

Contribution of Crop Research to Covering the Bioeconomy's Demand for Raw Materials

Preliminary Remarks

Biobased raw materials are the most important foundation of the bioeconomy. As the bioeconomy increases in significance, the various ways of utilizing the biomass (food, feed, fiber, fuel, flowers, fun) may result in even greater competition for its generation and use. A raw materials strategy should have "food first" as its priority. It must also guarantee the sustainable use of basic resources (soil, water, nutrients, biodiversity) and should additionally be in harmony with societal perceptions of demand. To achieve these aims, it is necessary to organize the utilization of biobased raw materials more efficiently and more in line with demand. The most important aim, however, is to boost the sustainable production of biobased raw materials. This is where crop research assumes a special role.

Recommendations

The essence of the bioeconomy is a circular economy based on renewable raw materials that can essentially manage with solar energy as an external contribution. Sustainability is achieved in that this system supports itself without the addition of non-renewable materials or the expansion of production factors such as additional acreages. New technologies – not least in agriculture – are necessary if we are to gradually approach this ideal state. In the Bioeconomy Council's opinion, the following political fields of action exist and they can be used to strengthen crop research in Germany so that it can make a valuable contribution to the development of a bioeconomy:

- › **Increase production:** The aim of increasing sustainable production is to enhance the agricultural yield and therefore the output. At the same time it is necessary to counteract adverse environmental impacts, hence the need to reduce our resource footprint. In this case, it is absolutely essential to manage resources that have limited availability, such as soil, water, nutrients and energy, both carefully and efficiently. The funding policy must be adapted to these changing conditions, not least for the purposes of improving the coordination of funding instruments and objectives. It is therefore advisable to commit more heavily to research and development aimed at sustainably increasing the production of biobased raw materials and at achieving greater protection against losses of product quality and yields. In crop research, genomic and phenotypic selection should be combined and should support innovative sustainable systems of phytomedicine.
- › **Utilization and maintenance of biodiversity:** Genetic diversity is the raw material for breeding plant varieties that are more productive and better able to adapt. In this connection, genome research and phenotyping should be encouraged under controlled conditions so as to evaluate the genetic diversity that is present in relevant databases. Genetic data should be made available to the public and breeders. This also includes a practical interpretation of the Convention on Biological Diversity (CBD) and the associated Nagoya Protocol. There should also be funding for new biostatistical methods for pre-breeding. Funding is particularly important for previously neglected agricultural crops which can contribute both to the diversity of the supply of raw materials and also to the resilience of the systems. Genetic diversity of, for example, antagonistic or symbiotic micro- and macro-organisms is also hugely important for the evaluation, investigation and utilization of biological defense systems (antagonists and micro-organisms) against biotic or abiotic stress components.
- › **Understanding the plant system:** It may be possible with the help of predictive breeding to bring together the knowledge gained from genome research, phenotyping, integrative bioinformatics and breeding informatics with reference to specific biological questions. This is the basis for better understanding the biological plant system and being better able to predict breeding success. New physical and molecular biology processes for phenotyping, the development of user-friendly bioinformatics programs and databases plus the development of biostatistical methods should therefore be supported. To do this, there should be better financial provision for existing experimental stations and a long-term, broad-based field trials network. In addition to the plant system per se, consideration should also be given to further investigating the trophic systems of organisms in real cropping systems in order to improve the resource efficiency of the crop by specifically and sustainably influencing agro-economic systems. The knowledge gained in this way must also be incorporated in the formulation of breeding aims.



Crop research can make an important contribution to covering the growing demand for biobased raw materials.

- › **Collaboration between business and science:** Research in bioeconomy will pay off if the technologies and innovations developed during research become popular as products or processes in the market or form the basis for products that enjoy economic success. Basic research in Germany is positioned to be internationally competitive. By comparison, there is inadequate provision for transferring new knowledge from basic research to business and for developing the steps between research and utilization that are absolutely essential. Successful networks have been established in the crop breeding sector and also in phytomedicine. This public-private partnership concept should be strengthened from basic research through to applied research. Financial and legal frameworks must be reliably designed to meet these needs. Subsidy programs should be agreed between the various areas of responsibility.

Conclusion

Given the expectation of a rising demand for biobased raw materials, not only crop research but also agriculture in general are facing new challenges. Yield increases and loss minimization are necessary requirements for the success of a bioeconomy. With the measures described above, Germany can contribute to covering the worldwide demand for biomass in both quantity and quality. This strategy, however, must be aimed in all its components at overall sustainability and should therefore take ecological, economic, technological and social concerns into account. From an ecological perspective, what matters is maintaining the important but limited resources of soil, water, nutrients and the diversity of plants, animals and micro-organisms for coming generations by using them in a sustainable manner.

About BÖRMEMOS

BÖRMEMOS summarize the Council's appraisal of key aspects of the bioeconomy in a condensed form. They do not claim to provide a comprehensive study of these facts. Rather, they present a focused and generally comprehensible view of each area and its relationship to the bioeconomy. BÖRMEMOS are designed as an incisive contribution to public debate. They are part of a series of analyses to be published by the Bioeconomy Council. They have their theoretical basis in extensive background papers that are also published on the Council's home page. BÖRMEMOS are assessed together with BÖR background papers (peer review). While this process is taking place, they are identified as preliminary and the authors are named. This memo on crop research was provisionally published on 4th June 2014 and finally approved by the Council at the 10th meeting on 14th November 2014, after going through the process outlined above.