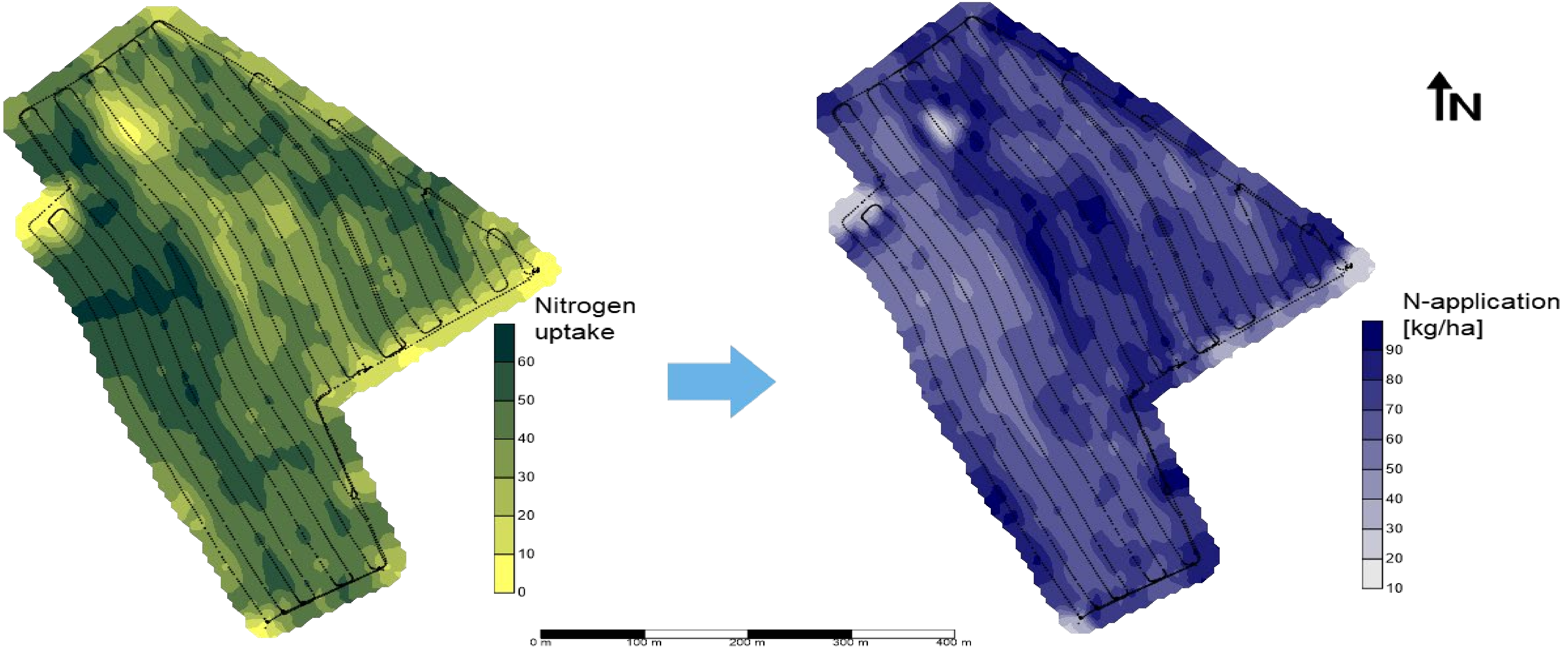
Photoanalysis

Digital Leaf Color Chart (DLCC)

N-Sensor ALS2

Atfarm

N-Sensor measures crop nitrogen uptake and creates a prescription map for variable rate application



Repeated field trials confirm that variable rate nitrogen fertilization has multiple benefits

Replicated trials to estimate the effect of variable rate nitrogen fertilization compared to a uniform nitrogen fertilization

Trials: Winter wheat

Yield:	+3.6%
Nitrogen rate:	-2%
Nitrogen surplus:	-10 kg/ha

Trials: Winter oilseed rape

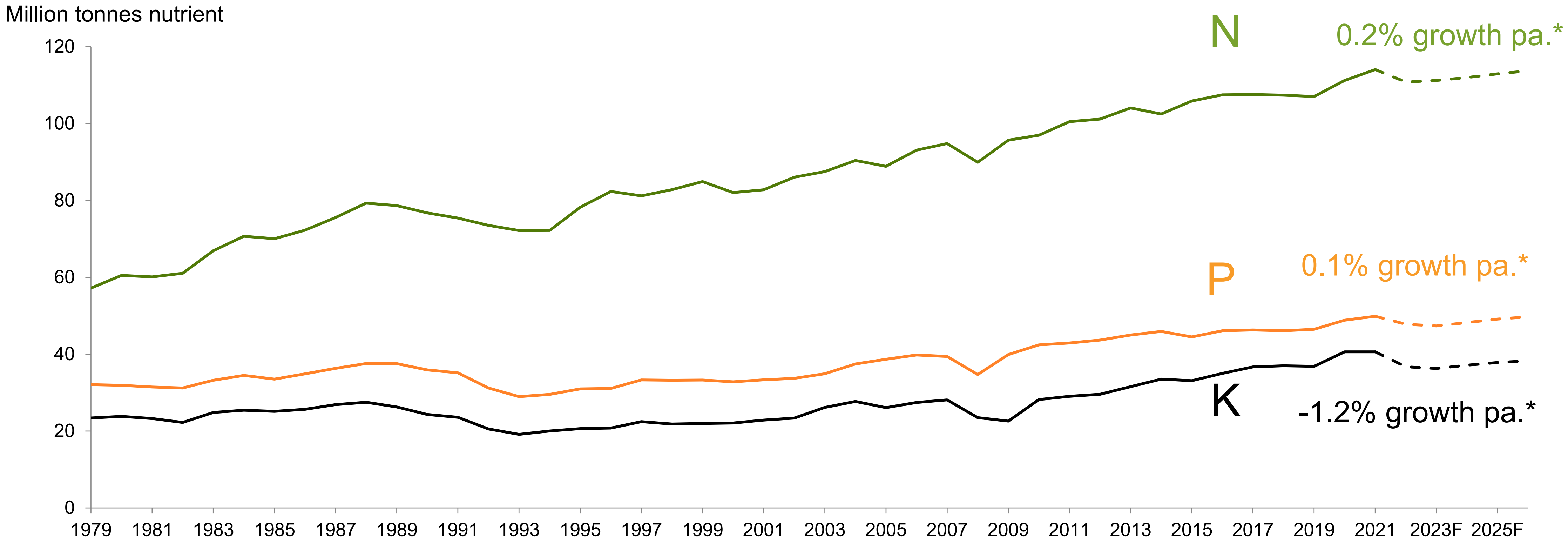
Yield:	+4.4%
Nitrogen rate:	-6%
Nitrogen surplus:	-18 kg/ha

→ *Improved crop yield, reduced nitrogen fertilizer rate and higher nutrient use efficiency*

Source: Agri Con GmbH

The fertilizer industry

Global consumption trend per nutrient, currently restricted by supply availability

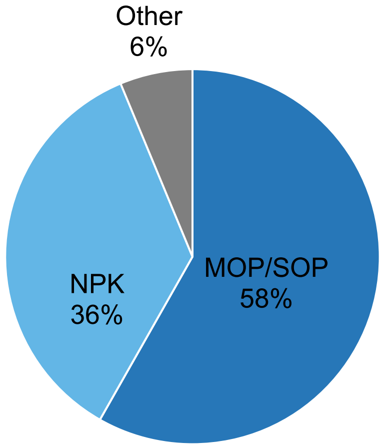


* CAGR avg. 2020-2021 to 2026

Source: IFA 2022

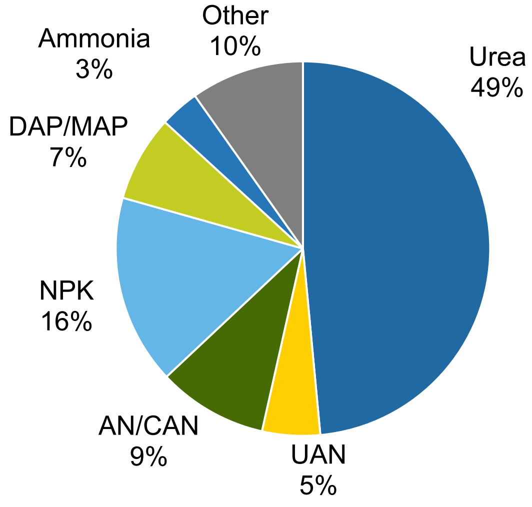
Key global fertilizer products

Potash K_2O



40 million tonnes

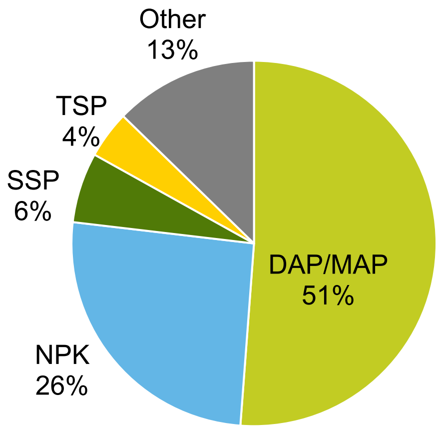
Nitrogen N



112 million tonnes*

* Does not include industrial nitrogen applications

Phosphate P2O5



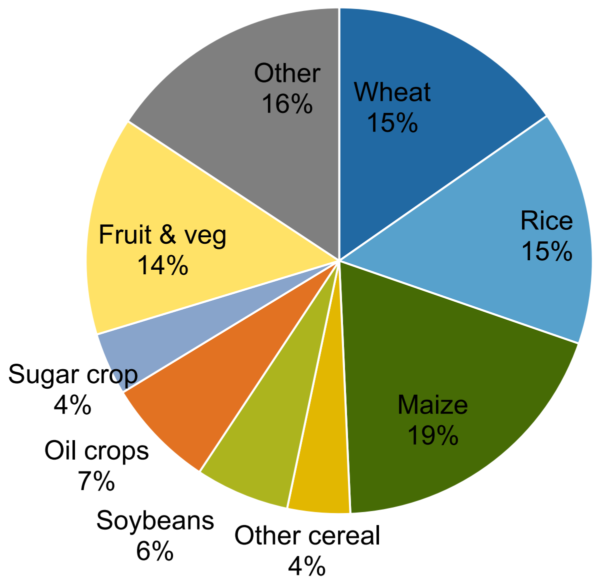
49 million tonnes

Source: IFA 2022, data for 2020

Nutrient application by crop

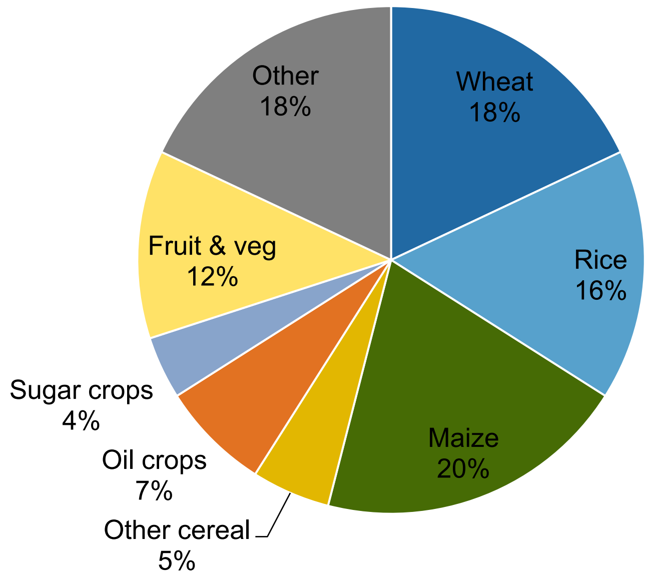
N + P + K

By tonnes nutrient



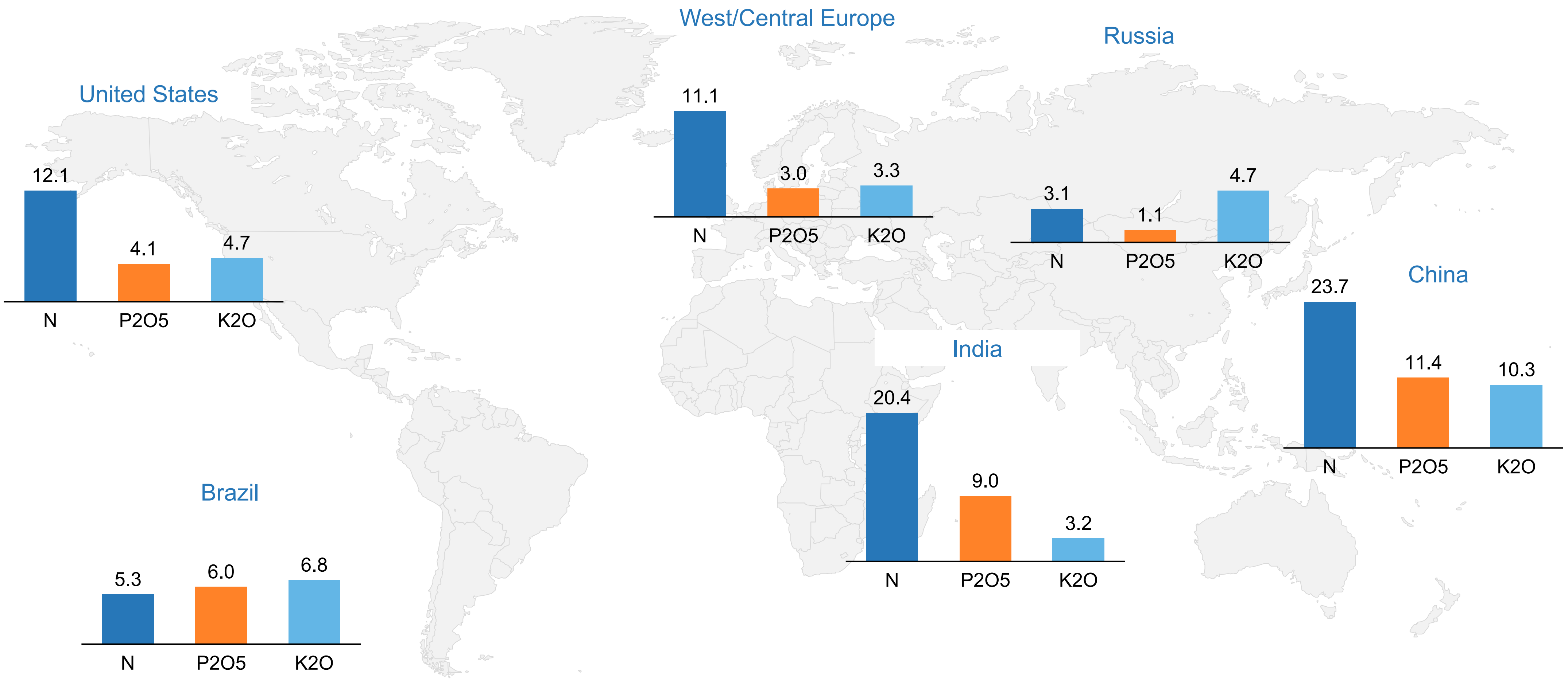
Nitrogen

By tonnes nutrient



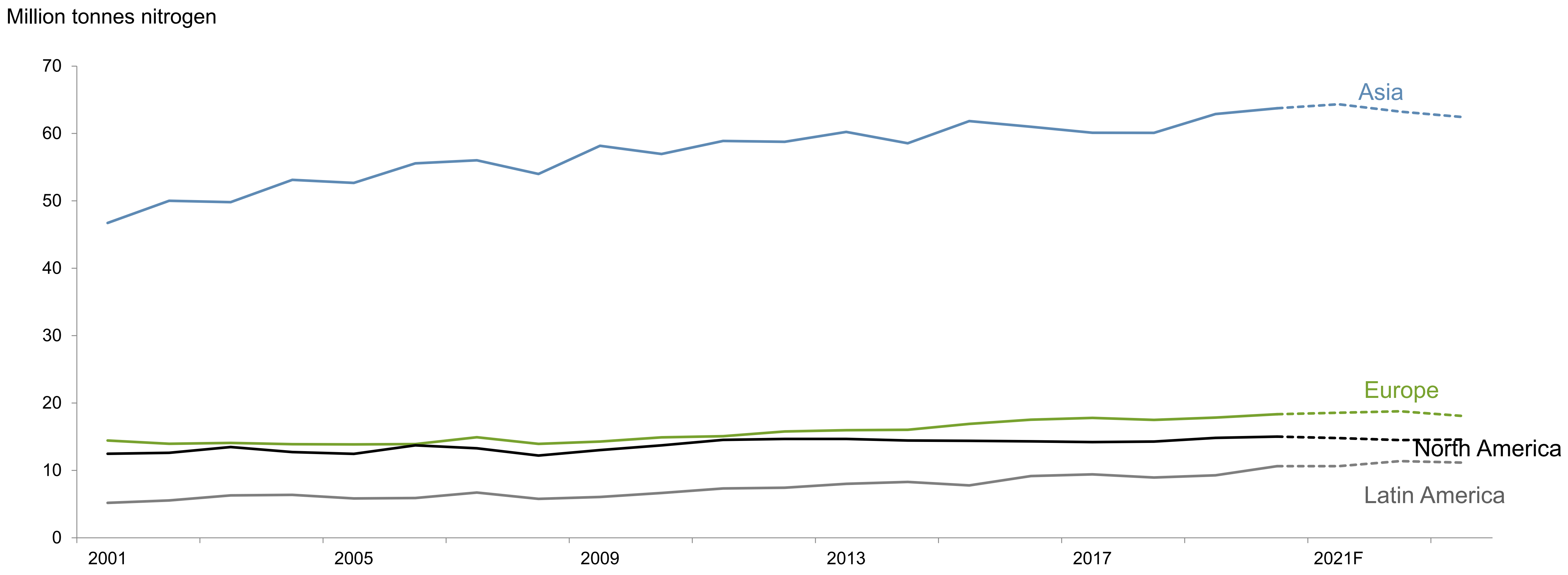
Fertilizer consumption by region – 5 key markets

Million tons nutrient consumption



Source: IFA 2022, data for 2020

Nitrogen consumption in key regions

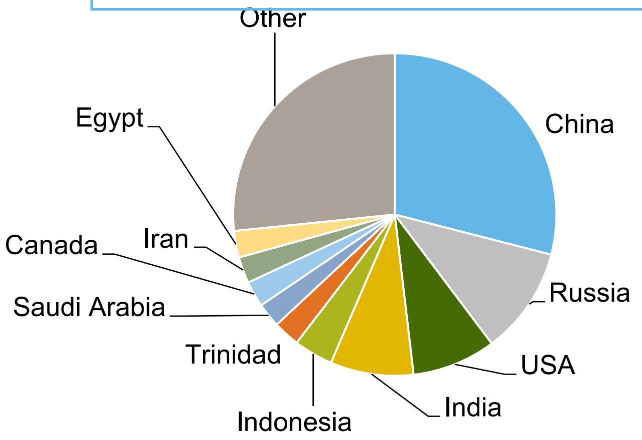


Source: IFA, June 2022

The N industry is fragmented, while the P and K industries are more concentrated

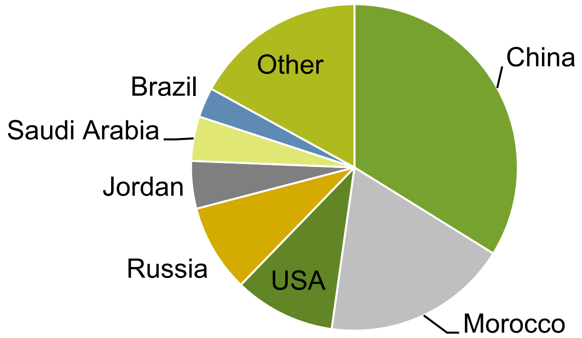
2021 figures[1], million tonnes nutrient

Nitrogen (N)



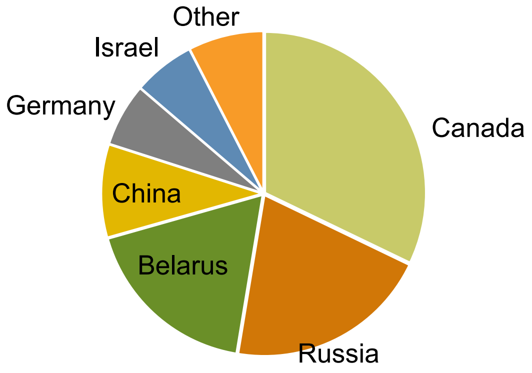
- Despite a consolidation trend, the industry is still highly fragmented
- The world largest nitrogen producers are CF, Yara, Nutrien, Ostchem, OCI, TogliattiAzot, Koch and Eurochem

Phosphate (P)



- More concentrated than N-industry
- The biggest producers are Guizhou Phosphorus Chemical Group in China, Nutrien and Mosaic in USA, OCP in Morocco, Ma'aden in Saudi Arabia and Phosagro in Russia

Potash (K)

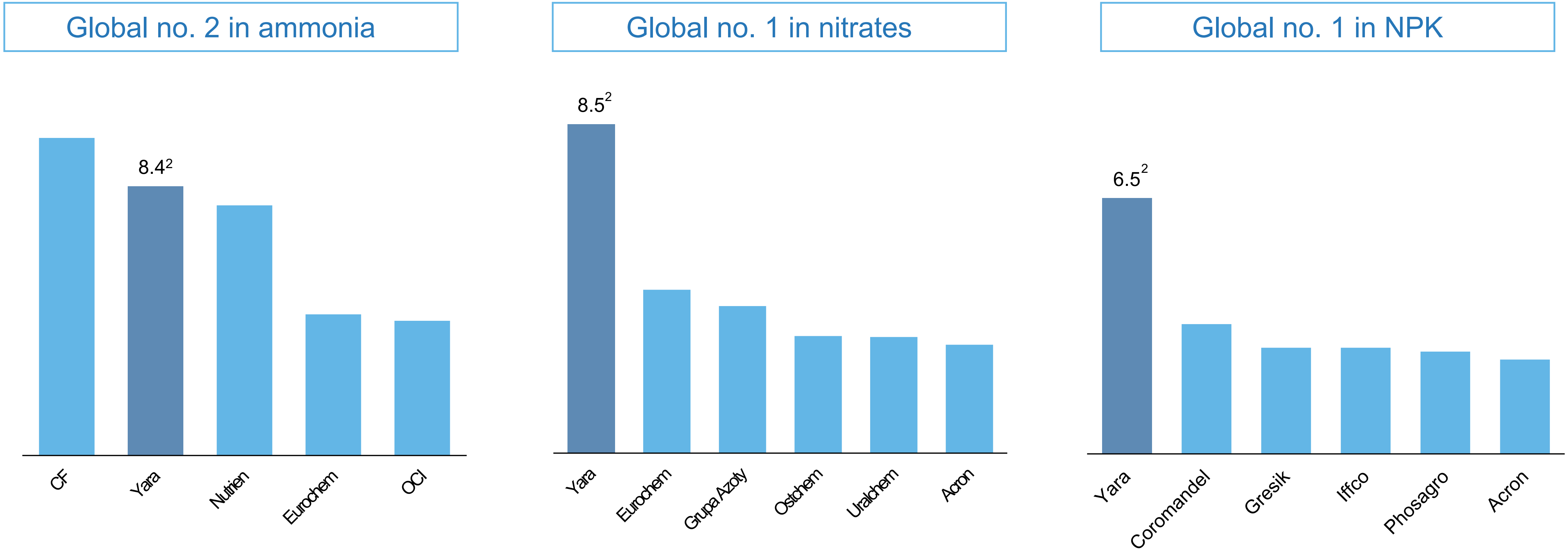


- Highly concentrated industry, with top 3 producing countries representing appx 70% of global market
- The main producers in Canada are Nutrien and Mosaic, Belaruskali in Belarus, Uralkali in Russia and K+S in Germany

Source: IFA

Yara – the leading crop nutrition company

2018 production capacity, excl. Chinese producers[1] (mill. tonnes)



* Incl. TAN and CN

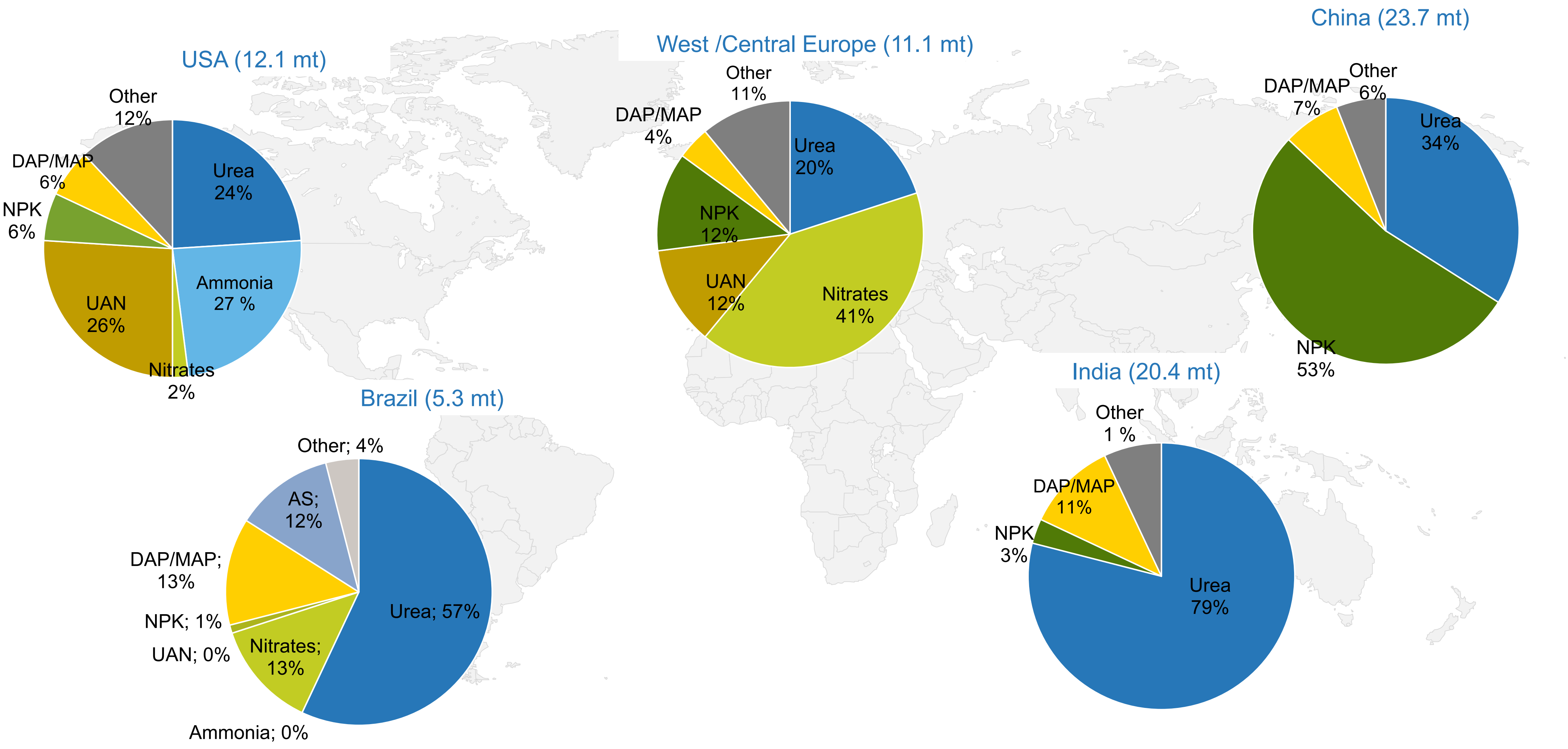
* Compound NPK, excl. blends

Source: Yara estimates, company info

1) Incl. companies' shares of JVs

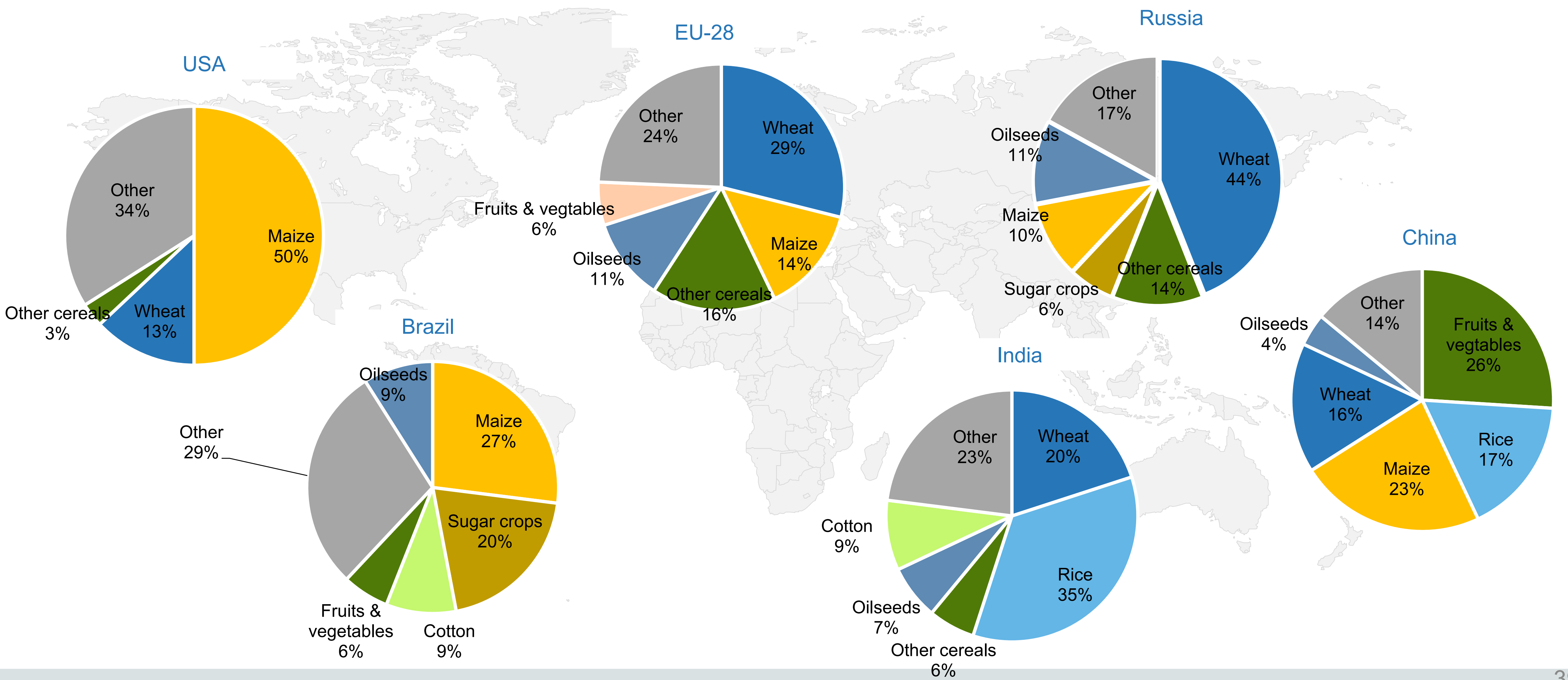
2) Yara capacity as of Dec 2021

Nitrogen fertilizer application by region and product



Source: IFA 2022, data for 2020

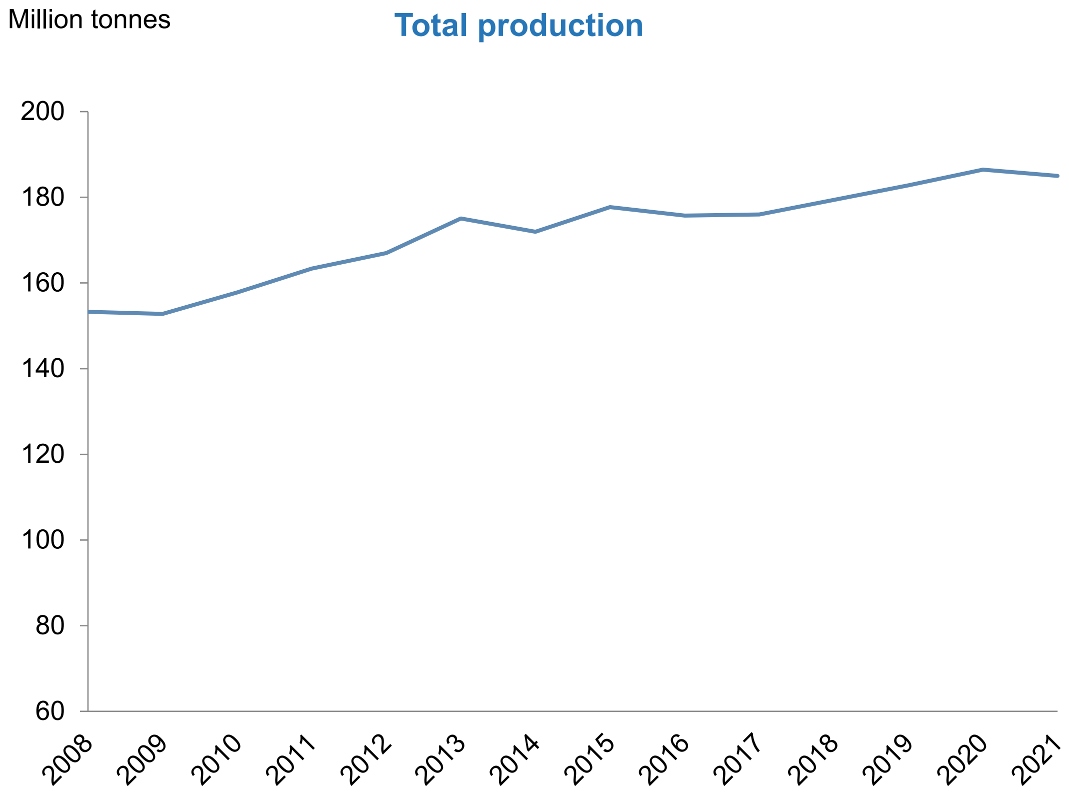
Nitrogen fertilizer application by region and crop



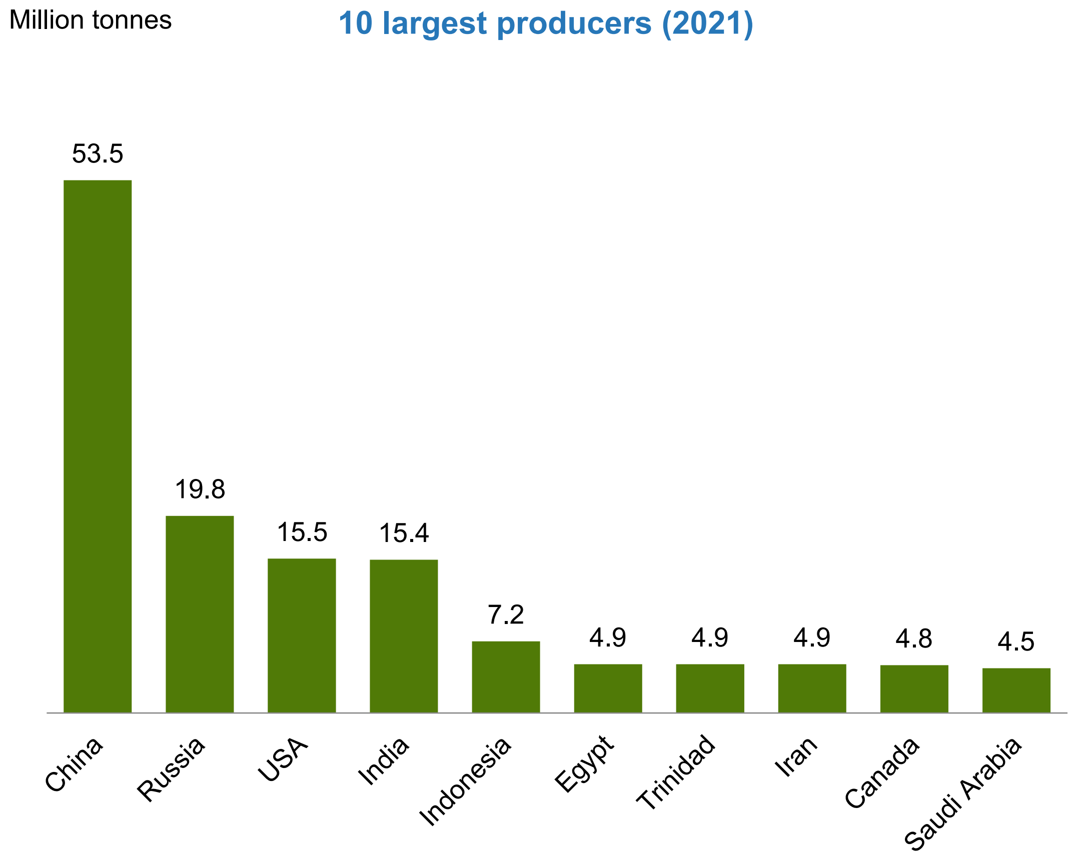
Source: IFA 2021

Ammonia

Global ammonia production

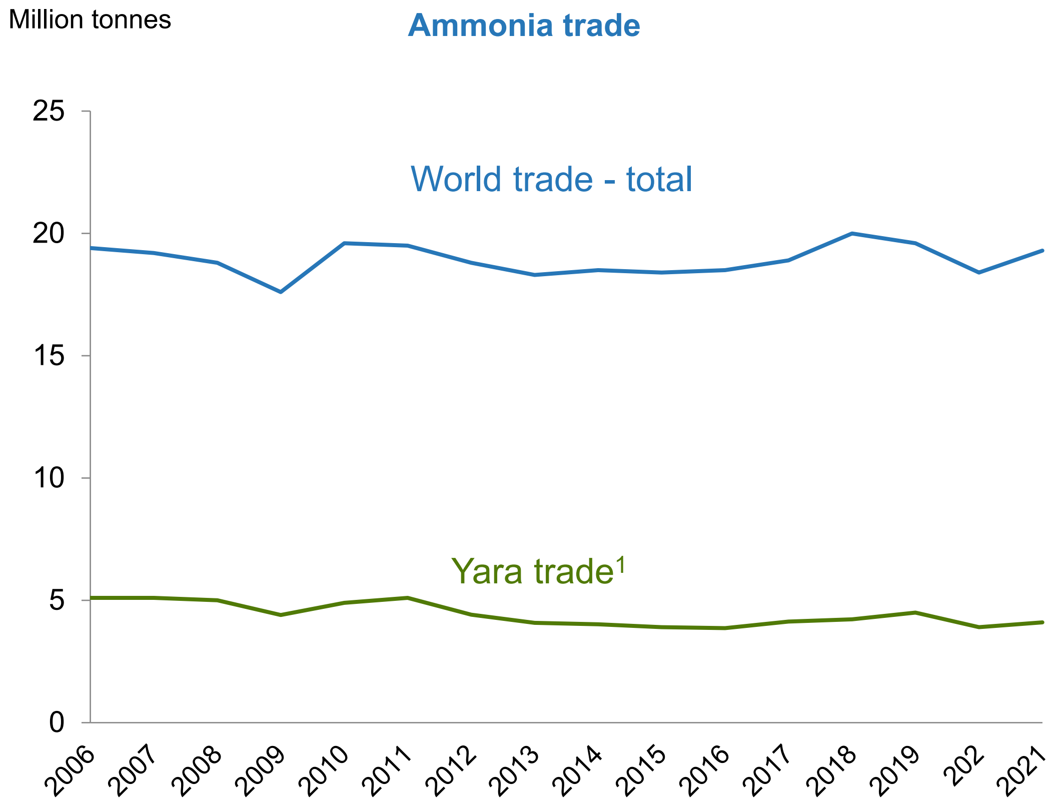


2011-2021 trend growth rate = 1.2%/year

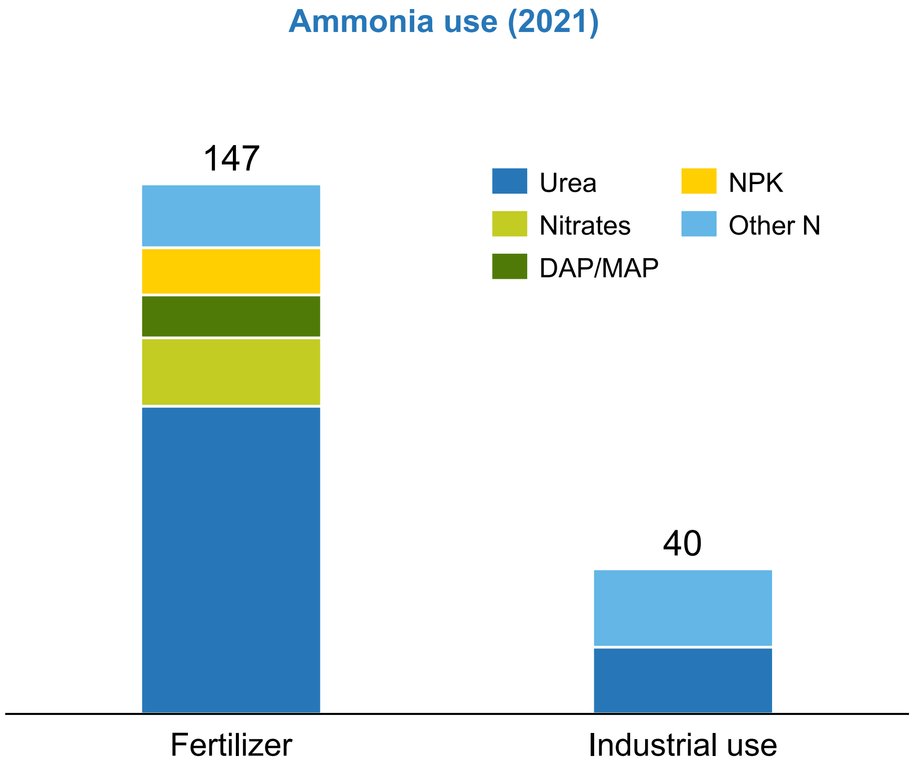


Source: IFA

Most of global ammonia production is upgraded to urea and other finished fertilizer



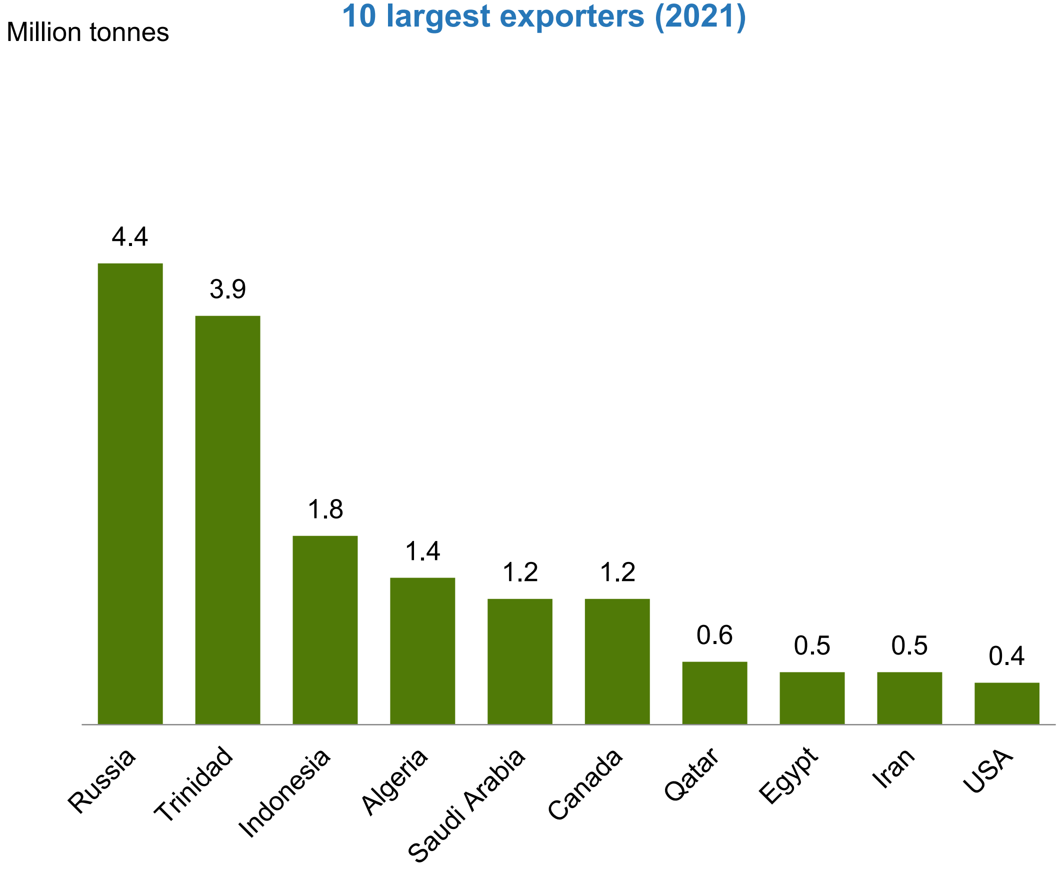
Source: Yara, IFA

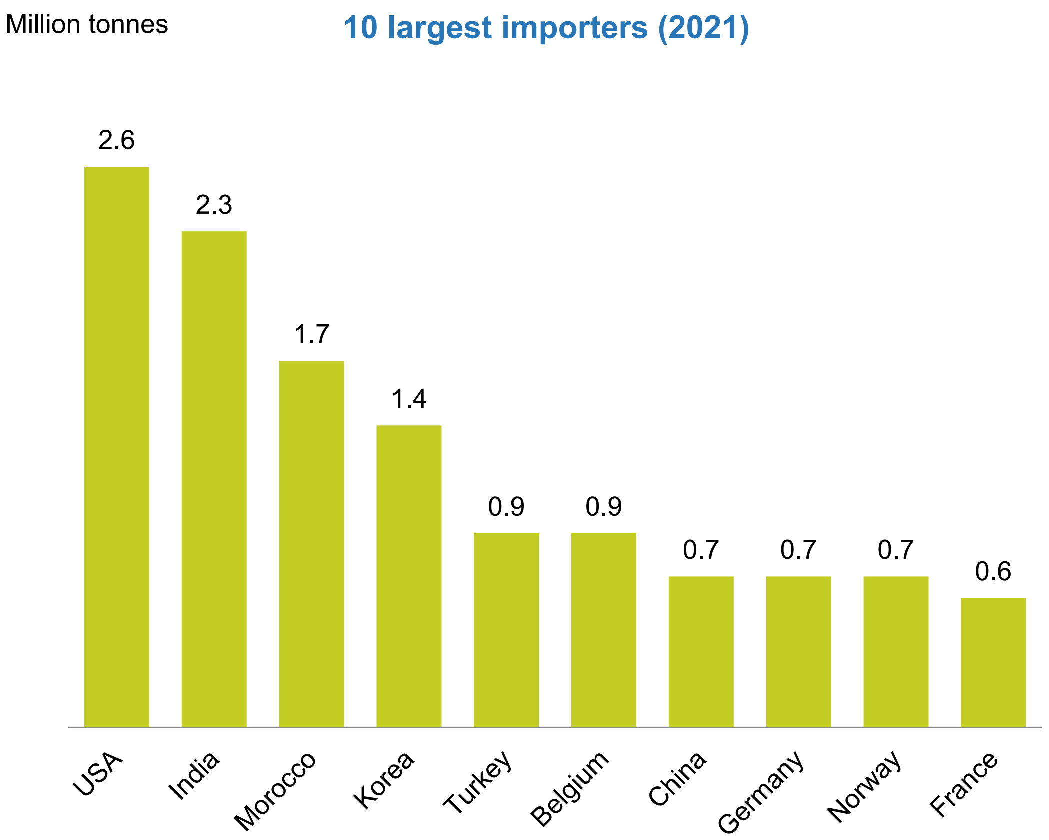


Source: Fertecon

1) From 2019 Yara trade is based on sales volumes in the Yara Clean Ammonia ("YCA") reporting segment, which leads to some minor variations compared with previous years.

Global ammonia trade

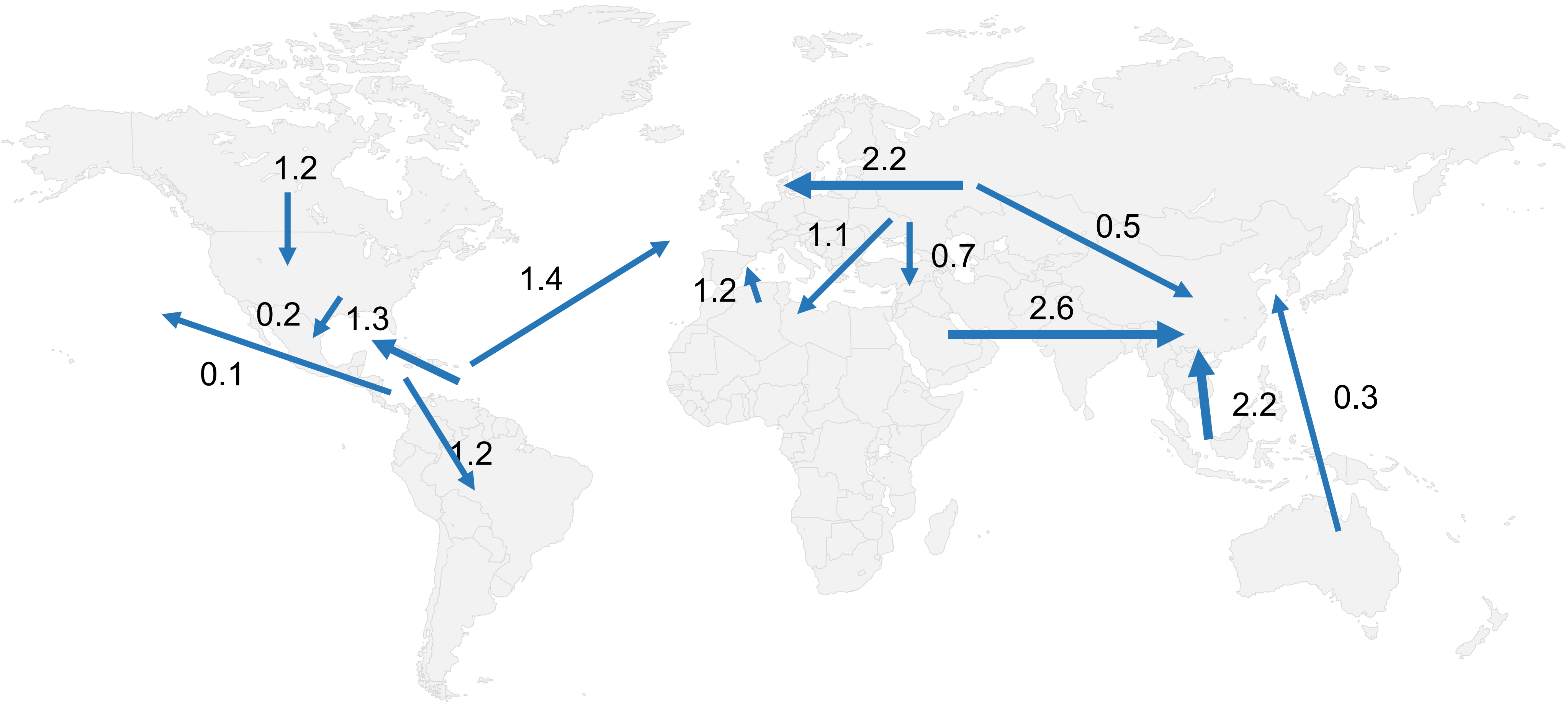




Source: IFA

Main ammonia flows 2021

Million tonnes

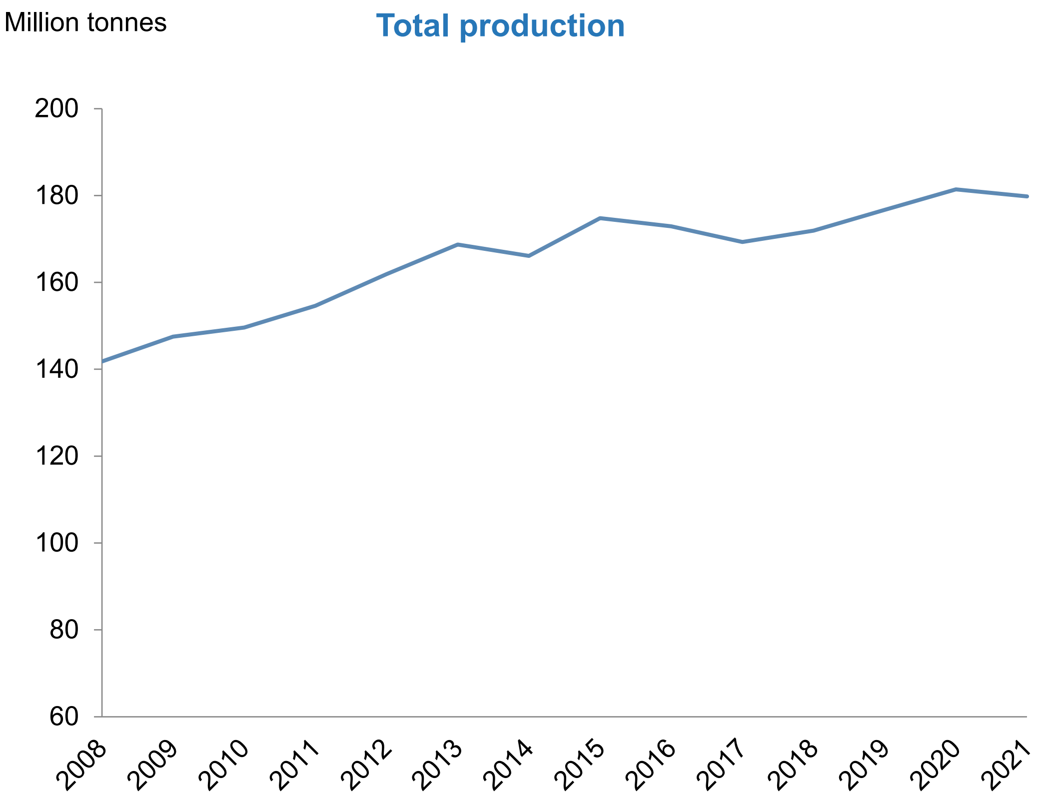


Source: IFA 2021, 83% of trade shown. Asia deficit equals roughly 0.6 million tons, supplied from Russia and Trinidad

Urea

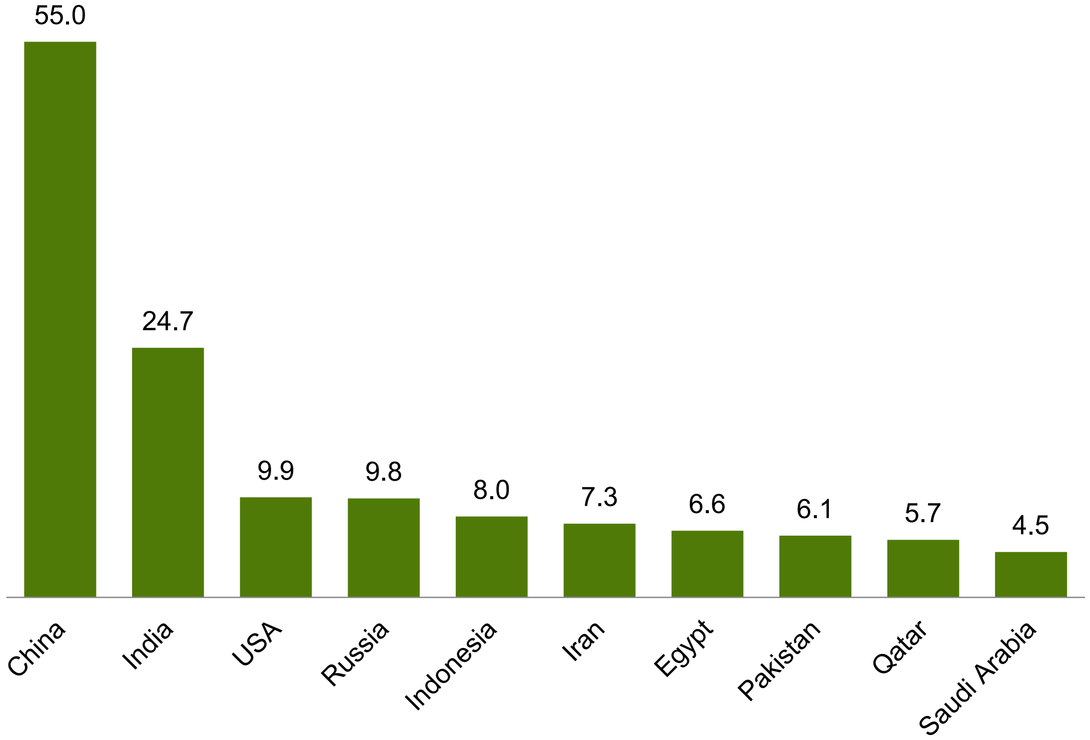
Global urea production

Total production



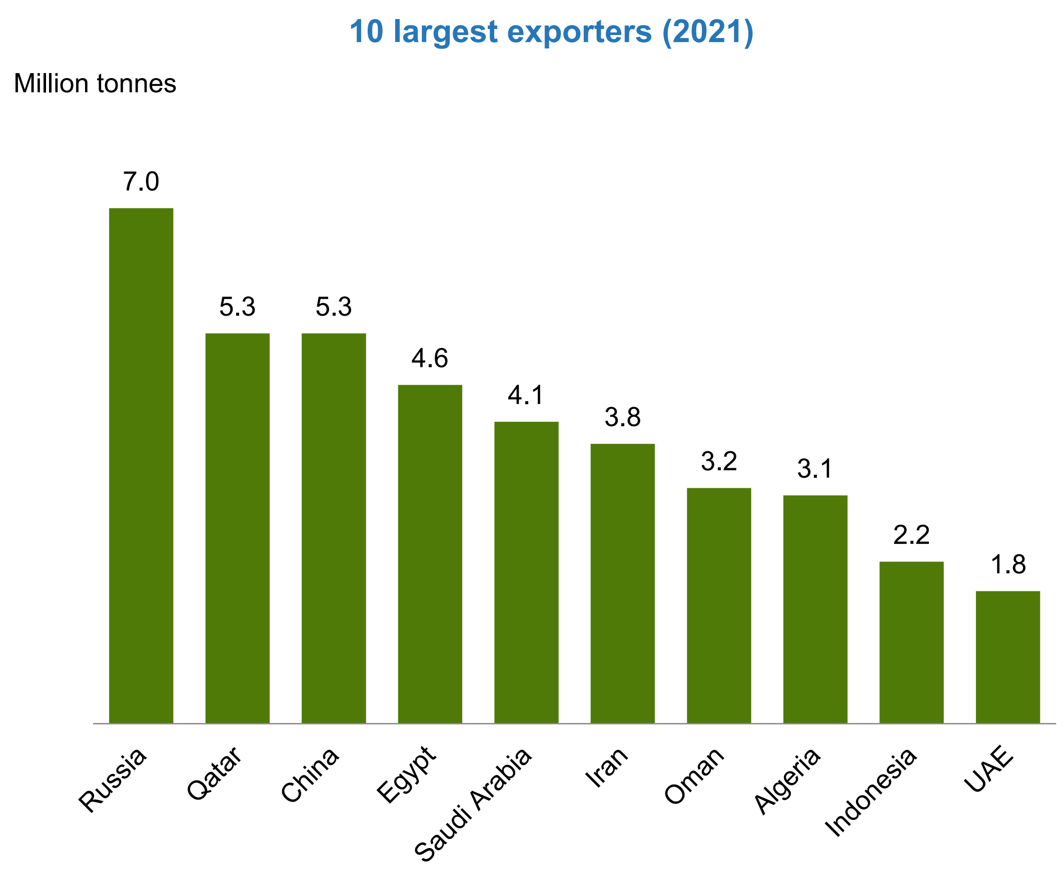
2011-2021 trend growth rate = 1.3% p.a.

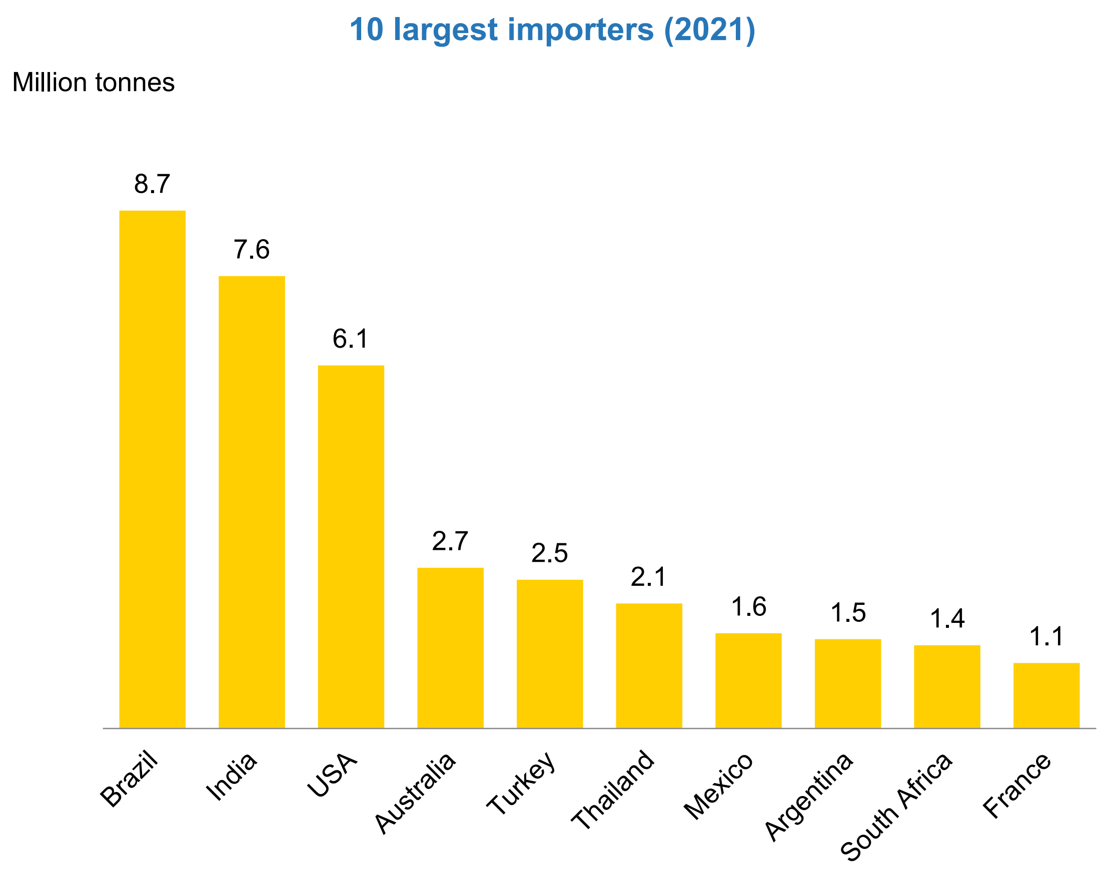
10 largest producers (2021)



Source: IFA

Global urea trade

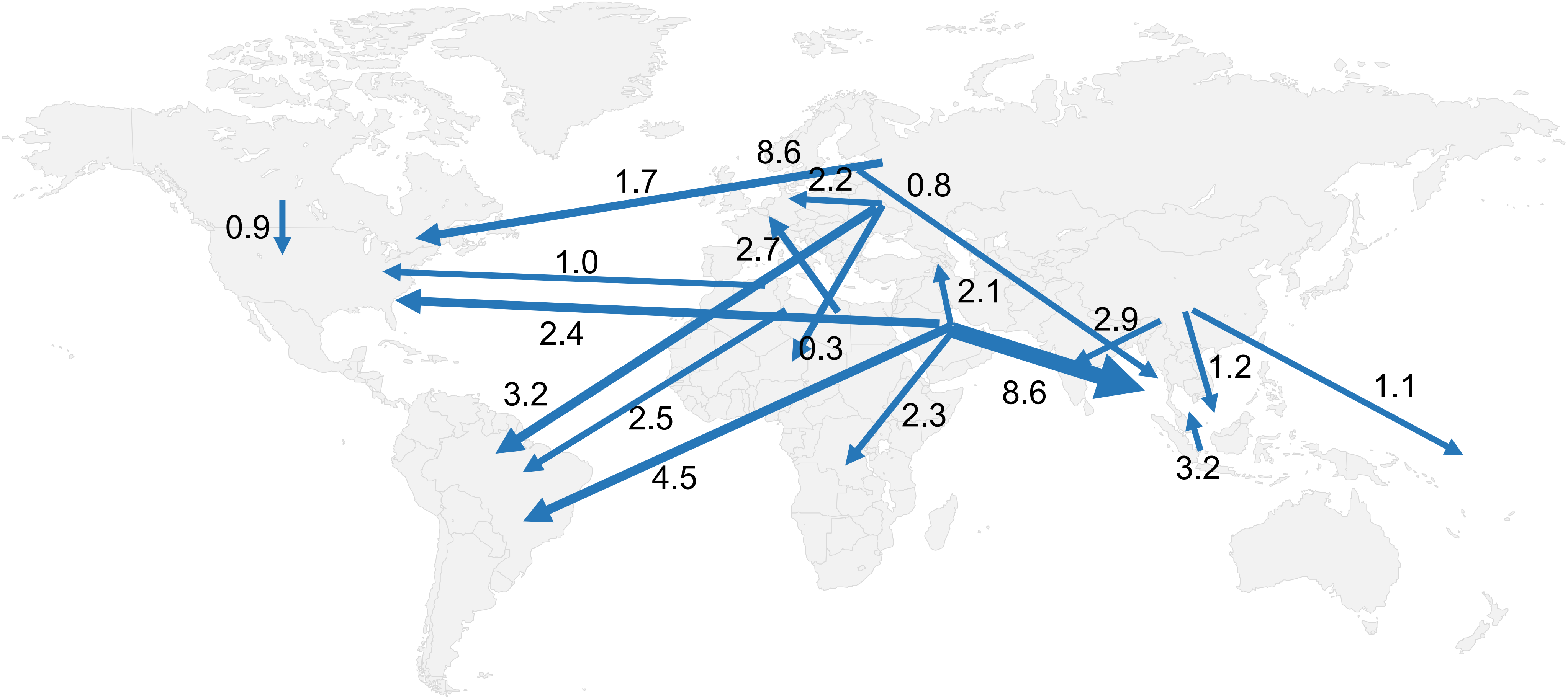




Source: IFA

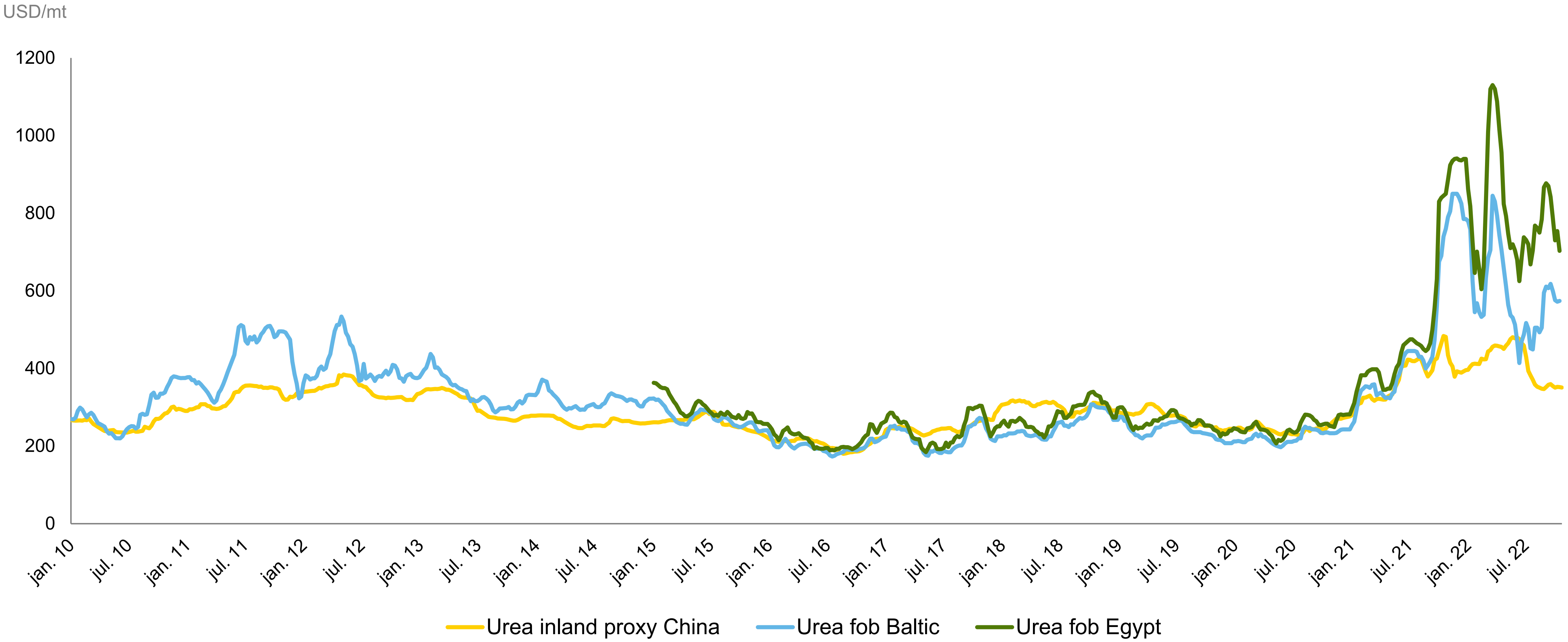
Main urea flows 2021

Million tonnes



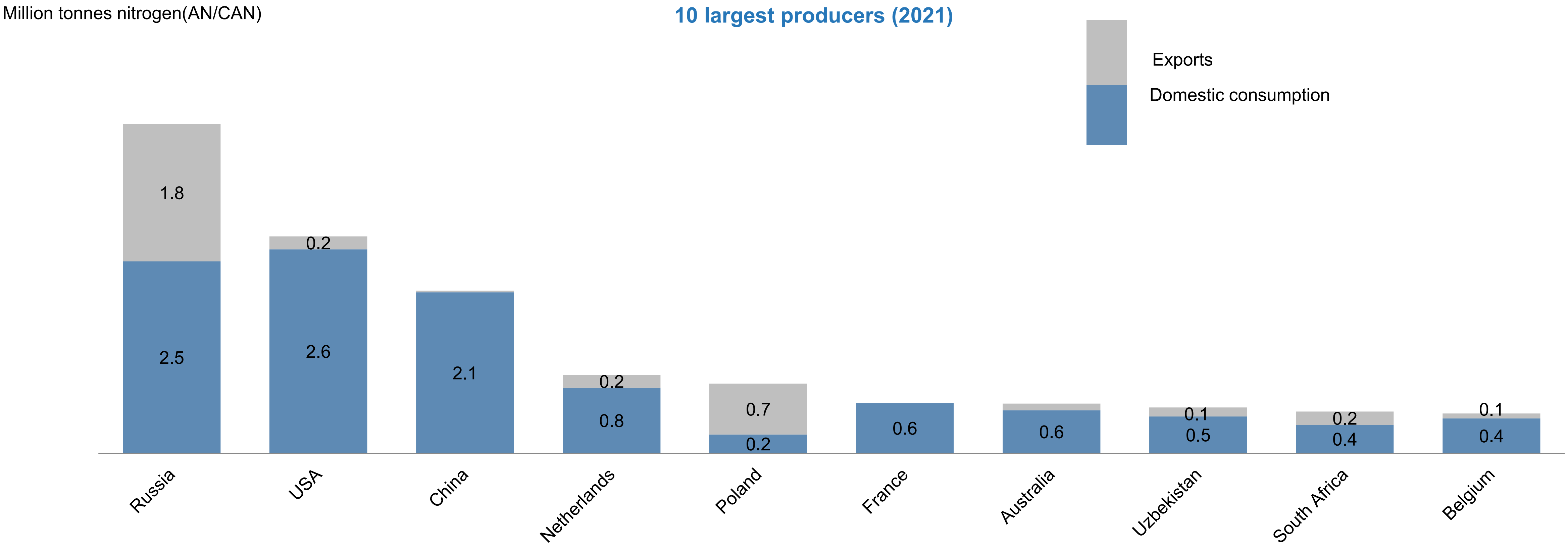
Source: IFA 2021, 83% of total trade shown

High and volatile urea price since late 2020



Nitrates

Global nitrate production



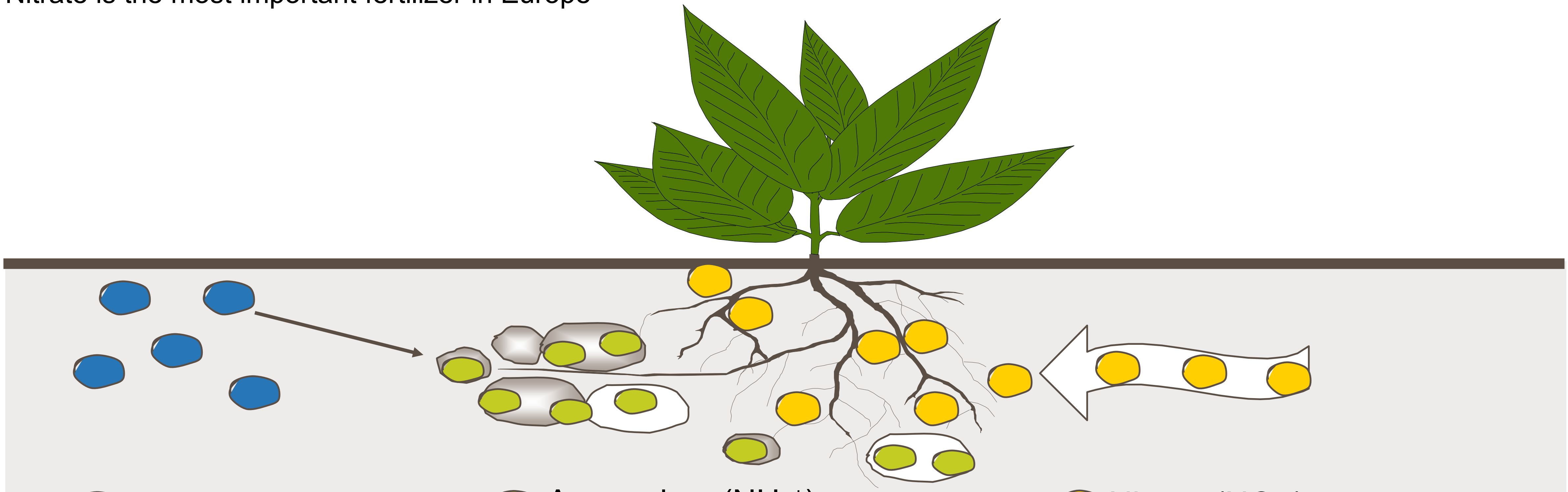
Source: IFA, AN/CAN including nitrate part of UAN, as are industrial grades

Nitrates are products with a nitrate content of 50 % or more

N fertilizer	N content	Nitrate (% of total N)	Other nutrients
CAN (calcium ammonium nitrate)	27%	50%	4% MgO
AN (ammonium nitrate)	33.5%	50%	
NPK	various	about 50%	P & K
CN (calcium nitrate)	15.5%	93%	19% Ca
Urea	46%	0%	
UAN (liquid urea ammonium nitrate)	28%	25%	
ASN (ammonium sulfate nitrate)	26%	25%	13% S
AS (ammonium sulfate)	21%	0%	24% S

Nitrates vs. urea

Nitrate is the most important fertilizer in Europe



Urea (CON_2H_4)

Urea-N needs to be converted into ammonium-N before it is plant available.

Ammonium (NH_4^+)

Ammonium-N is fixed onto clay minerals in the soil and therefore immobile. The plant roots have to grow actively towards the nutrient.

Nitrate (NO_3^-)

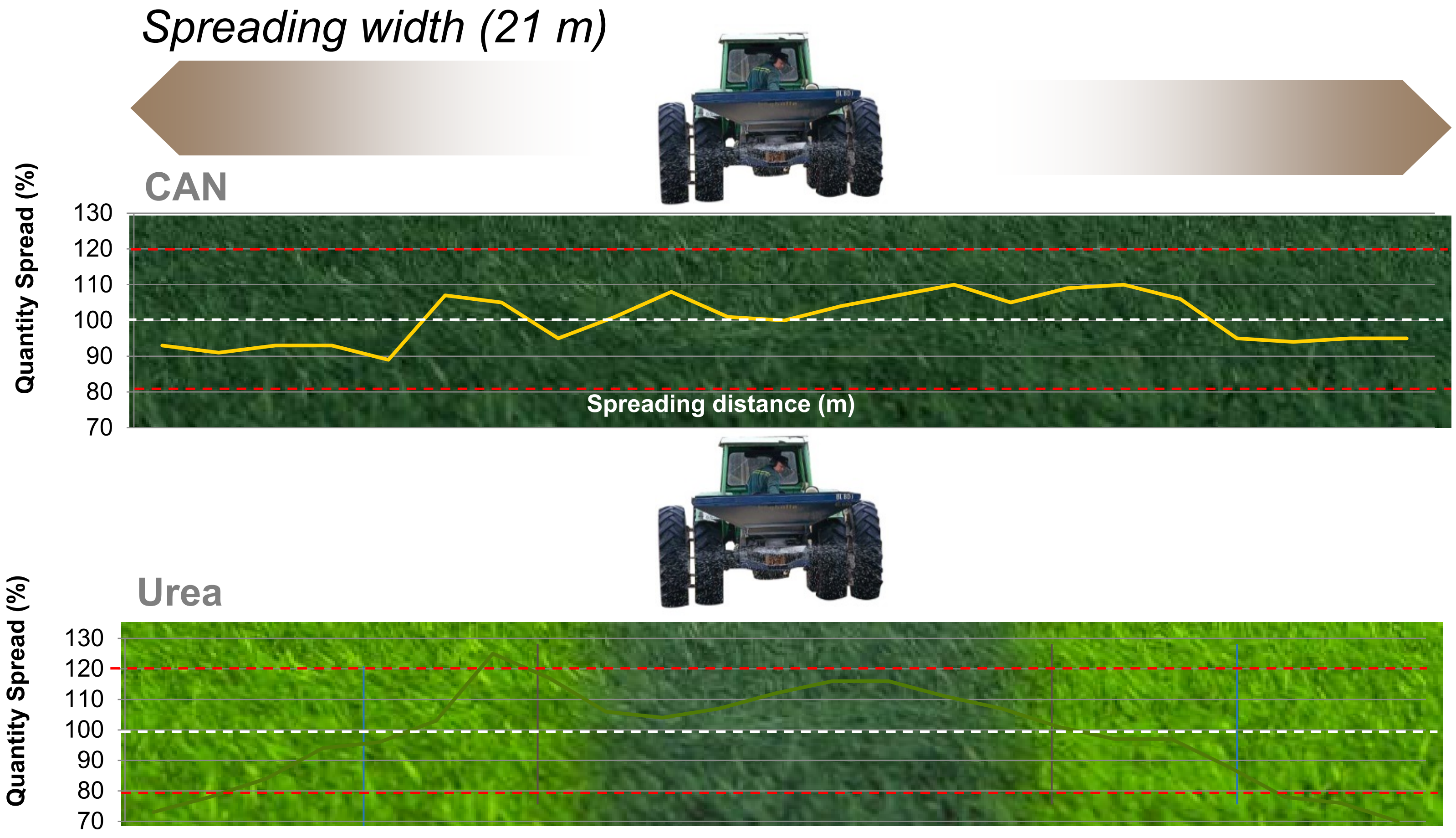
Nitrate-N is always dissolved in the soil water and is transported passively together with the water into the plant root. Thus, nitrate is rapidly effective.

Better spreading with nitrates

The poor spreading patterns with Urea cause striped fields and considerable yield loss

Good uniformity with CAN:

Lower uniformity with Urea:



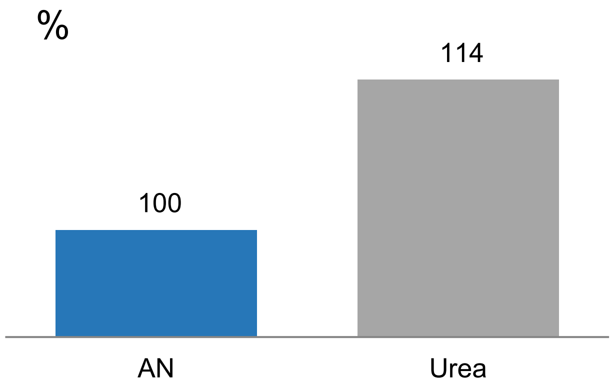
Due to better spreading quality of CAN a higher yield equivalent is achieved in field trials

Source: Yara research, trial studies in Germany (n=112, 2007-2017) on different soil types

Nitrate outperformance compared with commodity nitrogen products

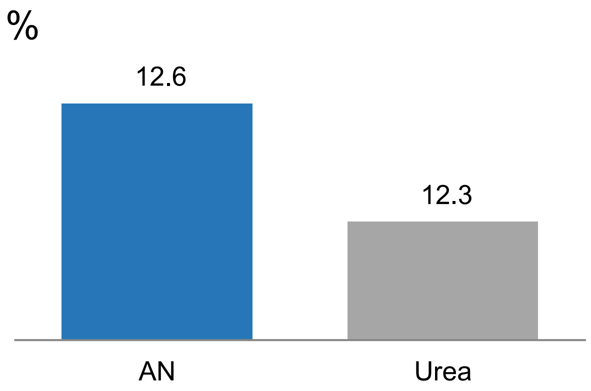
Trial results for arable crops (cereals, UK)

Extra N required for same yield



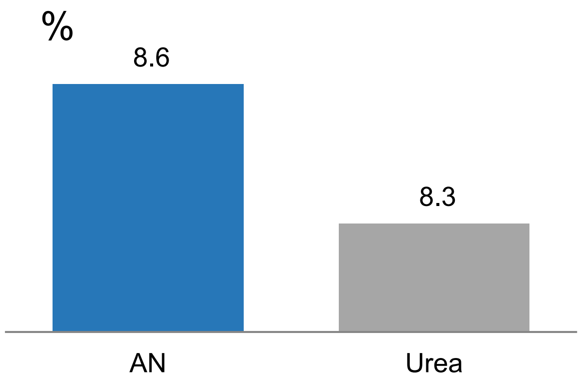
To maintain the same yield, significantly more nitrogen was needed from urea than from ammonium nitrate

Protein content at identical N rate



Protein content was significantly lower on fields fertilized with urea than with ammonium nitrate

Yield at identical N rate



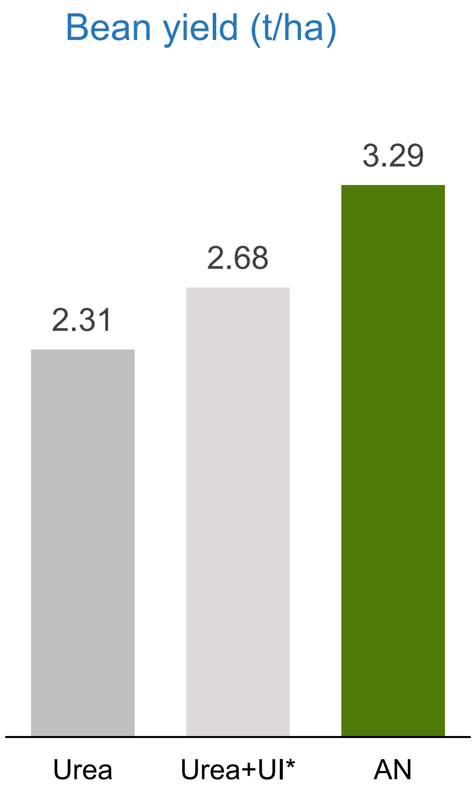
Yield was also significantly lower with urea than with ammonium nitrate

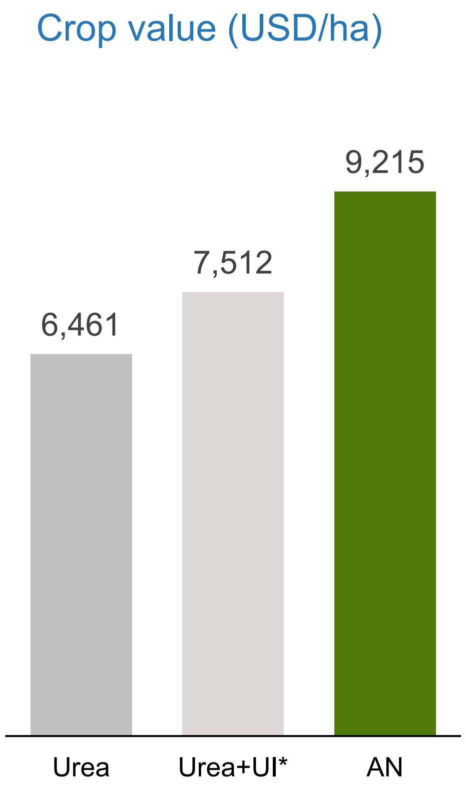
Source: DEFRA

Yield advantages with nitrates in tropical climate

Trial study in Brazil, higher coffee bean yield with nitrates as compared to urea

- Research shows that the benefits of nitrates are even more pronounced in the tropics than in colder climates
- Nitrates provide direct and efficient uptake of N

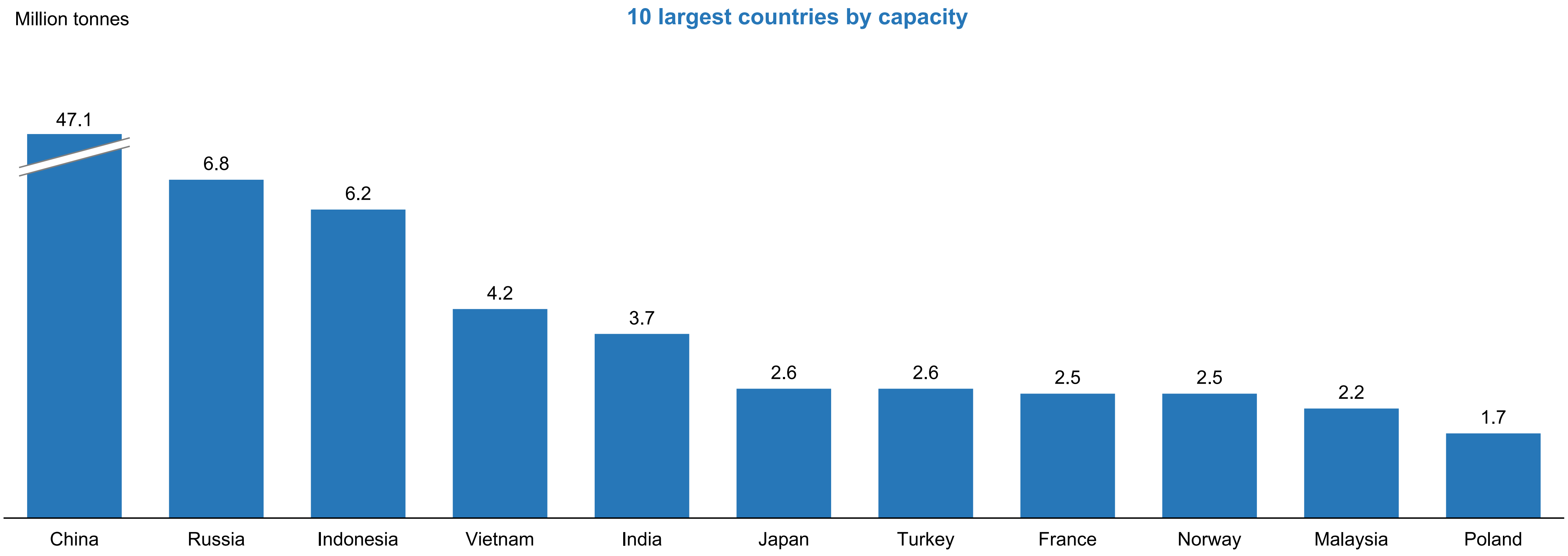




* UI = Urease Inhibitor
Source: trial 2018/2019 - Lavras University, Minas Gerais, Brazil & Yara Research

NPKs

Global compound NPK capacities



Source: IFA 2016, data for 2013/2014

Compound NPKs contain all nutrients in one particle

Compound NPKs

All nutrients in each and every particle

Even spreading of all nutrients

NPK bulk blends

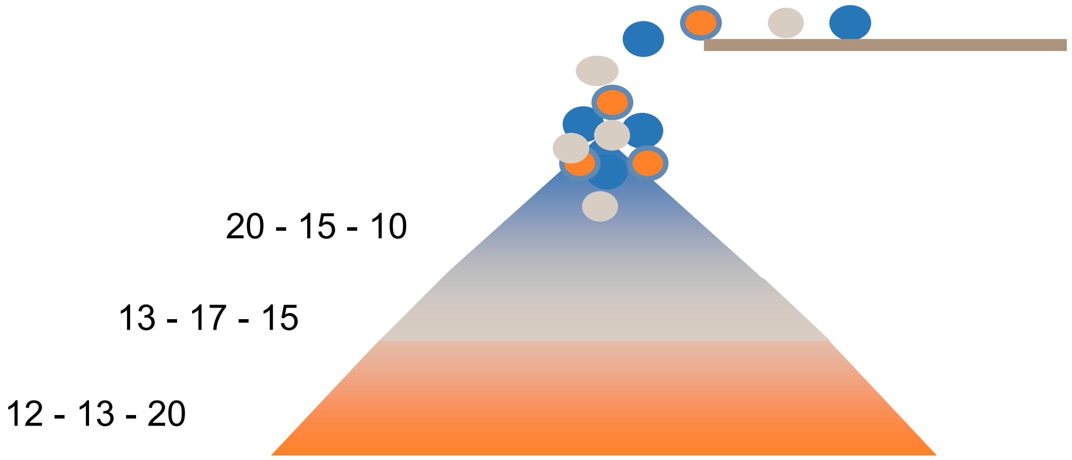
A mix of products with different spreading properties

Risk of segregation and uneven spreading

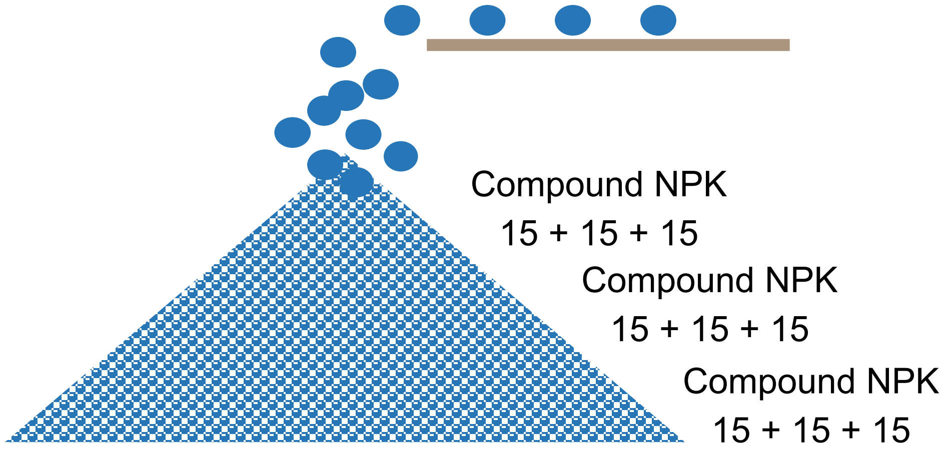
Bulk blend segregation during loading and unloading

Urea + DAP + MOP
15-15-15

Compound NPK
15-15-15



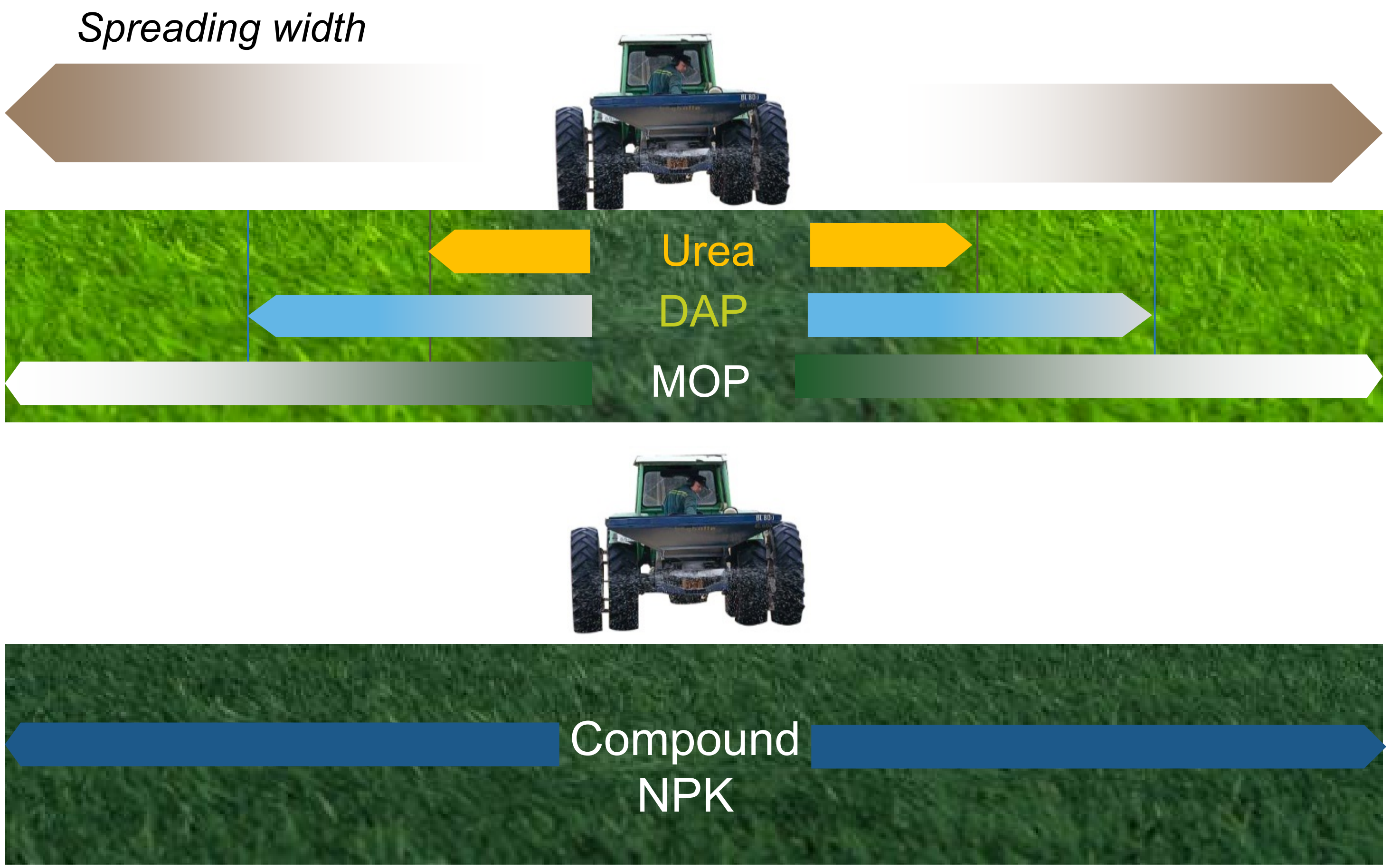
N – P_2O_5 – K_2O analysis
in a pile of poor quality blend



N – P_2O_5 – K_2O analysis
in a pile of compound NPK 15-15-15

Segregation due to differences in specific weight and granule size

Better spreading with compound NPKs



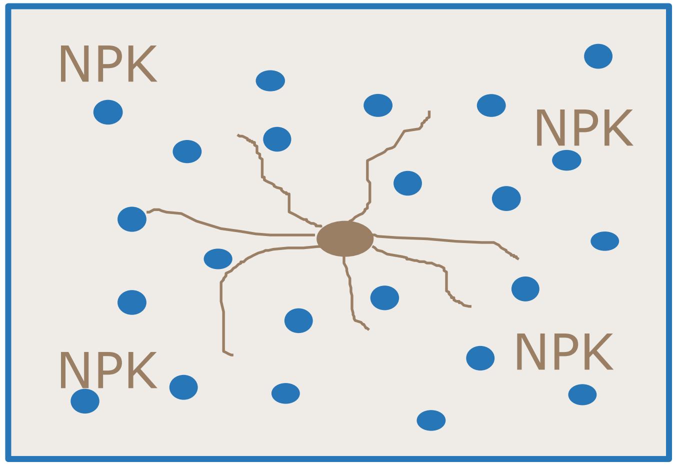
The spreading width of light particles like Urea is less than those of heavier particles like DAP and MOP

Poor spreading patterns cause striped fields and significant yield losses

Compound NPKs give excellent spatial distribution of nutrients and higher crop yields as a result

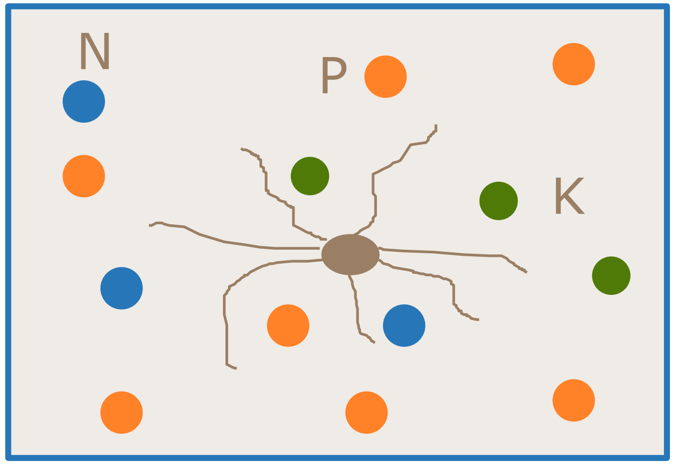
Compound NPKs
16+16+16

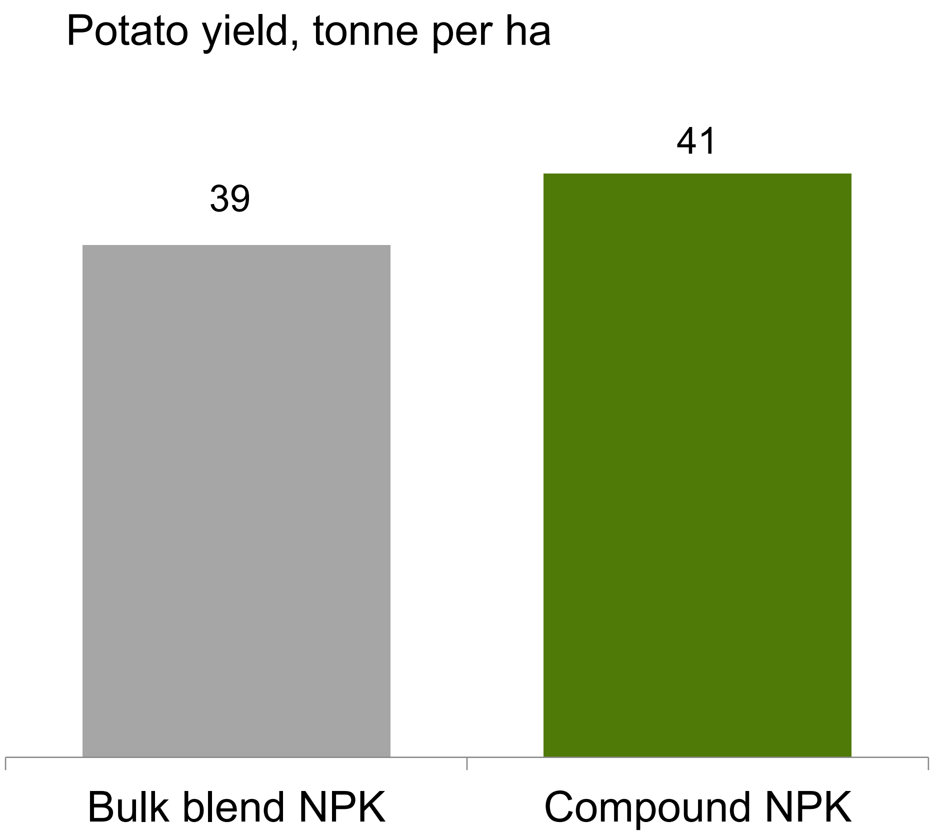
more particles and
better distribution



Bulk blend
Urea-DAP-MOP

fewer particles,
longer distance to roots



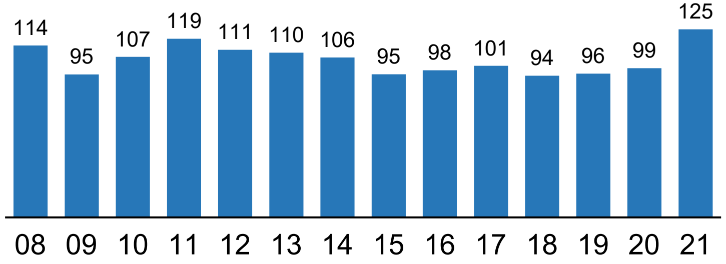


Source: Yara field trials, Hanninghof research center (9 harvest dates)

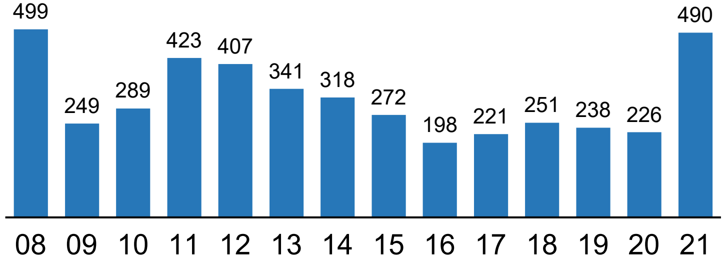
Industry value drivers

Fertilizer prices are cyclical

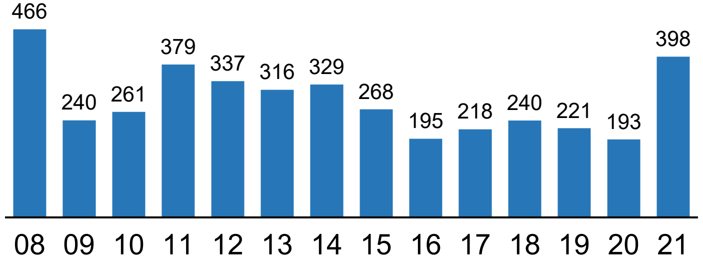
FAO Food price index (2014-2016=100)



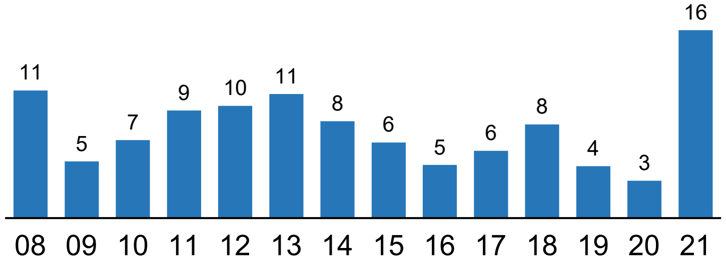
Urea prilled fob Black Sea (USD/t)



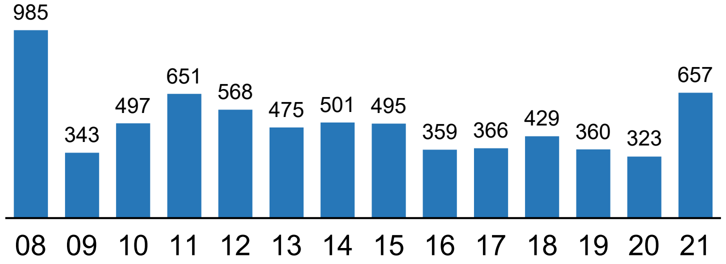
CAN cif Germany (USD/t)



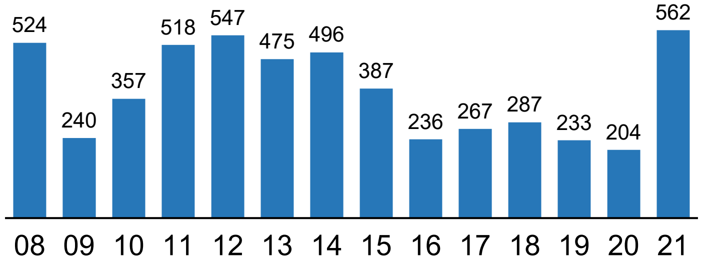
TTF (USD/MMBtu)



DAP FOB Morocco (USD/t)



Ammonia fob Black Sea (USD/t)



Source: Fertilizer market publications, World Bank

Nitrogen fertilizer value drivers

	Drivers:	Effect on:
Revenue drivers:	Global urea demand vs. supply	Urea price
	"Marginal producer" production costs	Supply-driven urea price
	Crop prices/grain inventories	Urea demand / demand-driven urea price
	New urea capacity vs. closures	Urea supply
	Urea price	Most other nitrogen fertilizer prices
	Cash crop prices	Value-added fertilizer premiums
Cost drivers:	Gas demand vs. supply	Gas costs
	Manning and maintenance	Fixed costs
	Productivity and economies of scale	Unit cost

Drivers of demand

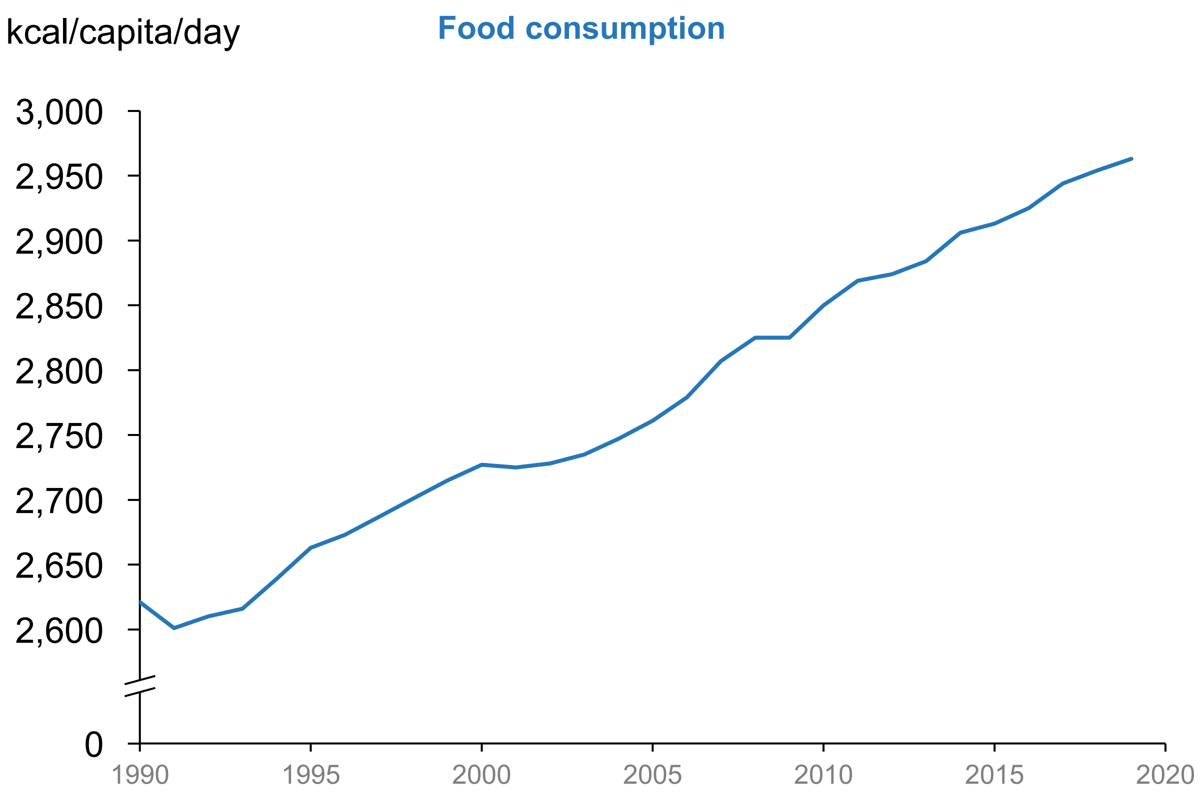
Drivers of fertilizer consumption growth

Fertilizer consumption is mainly driven by food demand

- Population growth
- Economic growth and diet changes
  - More protein-rich diets
  - More fruit and vegetables
  - Reduced hunger
- Nutrient use efficiency in farming
- Waste and loss across the food value chain

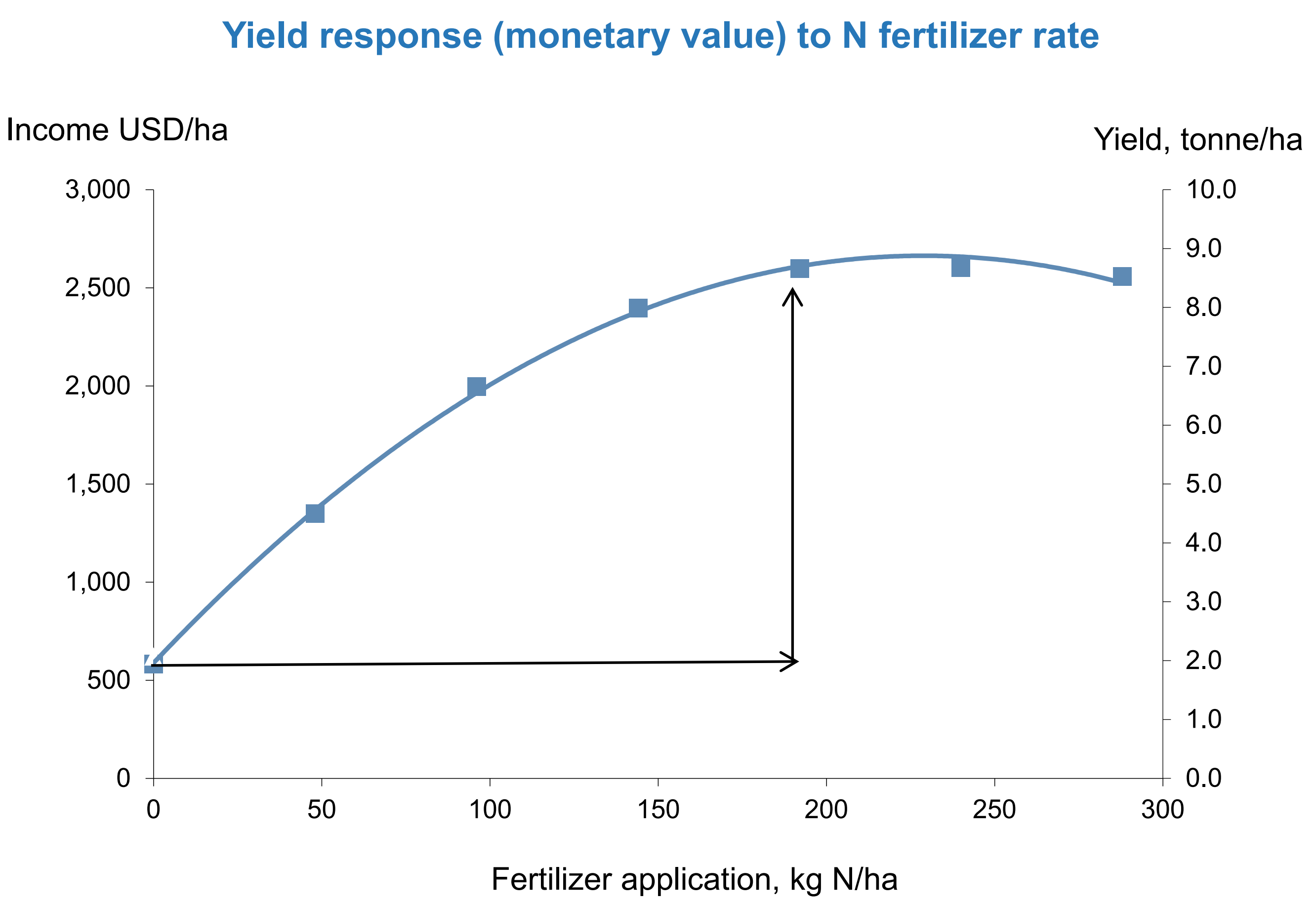
Industrial consumption is mainly driven by economic growth

- Economic growth
- Environmental limits (e.g. reduction of NOx emissions)



Source: FAO, food supply kcal/capita/day

Profitability of investment in mineral fertilizers



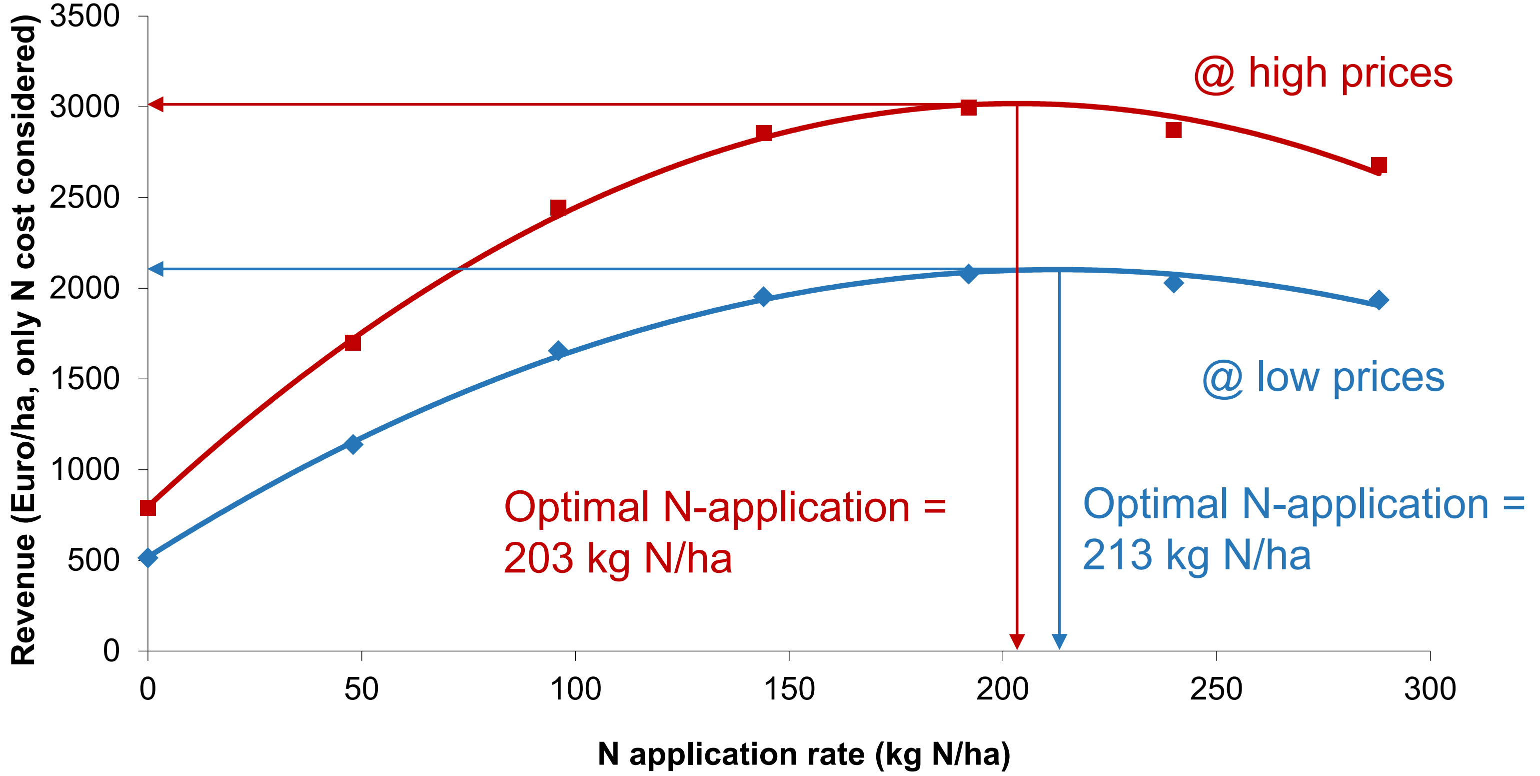
- The investment in nitrogen fertilizer is highly profitable for growers
- Fertilizer investment: 332 USD/ha
- Net return: 2,036 USD/ha
- **Net return ~ 5 x investment**

Source: Winter wheat yield data: Long term trial, Broadbalk, Rothamsted (since 1856).

Higher grain prices allow for increased nitrogen fertilizer values

- High crop prices provide much-needed incentives to farmers and global food production
- Farmers get the full revenue effect of yield improvement while fertilizer is a relatively smaller component of their margin, hence optimal nitrogen application is only slightly lower in this example with high prices vs a scenario with low prices.

Illustration of price impacts

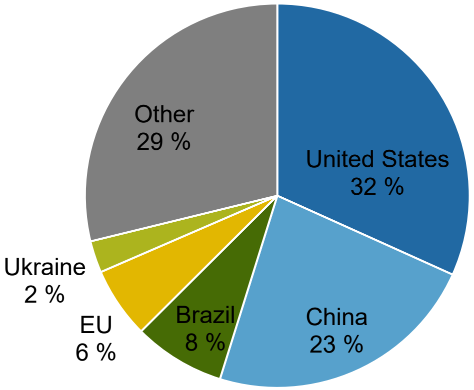


High prices (red line) = 248 EUR/t for grain and 518 EUR/t urea, low prices (blue line) = 381 EUR/t for grain and 1625 for urea.
Source: Winter wheat yield data: Long term trial, Broadbalk, Rothamsted (since 1856).

Key crops by region

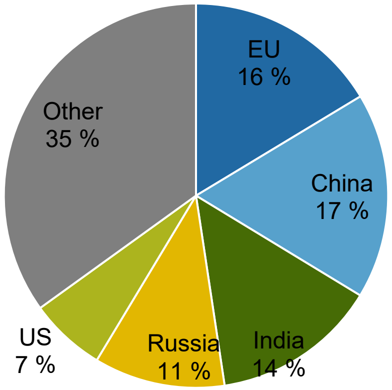
Global production:

Corn



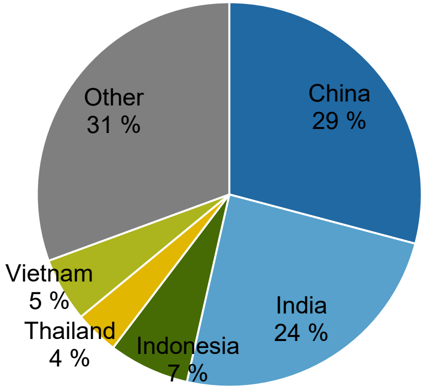
1,129 mt

Wheat



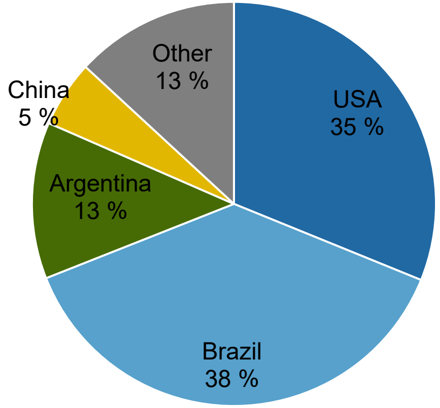
775mt

Rice



509 mt

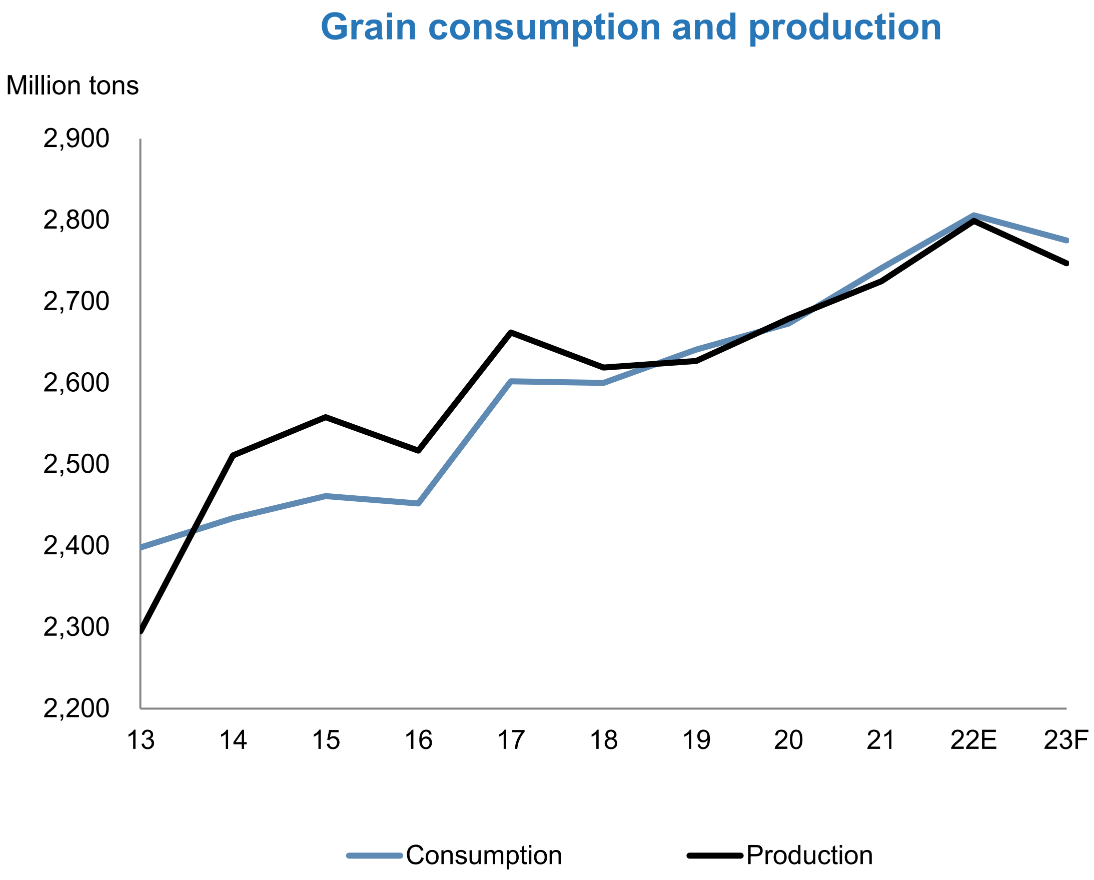
Soybeans

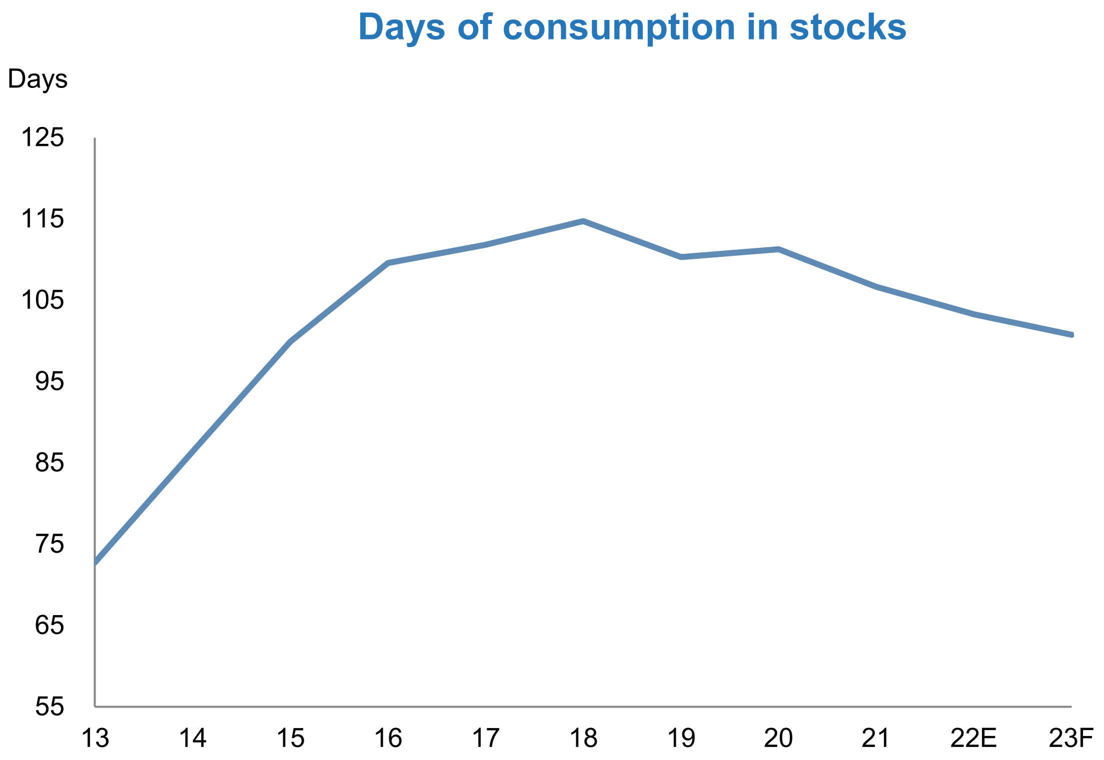


368 mt

Source: USDA October 2022, data for 2020/21 season

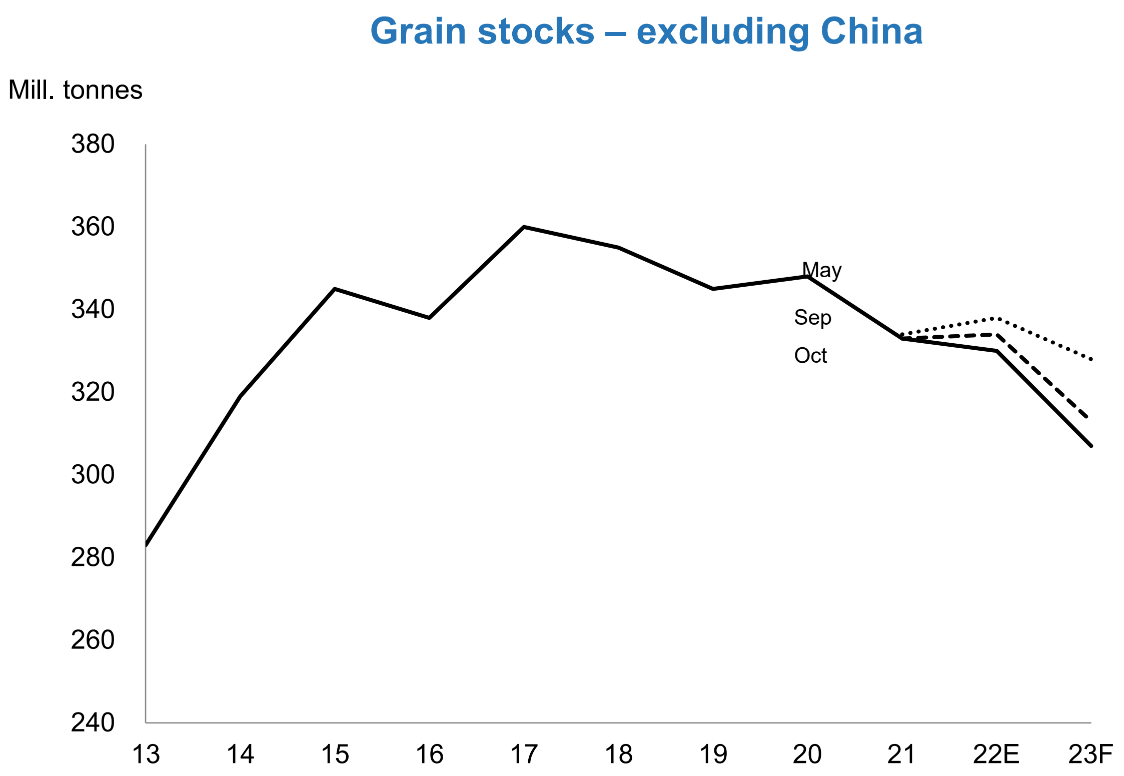
Grain production forecasted to fall short of consumption for the 2022/23 season

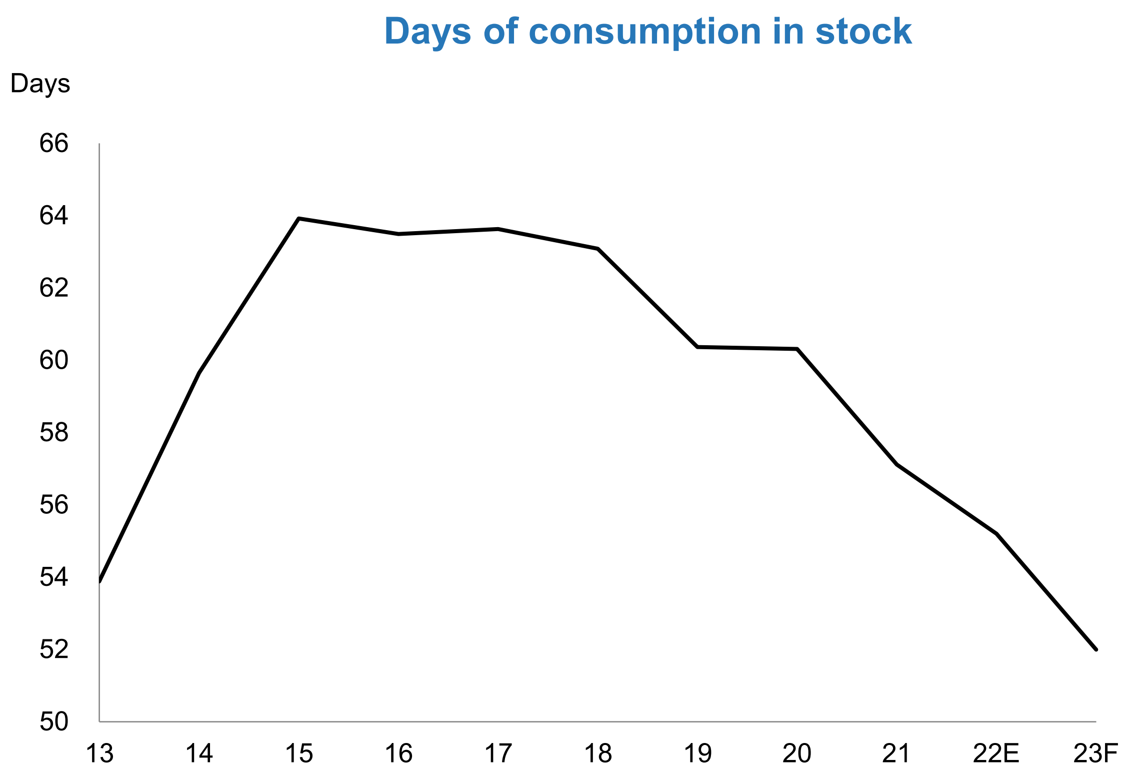




Source: USDA October 2022

Grain inventories outside China seen declining this agricultural year (July-June)

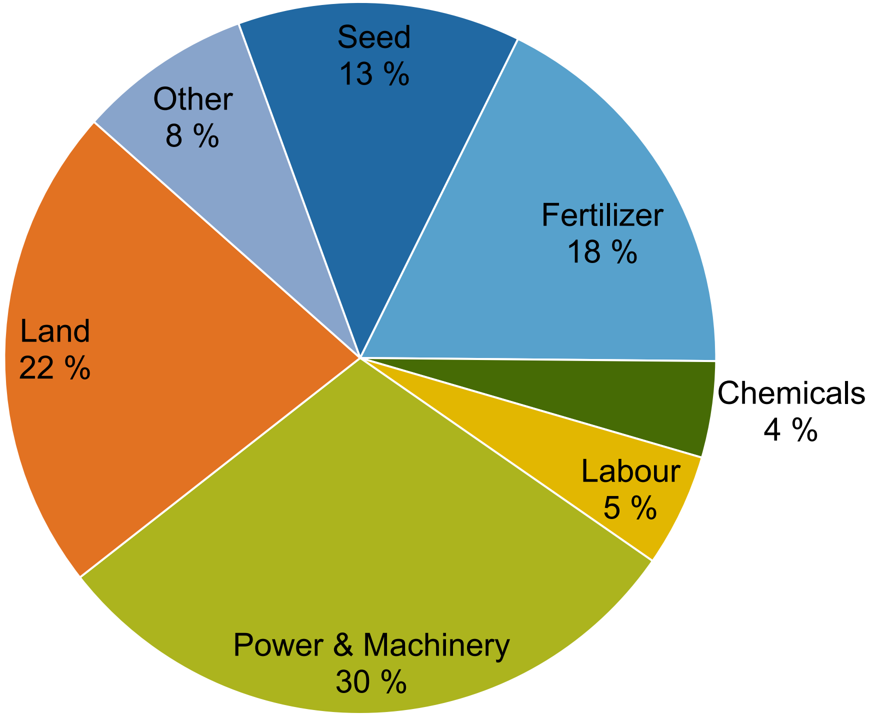


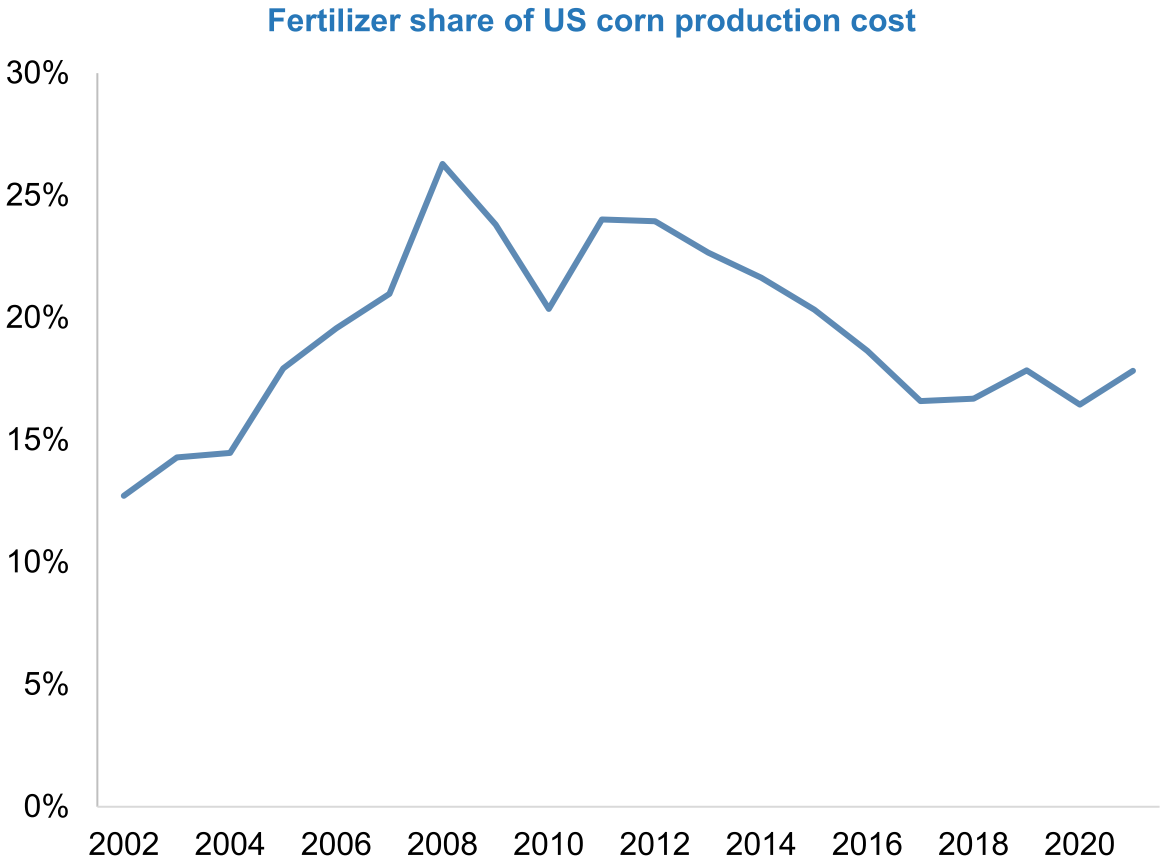


Source: USDA October 2022

Breakdown of grain production costs

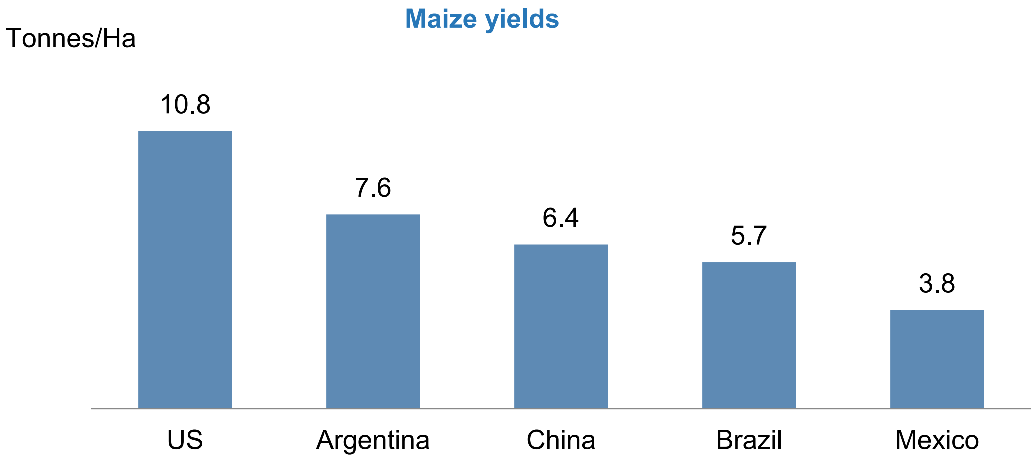
Example: 2021 average US corn production costs

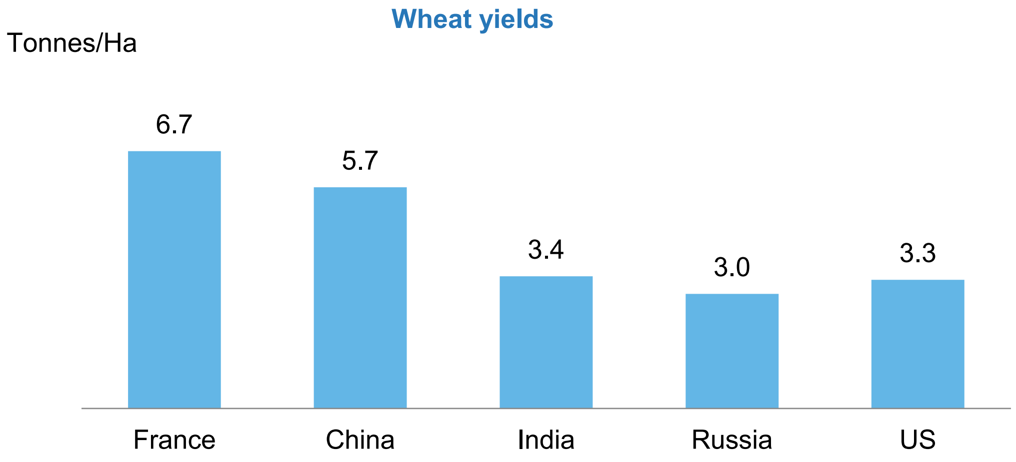


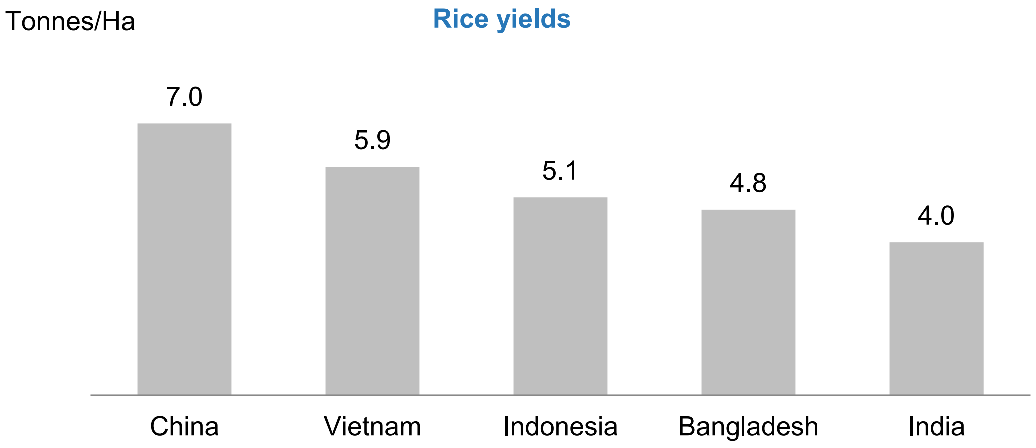


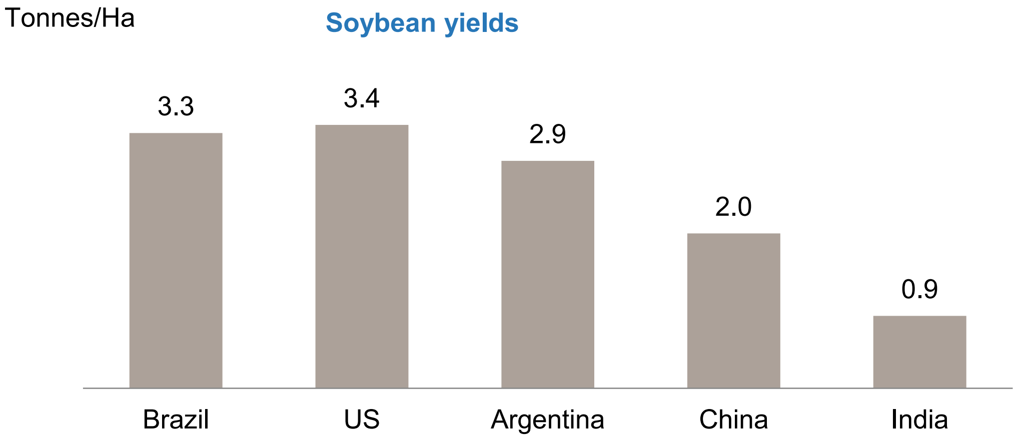
Source: USDA (Commodity costs and returns)

Large variations in grain yields across regions



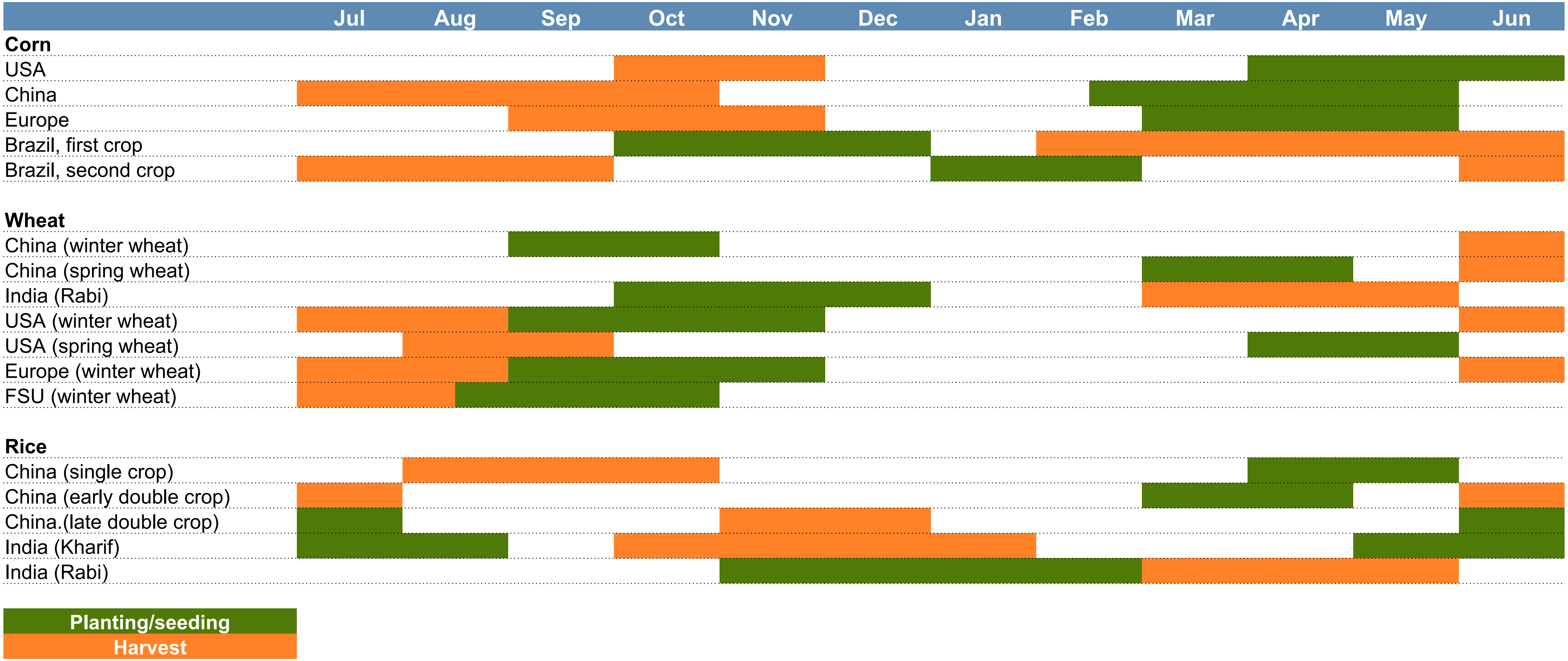






Source: FAOSTAT 2020

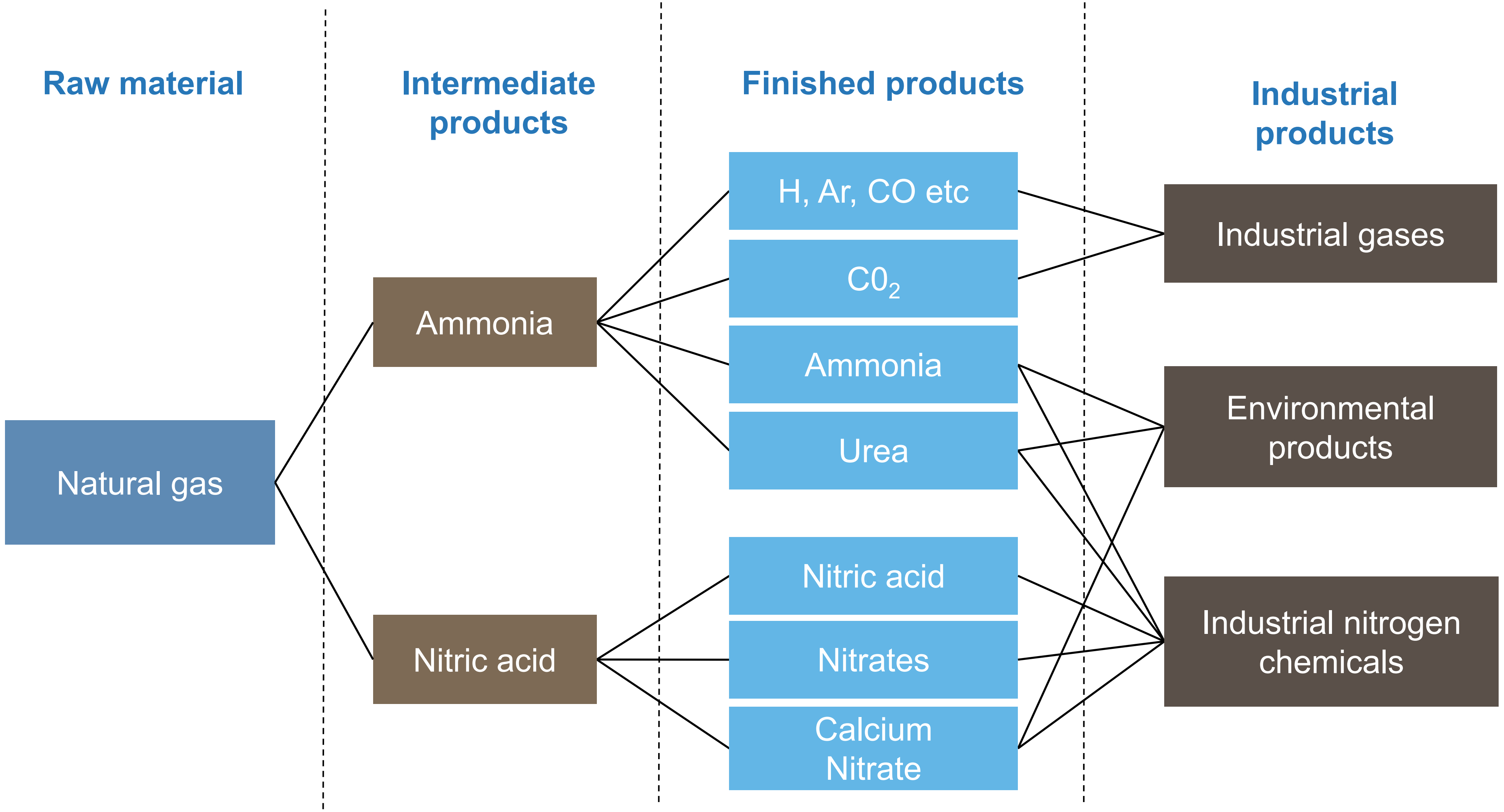
Seasonality in fertilizer consumption



Source: USDA

Drivers of supply

Nitrogen value chain



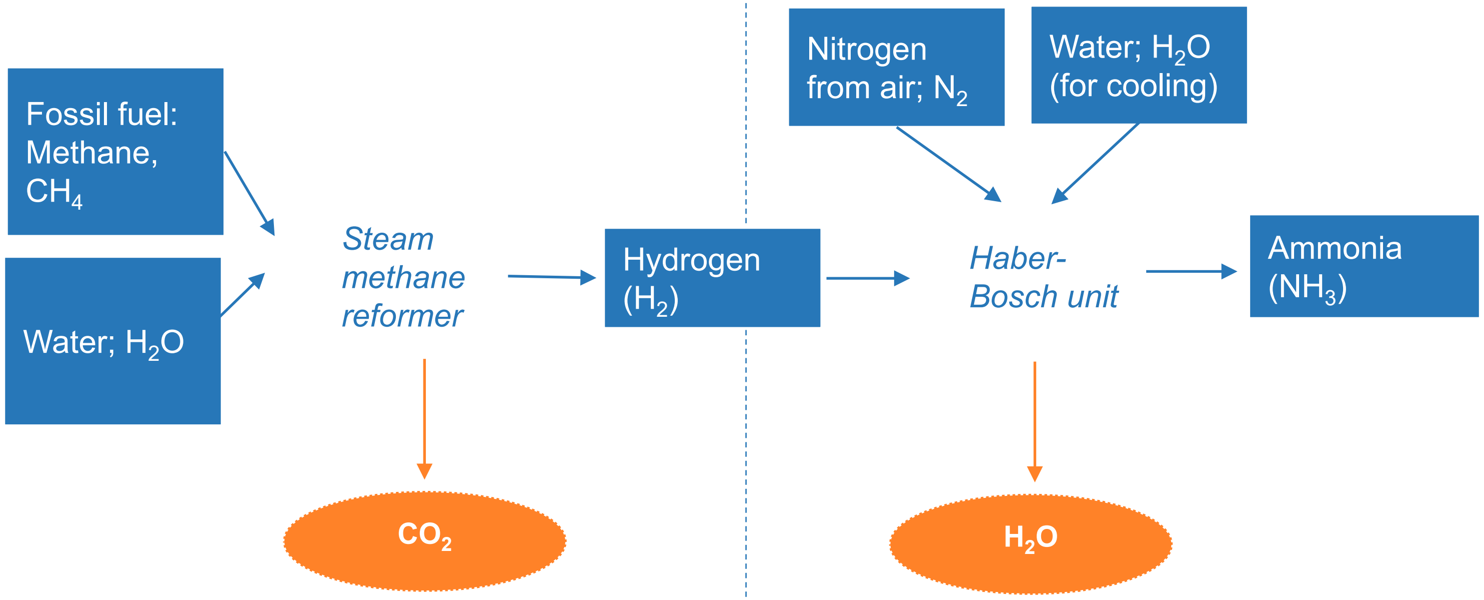
Ammonia production process based on natural gas

Steam Methane Reforming (SMR, “front end”)

Natural gas reacts with steam in presence of a catalyst yielding hydrogen and carbon dioxide

Haber-Bosch synthesis loop (“back end”)

Combines hydrogen gas (H_2) and nitrogen gas (N_2) at high pressures and temperatures to form ammonia

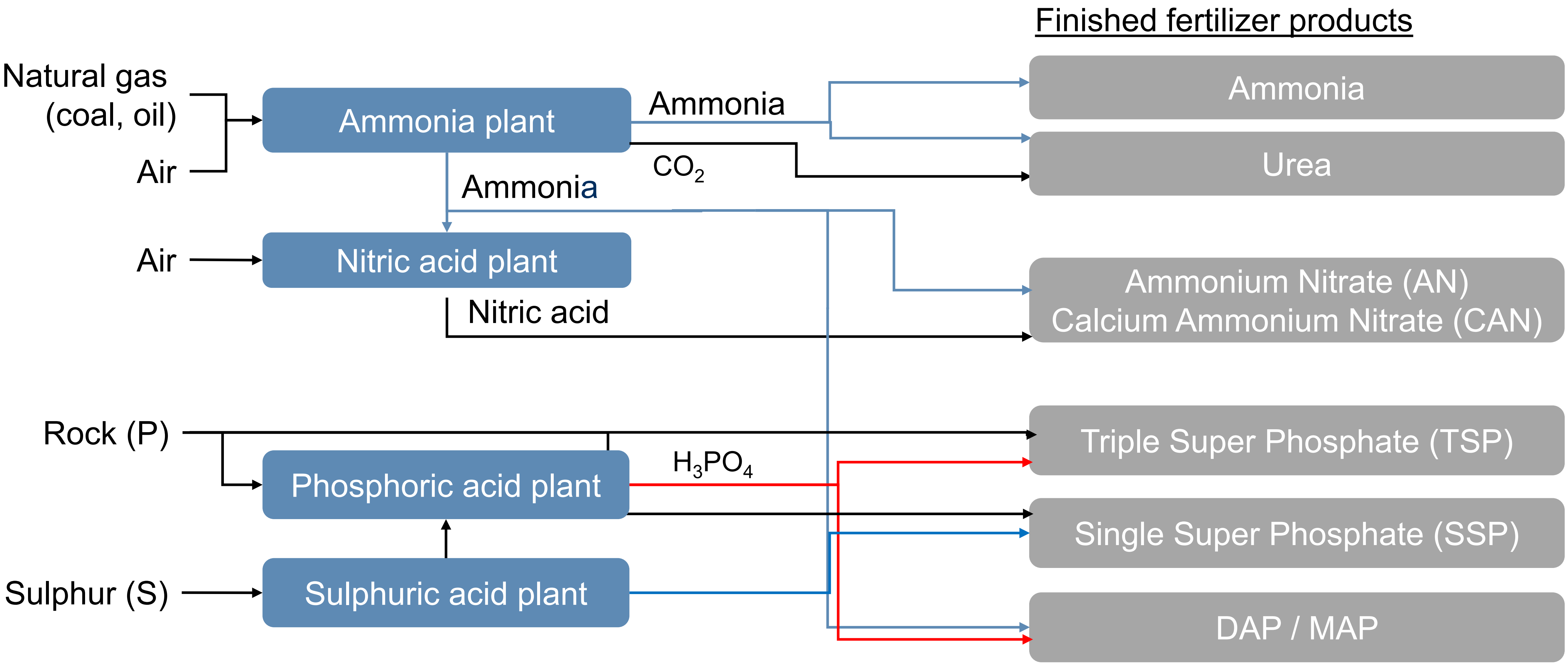


CO_2 can be captured and used in urea production or carbon capture and storage

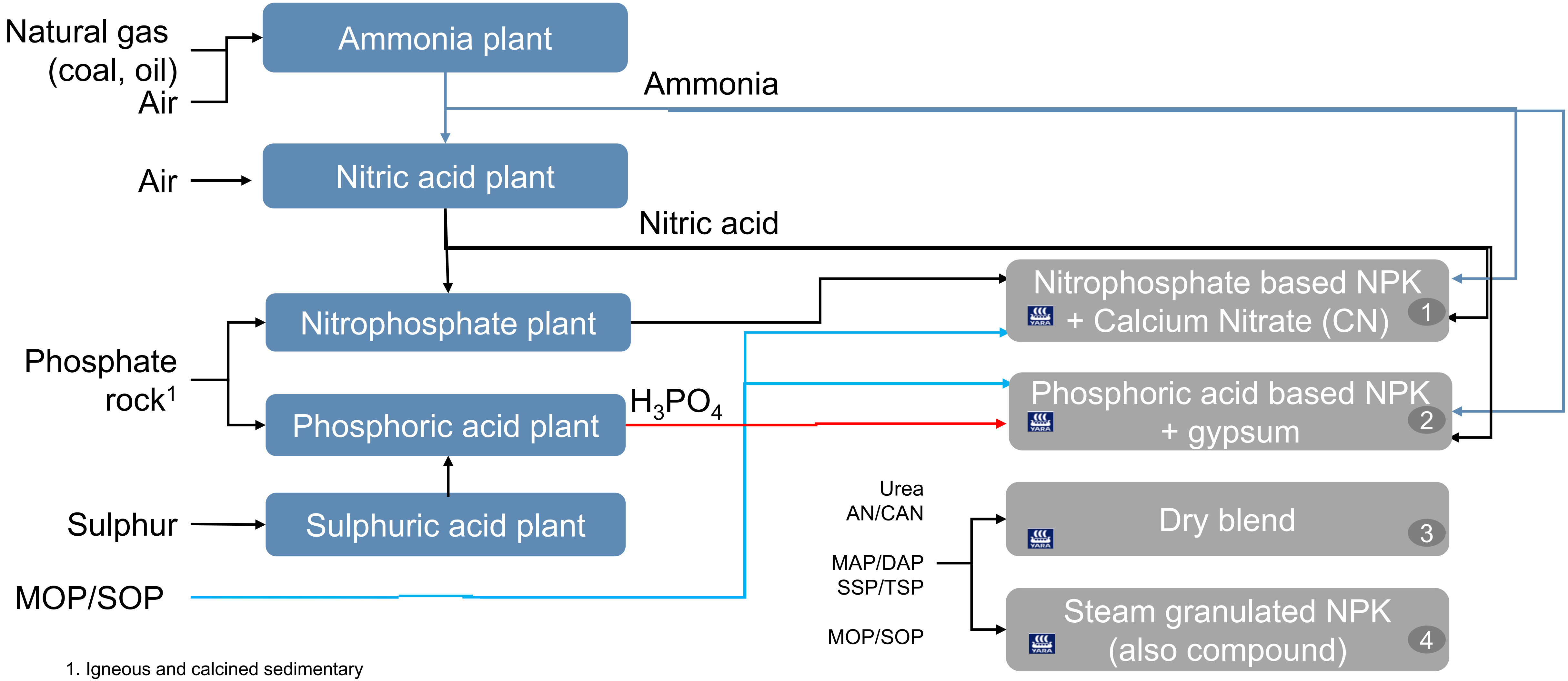
Water is returned unpolluted

- Production process requires high pressure and temperatures
- Ammonia is a hazardous gas and requires expertise for safe handling
- At -33 degrees/pressure ammonia is a liquid and can be stored and transported in tanks / specialized vessels

Fertilizer production routes

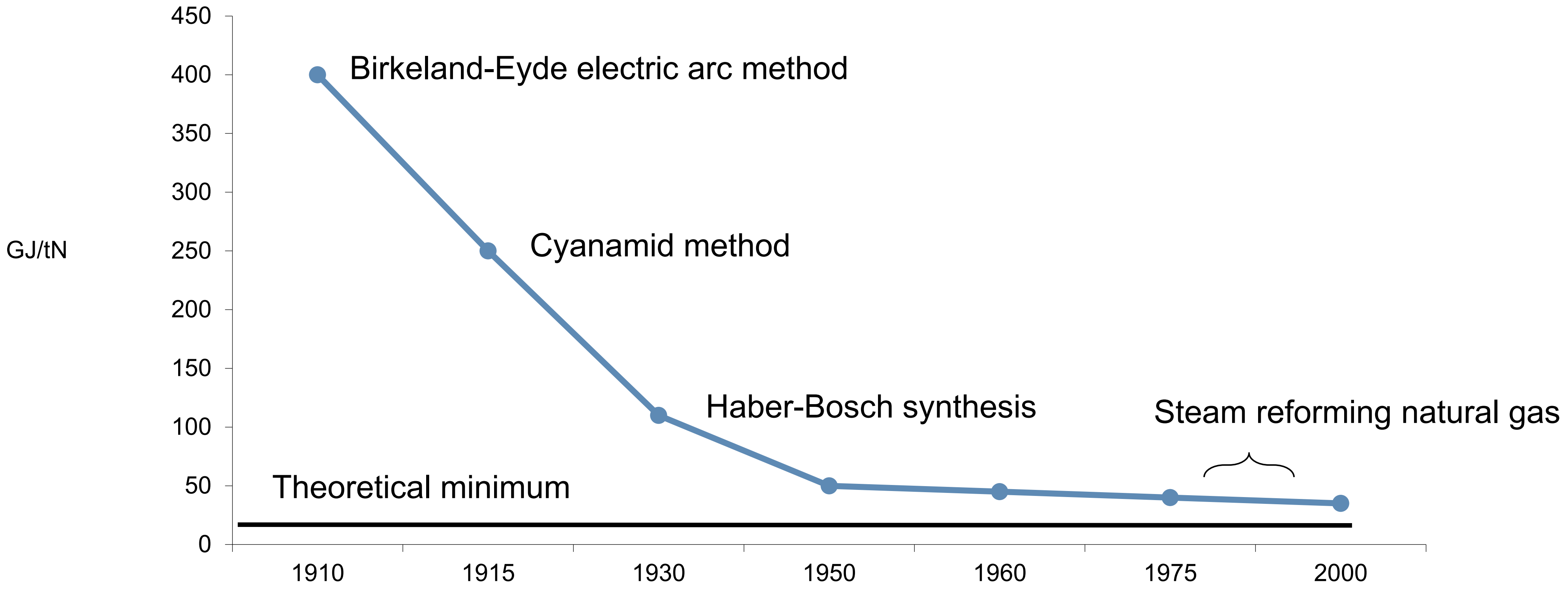


NPK production routes



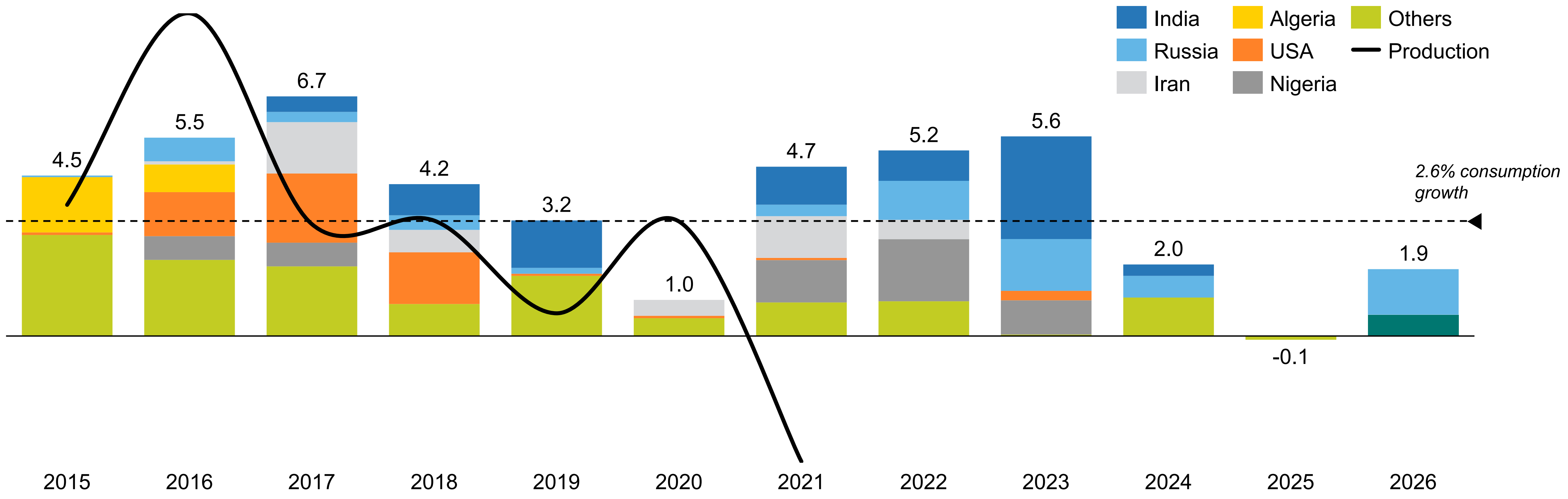
1. Igneous and calcined sedimentary

Nitrogen technology evolution



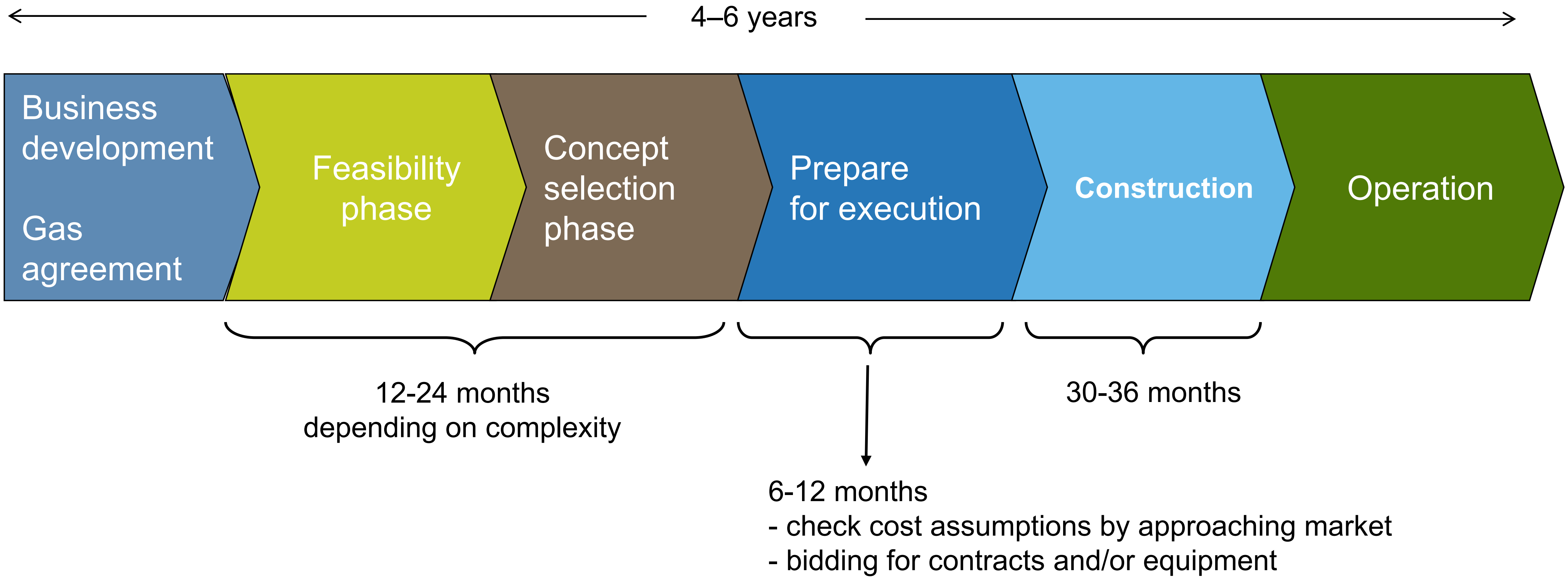
Peak of supply additions is now, limited new projects from 2024

Global urea capacity additions ex. China [1] (mt)



1) Urea projects assessed as "probable" by CRU
Source: CRU Aug 2022

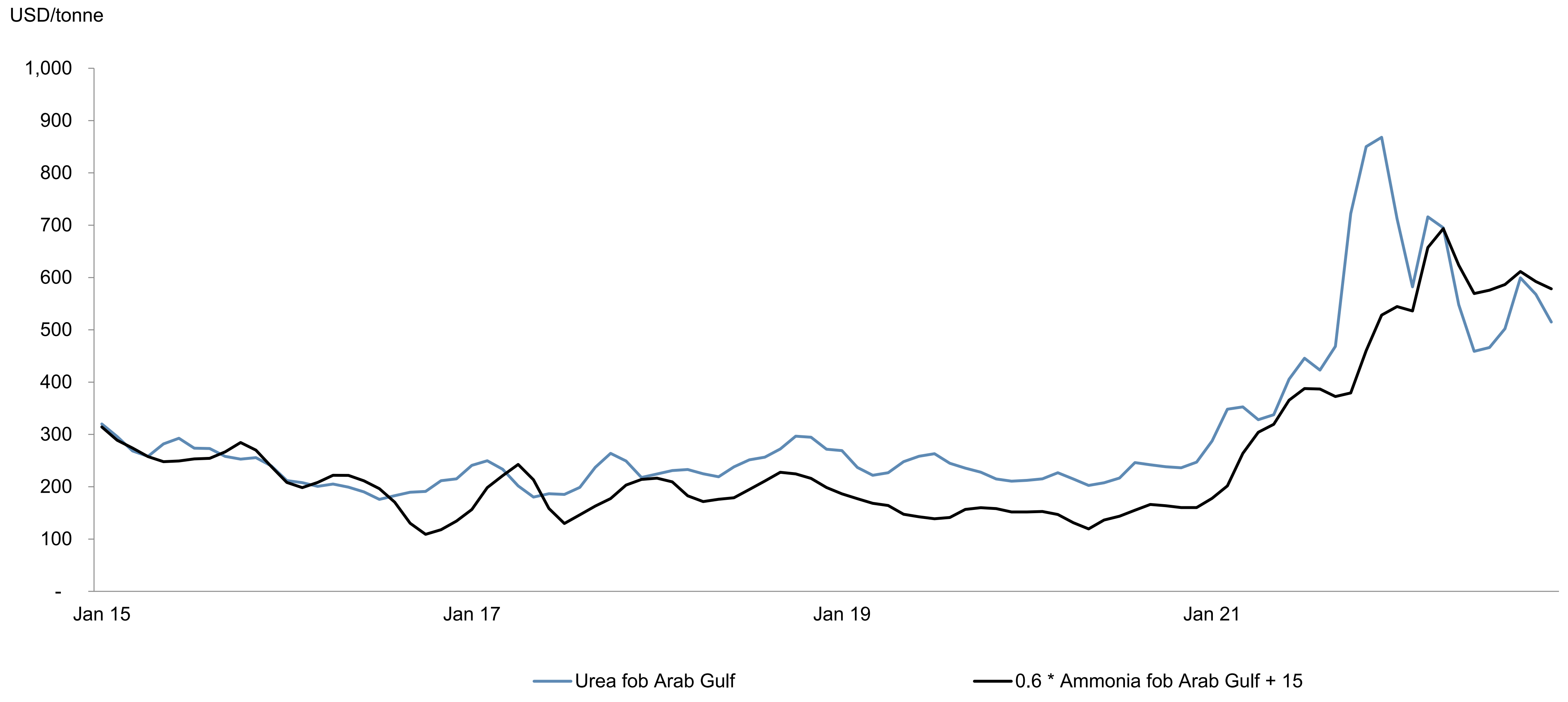
5-year typical construction time for nitrogen fertilizer projects*



* Ammonia and urea plant example

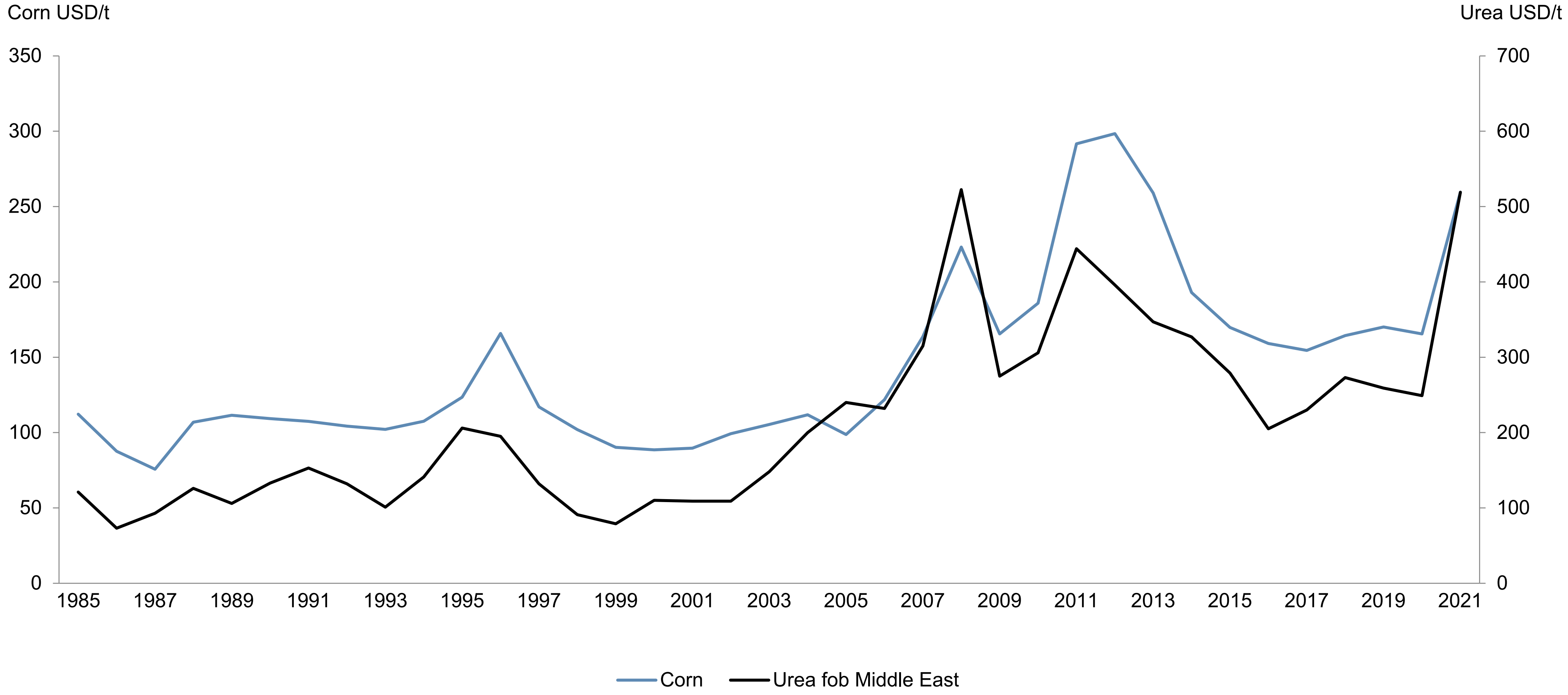
Price relations

Upgrading margins from ammonia to urea



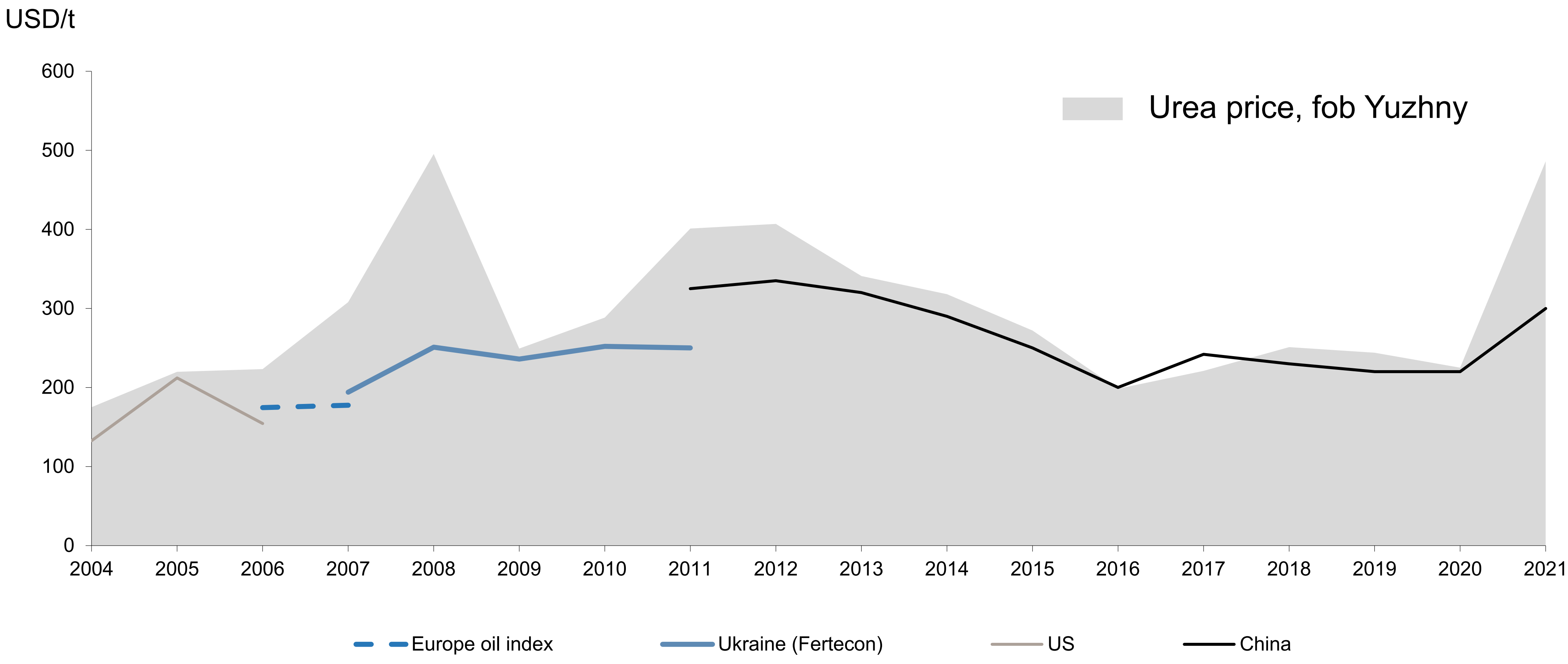
Source: Average of international publications

Grain prices important for fertilizer demand and pricing



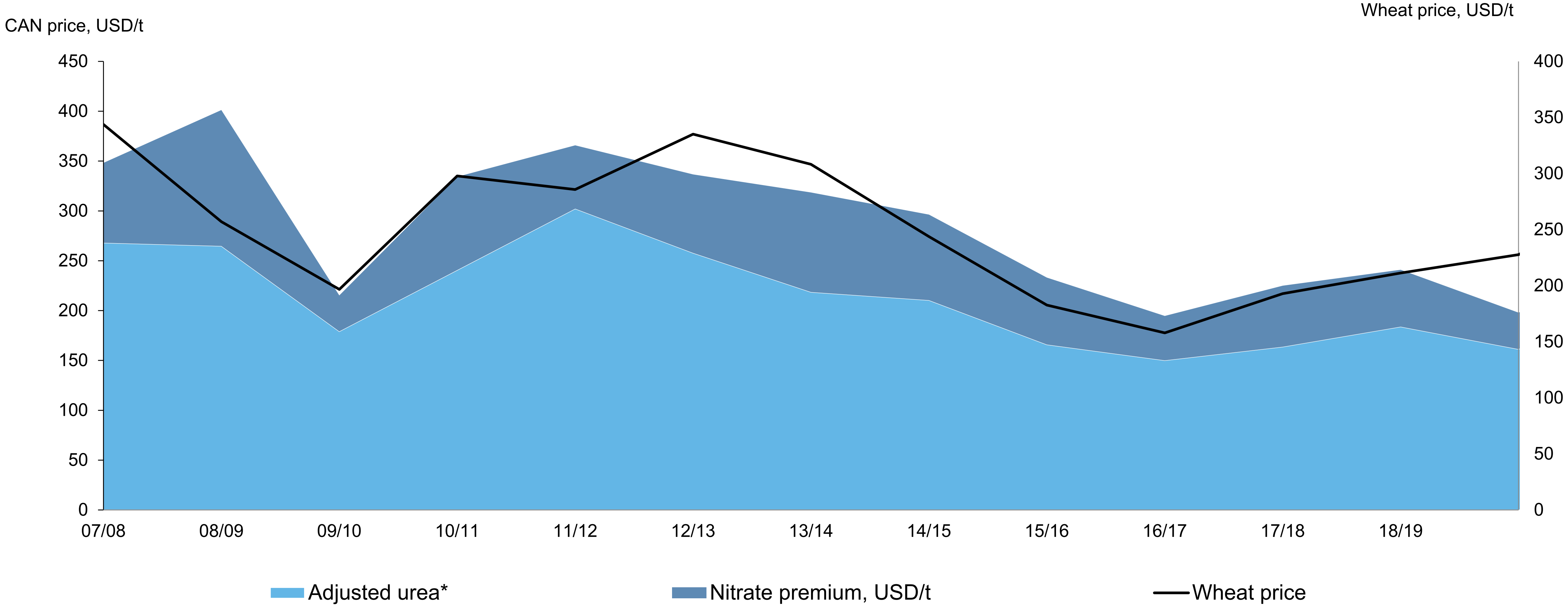
Source: World Bank, Fertilizer publications

The urea market has been increasingly demand-driven since 2020



Source: Fertecon (Ukraine), Yara estimates. The cost lines are drawn for illustration purposes only and not intended as exact cost estimates.

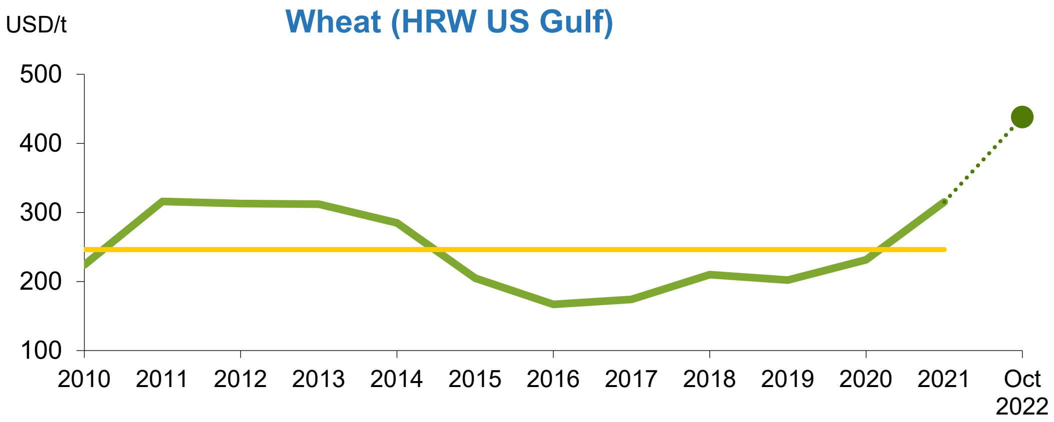
Nitrate premium is mainly a function of crop prices

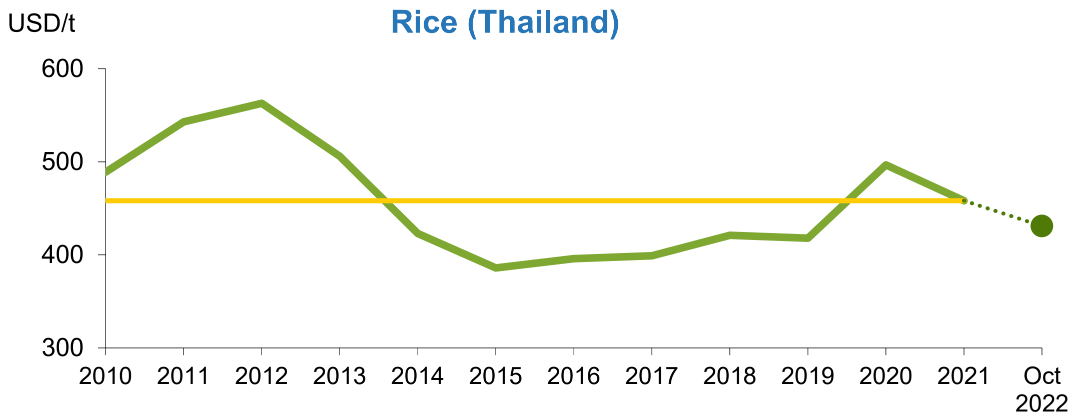


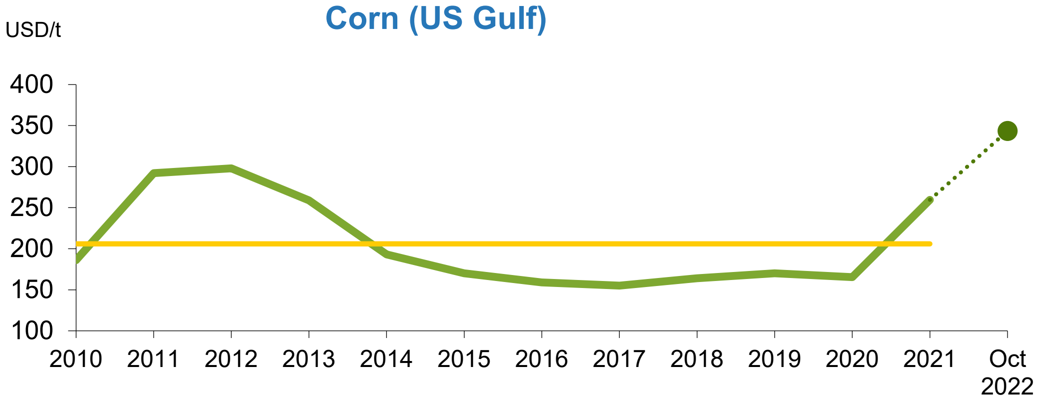
* Urea fob Black sea adjusted for import costs into Europe and nitrogen content similar to CAN

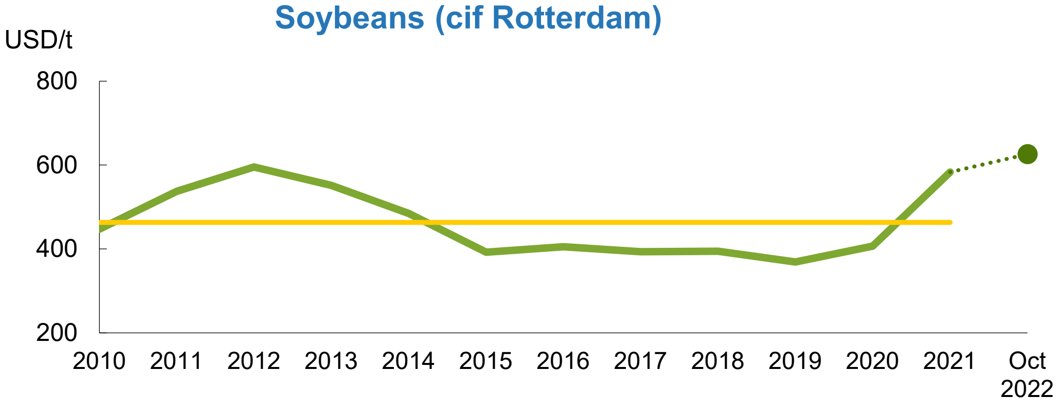
Main agricultural commodity prices above historical averages, but significant variations

Average prices 2010- 2021





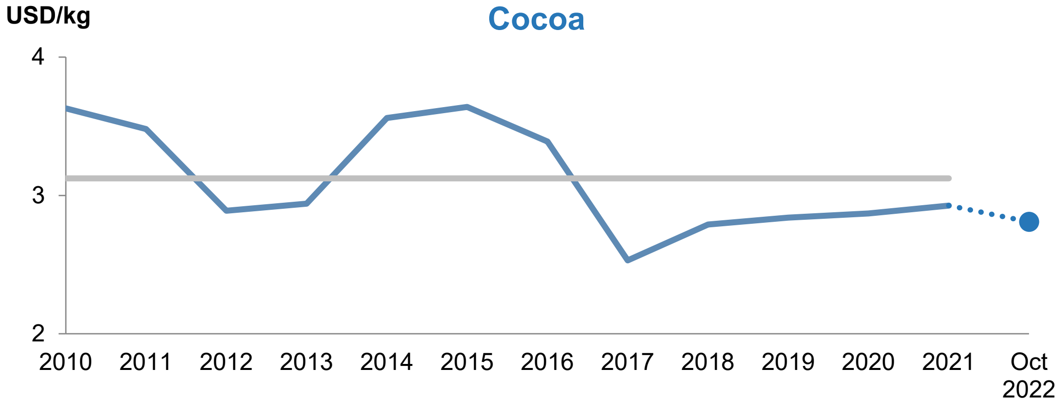


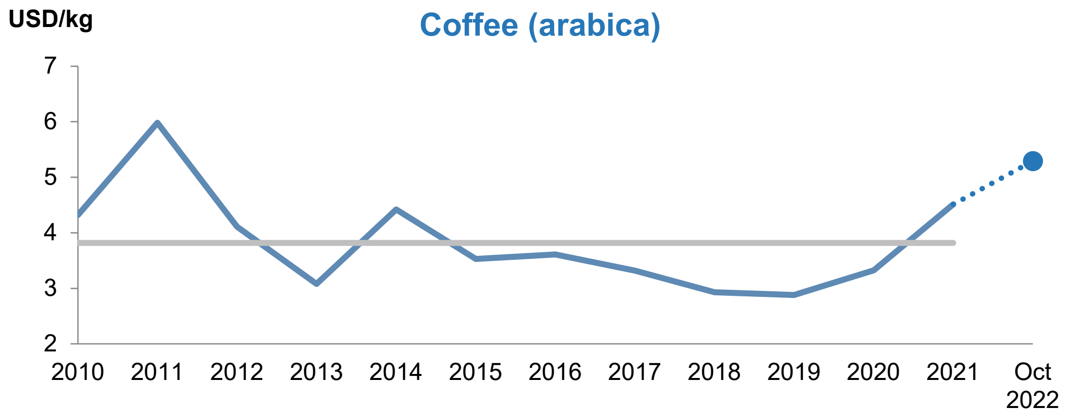


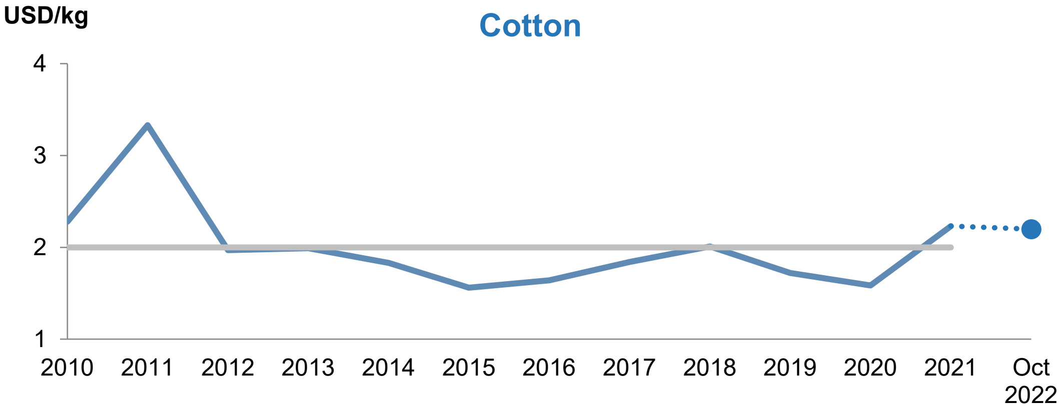
Source: World Bank

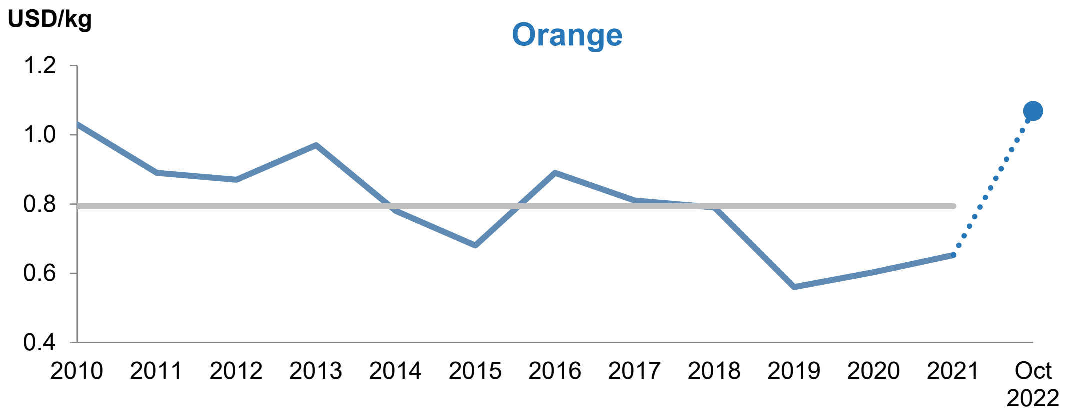
Cash crop prices – yearly averages

Average prices 2010 - 2021



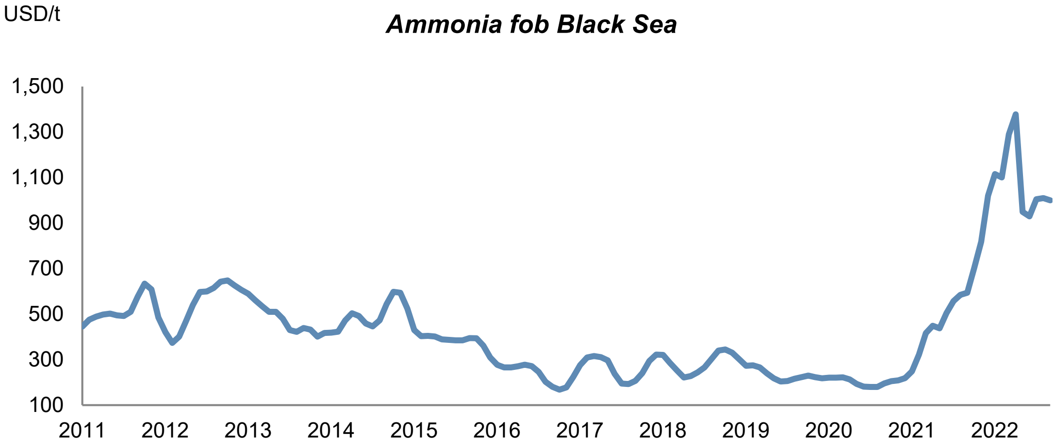


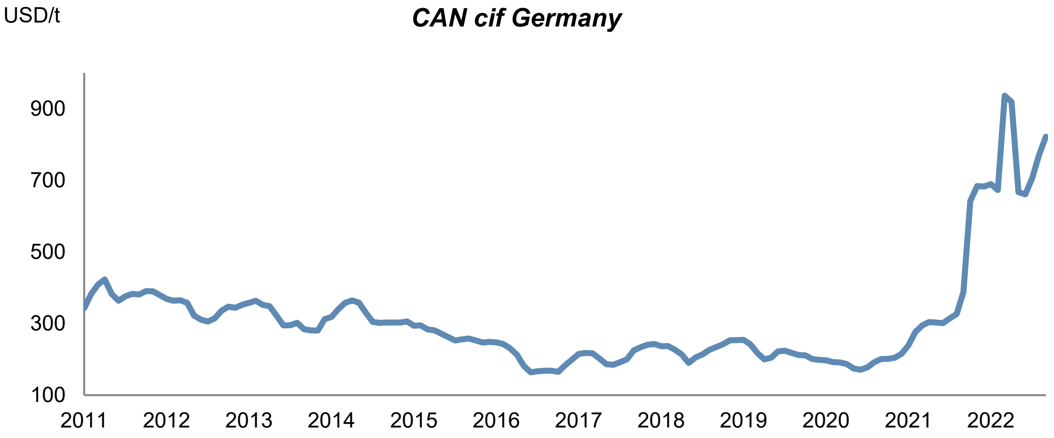


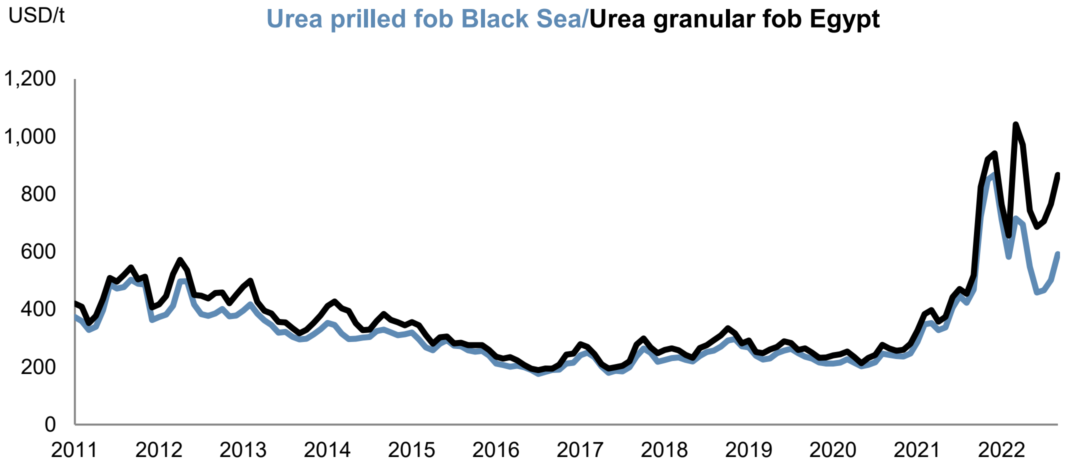


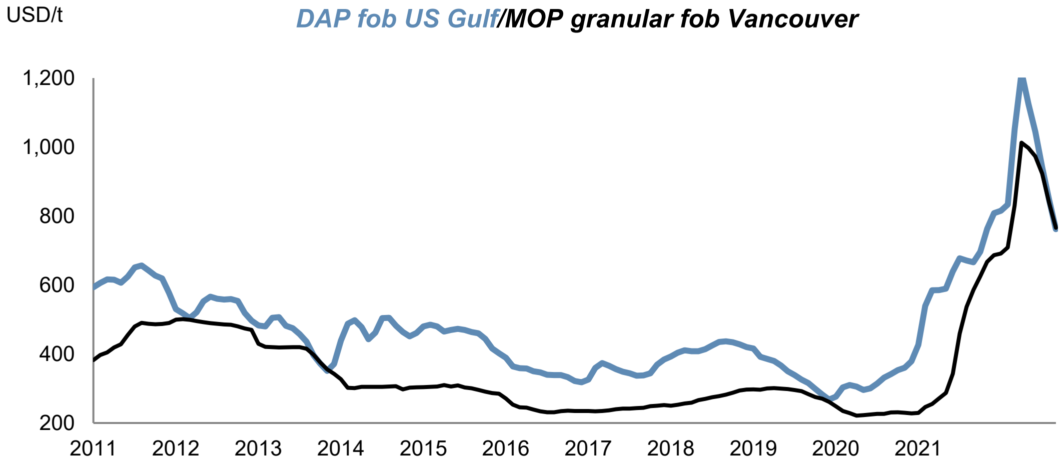
Source: World Bank

10-year fertilizer prices – monthly averages





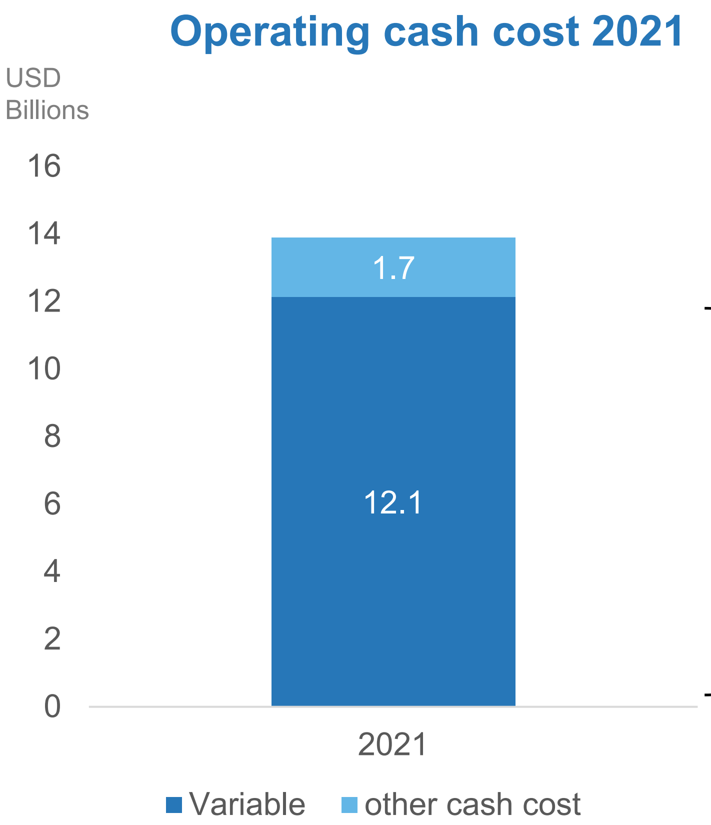




Source: Average of international publications

Production economics

Yara's operating cash costs are mainly variable



Other cash cost (12%)

Variable costs (88%)

- Dry raw materials
- Energy
- Freight
- 3rd party finished fertilizer

- Temporary plant closures can be carried out with limited stop/start costs
- Example for ammonia/urea plants:
  - Typically, half a week to stop and up to a week to start
  - Cost of stopping is 2 days energy consumption
  - Cost of starting is 3 days energy consumption

Ammonia cash cost build-up – example

	Gas price:	7	USD/MMBtu
x	Gas consumption:	36	MMBtu/mt NH_3
=	Gas cost:	252	USD/mt NH_3
+	Other prod. cost*:	39	USD/mt NH_3
=	Total cash cost	291	USD/mt NH_3

36 MMBtu natural gas/tonne ammonia

Ammonia (NH_3)
(82% N)

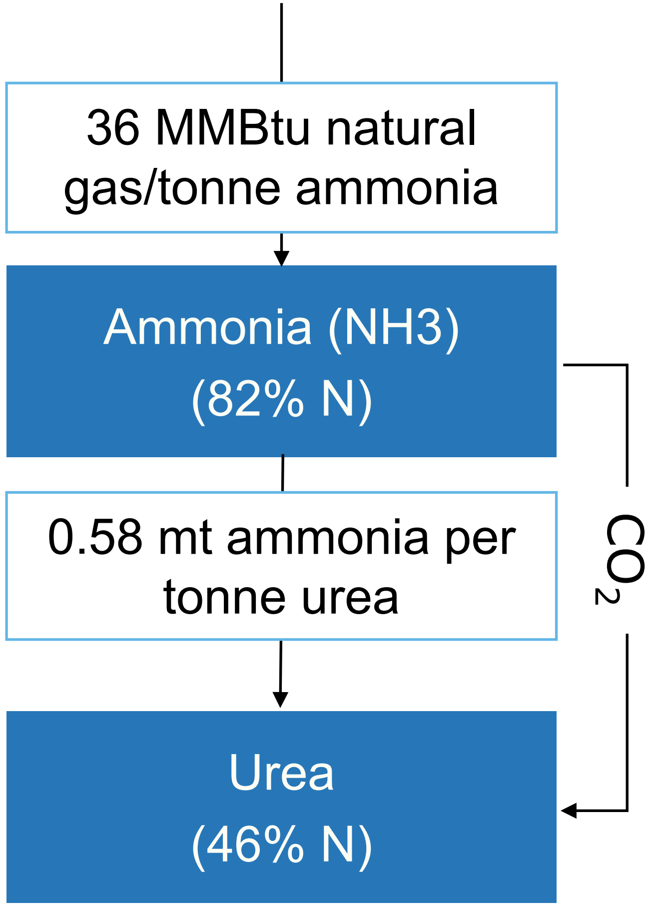
Typical natural gas consumption for ammonia production

* Source: other production cost is based on Fertecon (2022) for 2021, estimates for US Gulf

Urea cash cost build-up – example

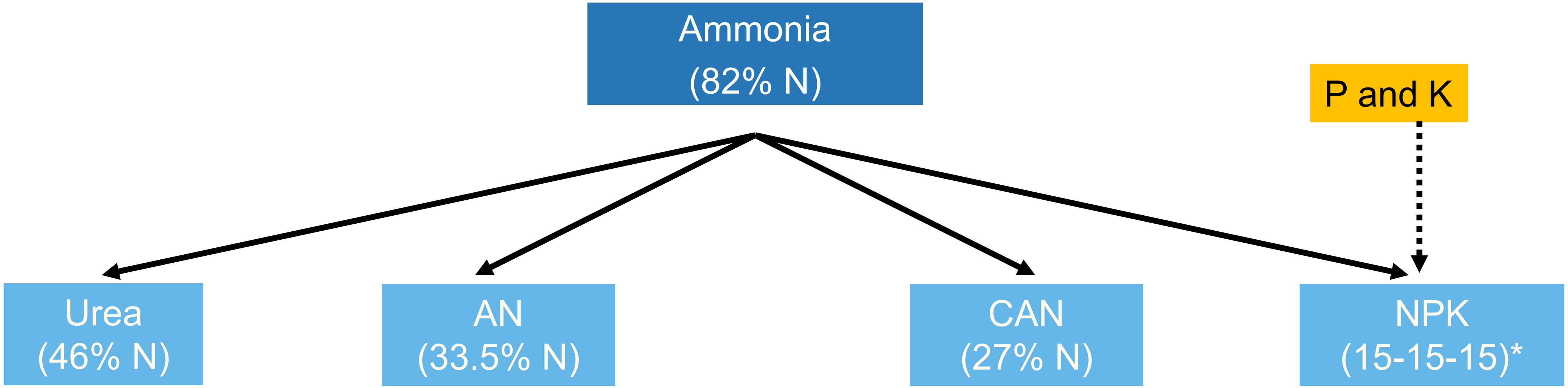
	Ammonia cost:	291	USD/mt NH_3
x	Ammonia use:	0.58	NH_3/mt urea
=	Ammonia cost	169	USD/mt urea
+	Process gas cost*	36	USD/mt urea
+	Other prod. cost**:	46	USD/mt urea
=	Total cash cost	251	USD/mt urea

* Process gas cost is linked to natural gas price, 5.2 MMBtu gas per 1 mt urea
** Excl. freight & loading cost (~8 USD/t)



* Source: other production cost is based on Fertecon (2022) for 2021, estimates for US Gulf

Theoretical consumption factors

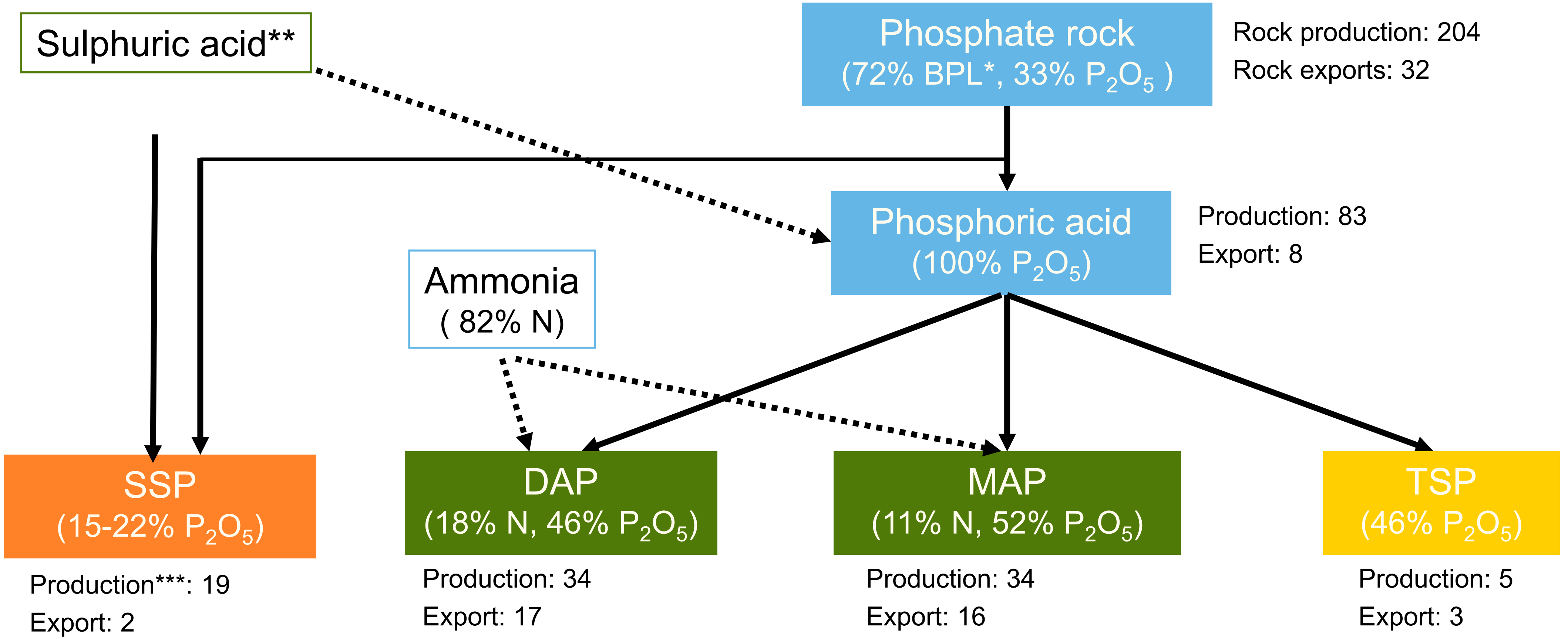


- Price comparisons should always be based on nutrient tons, not product tons

* There are many NPK formulas; 15-15-15 is one example

Main phosphate processing routes

2021 production and exports, million tons product

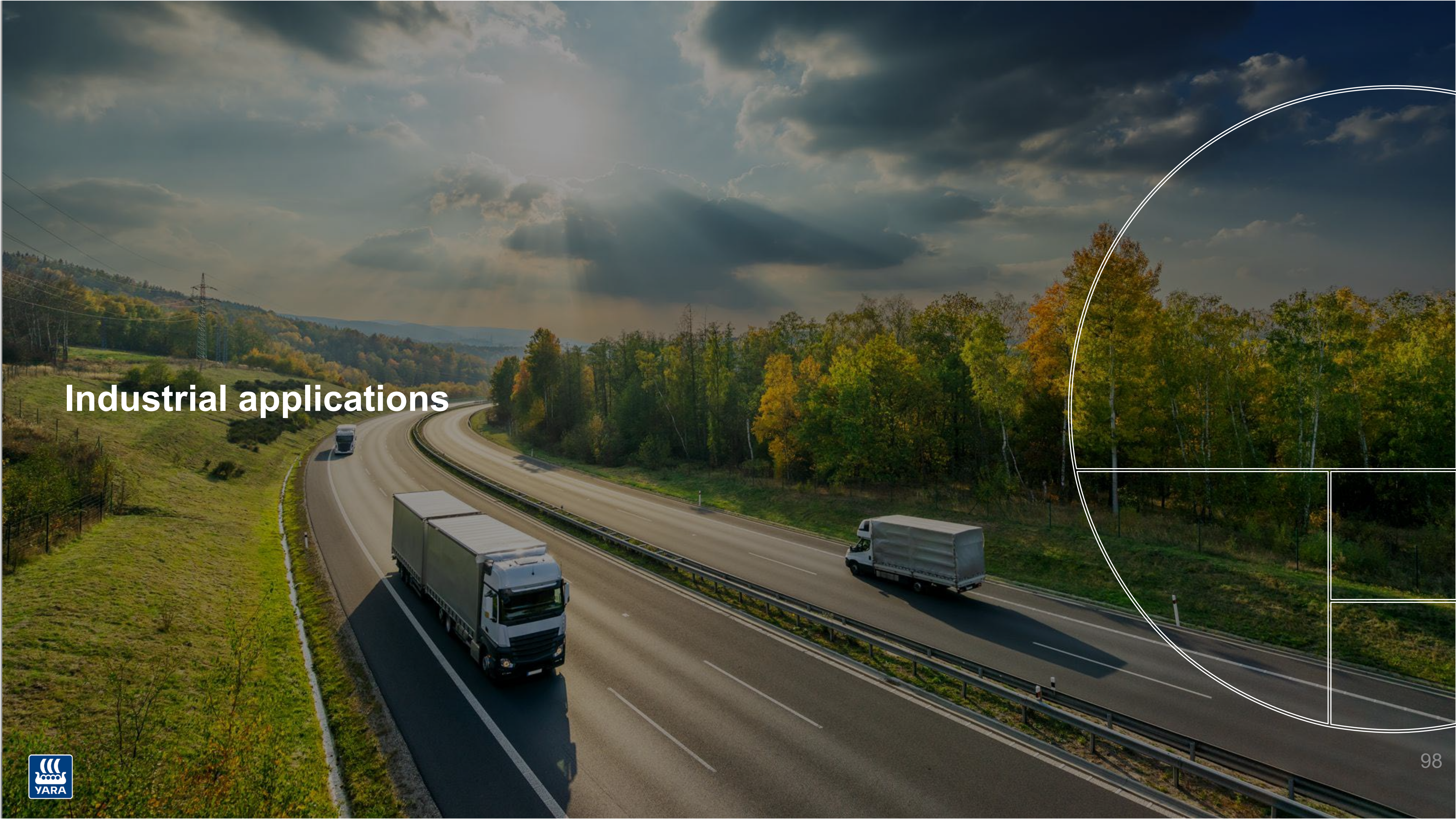


* P2O5 content of phosphate rock varies. This is an example.

** 1 ton of phosphoric acid requires 1 ton of sulphur.

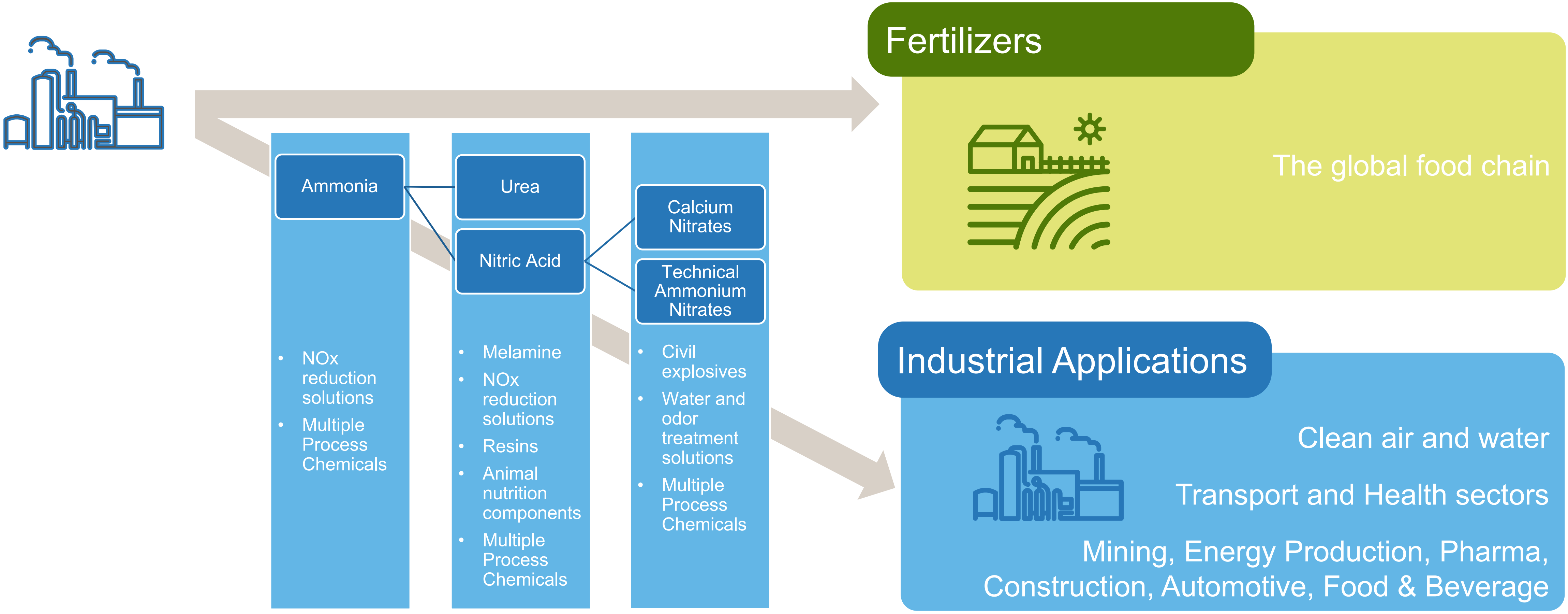
***2020 figures

Source: IFA

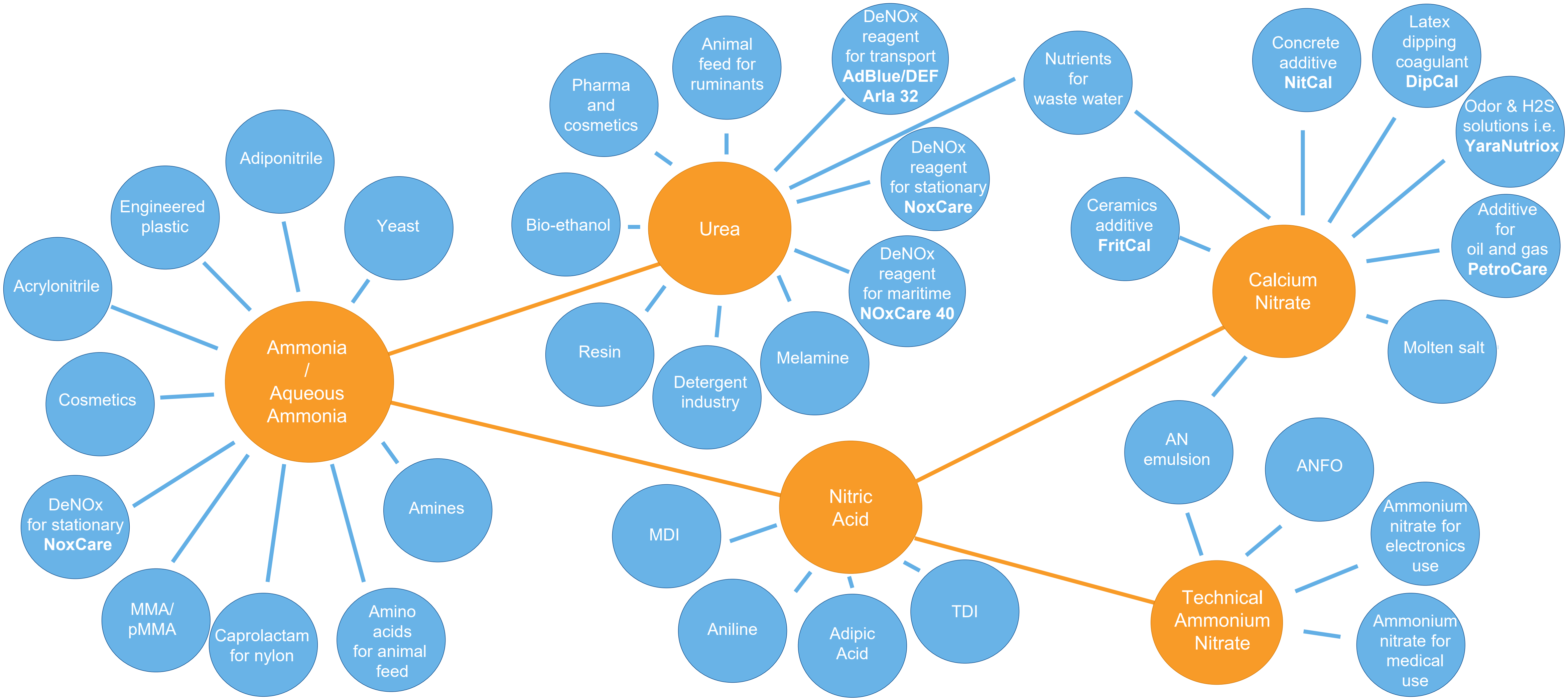


Industrial applications

Nitrogen is key for food production and indispensable in numerous industrial applications in addition to fertilizer

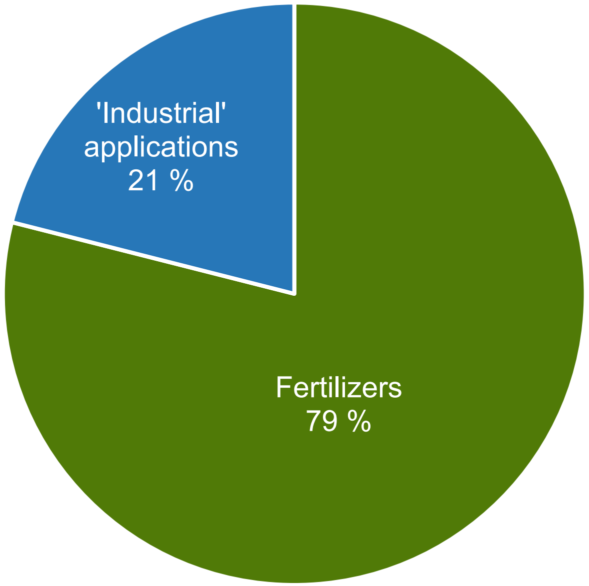


Nitrogen has many industrial applications



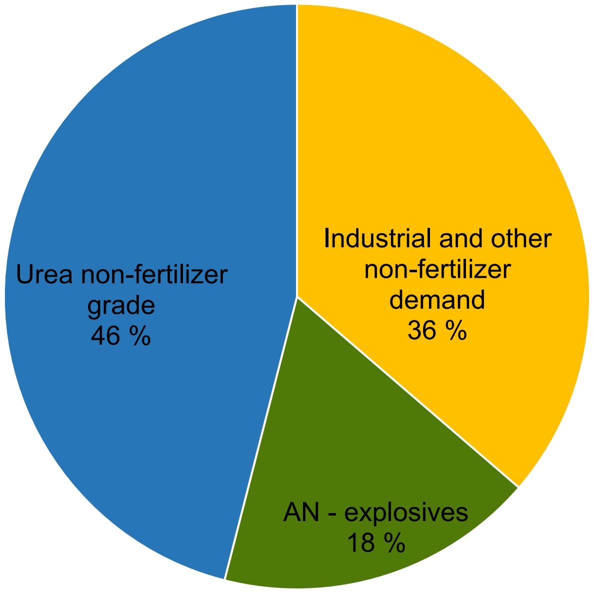
Industrial use accounts for ~21% of global nitrogen consumption

Global ammonia consumption



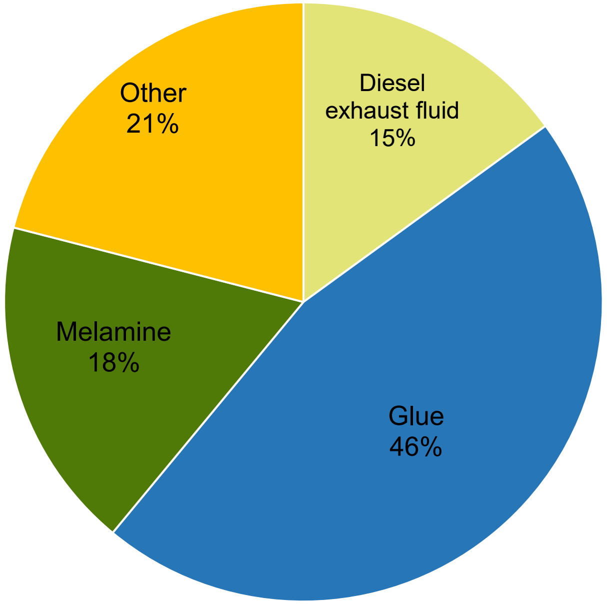
~ 191 mt ammonia

Industrial ammonia consumption



~40 mt ammonia

Technical grade urea consumption

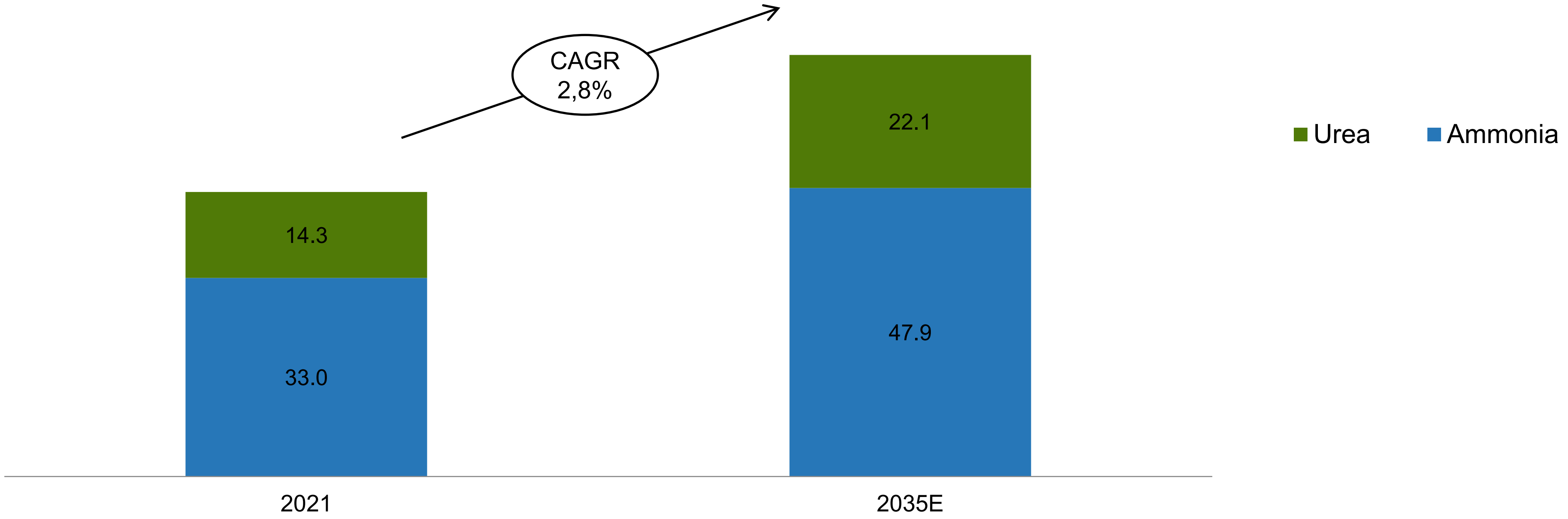


~31 mt urea

* Sources: IHS Markit, Argus, 2021 estimates

Global demand development for industrial nitrogen applications is strong

Million tonnes nitrogen



Demand growth for Industrial applications is estimated to ~2.8 % annually

Source: Fertecon

Reagents, technology and services to improve air quality

Nitrogen oxides (NOx) are a major air quality issue causing serious problems mostly in urban centers related to both the environment and human health. Legislation around the world drives the business growth.

- **Air 1™   AdBlue/DEF** is a generic name for urea-based solution (32.5% liquid urea) Air 1 is Yaras brand name for AdBlue that is used with the selective catalytic reduction system (SCR) to reduce emissions of oxides of nitrogen from the exhaust of diesel vehicles such as trucks, passenger cars and off-road vehicles

- **NOxcare™** As a world leader in reagents like urea and ammonia in combination with our experience in abatement systems like SNCR and SCR technology Yara offers its clients one of the most comprehensive and effective solutions to reduce NO_x emissions in industrial power plants and utilities.

YARA

Calcium nitrate applications in wastewater treatment, concrete manufacturing, oil fields and latex industries

- **Nutriox™** provides H2S prevention for Corrosion, Odor and Toxicity control of municipal and industrial wastewater systems
- **Nitcal™** is a multifunctional concrete admixture serving concrete admixtures companies around the world
- **PetroCare™** prevents well souring and supports drilling in oilfields around the world, for both the oil majors and the service companies that serve them
- **Dipcal™** is the premier dipping coagulant for the latex industry
- Other important applications are in the ceramics, bio-gas and solar CSP industries

Technical Nitrates for Civil Explosives

- Various grades of Ammonium Nitrate and Calcium Nitrate for use in the civil explosives and mining industries

- Largest customer segments are civil explosives companies, open-pit coal and iron mining sectors

Animal Feed industry with several nutritional products based on core chemicals

- **Feed Phosphates**

  Macro-minerals such as phosphorus and calcium are essential elements to sustain healthy and productive animal growth

- **Feed Acidifiers**

  Antimicrobial effect and lowering pH, replace AGP (antibiotic growth promoter) and effective against salmonella and moulds

- **Feed Urea**

  Source of NPN (non-protein nitrogen) used by rumen micro-organisms forming proteins, replacing part of vegetable protein

- **Ammonia for fermentation**

  Amino acids like lysine, methionine, and threonine are essential to add to lower the total use of protein

Market Data Sources

Sources of market information

Fertilizer market information

Argus	www.argusmedia.com
IHS Markit/S&P Global (Fertecon)	www.spglobal.com/commodityinsights/en/ci/products/agribusiness-fertilizers.html
Fertilizer Week	www.crugroup.com
Profercy	www.profercy.com
ICIS/The Market	www.icis.com
Green Markets (USA)	www.fertilizerpricing.com
China Fertilizer Market Week	www.fertmarket.com

Fertilizer industry associations

International Fertilizer Industry Association (IFA)	www.fertilizer.org
Fertilizers Europe (EFMA)	www.fertilizerseurope.com

Food and grain market information

Food and Agriculture Organization of the UN	www.fao.org
International Grain Council	www.igc.org.uk
Chicago Board of Trade	www.cmegroup.com
World Bank commodity prices	www.worldbank.org
US Department of Agriculture (USDA)	www.usda.gov


YARA
Knowledge grows