**Fertilizer Production:**
When operating with “Best Available Techniques” (BAT) ammonia and nitric acid plants, the total carbon footprint of AN is 3.6 kg CO₂-eqv per kg N.

**Ammonia production:**
Binding nitrogen from the air requires energy. Natural gas is the most efficient energy source. Yara plants are among the best performers in terms of energy efficiency worldwide.
- European average energy consumption: 35.2 GJ per ton ammonia (≈ 2.2 kg CO₂ per kg N in AN)
- EU BAT energy consumption: 33.8 GJ per ton ammonia (≈ 2.1 kg CO₂ per kg N in AN)

**Nitric acid production:**
Nitric acid is used for making AN-based fertilizers. Its production releases NO₂. Catalytic cleaning developed by Yara reduces NO₂ emissions below BAT level.
- NO₂ emission without cleaning: 7.5 kg NO₂ per ton nitric acid
- EU BAT emission with cleaning: 1.25 kg NO₂ per ton nitric acid (≈ 13 kg CO₂-eqv per kg N in AN)

**Solidification:**
AN solutions made from ammonia and nitric acid are granulated or prilled to form high-quality solid fertilizers. Solidification needs energy.
- European average energy consumption: 0.7 GJ per ton of product (≈ 0.1 kg CO₂ per kg N in AN)

**Transportation:**
Ammonium nitrate is transported by ship, rail, road or rail.
- European average: 0.1 kg CO₂ per kg N

**Fertilizer Use:**
Nitrogen, whether from organic or inorganic sources, is subject to natural microbial conversion in the soil. During this process, N₂O can be lost to the air. In addition, CO₂ is also released by liming and farming machinery.
- Average footprint for AN: 5.6 kg CO₂-eqv per kg N

**Biomass Production:**
Plants capture large amounts of CO₂ during growth. Optimum fertilization increases biomass production, and thus CO₂ uptake, by a factor of 4-5 compared to fields that remain long-term unfertilized. For example, at a yield of 8 t / ha achieved with 170 kg N / ha, the grain fixes 12 800 kg / ha of CO₂. This corresponds to 75 kg of CO₂ fixed per kg of N applied.
- Example footprint: 75 kg CO₂-eqv per kg N

**Biomass Consumption:**
Most of the biomass produced is consumed as food or feed. CO₂ fixation is therefore only short term and cannot be considered a saving on a global scale. The balance is different for bio-energy since it avoids the burning of fossil fuels. For example, using biomass instead of mineral oil for heating purposes reduces the CO₂ emission by as much as 70-80%.

**Forest and Wetlands:**
Forests and wetlands store 2-8 times more CO₂ than croplands. Land-use change, mainly due to burning of tropical forests, is a large source of CO₂ emissions, accounting for 22% of manmade CO₂ emissions. Preserving tropical and boreal forests is the most important contribution to mitigate climate change.

**Transportation Potential:**
- Improve energy efficiency of ammonia production and other production systems.
- Install and further optimize catalytic cleaning of NO₂

**Fertilizer Use Potential:**
- Measure balanced nutrition
- Tailor N-application according to actual crop needs
- Use placement fertilization when appropriate
- Use of precision farming tools (N-Sensor, N-Tester, online applications)
- Maintain good soil structure (draining, avoid puddling)
- Select appropriate fertilizer (AN or CAN based rather than ammonium or urea)
- Efficient manure management

**Biomass Production Potential:**
- Ensure optimal fertilization to increase biomass production and CO₂ uptake per ha
- Avoid land-use change at one place to compensate for reduced efficiency at another place
- Preserve and improve soil carbon stocks by increased inputs of organic materials to the soil (e.g. residues) and conservation tillage techniques
- Catch and cover vegetation in between actual crops in order to reduce N leaching losses and to produce additional CO₂-fixing biomass
- Restore degraded agricultural land

**Biomass Consumption Potential:**
- Optimize efficiency of bio-energy production
- Increase productivity in food and feed production, allowing more acreage for bio-energy production

**Forest and Wetlands Potential:**
- Protect tropical forests and wetlands
- Reforestation, reclamation of wetlands
- Forest fertilization to increase long-term carbon capture
- Avoid further land-use change by increasing productivity on existing agricultural land

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