BASF– Feedback on the Farm to Fork Strategy Roadmap

BASF supports the objective of the Commission's European Green Deal as well as the ambitious and holistic approach of the Farm to Fork Strategy Roadmap.

BASF provides a full toolbox of innovative technologies, solutions, and know-how to enable farmers to produce safe, sustainable, and nutritious food while simultaneously reducing Green House Gas emissions in the agriculture sector and adapt to climate change. We are committed to help make farming more productive and resilient.

The Green Deal and the announced Farm to Fork Strategy aim to reduce Europe's impact on the environment and climate, as well as to achieve sustainable, safe healthy and nutritious diets. We at BASF believe that plant sciences, agricultural technologies, including Climate Smart Agriculture as well as innovative animal feed additives have an important role to play in meeting these objectives. We are therefore pleased to share some concrete thoughts on how our technologies can support the ambitions of the Green Deal and the announced Farm to Fork Strategy:

a) Ensuring Sustainable Food production through nitrogen stabilizers and innovative feed additives, precision agriculture, plant breeding and plant protection

b) Enabling the transition through tailored advisory services like measuring sustainability performance (AgBalance® and AgBalance® Livestock and customized projects).

We are furthermore pleased to offer more support and expertise as both the Green Deal and the Farm to Fork strategy are further developed and implemented.

Ensuring Sustainable Food Production

Nitrogen Management in Agricultural Production

Nitrogen stabilizers provide a good example of how chemistry can contribute to achieving key objectives of the Green Deal. The use of nitrogen is essential for agricultural production but only about 50% of nitrogen applied through fertilizers is absorbed by plants. The rest remains in the soil, is lost into the atmosphere as ammonia (NH_3) and nitrous oxide (N_2O), or leaches into ground and surface water as nitrate (NO_3^-). If nitrogen is lost, the yield and quality potential of crops cannot be fully achieved. In addition, nitrogen losses pose a severe challenge to the environment, fostering eutrophication, global warming, and a decrease in biodiversity.

Urea is the most widely used mineral fertilizer worldwide. The disadvantage of urea is its ammonia volatilization potential after field application, which can be up to 80%.

Besides urea, there are many other nitrogen fertilizer products available, all of which under-go chemical and biological processes in the soil such as nitrification i.e. the conversion of ammonium (NH_4^+) to nitrate (NO_3^-). The loss of large quantities of nitrate into groundwater, drinking water or recreational water may result in eutrophication, the formation of toxic algal blooms and the loss of biodiversity. In addition, nitrate can be reduced to nitrous oxide (N_2O) in a process called denitrification. Nitrous oxide is also formed during nitrification. This is important as nitrous oxide is a GHG with a global warming potential 265 greater than carbon dioxide (CO_2) for a 100-year timescale (US EPA 2019).

Reducing loss of applied nitrogen into the environment by increasing nitrogen use efficiency is therefore essential for the environment and our climate. Use of nitrogen stabilizers such as nitrification and urease inhibitors Offer a promising away to limit nitrogen losses to the environment, and their use is easily to traceable. When a urease inhibitor is used, ammonia losses are reduced on average by 70% (Bittman *et al.,* 2014). Due to the delayed conversion, they also increase flexibility of fertilizer application timings, as they are more independent from weather conditions, and nitrogen availability is more reliably available to crops during critical growth stages. This leads to more consistent yields and an improved environmental footprint of urease-based fertilizers.

The German Fertilizer Application Ordinance already recognizes the value of the technology and requires all urea fertilizers in Germany which are not incorporated into soil must be ap-plied in combination with a urease inhibitor.

Another way to minimize nitrogen losses to the environment is use of nitrification inhibitors, which inhibit conversion of ammonium to nitrate. Use of nitrification inhibitors can reduce nitrate losses by 48% and nitrous oxide emissions by 44%, on average (Qiao *et al.* 2015).

We are convinced that use of nitrogen stabilizers such as urease and nitrification inhibitors represent a valuable contribution to achieving a more sustainable agriculture and climate change mitigation.

Animal Farm Management: Circularity in Phosphorus and Nitrogen

Manure, containing nutrients like phosphorus and nitrogen, is a valuable fertilizer. However, a large proportion of phosphorus and nitrogen from manure is not used efficiently. Up to 80% of the nutrients in fertilizers are leached out and lost through rain or irrigation, impacting quality of ground water, or causing eutrophication (Shigaki *et al*. 2006).

Natuphos® E improves the farm's phosphorus balance by tailoring phosphorus content in animal feed more closely to animal's requirements while minimizing losses through excretion. Due to better bioavailability of phosphorus through use of phytase phosphorus excretion is reduced by 70% (Winkler *et al.* 2017).

Additionally, Natugrain® TS degrades non-starch polysaccharides and decreases viscosity, which leads to a higher energy supply through the feed and to improved protein digestibility with up to 5% less excretion of nitrogen (Dusel *et al*. 2016).

Both enzymes are very good examples for circularity on farm level.

Contribute to the antibiotic usage reduction in animal husbandry

Antimicrobial resistances are a serious health risk and solutions are required to **reduce the need for antibiotics** by maintaining animals in optimal health. BASF helps to reduce the need for antibiotic use through well-known feed additives such as formic acid (Amasil) and mixtures of it for feed preservation as well as preventive feeding with glycerides of fatty acids like BalanGut™. By ensuring a healthy intestinal mucosa as well as beneficial microbiome, animal wellbeing and medication reduction is supported.

Precision Agriculture to optimize consumption of natural resources

We also recommend that the Commission should make full use of the rapidly evolving and innovative field of precision agriculture to optimize use of inputs and consumption of natural resources in environmentally sustainable ways.

BASF leverages the potential of digitalization in farming to optimize use of inputs and enable farmers to reach higher output with less use of natural resources. Digitalization offers great opportunities to promote resource-efficient and sustainable farming, as well as potential to reach a vast number of farmers to increase knowledge and raise awareness of on-farm sustainability. Under the brand Xarvio™, BASF offers tools to help growers farm better with less.

Cutting edge technologies in Plant breeding

New plant varieties developed through modern plant breeding techniques provide tremendous potential to help meet the European Commission's Green Deal and Farm to Fork objectives.

Plant breeding has enabled a wide variety of plants to adapt to specific agronomic conditions around the world. Plants that are more resistant to pests and diseases as well as to drought have already made a significant contribution to sustainable food production, globally.

The current categorization of genome editing techniques, including CRISPR/Cas, as GMO hinders development of new plant varieties based on these cutting-edge technologies, effectively denying farmers and small breeding companies access to these important innovations. We therefore recommend that this issue should be addressed in the Farm to Fork Strategy and the European Commission should recognize the important contribution which plant breeding should make toward achieving its Green Deal objectives. Furthermore, to ensure maximum impact, changes to plant protection and seed policies should be based on objective and reproducible scientific evidence and

should be proportionate, non-discriminatory, and non-restrictive to companies willing to invest in innovative varieties that will could make important contributions towards more sustainable farming systems and climate change mitigation.

Plant protection products for safe and sustainable food

Over the past 60 years, research in plant science has enabled production of safe and sustainable food, increased yields, reduced food loss, and extended the shelf life of agricultural products. Furthermore, advances in crop protection technologies over this period have also reduced application volumes by 95% and while at the same time reducing naturally occur-ring health risks, such as carcinogenic mycotoxins in food.

Moving to 100% organic farming would result in an increase of greenhouse gas emissions if the area of agricultural production land had to be increased to compensate for reduced productivity (Cranfield University, 2019). For every kilogram of CO_2 equivalent invested in the manufacture and use of plant protection products, at least 10 kilograms of the gas is removed from the atmosphere thanks to yield increase.

We acknowledge the Commission's objective to reduce both risk and use of pesticides based on societal concerns and demands. In alignment with the European Crop Protection Association (ECPA) we value the use of the Harmonized Risk Indicator 1 (HRI 1) developed and published by the European Commission as a reasonable way to measure the hazard reduction of pesticides used in both organic and conventional agriculture.

Enabling the transition through tailored advisory services

Measuring sustainability

The Commission intends to propose actions to make food production and consumption more sustainable. To be meaningful, sustainability claims require objective measurement. Attempting to measure all relevant factors would however be complex and require consideration of the sizeable differences in climate and agronomic condition that exist across the EU.

BASF is however convinced that managing sustainability requires clear measurement and has therefore developed AgBalance® to help farmers to measure, demonstrate and improve the sustainability of their current farming operations. The AgBalance® model is a holistic life-cycle assessment tool that calculates the impact of complex farm data and downstream processes on the environment, on economic performance and even on society, giving results and recommendations for individual farm needs. In addition, it can be used to model future scenarios and the best combination of future actions to maximize crop yields, protect health, resources, and the environment, and improve efficiency.

https://agriculture.basf.com/global/en/sustainable-agriculture/agbalance.html

Furthermore, BASF has developed AgBalance® Livestock, a holistic sustainability assessment software tool based on life-cycle analytics, evaluating the ten most relevant environ-mental impact categories of animal protein production.

AgBalance® Livestock provides science-based transparency on environmental impacts along the animal protein value chain, from “cradle-to-slaughterhouse”, i.e., from feedstuffs and feed production, to animal farming and slaughter.

BASF’s IT solution assesses the detailed environmental footprint of animal protein based on readily available data from farm and feed mill operations and thereby complements existing digital solutions in the animal protein value chain, such as feed formulation and farm management software.

By applying AgBalance® Livestock, feed millers and farmers can create more sustainable diets and consider best practice farm management alternatives to discover the best option to produce more sustainable protein.

Environmental footprint substantiating green claims.

We are aware of food chain complexities and the challenges in terms of data accuracy, availability of regional data, life-cycle metrics in general and non the least regarding agreed reporting methodology.

BASF is actively working in the GFLI initiative (Global Feed LCA Institute) by providing scientific expertise in heading the Technical Management Committee of the GFLI.

Additionally, we welcome initiatives like the Product Environmental Footprint (PEF) to further develop and harmonize the life-cycle methodology for assessment of (food) products along their value chains resulting in more transparency.

Conclusions

Throughout this process, we consider it essential that the European Commission engages with the agri-food industry, from seed to fork. BASF would be pleased to offer its expertise to the Commission to develop a coherent, evidence-based Farm to Fork Strategy for a climate and environmentally friendly, healthy, and sustainable food system.