

SPECIALTY FERTILIZERS

IMPORTANCE, DRIVERS, AND EXTENSION

Pieterjan De Bauw
R&D Scientist / Agronomist
8/12/2021

© Tessenderlo Group – Specialty fertilizers



Tessenderlo Group
EVERY MOLECULE COUNTS

Outline

- Introduction of Tessenderlo Group
- Specialty fertilizers and the '4R strategy'
- Fertilizer portfolio of Tessenderlo Group
- Extension and advisory on specialty fertilizers
- Scope for collaboration and co-creation



About Tessenderlo Group

A DIVERSIFIED INDUSTRIAL GROUP FOCUSING ON AGRICULTURE, VALORIZATION OF BIO-RESIDUALS, ENERGY, AND PROVIDING INDUSTRIAL SOLUTIONS



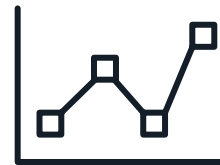
+100

locations across
26 countries



+4,800

employees



+1.7

billion EUR revenue
in 2020



About Tessenderlo Group

4 OPERATING SEGMENTS



Specialty Fertilizers

AGRO



**BIO
VALORIZATION**



**INDUSTRIAL
SOLUTIONS**



T-POWER



We have a bold and inspiring vision of our role in the world:
ENSURE THAT LIFE ON OUR PLANET CAN THRIVE BY CREATING A
WORLD THAT MAKES THE MOST OF ITS RESOURCES



Growing more food
than ever before



Using water as
cleverly as possible



Tackling the world's
shortage of natural
resources



Creating added
value from
bio-residuals



Generating
electricity



A diverse agro segment



MINERAL FERTILIZERS

CROP VITALITY / TESSENDERLO KERLEY INTERNATIONAL

Leading producer of **liquid fertilizers** for broad acre crops, fruit and vegetable crop cultivation as well as high quality **solid & soluble fertilizers** to increase efficiency, yield and quality of crops

ORGANIC FERTILIZERS

Range of organic products (pellets, foliar fertilizers, compost) based on **recycled side streams**

CROP PROTECTION

NovaSource® develops and markets a portfolio of **crop protection** products for niche uses in agriculture worldwide



Towards sustainable agriculture...
Innovation is KEY!

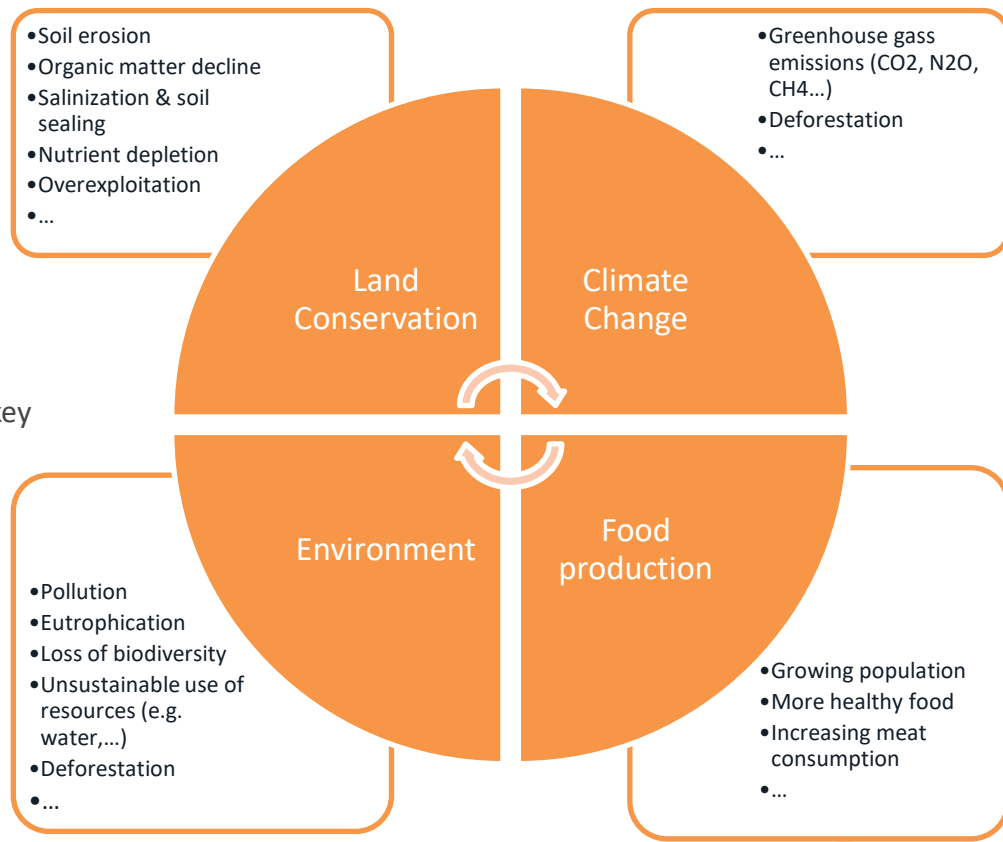


EVERY MOLECULE COUNTS

Drivers for sustainable crop nutrition

Pressure on agriculture in the world

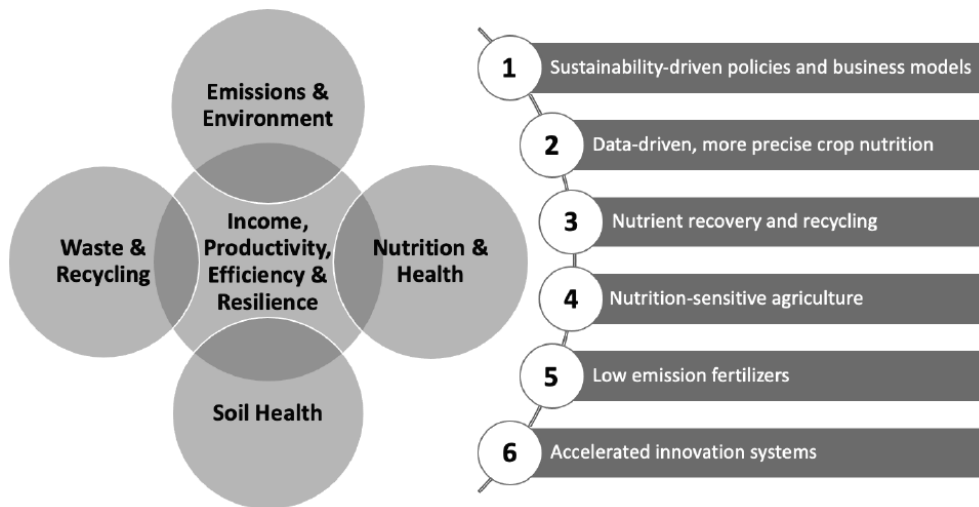
- A diverse set of global challenge
- Conserving & regenerating the soil nutritional status means...
 - Avoid losses to environment...
 - Replenish what is exported...
 - Fertilizers will always be needed, but balance is key
 - 'Reducing inputs' (~FAO, EU,...) needs nuance!
 - Improving nutrient use efficiency



Drivers for sustainable crop nutrition

A new paradigm

- Food system approach to achieve multiple **socioeconomic, environmental and health objectives**
- Production and management of nutrient inputs must change to **more effectively nourish crops, reduce harmful environmental impacts caused by nutrient losses and contribute to restoration of soil health**



“The role of the global fertilizer industry”

- Need for sustainable- & innovation-driven plant nutrition
- Need to become providers of integrated plant nutrition solutions
- New business models that do what is right for people and planet
- Revenue growth to be driven by growth in performance value offered to farmers & society, not volumes fertilizers sold

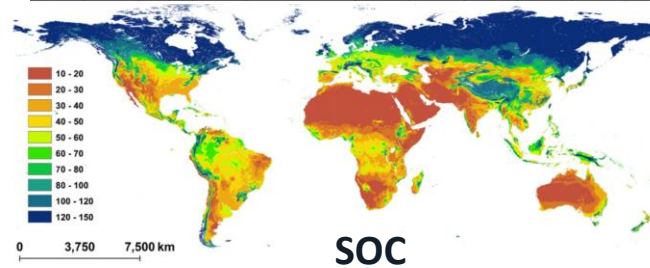
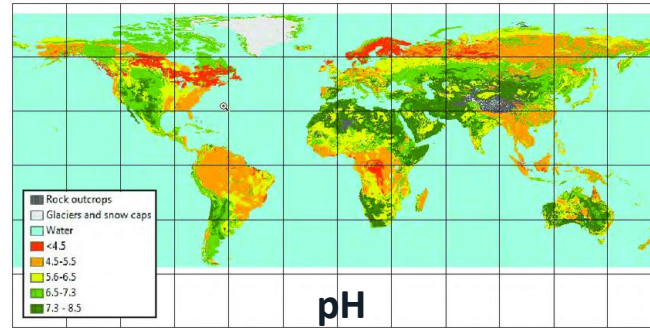
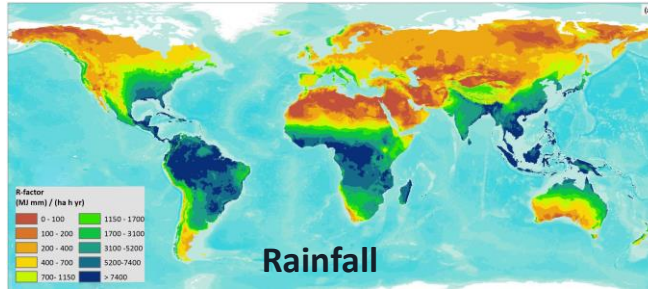
*Scientific Panel on Responsible Plant Nutrition. 2020. A new paradigm for plant nutrition. Issue Brief 01. Available at www.sprpn.org

A rational and scientific framework to guide innovation



Huge heterogeneity in agro-ecological systems

- The **diversity of challenges** calls for a **diverse set of solutions**
- This includes diversification and optimization towards precision crop nutrition, **tailored to local needs**



Shifting Rainfall patterns
Soil pH
Soil organic matter & structure
Nutritional status
Cropping system
...



Sustainable crop nutrition: 4 R's nutrient stewardship

- Balanced nutrition without losses or mining soil reserves
- Different pathways in diverse agroecological systems
- Needs a site specific (precise) approach
-> 'Agronomy at Scale'



Knowledge is crucial

- local situation
- technical specs of fertilizers
- Well researched product application guides

Matching local needs with specialty fertilizers

Provide agronomic solutions to site specific challenges



Sustainable crop nutrition: 4 R's nutrient stewardship

- Balanced nutrition without losses or mining soil reserves
- Different pathways in diverse agroecological systems
- Needs a site specific (precise) approach
-> 'Agronomy at Scale'



RIGHT SOURCE

Matches fertilizer type to crop needs.



RIGHT RATE

Matches amount of fertilizer type crop needs.



RIGHT TIME

Makes nutrients available when crops need them.



RIGHT PLACE

Keep nutrients where crops can use them.

Matching local needs with specialty fertilizers

Provide agronomic solutions to site specific challenges

Beyond nutrients
→

Salinity
Alkalinity
Acidity
Leaching
Erosion
Eutrophication
Toxicities
Pathogens
...!



What is a specialty fertilizer..?

- ⇒ Innovative, effective, and tailored fertilizer products to address specific crop nutrition requirements
- ⇒ “Smart fertilizers” to promote plant growth in adverse conditions while minimizing environmental impact

Drivers

- precision farming
- high fertilizer losses to environment
- need for improvement of fertilizer use efficiency
- favorable government policies
- Innovation & R&D in crop nutrition industry

High level market info

- More expensive and hence more applied in ‘higher value systems’
- Much less consolidation (i.e. fragmented & relatively few dominant players) compared to commodity fertilizers
- Global market for specialty fertilizers is projected to grow



Diversification of specialty fertilizers

- ~Crop type
- ~Region/Agroecosystem/Environment
- ~Application method
 - Foliar
 - Fertigation
 - Soil
- ~Form
 - Dry
 - Liquid
- ~Type
 - Controlled release
 - Slow release
 - Micronutrients
 - Water soluble
 - Customized
- ~Technology
 - N-stabilizers
 - Coated & encapsulated
 - Chelated
 - other modes of actions...

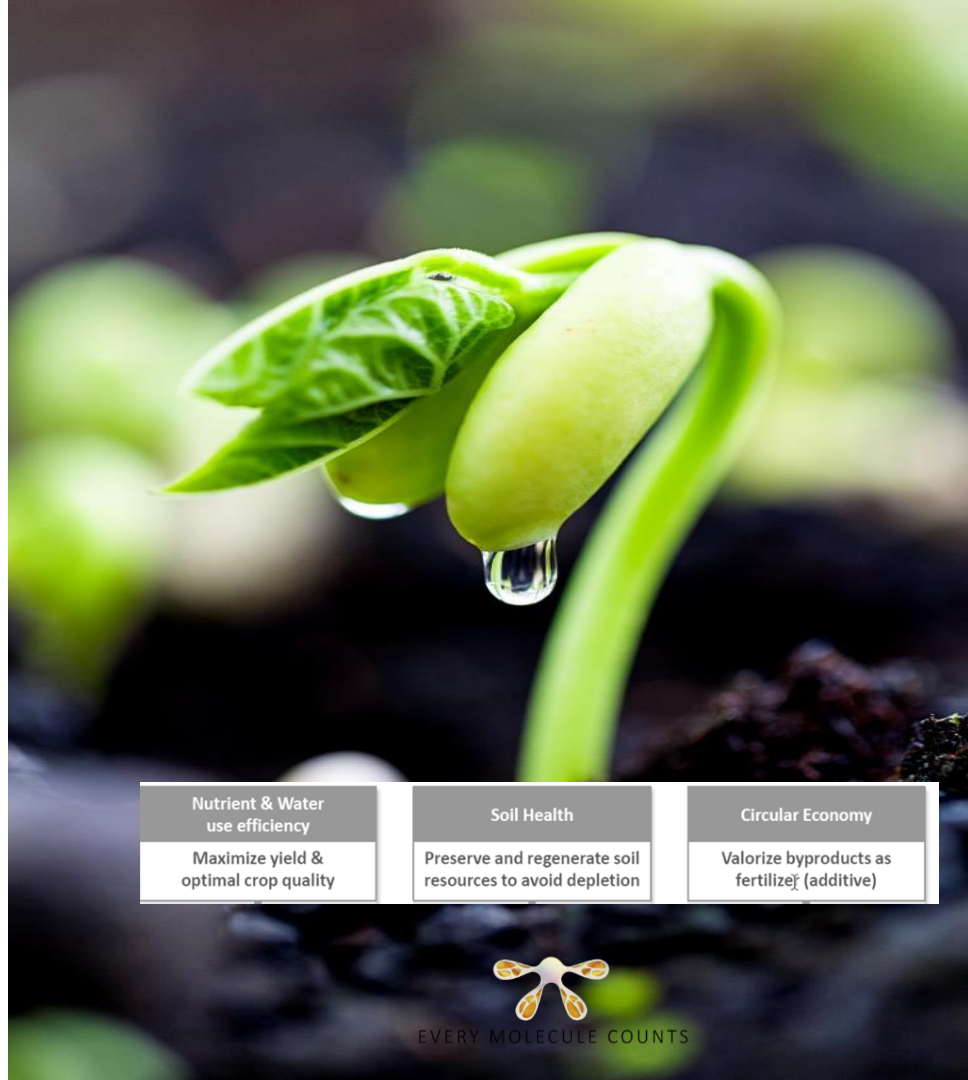


Vision of Tessenderlo Group

Providing solutions for global trends

- ✓ **Innovation** is the only way to secure that we can feed future generations
- ✓ Our planet is the most important stakeholder of our company
- ✓ **Maximizing the re-use** of every molecule
- ✓ Waste only exists when there is a lack of innovation and creativity
- ✓ Treating **water** respectfully is a business model
- ✓ Transparency is the foundation for a sustainable company
- ✓ Our **safety and environmental standards** are the same all over the world, because every human being is equally valuable
- ✓ Only a sustainable company can truly contribute to sustainability

EVERY MOLECULE COUNTS



Nutrient & Water use efficiency	Soil Health	Circular Economy
Maximize yield & optimal crop quality	Preserve and regenerate soil resources to avoid depletion	Valorize byproducts as fertilize[r] (additive)



Sustainability and social responsibility



Product range of Tessenderlo Kerley International : liquid fertilizers

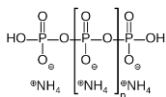
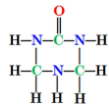
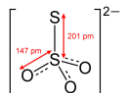


Liquid fertilizers: To deliver precise application and efficient nutrient uptake

The **active thiosulfate technology** brings a key nutrient (S) and acts as a catalyst, thus enhancing the uptake of other nutrients and optimizing the overall fertilizer efficiency. It also functions as **N stabilizer**.

N-Sure® is a N fertilizer due to the unique chemistry of **Triazone™**. In **soils**, the N is slowly released through microbial activity. As a **foliar**, it keeps the surface of leaves moist allowing for direct uptake of the triazone molecule into the tissue.

P-Sure® is an ammonium polyphosphate solution delivering both quickly and slowly available P

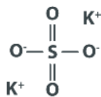


Product range of Tessenderlo Kerley International : solid & soluble fertilizers



Potassium sulfate fertilizers for the agricultural end markets.

Sulfate of potash (SOP) is predominantly used as a fertilizer for high value crops such as **flowers, fruits and vegetables** in different markets. They have an **extremely low salt index**, equal performance in **alkaline or acidic soil**, and show **very high efficiency**.



Product range of Violleau® fertilizers: organic & botanical products



Fertilizers pellets, compost, and water soluble fertilizers for the **organic/biological** agricultural end markets.
Based on **revalorized waste streams** to close nutrient cycles. They contain **organic carbon, enhance soil structure,** and stimulate **microbial activity**.



Our portfolio

Several pathways to 'precision crop nutrition'

More Sustainable fertilizers enabling balanced crop nutrition, for all markets

N Sure®

- Triazone N
- Slow release
- Reduced leaching

P Sure®

- Polyphosphate
- Balanced nutrition
- Gradual P release

Thiosulfates+ /SOP+

- Additions of specific compounds to improved functionality and sustainability

K-Leaf®

- Foliar K & S
- Organic

VIO® Humus

- Soil conditioners processed from manure and vegetable side streams

Mineral

Organo-mineral

Organic

Bio Dynamic

SOP Portfolio

- Pure K & S
- low salinity index
- Solids & water soluble

Thiosulfates portfolio

- Liquids of K, N, Ca, Mg, S
- Nitrification inhibitors
- Positive effects on NUE
- Multiple benefits of reducing properties on soil & crops

Organic + mineral ingredients

- Range of products to meet specific demands

Violleau® + Crop Vitality™ portfolio

- Nutrient recycling from waste streams
- Animal processed Proteins & Vegetal materials
- Controlled release
- Microbial activity!
- Restoring soil organic matter & structure
~'Carbon farming'



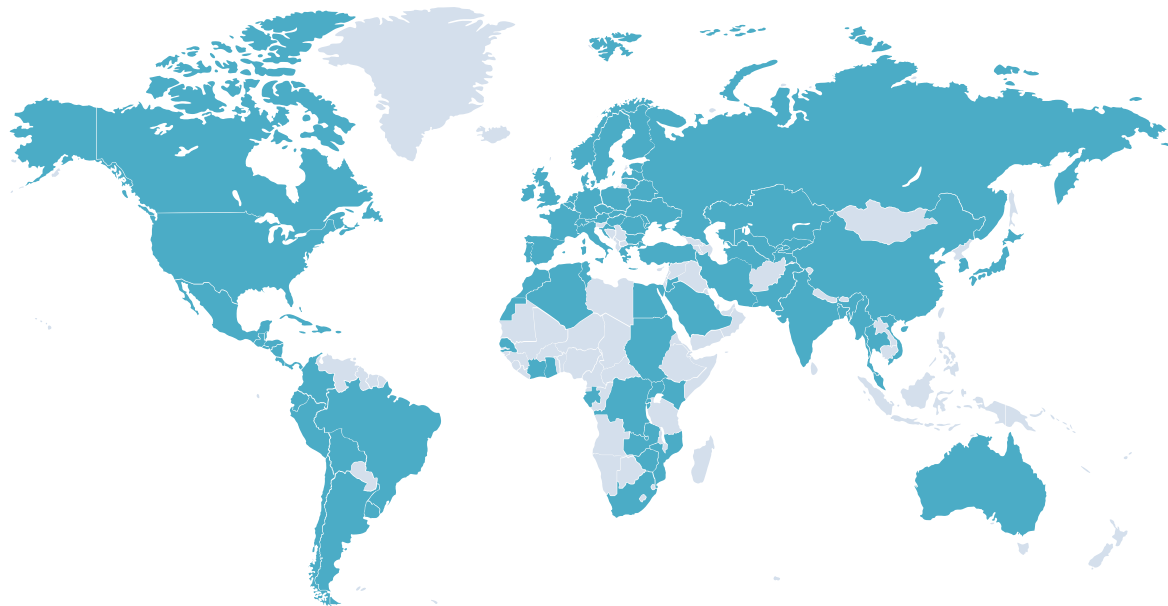
Tessengerlo Fertilizers

STRENGTHS & FUTURE PROSPECTS...

Our global team of commercials and agronomists provides its expertise to growers in over **100 countries worldwide**.

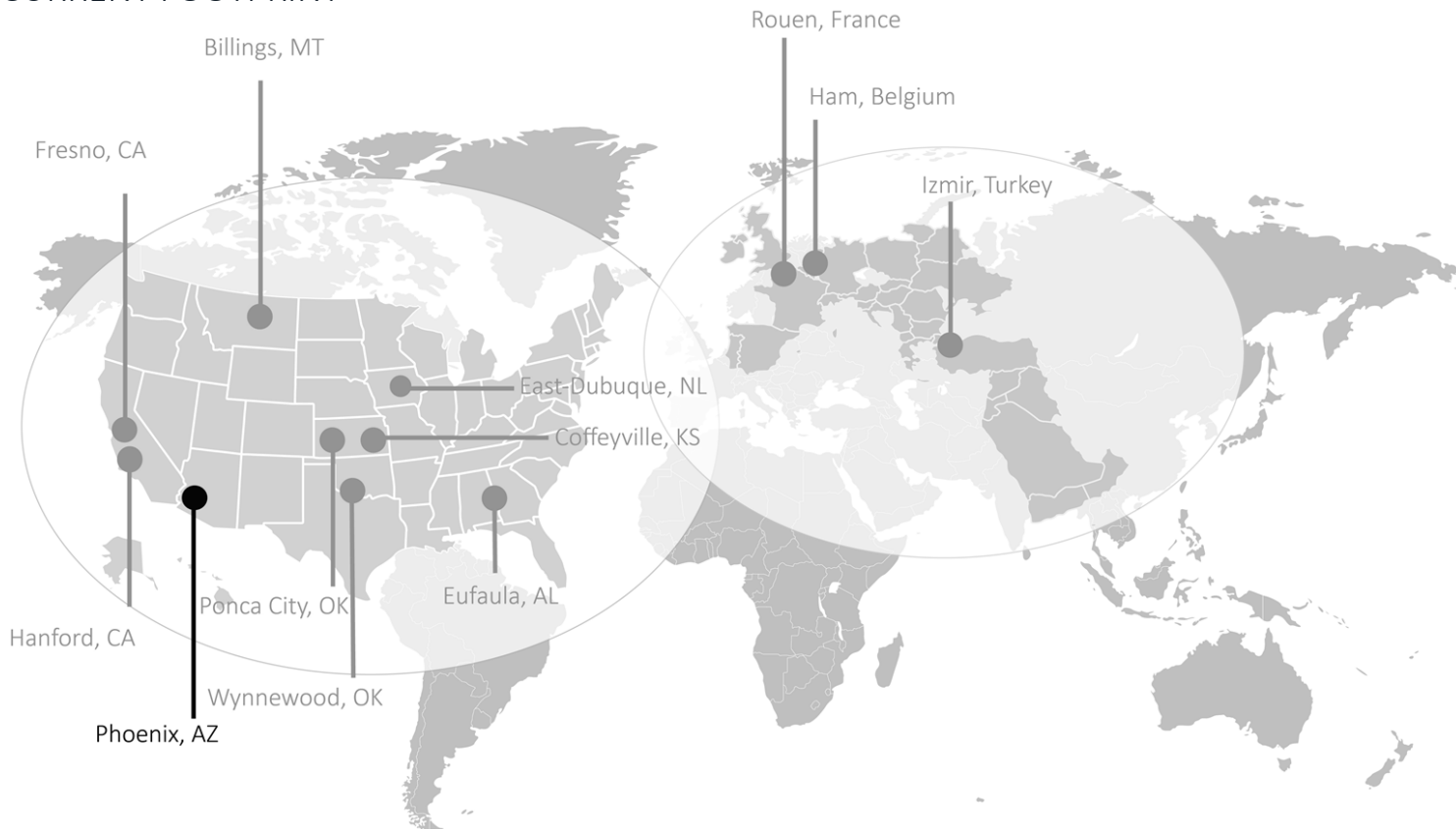
Technologies adapted to local context!

- Product portfolio value-in-use benefits
- Robust logistic set-up
- Recognized brand images
- Dedicated team of local agronomists
- Longstanding expertise & innovation!



⇒ Continued diversification of specialty fertilizers & research towards precision crop nutrition worldwide!

FOOTPRINT: CURRENT FOOTPRINT



Global use of specialty fertilizers

- North America and Europe are the largest markets
- Asian countries progressively boosting demand for specialty fertilizers in the Asia Pacific



Towards integrated, site specific solutions

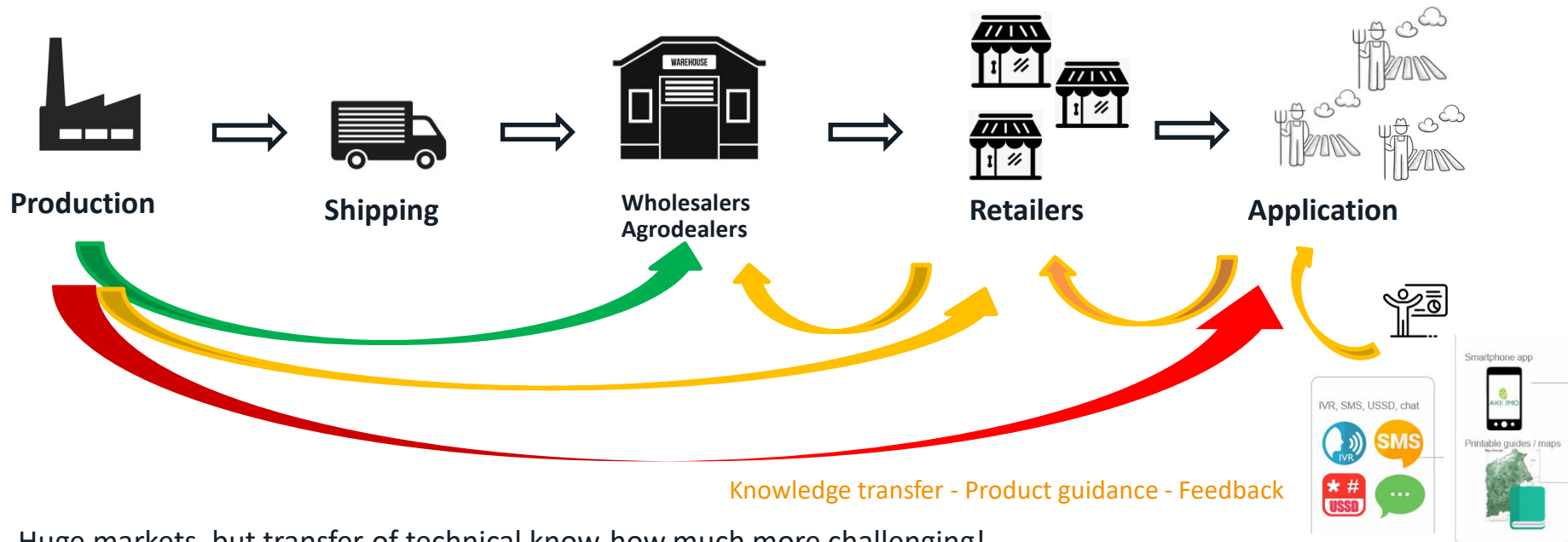
- Specialty fertilizers: enable very precise crop nutrition, but often more complex agronomic implementation
- Knowledge & awareness is key
- Extension & education needed to optimize value creation of specialty fertilizers in local context (4R)

Simplified model of specialty fertilizers & knowledge in larger scale & more capital intensive farming systems



Towards integrated, site specific solutions

Simplified model of specialty fertilizers and knowledge in smaller scale & less capital-intensive farming systems

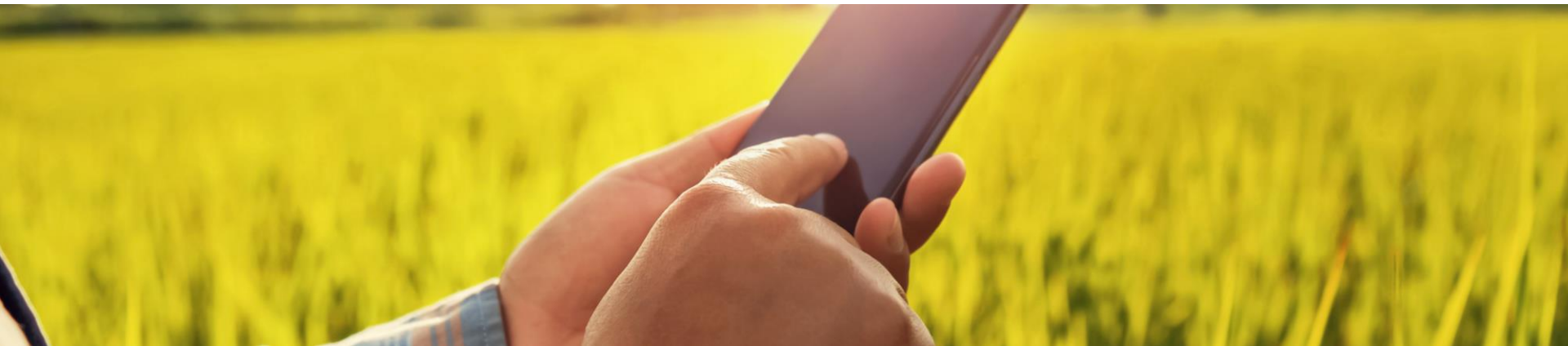


- Huge markets, but transfer of technical know-how much more challenging!
- Poor feedback
- Importance of solid extension services
- Growing importance of **digital decision support tools & fertilizer recommendation tools**



When developing fertilizer recommendation tools: towards precision crop nutrition

Obviously a prior focus on NPK...



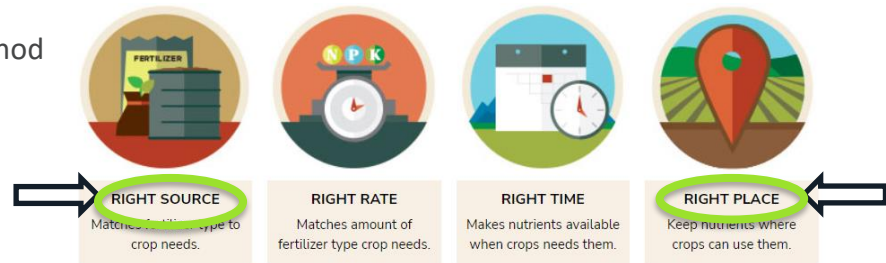
- **Beyond NPK... And beyond nutrients**
- **Risks of 'market lock-in's to basic fertilizers**
 - » Some tools focus on a fixed set of commodity fertilizers (e.g. Urea, MOP, DAP,...)
 - » Might obstruct price competitiveness
 - » Might slow-down the adoption of new/more sustainable specialty fertilizers
- **Remaining challenges to work on to**
 - » Integrate the needs for all other essential nutrients
 - » Integrate the varying agronomic effects of contrasting fertilizers
 - often ignored in current tools (e.g. pH, salt, redox potential, organic matter, microbial stimuli...)
 - » Integrate decision support on fertilizer type, form, & application method



Scope for co-creation and public-private collaboration

Consortium of precision crop nutrition and specialty fertilizers

- Integrate secondary nutrients in fertilizer recommendation tools (i.e. S, Mg, Ca,...)
- Determine important areas/agro-ecological systems for integration of certain secondary nutrients (i.e. S)
- Integrate more site-specific agronomy in fertilizer recommendation/decision support tools, to get 'right source' at 'right place'
 - fertilizer type, form, technology, and application method



- Inclusion of indices indicating sustainability & environmental impact (e.g. land degradation etc.)

Scope for co-creation and public/private collaboration

Consortium of precision crop nutrition and specialty fertilizers



- Obviously, first things first,...
- Keep the door open to integrate 'specialty fertilizers' in decision support tools to optimize solutions to the local needs



Questions, comments, or suggestions...?

Contact info:

Pieterjan De Bauw

Pieterjan.debauw@tessenderlo.com

www.tessenderlo.com



Additional slides



Crop Vitality™



- ✓ Value-added specialty liquid plant nutrition to support growers worldwide in efficient and sustainable agriculture.



- ✓ Top producing growers, crop consultants and retailers rely on our liquid fertilizers to grow high-performing plants that yield the highest quality fruits, vegetables, nuts and grains.



- ✓ Our principal products are ammonium thiosulfate, which is branded as Thio-Sul® and potassium thiosulfate, which is branded as KTS®.

Tessenderlo Kerley International



- ✓ Tessenderlo Kerley International supplies value-added liquid, soluble and solid plant nutrition in order to support growers in realizing efficient and sustainable agriculture.



- ✓ Our dedication to give farmers the precise tools needed to stimulate the vitality of their crops is at the very heart of what we do – both today and in the future.

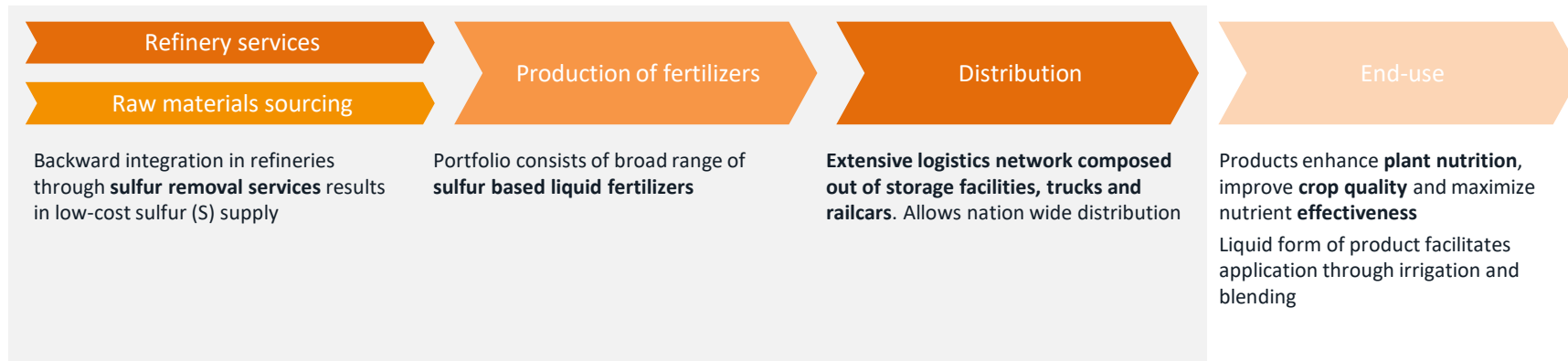


- ✓ Our portfolio consists of a variety of well-recognized specialty fertilizers such as SoluPotasse®, K-Leaf®, Thio-Sul®, KTS®, CaTs®, etc.





VALUE CHAIN: WELL-POSITIONED ALONG THE VALUE CHAIN



MARKET POSITION: US LEADING POSITION IN KEY PRODUCT LINES

Thio-Sul® and KTS® are applied to **broad acre crops** (e.g. corn, wheat, cotton) and **specialty crops** (e.g. grapes, almonds, tomatoes).



Thio-Sul® is a liquid ammonium thiosulfate solution that helps increase potential by satisfying a crop's essential need for **nitrogen and sulfur**. It is generally **blended with UAN**, a concentrated solution of urea and ammonium nitrate commonly used as nitrogen fertilizer. Adding Thio-Sul® to a UAN solution is an economical, effective and convenient way to stabilize and **maximize nitrogen efficiency**, by slowing the rate of nitrification, and **providing sulfur to plants**.



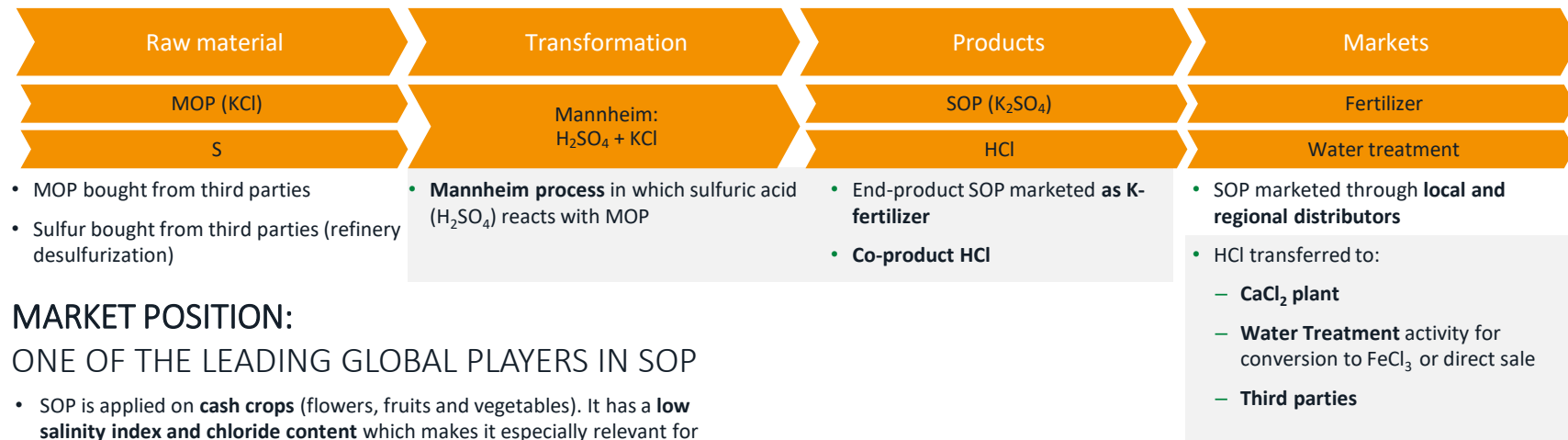
KTS® is a clear, chloride-free solution with the **highest potassium and sulfur content** available on the market.



Agro – sulfates



VALUE CHAIN: TESSENDERLO PRODUCES SOP (K-FERTILIZER)



MARKET POSITION:

ONE OF THE LEADING GLOBAL PLAYERS IN SOP

- SOP is applied on **cash crops** (flowers, fruits and vegetables). It has a **low salinity index and chloride content** which makes it especially relevant for chloride sensitive crops and/or arid regions.
- Sold in over 80 countries worldwide.
- Most growth in water soluble specialty market.

FOOTPRINT:

SINGLE PRODUCTION LOCATION IN HAM (BELGIUM)

In 2020, Tessenderlo Kerley International (Agro segment) signed a long-term partnership agreement with an international partner to produce premium SOP fertilizers (both standard and water-soluble grade) at a plant in Helsingborg (Sweden).

