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Keynote II: Sustainable crop production: managing the needs of productivity, environmental safety and agronomic reality

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Synthetic chemical and biological plant protection products (PPPs) are used in crop production to control pests and weeds, thereby ensuring yield and crop quality. In the absence of PPPs, approximately one-third of global crop yield would be lost (EPRS, 2019). In years with extreme weather conditions, not using synthetic chemical PPPs can lead to total crop loss, as seen in organic potato cultivation in Germany this year. In addition, farmers face stringent quality standards imposed by food trade organizations, especially when marketing fruits and vegetables. Defects resulting from
fungal or pest infestation are deemed unacceptable and therefore non-marketable, even if the produce is still fit for human consumption. In Germany alone, the utilisation of modern PPPs is estimated to generate an economic value between one and four billion euros annually (von Witzke & Noleppa, 2013).
However, due to the potential risks associated with PPPs, the use of plant protection products is subject to a wide range of regulatory requirements. The regulatory system for assessing PPPs and their active ingredients have developed continuously in recent decades, particularly in Europe. EU PPP legislation is considered to be the strictest in the world (EC, n.d.). In addition, PPPs may only be used under the principles of Integrated Pest Management (IPM): All preventive measures should be taken before PPPs are used, in order to limit their use to the necessary minimum level. The stringent demands for health and environmental protection, coupled with the high costs of research and development for new PPPs active substances, have resulted in more substances losing their authorization than new substances gaining approval. In 1993, agriculture had access to approximately 700 chemical active substances; today, only about 200 remain, marking a decrease of over 70 %. There has also been a reduction in the availability of biological PPPs, hence biological PPPs will not be able to cover the gaps from lost chemical PPPs in the near future. Treatment gaps in key agricultural crops are worsening despite major investments in the sector (€10
billion in precision application and digitalisation and €4 billion in biopesticides by 2030 planned by the European crop protection industry, Innovation & Investment - CropLife Europe). This bottleneck is already evident in widespread crops, with only a few insecticides remaining for potato, rapeseed and fruit cultivation. While Germany maintains a self-sufficiency rate of approximately 100% for cereals,
this figure drops to 22% for fruits and vegetables. If PPPs were no longer used, the average degree of self-sufficiency in Germany would be approximately 50% (Noleppa, 2017). Furthermore, the emergence of new pathogens or invasive species is facilitated by climate change. New problems may emerge within a few years, leading to significant yield losses. For example, the "Syndrome Basses Richesses" (SBR) in sugar beet and potato, a bacterial disease transmitted by a
planthopper, has the potential to cause substantial economic damage. The ongoing loss of chemical active substances thus gives rise to considerable economic disadvantages for farmers and consumers alike. The necessity to import crops from other regions of the world, where environmental and operator exposure safety standards are often lower, results from yield losses in Germany. Furthermore, declining harvests give rise to alterations in land use, including the conversion of natural areas into agricultural land in other regions. This process has the potential to result in the loss of biodiversity hotspots and the release of considerable amounts of greenhouse gases through deforestation and humus depletion. So, the question to be asked is: What level of risk can we accept from the use of PPPs? And how can we reduce the risks of pesticide use without reducing crop yield? What do we suggest?
A positive example of a solution to the competing goals of plant protection in agriculture and the protection of natural resources is the is the cooperation between drinking water providers and PPP manufacturers ("Round Table"). The key elements are the regular sharing of information, joint problem-solving in relation to pesticides and drinking water resources, and the operation of a database on the presence of plant protection products (PPP) in raw water resources. This exchange format has facilitated the overcoming of prejudices, the attainment of mutual understanding of the constraints and motivations of the other party, and the development of targeted solutions. The format could also be transferred to other areas with a view to jointly clarifying causes and finding solutions, for example, the interpretation of data from small water body monitoring. An additional solution to maintaining yields while reducing risks is the implementation of novel digital and preci-

sion application techniques, including partial area spraying, spot applications, and individual plant spraying. The widespread application of modern technology in agriculture has the potential to reduce the use of PPPs by an average of 25% (HFFA, 2022). The potential reduction in risk for specific
compartments (e.g. water bodies) is considerable. This is an area that requires further investigation, as there is currently a lack of data concerning the potential risks associated with the utilisation of novel digital and precision application techniques, including partial area, spot and individual plant applications. It is imperative that research and data generation be conducted on these methods and
their potential for site-specific risk reduction. The objective is to identify the optimal risk reduction strategy for a given location, comprising a combination of the most suitable measures, and to quantify their impact.
It is of great importance to conduct research into the effects of pesticides in the environment. In order to better characterise the environmental effects, data is required. When evaluating pesticide findings from monitoring programmes, it is essential to consider the relevance of these findings for the risk assessment and the overall risk context. The consequences for food production of not using chemically synthesised PPP are significant. Therefore, research is necessary to find solutions that enable the use of pesticides while simultaneously fulfilling the high environmental protection goals.

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