

**Editorial**

# Field to Fork: Challenges in Ensuring a Sustainable Food Supply

The United Nations Sustainable Development Goals for 2030 include targets around reducing hunger for people worldwide (1). There are a number of challenges which industry is working hard to address. In farming, the challenges include crop growth and nutrition and making the most of available land for food production. Once the food is harvested, there are further challenges for the food and beverage industry in ensuring that enough of the produce reaches the people who need it in a fit state for human consumption.

## Crop Nutrition and Protection

One of the key crop nutrients is nitrogen. Although the earth's atmosphere is around 78% nitrogen, most of this is locked in a form that plants cannot use. To make it accessible, it must be 'fixed' or reduced into a more active chemical form. Some natural processes can fix nitrogen, including microorganisms living in the roots of certain vegetables as well as events such as lightning strikes. However much of the nitrogen that is used today to produce food for humans comes from the industrial fixation of nitrogen into ammonia, which has grown today into a huge area of industry carried out in many countries worldwide.

There are challenges in this industry – not least of which is ensuring the cost effectiveness and energy efficiency of the process. By far the most widely used process is the Haber-Bosch process which produces up to half the nitrogen entering the human food chain. Alternatives are being looked at that are not yet ready for commercial scale roll out but they are gaining interest in the academic community (2).

Another area important to ensuring secure food supply is the protection of crop plants from pests and diseases. The pesticides industry was worth around US\$58 billion in 2016 (3)

and ways are being sought to ensure both effectiveness and, increasingly, to reduce the social and environmental impacts of chemicals in agriculture (4, 5). There is no doubt that this will be an important area of research for some time to come.

## Land Use

It is now recognised that food security can be impacted by other pressures on land use (6). When biofuels were introduced the first generation were based on food crops such as sugars or oils. Now second- and third-generation biofuels, made from 'waste' or other forms of non-food competing biomass, are becoming available (7, 8). The challenges in processing matter such as cellulose and lignin are many: catalytic and pyrolytic approaches have been investigated to create efficient ways to prepare fuels that can meet future energy needs as part of an energy mix without detrimental impact on the food supply.

## Preventing Food Waste

The story of food does not stop at harvest. There are other areas where industry plays a role in getting food onto people's plates. Studies suggest that up to one third of food produced worldwide is lost or wasted (9). There is a need for low-cost, sustainable solutions to the problem of food spoilage and waste in increasingly global food supply chains.

The platinum group metals (pgms) have proved unlikely allies in the fight against food waste as a number of past articles in this journal have shown (10, 11, 12). There are commercial solutions on the market which involve both pgm and non-pgm materials. For example, the use of nickel catalysts to improve oxidative stability of edible

oils, extending the shelf life, as well as adsorbents, packaging materials and other technological solutions to control the environment around fresh food and prevent spoilage. This is a vibrant area and more research will no doubt reveal new approaches.

In this journal look out for articles detailing the history of ammonia production, the development of new processes for biofuels that do not compete with food and work on new packaging technologies that can help ensure food reaches people, reducing waste in the worldwide food chain.

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