CHAPTER 17

Future Developments in the EU Bio-Based Economy

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17.1 New Developments in Gene Editing

In the recent 15 years, substantial improvements in plant and animal breeding have been made (Sprink et al. 2016). The new technologies such as CRISPR-Cas, zinc finger printing, TALEN or oligonucleotide-directed mutagenesis (ODM) allow higher level of precision and saving of time in breeding and are expected to substantially reduce costs (Purnhagen and Wesseler 2019). Nevertheless, they are conversely discussed in the EU and elsewhere. As mentioned in Chap. 13, the recent decision of the Court of Justice of the European Union (CJEU) has generated substantial doubt among the scientific community about the possibilities of applying the technology within the European Union (Purnhagen et al. 2018). While mainly the plant breeding sector has expressed concerns, the implications of limiting the application of the technology in EU will be far beyond the plant breeding sector. The gene-editing technologies are so fundamental that

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they can provide improvements beyond plant breeding. They are used for developing bacteria that produce widely used enzymes for biorefineries. Applications include the cleaning of wastewater, conversion of biomass into bioenergy, a range of biopolymers, and more. These are key technologies for developing the bio-based economy, and constraining possible solutions will reduce the potential of a circular bioeconomy.

The applications in plant breeding itself are of high importance. The new gene-editing technologies allow to improve pest and disease resistance of crops and in particular to increase the potential of biological control (special issue of Pest Management Science on Natural Products in Pest Management: Innovative approaches for increasing their use, 2019). This not only increases crop yield and crop quality and reduces the ecological footprint of agriculture production but also allows to improve adaptation to climate change. Increasing the costs of gene-editing technologies by stringent regulations that are not justified by safety arguments but are a result of lobbying and political correctness endangers not only application of the technology in the European Union but the development of those technologies in the first place. A recent study by Martin-Laffon et al. (2019) indicates this to be the case for the CRISPR-Cas technology. Therefore, it is not surprising that a number of initiatives by industry groups (e.g. EuropaBio), scientists (letter to the European Commission) and students (Citizen initiative) have started to urge the European Commission to revise the approval process for new plant breeding technologies as it is seen as no longer being fit for purpose.

17.2 Food Products Derived from Cell Cultures and Alternative Proteins

Another important trend is the production of food products from cell cultures. This includes meat and fish. Companies like Finless Food (the United States), Memphis Meat (the United States) or Mosa Meat (the Netherlands) are examples of food companies investing in these technologies. While the products address a number of consumer concerns such as animal welfare (raising of animals), conservation of biodiversity (fish) and environmental impacts of animal production, the products still seem to be far away from reaching the market. Nevertheless, the impact can be expected to be huge.

Other technologies have already reached the market. This includes burgers based on protein from insects or plants. Companies like Redefine

Meat (Israel), Bug Foundation (Germany), Beyond Meat and Impossible Food (both the United States) or Protix (The Netherlands) are start-ups that have entered the market. One among other hurdles for the companies entering the European food market is the novel food regulation. The Bug Foundation, for example, launched their insect burger in Belgium and the Netherlands but faced delays in Germany (see company website).

17.3 Urban Farming

The new developments in food production mentioned require much less land and have the advantage of establishing production facilities close to the consumer in urban areas. Food production moves closer to urban areas. The trend towards urban farming is further supported by technological changes in vegetable production. More efficient LED lightning allows to produce vegetables in containers year round in closed systems. Improvements in salt-water quality allow to produce high-quality shrimps the year round in closed systems. Similar solutions are under developments for other aquaculture products.

Overall, some of the urban food production systems such as plant protein-based meat substitutes are already on the market; others will still need some time. Nevertheless, these developments have the potential to revolutionize food production. They are considered to be environmental friendly, result in less greenhouse gas emissions, and are animal welfare friendly.

The move of food production towards urban areas will be a challenge for rural areas. Alternatives to food production will be needed generating value added in rural areas. This stresses the importance for further developing the circular bioeconomy to provide jobs and economic growth for rural areas to avoid an increase in the urban-rural welfare bias.

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