June 2022

Comments of the International Fertilizer Association regarding

Target 7 of the First Draft of the Post-2020 Global Biodiversity Framework

Target 7: Reduce pollution from all sources to levels that are not harmful to biodiversity and ecosystem functions and human health, including by reducing nutrients lost to the environment by at least half, and pesticides by at least two thirds and eliminating the discharge of plastic waste.

Building on its previous comments to Draft Target 7, the International Fertilizer Association would like to submit an alternative text proposals that would make the Target specific, measurable, ambitious, realistic and time-bound (SMART), and ensure that the Post-2020 Global Biodiversity Framework as a whole remains ambitious and outcome-oriented[1].

IFA Proposal : *Reduce pollution from all sources to levels that are not harmful to biodiversity and ecosystem functions and human health, [including by reducing nutrients lost to the environment] through the improvement of nutrient use efficiency […]*

Rationale: **Proposing a nutrient loss reduction target of over 50 percent is an unrealistic goal, even for regions with advanced agricultural practices**.
Science-based observations around the world and regional data collaction have shown that global nutrient losses could be reduced by about 20 percent within the next decade and by 40 percent by 2040[3]. This would require, however, significant investments and improvements in agricultural management practices, technology and policy worldwide, as well as enhanced access of farmers to innovations and knowledge, and a readjustments of fertilizer subsidy schemes.

IFA thus encourages to remove a specific quantitative value for nutrient losses in the target (in line with SBSTTA's remarks on the Updated Zero Draft[2]) and include Nutrient Use Efficiency.

[1] CBD/WG2020/3/3 Page 3
[2] CBD/SBSTTA/Co chair's Text on Item 3/Page 10
[3] These figures are based on crop Nutrient Use Efficiency (NUE) data of the past 30 years. Improvements in NUE can be translated into nutrient loss reduction. Global nitrogen use efficiency in crop production increased by 33 percent since 1987, accelerating to 13 percent in the last decade. This trend allows to presume that a 20 percent loss reduction could be achieved by 2030. This is still a very ambitious target and requires significant investments and improvement in management practices, technology and policy worldwide.

Nutrient Use Efficiency is defined as the proportion of nutrients applied from all sources (organic and mineral), that are taken up by the crop. It is context and location specific, allows to take into account the variety of soil and climate conditions, and addresses over-applications in many regions of the world as well as under-use.

It bears emphasiss that the underuse of plant nutrients can also cause significant damages to biodiversity: nutrient depletion in soils can indeed put a lot of stress on animals' and plants' health, trigger low biomass development and risks of soil erosion.

IFA thus advises Parties to take into consideration their countries' specificities in terms of crop mix, crop yields, agro-ecological conditions and fertilizer management when seeking to improve their Nutrient Use Efficiency. **Please find in the Annex below an IFA analysis** of 6 different country NUE profiles (for Brazil, USA, Denmark, China, India and Nigeria) that highlight the diversity of profiles in the world.

More information can also be found at https://www.fertilizer.org/climatechange

Annex: IFA Analysis of NUE Country Profiles (2019)

The following six case studies provide an overview of the diversity of country NUE profiles in the world. They also highlight options for each country that could lead to an improvement of nutrient management, which would contribute to environmental protection, food security, and climate change adaptation & mitigation.

Brazil:

High NUE due to the prominent place of soybean in the crop mix in intensified grain systems

Brazil's NUE estimates have remained high since the 1960s, ranging from 60% to 83%, with a slight decrease in the early 1970s (from 74% to 60%) that reflected an accelerated use of all N inputs (e.g. BNF, manure, and fertilizer N) compared to growth in crop production. During this time period, Brazilian agriculture diversified from prominently sugarcane, coffee, tobacco and rubber production to include maize, soybean, wheat, fruits and vegetables. Agricultural productivity began increasing rapidly in the 1970s thanks to the adoption of soil amendments, such as lime, NPK fertilizers, and adapted crop varieties.

Subsequently, NUE increased in the early 1980s and again in the mid-to-late 2000s, during periods where growth of the N output outpaced that of N inputs. Brazil has sustained its productivity growth coupled with a high NUE, with the latter averaging 79% in 2016. While Brazil's high NUE was a result of low N input in the 1960s, the country has maintained its NUE amidst increasing productivity primarily due to the contributions of BNF in soybean and, to a lesser extent, sugarcane systems. Furthermore, its tropical and subtropical climates permitted the rapid increase of soybean and maize production within intensified double-cropping systems in the Cerrados region. Notably, inputs from fertilizer and manure sources have also continued to increase.

USA:

Adoption of fertilizer BMPs by corn growers and a large area planted to soybean contribute to a high average NUE level

USA's country-level NUE declined sharply in the 1960s, reflecting the rapid adoption of fertilizers relative to crop production gains, before stabilizing in the 1970s and 1980s due to gains in crop productivity keeping pace with additional fertilizer inputs. Since the 1980s, USA's NUE has largely improved, reflecting further enhancements in productivity and a slowing growth in N inputs other than BNF. In 2016, the USA had a high NUE of 73%, largely attributable to high technology adoption (fertilizer, seed, crop protection, and precision agriculture), broad implementation of the 4Rs, and the predominance of soybean and cereals in the crop mix.

Agricultural production, and thus NUE, varies regionally in the USA, and the national trends are largely driven by one region (the Corn Belt) characterized by a high proportion of BNF and lower proportion of manure in the total N input (Swaney *et al*., 2018). Site- and crop- specific fertilizer management, digital farming, and continual improvement in crop varieties are needed to further enhance NUE in the decades to come.

Denmark:

Nitrogen policies improved NUE by imposing organic and mineral nutrient application limits, however too low limits have impacted the quality of Danish wheat

Denmark's NUE trend is characterized by a decline until the mid-1970s, followed by a steady increase since then from 23% (unsustainably low) to 67% (near optimal). The initial decrease in NUE was caused by a rapid increase in fertilizer N inputs in the 1960s and 1970s, which exceeded the growth in productivity (e.g. limited crop responsiveness). During this time, manure N inputs already exceeded crop N removal. Denmark's NUE began improving as manure N inputs declined and fertilizer consumption plateaued in the 1980s.

Since 1985, Denmark has introduced a series of Nitrogen Policies aimed at reducing N losses by limiting the application of N fertilizers (from mineral fertilizers and manure). As part of the implementation of the EU Nitrates Directive, Denmark has determined a "Nitrate Vulnerable Zone" covering its entire national territory and has established a Code of good farming practices to be implemented on a mandatory basis for farmers to comply with.

The current regulation in Denmark is based on a plan for sustainable agriculture developed in 1991, where N quotas and fertilizer accounts were introduced (Knudsen, 2016). The regulation lead to a reduction in the use of mineral N fertilisers by 50% over the period 1999-2016. As these quotas were based on sub-optimal rates (and only revised in 2017), they have resulted in a higher loss of income for agriculture than originally expected by Danish decision-makers. Under-fertilisation has increased because the need for N has grown over time due to higher yield potentials, and lower mineralisation of N from the soil because of lower input. In addition, increasing prices of protein have led to higher demands for N. In a nutshell, the Danish Nitrate Action Program was for long based on fertilization limits by crop, which were below the economic optimum. It has led to the steady decline of Danish wheat quality.

China:

Still comparatively low NUE owing to limited adoption of fertilizer BMPs, but significant improvements have occurred in the last 10 years

From the 1960s to the 1990s, China's country-level NUE declined dramatically, reflecting the rapid adoption of fertilizers relative to crop production gains. While China's NUE stabilized in the 1990s, N inputs plateaued in the 2000s while crop production continued to grow. Over the past 10 years, NUE has begun improving, presumably due to improved fertilizer, soil, and crop management (He *et al*., 2018). Substantial increases in NUE among millions of smallholder farmers between 2005 and 2015 have been documented (Cui *et al*., 2018) and opportunity exists to further extend the implementation of enhanced practices. China had an average NUE of 44% in 2016, which is still lower than many other countries. Its relatively lower NUE is largely attributable to the large share of less efficient fruits and vegetables in the crop mix, prevalence of smallholder farming, and low levels of technology adoption.

China's NUE is expected to continue improving under China's zero growth policy adopted in 2015, and through greater mechanization and further technological improvements. Both fertilizer application rates and yield gaps for most crops remain large, which are indicative of sub-optimal management practices. Fertilization remains not only important for closing yield gaps, but also for maintaining productive agricultural systems. Along with reduced tillage, adequate and balanced fertilization helps to prevent losses of soil organic matter in China's agricultural systems (Huang and Sun, 2006).

India:

Low and still declining NUE owing to fertilizer subsidies and low adoption of fertilizer BMPs by farmers

Since the beginning of the 1960s, India's NUE has declined from 95% (unsustainably high) to 41% (low NUE). This decline is in part due to the release of high-yielding rice and wheat varieties in the 1960s, which led to the rapid adoption of N fertilizers. Over time, fertilizer N consumption outpaced the steady increases in agricultural productivity. Since 1985, the decline in NUE slowed to approximately 40%, reflecting changes in N consumption patterns with continual improvements in output. In 1999, fertilizer consumption stabilized for several years, but growth resumed in the mid-2000s before temporarily plateauing in 2012. India has not yet been able to increase its NUE since 2012. The Indian Nitrogen Assessment states that imbalanced fertilization (e.g. excess N and phosphorus (P) relative to potassium (K), Sulphur (S), and micronutrients), and in turn declining soil health, is responsible for its low NUE. IFA – 6

Fertilizer consumption in India is strongly influenced by fertilizer subsidies (Gulati, 2017). Since the inception of the fertilizer subsidy program in the 1960s, urea (the main fertilizer used in the country) has remained heavily subsidized. In 2010, changes to the fertilizer subsidy scheme have also freed prices for P, K and non-urea N fertilizers. This change led to a significant price gap that has encouraged imbalanced and inefficient fertilization practices and continued low NUE. Farmers' low adoption of BMPs is an additional constraint to improving NUE. The outlook for the country's NUE will be primarily driven by future changes to the fertilizer subsidy policy.

Nigeria:

NUE levels above 100% reflect too low input rate and continuous soil mining, which undermines crop productivity

Nigeria's NUE is unsustainably high and consistently exceeded 100% since the 1960s. This is indicative of soil N mining, where N removal exceeds N inputs into the system. As of today, Nigeria's agriculture continues to be characterized by low N inputs and low yields.

A holistic approach is necessary for increasing the country's crop productivity, including access to and integration of fertilizer inputs, soil conditioners, crop protection, seed technology, irrigation, and other inputs, as outlined by Nigeria's recent "Agricultural Promotion Policy" (Federal Ministry of Agriculture and Rural Development, 2016).

In a long-term perspective, based on demographic projections to 2050, Nigeria will have to reduce its yield gap from about 80% today to 20% only, should the country want to maintain its current level of self-sufficiency for cereals. Such an ambitious productivity gain can only be achieved through a significant increase of the N input to cropping systems (ten Berge *et al*, 2019), which would at least offset N removal with the harvested crops.

Key Findings based on these selected country profiles:

- Too high and too low output/input ratios (NUE) levels are equally unsustainable;
- NUE must be interpreted within the context of crop production systems;
- Countries with a large share of their area planted to leguminous crops have a higher NUE while countries with a high proportion of less N use efficient crops (e.g. fruits and vegetables) have a lower NUE;
- Countries where farmers use improved crop varieties, irrigation, fertilizer best management practices, and technology (e.g. precision farming) have a higher NUE;
- Countries where fertilizer price is heavily subsidized have a lower NUE;
- Countries with high livestock production density (i.e. higher percentage of total inputs as manure N) have a lower NUE;
- Sub-Saharan African countries (and countries with similar low fertilizer application rates and low crop yields) can learn from experiences elsewhere and potentially avoid the typical NUE trend, where NUE falls sharply as nutrients' consumption increase much faster than removal by crops, before a "turning point is reached where surpluses stabilize or decrease owing to access to improved knowledge, inputs and technologies.