INTERNATIONAL FERTILIZER ASSOCIATION

COVID-19 AND BEYOND

Responsible Plant Nutrition for Food Security and Human Health

Calls for an in-depth transformation of our food systems to better address food insecurity and malnutrition are amplified by the impending post-COVID economic recession, expected to increase the alarming number of 821 million people (10.8 % of the current world population), who were suffering from chronic undernourishment even before the virus erupted (source: FAO, 2019). In the meantime, more than 2 billion people suffer from micronutrient deficiencies, and this number is also anticipated to rise as the drop in income may result in unbalanced diets containing less micronutrient-rich foods.

It bears emphasis though, that the production of most of our food originates on the farm. Thus, we must, in addition to meeting immediate and short-term needs, focus on a long-term transformation of our farming and food systems, if we want to be able to secure sufficient access to nutritious food while minimizing environmental impacts.

This puts fertilizers (and other inputs) at the forefront of an agricultural transformation, as it is estimated that, in absence of mineral fertilizers, farmers could only produce half of the current global food output (Erisman et al., 2008).

However, the role of plant nutrition cannot be reduced solely to production and yield increase:

1. FERTILIZER BENEFIT HUMAN HEALTH

Fertilizers do not only contribute to the supply of calories, but they help provide all the essential nutrients that the human body requires. In this current crisis, it is even more imperative to stress fertilizers' benefits for human health:

Scientific evidence shows that plant nutrient management can increase the density in some essential nutrients such as proteins and minerals. As plants are the primary source of nutrients for humans and animals, there is a direct and indirect link between fertilizer application to plants and human & animal nutrition:

Human nutrition is not only dependent on the crop volume produced, but also on the nutrient density and quality of the plants consumed directly (or indirectly through animals).

Some examples that fertilizers are not only food for crops, but support indirectly human dietary requirements:

Nitrogen (N) is a key component of proteins; plants provide on average 30% of protein intake to human diets.

Phosphorus (P) is needed by crops, animals and humans for their energy production and transport.

Potassium (K) applications increase the K content in all organs of plants, including its edible parts, and contribute ultimately to make fruits and vegetables an essential K source for our diets. K has a positive impact on blood pressure.

Magnesium (Mg) is distributed throughout plants, including the grain, subsequently, it is present in vegetables, grains and nuts consumed in human diets. Mg supports our muscles and nerve functions.

2. MINERAL FERTILIZERS, CONTAINING MICRONUTRIENTS, CAN HELP ADDRESS DEFICIENCIES IN HUMANS AND STRENGTHEN OUR IMMUNE SYSTEM

Micronutrients are essential for human health: they contribute to prevent chronic diseases and enhance our physical and mental abilities. Zinc and iron, for example, also strengthen our immune system, thus help improve our natural resilience to pathogens. Zinc is known to support antiviral immunity.

However, more than 2 billion people suffer from micronutrient malnutrition, referred to as "*hidden hunger*". According to a report of the World Health Organization on the risk factors responsible for the development of illnesses and diseases, zinc and iron deficiencies ranked 5th and 6th among the 10 most important factors in low-income countries (WHO, 2002).

One of the quickest and most cost-effective strategies to minimize the extent of micronutrient deficiencies in human populations is the enrichment (biofortification) of staple food crops with micronutrients, such as zinc, iron, selenium and iodine, which can be done through genetic improvement or agronomic measures.

There is a close correlation between micronutrient deficiencies in soils and plants and micronutrient deficiencies in humans (Figure 1):

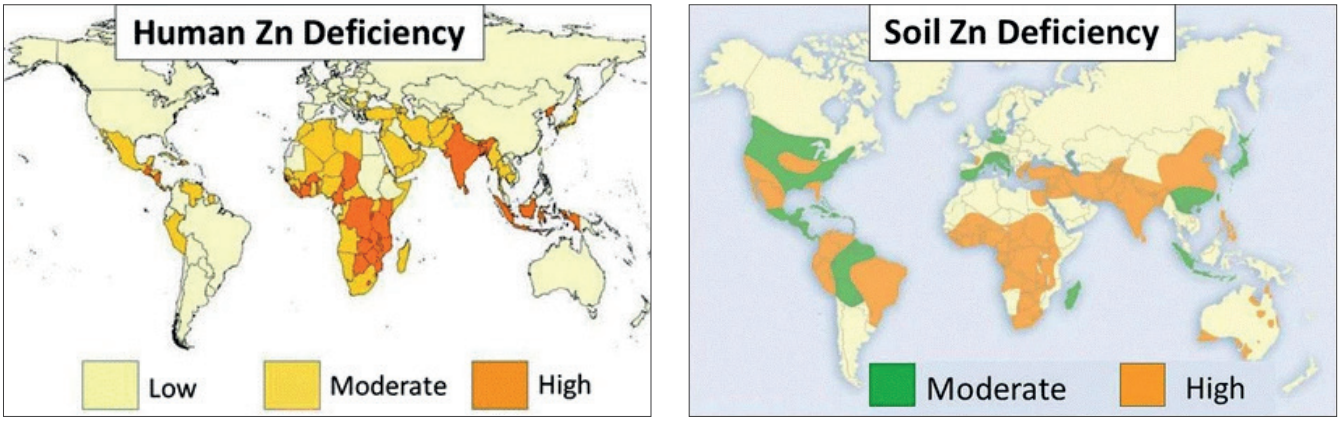

Figure 1: Geographical overlap of human Zn deficiency and soil Zn deficiency (Cakmak et al., 2017a, Plant and Soil, 411:1-4)

Agronomic biofortification is defined as "*the application of mineral micronutrient fertilizers to soils or plant leaves* ***with the objective to increase the micronutrient content in the edible part of the crops*****". It is complementary of the genetic biofortification option and can be very effective at delivering zinc, selenium and iodine to humans, especially those who don't have access to processed fortified foods.**

3. RESPONSIBLE PLANT NUTRITION BALANCES HIGH PRODUCTIVITY REQUIREMENTS WITH ENVIRONMENTAL STEWARDSHIP

The **insufficient quantity of a single essential plant nutrient** affects plant growth and thus crop yield, as well as soil health. In vulnerable regions, such as Sub-Saharan Africa where soils are already depleted and desertification is a constant threat, reduced access to fertilizers risks to further damage the soils and worsen the already fragile economic situation of farmers.

Excess of organic and mineral nutrient applications in other regions of the world have led to water and air pollution, biodiversity loss - not to mention that mineral and organic fertilizers are a natural source of Greenhouse Gas emissions.

Optimizing nutrient uptake by the plant is crucial to reduce losses to the environment, minimize or reverse the degradation of our natural resources and achieve a form of sustainable intensification that can contribute to reducing deforestation and Greenhouse Gas Emissions.

Based on the recognition of current levels and future needs, the adoption of the evidence-based **4R principles** (using the right nutrient source at the right rate, at the right time, in the right place) supports improved nutrient use efficiency, sustainable productivity, and reduced negative environmental impacts.
The **4Rs can be applied to mineral as well as organic fertilizers** and complemented with other Best Management Practices (such as crop rotations, conservation tillage, fertigation, etc.).

Where available and economical, applying organic fertilizers and supplementing them with mineral fertilizers as needed may produce high crop yields and high nutrient use efficiency.

RECOMMENDATIONS FOR GOVERNMENTS:

1. Plant health and food quality depend on well-balanced and well-adapted plant nutrition, which, in turn, benefits humans and animals when consumed. Governments can assure that a post-Covid crisis does not aggravate human malnutrition by creating local conditions and an enabling environment for open supply and trade of agricultural inputs, including fertilizers. Fertilizers have to remain on the list of essential goods for food security and nutrition. Fertilization with micronutrients must be paid due attention to and should be incentivized where needed.

2. 500 million smallholder farms manage an average of 70 – 80 % of agricultural land (FAO, The State of Food and Agriculture, 2019). National governments can prioritize their access to knowledge, inputs and markets through policies, government programs and subsidy schemes, tailored to the country's farming systems, actual nutrient management performance, and promoting balanced and efficient fertilizer use.

3. Partnerships and close cooperation with the fertilizer value chain, food producers and farmers can help to understand the occurrence of problems due to Covid-19 and facilitate **development of an effective multi-stakeholder Response Strategy to unlock barriers.**

4. Governments can **facilitate financing schemes that support access to affordable credit** by actors along the fertilizer value chain and farmers.