SOIL RANGE

INTERESTS AND ACTION OF THE RANGE

AGROBIOTOP
Naturellement efficace

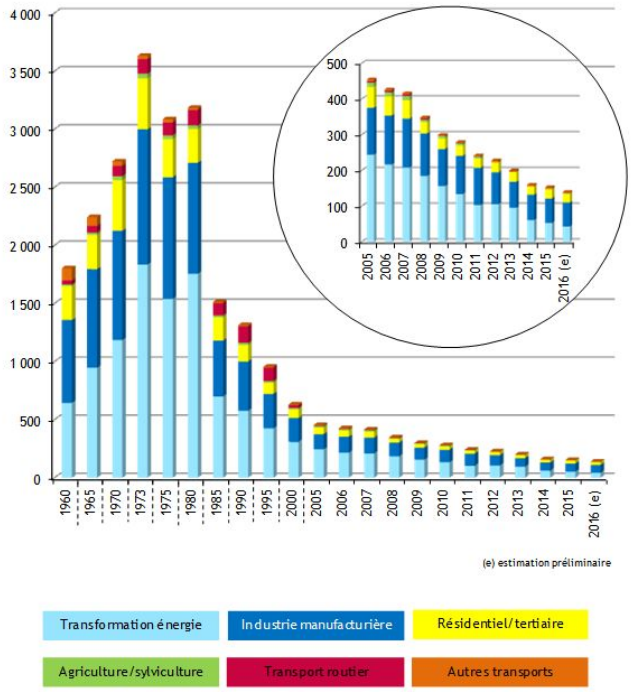
SOUFREL

The issue of sulphur in today's agricultural world

- **Replacement of sulphur-containing fertilisers with high-dose NPK fertilisers that no longer contain sulphur**
  - Superphosphate, ammonium sulphate replaced by urea, triple superphosphate, ammonium nitrate and ammonium phosphates
- **Environmental measures to improve air quality**
  - Reduction in atmospheric sulphur fallout
- **Increased crop yields and quality**
  - Increase in exports and sulphur requirements for crops

S deficiency since the 1980s

Renewed interest in sulphur for fertilisation



Atmospheric emissions of SO2 by sector in mainland France in kt

Source: CITEPA / Format: SECTEN – April 2017

Sulphur in the soil

Sulphur element in the soil

- **Soil composition in sulphur**
  - 20 to 2000 mg S/kg (European soils) *– Freney et Williams, 1983*

- **Forms of sulphur in the soil**

  - S mineral
    - Function of redox potential:
      - Sulphide H_2S ou S^{2-}
      - Elemental sulphur S
      - Thiosulfate $S_2O_3^{2-}$
      - Sulfite H_2SO_3 ou SO_3^{2-}
      - Sulfate SO_4^{2-}

  - Organic S (amino acids, proteins)
    - 60 to 95% of S
    - Humus, crop residues, microbial biomass

Roles of sulphur in soil

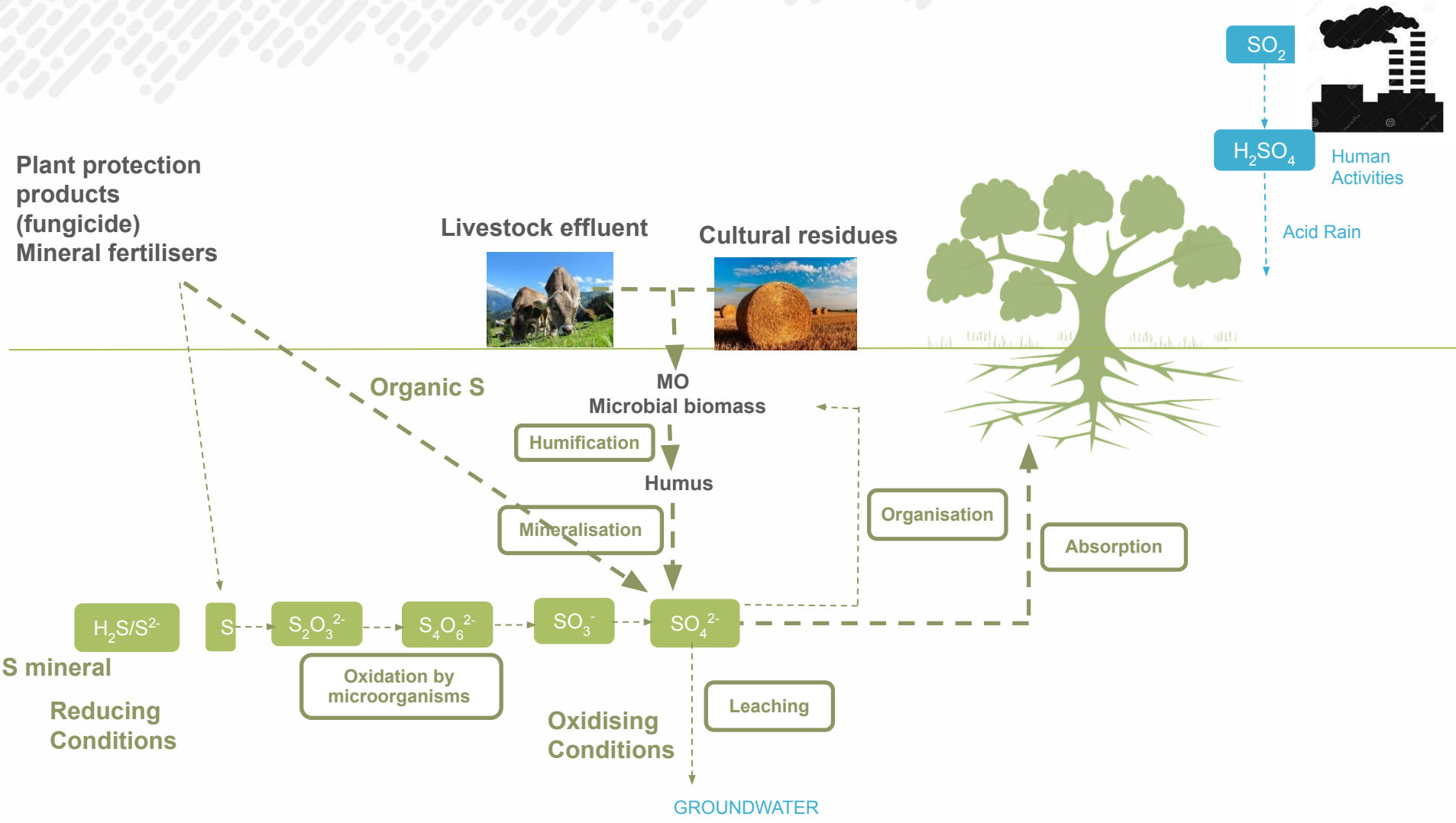
- **Constituent of humic substances and CAH**

- **Enriching the soil with organic matter**

  → Soil fertility

- **C/N/S ratio in soil = 100/10/1**

Sulphur cycle in agriculture



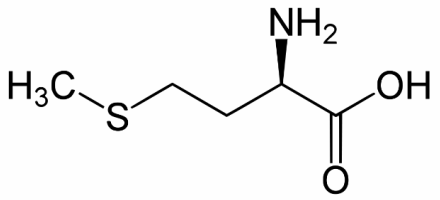
Sulphur in plants

Sulphur in plants

- **Sulphur content of plants**
  - 0,1 – 0,5%
  - Ranked quantitatively among plants just after N, P, K
- **Absorption of S by plants**
  - Only in the form of sulphates SO_4^{2-}

Roles of sulphur for plants

- **Protein synthesis (constituent of sulphur amino acids)**
  - Methionine
  - Cysteine
  - Cystine



Methionine

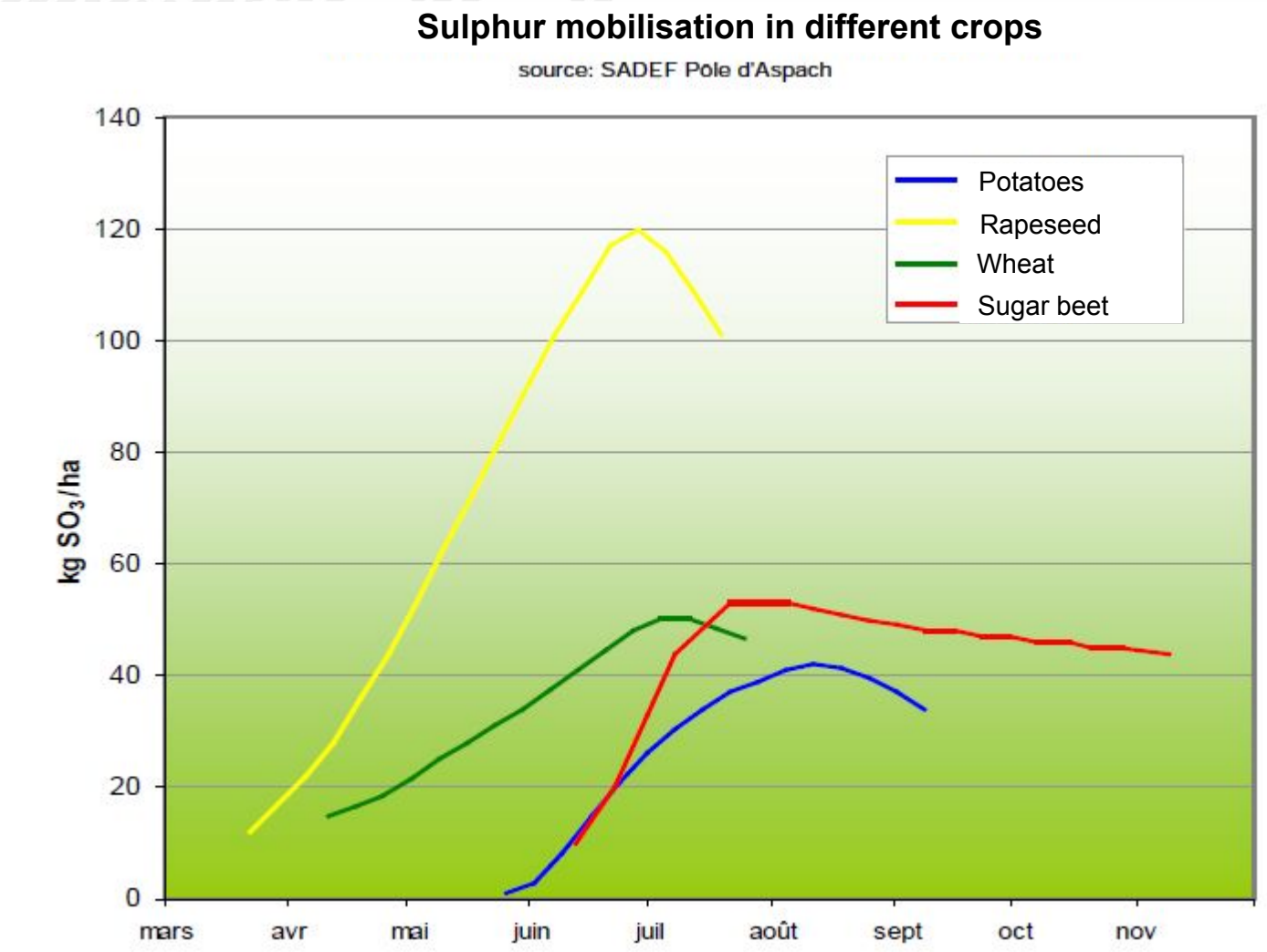
- **Composition of chlorophylls**
  - Therefore essential for photosynthesis
- **Composition of enzymes, vitamins (biotin, thiamine, glutathione)**
- **Activation of enzymes involved in the metabolic processes of fatty acid energy**
- **Formation of nodules in legumes**
- **Involved in plant protection mechanisms**
  - presence in glucosinolates, alliin
  - volatile sulphur compounds emitted by leaves with fungicidal effects

Crop sulphur requirements

Requirements	Crops	Elemental S requirements in kg/ha	Equivalent in kg SO3/ha
Strong	Rapeseed, cabbage, mustard, garlic, onion, alfalfa, clover, forage grasses	40 to 80	200 to 100
Medium to strong	Orchards Vines	40	80
Medium	Straw cereals, maize, potatoes, sugar beet and fodder beet	20 to 40	100 to 50
Weak	All others	8 to 20	50 to 20

Source : COMIFER

Sulphur mobilisation in crop



Source : COMIFER

Sulphur deficiency

- **Symptoms of deficiency**
  - Yellowing of young leaves
- **Consequences of S deficiency**
  - Effects on yield
  - Resistance to stress (biotic, abiotic)
  - Efficiency of N use
  - Quality (e.g. baking quality)

Types of sulphur fertilisers

The main forms of sulphur on the market

- **K sulphates, Mg sulphates**
- **Single superphosphates**

- **Sulphur-containing nitrogen fertilisers**
  - Sulphur-containing ammonium nitrates
  - Ammonium sulphates

- **Elemental sulphur**
  - Slow assimilation

- **Manure**
  - 1 to 3 kg/tonne of sulphur depending on the animal origin of the manure
  - Slow assimilation

Soufrel : Elementary S
interest and use

Benefits of elemental sulphur supplementation

- **Sulphate**
  - Directly assimilable by plant roots
  - Highly leachable in soils
  - Groundwater pollution, especially in conditions of heavy rainfall
  - Sulphate fertiliser application: more than 50% of sulphur applied in sulphate form is organised (converted by microorganisms into organic sulphur) within 1 week

- **Elementary S**
  - Requires oxidation by soil microorganisms
  - Slower action than sulphates
  - Acidifying effect optimising root pH

  Sulphur (S) + Oxygen (2/3 O2) + Water (H2O) > (microorganisms) > H2SO4

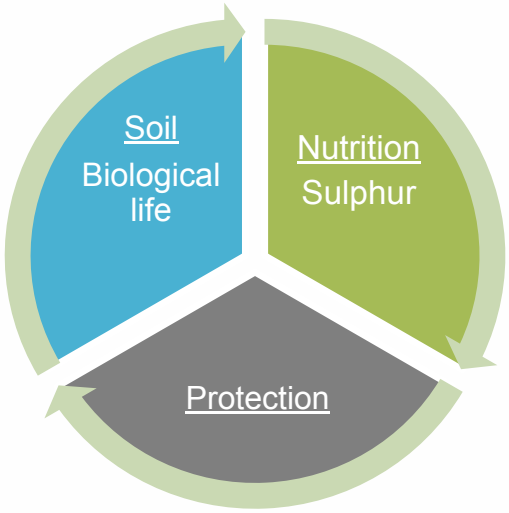
  - Long-term sulphur fertilisation strategy

Use of Soufrel

- **Use between 20 and 60 kg/ha at sowing (localised or otherwise)**
- **To be mixed in the seed drill hopper, micro granulator or fertiliser distributor.**
- **Product presentation and packaging:**

The synergy between Soufrel and Siliboost

- **SILIBOOST: enhances the effect of SOUFREL**
  - Stimulates biological activity in the soil
    - Stimulates bacteria that convert elemental sulphur into sulphate that can be absorbed by plants



And other complementary products...