THE FUTURE OF EUROPEAN CROP PROTECTION

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Introduction

The RISE Foundation seeks answers in all of its reports to the following questions:

- What transition is needed to our food production and/or consumption systems to maintain our agricultural productivity, but at the same time reduce the unwanted side effects and make our agriculture sustainable?
- What policies are needed to steer these adjustments?
- What help is needed from the producing sectors to make the transition to sustainable systems?

It is now well-known that we have reached a stage on this planet where we are surpassing planetary boundaries with potentially catastrophic consequences. All major sectors – food, mobility, housing, manufacturing – face major adjustments to the realities of living within the natural constraints of finite resources, pollution absorption capacity, and impacts on climate and biodiversity. Agriculture must be part of this transformation. The drive for gains in productivity to satisfy growing demand has created strong tensions given the environmental cost of this trajectory.

Context

Pesticides and their use in our current agricultural system have for decades been part of that tension. The way we protect crops against disease and competition has changed over the last century, from predominantly cultural and mechanical practices using a selected few minerals and other basic substances as pesticides, to an emphasis on the usage of synthetic Plant Protection Products (PPPs). Whilst on the one hand this has significantly reduced yield loss, improved crop predictability and product quality, considerable concerns have arisen over negative impacts on the environment and human health.

This has led many to question the role of PPPs in future agricultural production and a call to move to a zero-pesticide production. Others argue that climate change and the still-growing population make their use more crucial than ever in retaining and increasing productivity levels. So how do we define the appropriate strategy for crop protection? What should crop protection in Europe look like in 10 or 20 years’ time?

The RISE Foundation is in the very early days of this project and the event is intended to learn from the expert panellists and the audience.

“This event concerns the future and the system of crop protection we want, rather than a debate on specific individual substances, something that I would like us all to keep in mind when we move to the debate,” Potočnik stated.
Emeritus Professor Allan Buckwell,
Director of the RISE report

Considering that the purpose of this workshop was to pick the audience’s brain, RISE laid out the framework of how it considers crop protection in the EU is currently done, while exploring what the way ahead is.

Widespread concerns

There seems to be unhappiness with the current situation with crop protection amongst all interest groups. Constant references to reduce pesticide use in order to protect human health are made by the public and politicians. The French president even sees the necessity and time to urge the EU to set its target at zero carbon by 2050 and pesticides halved by 2025.

There is a high level of concern among farmers who perceive that their toolbox to deal with weeds, pests and disease is depleting, whilst the threats to crops are increasing. The crop protection industry is concerned about rising costs and the unpredictability of the regulatory system, and that this is threatening their ability to produce systems to protect crops.

Environmentalists see climate damage, the pollution of water, the air and soil, and biodiversity degradation as consequences of our intensive agricultural systems in which crop protection is an important component. And among regulators there seems to be disappointment that legislation has not had the effects they envisaged. So, where should we be taking this?

Why crops need protection

There are many threats in crop production, the main categories being weeds, fungi, bacteria and insects. If not treated, these threats to crop protection lead invariably to reduced yield and quality, reduced predictability of crop performance and higher production costs.

There are many types of protection that farmers have developed over the decades. Basic strategies include prevention of the damaging agents by applying crop rotation, maintaining good soil management, maximising plant resilience and natural defense mechanisms. A key part of crop protection is vigilance, early detection of the threat and initially the removal of the problem, if possible. This may be done mechanically or by applying biological control vectors, or synthetic Plant Protection Products (PPPs). There is generally a strong benefit: cost-ratio from a farmer’s perspective to the use of PPPs, even though they are not cheap to buy and apply.

The regulatory framework for pesticides

In the early 1990s, completing the European single market to foster trade by harmonising regulation across the Member States was the most important single objective of the EU. This was
necessary in the field of pesticides where different approaches existed in the different Member States.

- **Directive 91/414**, introduced in 1991, laid down uniform rules on the evaluation, authorisation, placing on the market and controlling of PPPs and the active substances they contain within the EU. It was a risk-based approach.

- Subsequently, **Regulation 396/2005** on the maximum residue levels tolerated in or on food and feed came into place. The prime purposes of this regulation were to protect consumer and animal health by setting limits and controls on the pesticide residues acceptable in food and animal feed stuffs, and to facilitate trade by setting common standards.

- In 2009, **Regulation 1107/2009** was adopted, concerning the placing of PPPs on the market, repealing Directive 91/414/EEC.

- The same year the **Sustainable Use Directive (SUD) 2009/128/EC**, and its implementation through National Action Plans, was enacted. Its overall objective is to reduce the harm of pesticides, which may require a reduction in the use of synthetic pesticides, as all other approaches to crop protection should be implemented first.

In addition, pesticide use is influenced by other environmental regulations such as the **Birds and Habitat Directive**, the **Water Framework and Drinking Water Directive**. These put additional constraints on pesticide use. In the regulation on pesticides, the EU controls active substances and Members States authorise individual PPPs which include one or more ‘actives’.

In 2018, as part of the EU’s REFIT evaluation of the two 2009 regulations, an independent evaluation of the effectiveness, efficiency, relevance, coherence, and the EU added value of Regulations 1107/2009 and 396/2005 was conducted for the European Commission by Ecorys.

This did not include the Sustainable Use Directive.

What impact of these regulations?

Has the number of available pesticides diminished? Has it made farming more difficult? What have been the benefits to human health and the environment? These are difficult questions to answer. The evidence is complex. There are invariably long lags between the passing of legislation and its implementation on the ground. There are quite different reactions among Member States and it is necessary to distinguish between active substances and PPPs. There are also complications such as derogations and emergency temporary-use authorisations. Understanding the impacts on the use of pesticides and their effects on health, the environment and agricultural production viability is not straightforward.
Evidence on the numbers of available pesticides

Prior to Directive 91/414, about 1000 active substances were on the market. By the end of 2009, this number had fallen to about 400 approved active substances in the EU. This included remaining existing substances and new active substances. Of the initial 1000 active substances, 26% were approved, 7% were not approved and 67% products were withdrawn by the manufacturers who, presumably judging their commercial value, did not justify the risk and cost of non-approval, or the products were simply obsolete.

The Ecorys study presented data on the active substances available between 2010 and 2016 per EU Member State. There is no clear decline in active substance availability over that period. In four Member States they declined, but in all the rest, they went up. In fact, the number of active substances grew from 427 in 2011 to 493 in 2018, an increase of 66. These 66 include, among others, 19 basic substances and some 20 pheromones.

Looking at the change in availability of PPPs which contain EU-approved active substances in the different Member States, in 20 countries the number rose, while in eight, it decreased. This information does not support the idea that Regulation 1107/09 has, so far, diminished the range of products available to farmers. However, the impacts of the full implementation of the regulation are still to be seen. Further analysis of this data is necessary.

Pesticide sales in the EU

Data from the European Environment Agency on pesticide sales in the EU from 2011 to 2016 shows no particular trend and certainly not a reduction. There are quite different patterns among Member States.

Two examples were examined for France and Denmark. Despite explicit targets for reduction in pesticide use in France, there has been no impact on pesticide sales. There has been a strong impact in Denmark, with a reduction in sales in 2013. This probably reflects the implementation of changes in the rather stringent pesticide tax regime in Denmark. However, some of the 2013 decline may have been due to farmers stocking up in 2012 in anticipation of the tax rise.

Overall sales data are a very crude measure which takes no account of the make-up of the products used, their distribution between high- and low-risk products, or their intensity of use.
Comparing **Global** data on trends in PPP use since 1990, figures on pesticide use per hectare of cropland point to the largest agricultural countries: China, Brazil, India, the United States, and the EU. The data shows rapid growth in pesticide use in China and Brazil. The EU is somewhat more intensive than the US.

“*However, there is no clear trend over a quarter century in either the EU or USA as shown in these crude broad statistics,*” Buckwell stated.

**Conclusions of the Ecorys study**

The study suggests that the approval criteria for active substances in the EU are among the most stringent in the world. There has been criticism of the process and especially its timeliness, delays and lack of predictability. The report states that the total number of available active substances has not significantly changed since the entry into force of Regulation 1107/2009. It concludes that the non-approval, non-renewal or withdrawal of 23 substances will have reduced health risks. Likewise, 15 active substances no longer approved on environmental grounds will have reduced risks for groundwater, soil and wildlife.

The report states that there is no evidence that EU agricultural competitiveness has been negatively affected, concluding that, overall, the two regulations are effective and relevant. The regulations allow a higher level of harmonisation across Member States, which enhances the functioning of the internal market and consumer health protection. A response of the European Commission to this report is awaited.

**The Sustainable Use Directive (SUD)**

A core feature of the Directive is the encouragement of **Integrated Pest Management (IPM)**, while it also requires Member States to implement many other actions through their **National Action Plans (NAPs)**. Such actions include creating awareness and information systems on acute and chronic pesticide poisoning, training, equipment inspection, prohibition of aerial spraying, protection of the aquatic environment, and reduction of pesticide use in sensitive areas.

The meaning of IPM is laid down through **eight principles** spelled out in the Annex of the Directive. IPM starts with prevention and/or suppression. The second principle concerns monitoring, making observations in the field and creating warning and forecast systems. The core idea of IPM is
to make chemical control the last resort, and even then, there must be careful consideration of the pesticide used and how it is applied.

Member States are expected to implement all the provisions of the SUD through their NAPs. But it has been a slow and uneven process. Quite different approaches have been taken across the EU. Of the first set of NAPs which had to be implemented by December 2012, 21 Member States reported risk reduction targets and nine reported use reduction targets. Only five had set measurable targets.

For example, France set very ambitious specific targets: their first NAP aimed for a 50% reduction by 2018 with respect to the 2008 usage. This goal was not achieved and ambitions were downscaled in the second NAP in 2018, now aiming for a 25% reduction in pesticides use by 2020 and a 50% reduction by 2025.

Denmark has taken a different and more sophisticated approach, aiming for a 40% reduction in pesticide load by the end of 2015, compared with the 2011 loads. This is monitored via a Pesticide Load Indicator developed in Denmark. The country is achieving its goals and taking this forward.

Given the slow pace of implementation of the Directive, it is still early to draw firm conclusions. The SUD envisaged that adoption of IPM would enable a steady reduction in the harmful effects of pesticide use by restricting synthetics to the minimum required and as a last resort. It is not clear whether this has been realised.

The slow implementation of the SUD may be partly due to the small amount of direct policy help. But what are the most appropriate indicators of success or failure of IPM? Some measures are thought to have been highly successful, for example, the training in the application and the application processes themselves. Is reduction in pesticide use a principal indicator? It has not happened in most Member States. Or is this too crude an indicator? Are we ready to conclude that there is slow progress or no progress? What inhibits IPM bringing about a reduction in PPP use?

What future strategies and innovations are needed?

There is a compelling political desire to reduce harm from pesticides, which invariably seems to imply reducing pesticides use. Is this necessarily a one-to-one relationship? What is needed to further drive IPM?

Four broad options include:

1. To what extent will digital farming and precision agriculture help?
2. What could be the role of gene editing and other new breeding techniques? This question cannot be avoided. Perhaps the usage of synthetic pesticides is reaching its limits and we should
try to build in ex-ante resistance to disease and pest attack to crop plants rather than using ex-post external correctives?

3. A third approach is to consider the role of a new, service-based crop protection model to try and change the incentives in play. The service providers could potentially take a wider, more effective approach to crop protection, less reliant on external application of synthetics.

4. The fourth approach, which is increasingly discussed, is to accept a de-intensification of agricultural production with lower variable inputs and lower yields, and therefore lower EU production, potentially matched with reductions in EU consumption. This approach would of course have important implications for agricultural trade?

Panel discussion

Adjunct Professor Michael Hamell,
University College of Dublin

The two pieces of legislation that underpin the issue are Regulation 1107/2009 on the approval of Plant Protection Products (PPPs) and Regulation 396/2005 on the maximum residue levels. Hamell suggested that the Sustainable Use Directive is the ‘cream on the cake’.

In addition, two reports on the National Action Plans: one by the Pesticide Action Network (PAN) and another by the European Commission, concur that Member States have done very little with regards to implementation.

The state-of-play of Integrated Pest Management (IPM) includes very good progress in the ‘protected crop area’, for example, in the Netherlands, 95% of the protected areas are under IPM. Other good examples are seen in Spain, in the case of tomatoes where there has been much progress and excellent research. There has also been dynamic progress in the orchards and wine sectors.

However, there has not been a lot of development in the ‘grandes cultures’ (i.e. the cereals and oilseeds crops). Even so, farmers have said that they are implementing IPM for their health, for their soil, and for economic reasons.

Do we need a change in the system?

There is a robust system in place for approving pesticides, but issues persist, mostly due to poor implementation of the Sustainable Use Directive. There has been far too much looking at IPM from the top of the pyramid (use of synthetic pesticides) instead of from the bottom (preventative and cultural approaches). In relation to that, there are three main points to focus on:

1. A better support system to help focus on the first basis of IPM (prevention, monitoring...);
2. Acknowledgement that biological control is an important part of IPM, even though the current regulatory approval system is not suitable for biologicals, hence, a better framework is needed;
3. Establishment of farmer confidence and knowledge. Some NGOs have advocated for a crop insurance scheme as a solution to help farmers implement IPM.
The current challenge is to implement IPM. The drivers of change here are the consumers. But also, industry must set out its vision for what it sees for the future, as should Member States. And at the political level, the path to sustainable crop protection needs a joint effort of the different European Commission Directorates, DG ENVI, DG AGRI and DG CLIMA, as well the appropriate resources.

Professor Per Kudsk,
Head of the Crop Health Section of the Department of Agroecology, Aarhus University, Denmark

With experience in researching IPM and how farmers perceive it, Per Kudsk considers IPM an important tool to reach SUD goals.

What is IPM?

There are currently over 65 definitions. IPM is combining different suppressive tactics with the ultimate goal of reducing reliance on PPPs. It is about integrating different available methods, which makes a lot of sense from an agro-economic point of view. The high reliance on PPPs creates problems like resistance. IPM is a tool that can handle this and an important driver for farmers. By reducing reliance on PPPs, their use and associated risks could also be reduced.

There have been many activities in countries that are developing IPM tools. However, a method to use these tools and to combine them in effective IPM strategies is still missing. Strategies should be developed at the same speed as we are losing, or are expecting to loose, active substances as a result of the application of the more stringent approval regime. For example, in Denmark, it is known that 60% of currently used active substances are up for re-evaluation in the next two years, so things can change quickly.

IPM is knowledge-intensive. A Plant Protection Product (PPP) often has to be replaced by a combination of tools. PPPs tend to be reliable and effective, they work every time and are therefore attractive for the certainty they give farmers. Alternative methods are generally less reliable. Knowledge is needed and farmers do not always succeed, which makes knowledge transfer and training very important.

We currently tend to have a vertical integration through the crop production chain from input supplier to farmer, to processor/retailer, while we may also need a more horizontal coordination amongst farmers for crop protection.

IPM having to be region-specific and crop-specific adds to its complexity. A system approach of looking at agricultural research is required for IPM. But in the past, there has not been much success with system approaches in agriculture, only specific success factors. An IPM indicator should be developed, such as a credit system or a check list, something that could also be used by farmers as a self-evaluation tool.
The development of IPM is a continuous process. We always want to go forward, but we must except to sometimes take a step back (when new pests arise), until a new solution is found.

Dr. Klaus Kunz,
Head of Sustainability and Business Stewardship, Bayer Crop Science

There is a shared responsibility to close the gap between what farmers need and what society expects. Biodiversity and climate change are critical topics, which are critical to all product developments. At the same time, safe and affordable food has to be produced. In addition, the farming profession has to stay attractive enough for the next generations. There are multifactorial reasons for biodiversity loss, such as land use.

The agricultural supply industries can make a contribution. Digital farming and precision application bring high expectations for input reduction. This applies to all types of variable inputs: water; fertilisers; and Plant Protection Products (PPPs). These should only be applied when needed and in the amount that is needed. A great opportunity in this sense includes the trust that these technologies can help to regain: new data generated through digital farming can provide new insights.

Biotechnology brings forward another big opportunity. There is a current black and white vision on this topic, implying that opportunities are being missed. Plants produced by genome editing cannot be distinguished from plants produced naturally. These opportunities are currently left out of the conversation.

Digital farming and biotechnologies are opportunities for crop-protection applications. The farmer should not be left out due to an over-emphasis of the environmental point of view.

Food for thought
Janet Potočnik

The Intergovernmental Panel on Climate Change (IPCC) is giving us 12 years. The need for change is present, however, the urgency is still missing. The EU’s Multi-annual Financial Framework (MFF) is the only instrument at hand to make real change, but the current plans for the 2020-2027 MFF are not sufficient to address the change needed, and when the following MFF comes about in 2027, it will be too late.

On one hand, natural capital and nature are not valued. On the other, different signals are sent to economic actors, with regulation sending them in one direction and economic incentives - in another. Regulation and economic incentives need to be aligned.

“We don’t need cars, we need mobility. [...] We don’t need plant protection products, we need protected plants. This approach will lead to different kinds of economic models. Fewer resources would mean less pollution, and the same profit for the producer.” Janet Potočnik
Discussion session

Precision and digital farming as part of the solution

Q: Precision farming implies fewer inputs, but it mostly focuses on the product application. Is there additional potential, for example, in managing the crop system, planting at the right time, depending on the soil conditions and environmental conditions? In other words, can precision farming and digital farming offer more?

A: The panel members acknowledged that: precision farming and digital farming can indeed offer more; that data collection on the soil conditions is extremely valuable; and that this is an area which should also be exploited.

Examples in California include mapping of field properties and finding the right timing for the soil and water for external input application. Such developing technologies need to be explored. Precision sowing can also offer solutions in terms of identifying which area of the field needs which type of seed.

Examples of the importance of precision agriculture include recent advances in apple orchards where the trees were developed to reduce pest build-up and require less indirect spraying. However, before moving directly to technological solutions, many hurdles at the base level, such as replacing continuous cropping by rotations, need to be addressed first.

Bringing the discussion on a global level

Q: In practical terms, talking about the European approach is good, but the world is interdependent in terms of trade. Has RISE given thought to having this discussion on a more global level? Experience has shown that it is important to have a joint discussion at an early stage.

A: Allan Buckwell acknowledged the importance of this aspect, while pointing out the need for each country to deal with its society. EU citizens want to take the most stringent approach and other parts of the world are less precautionary.

Additionally, a previous common, global risk-based approach to regulating pesticides is now being moved away from. More localised regulations are developing, which is not the good way forward and the approach should change direction again.

Prohibition of aerial spraying

Q: The prohibition of aerial spraying in the EU since the Sustainable Use Directive also precludes precise spraying with drones. How to address this issue?

A: Regulations may have to be re-appraised as new technologies develop or circumstances change. These matters are not static.

What IPM should cover

Q: It was suggested that prevention should be the basis of IPM, yet the discussion on IPM often quickly changes to gene editing and precision farming. Shouldn’t organic farming be mentioned? Perhaps a synthesis of the best practices of organic farming and best use of chemicals as a last resort could be a solution, reconciling these two types of farming.
A: Klaus Kunz replied that biological treatments are something that Bayer invests in. Still, one should ask the question: What is the best treatment? It could be this product or that product, independent of the question whether it is synthetic or biological. One should go for the best choice of solution. Per Kudsk agreed with the member of the audience that conventional agriculture can learn a lot from organic agriculture.

IPM is complex and advisory services on the whole have been in decline, we need more publicly funded advisory services. We cannot expect farmers to have this knowledge.

Regionalised issue vs. a common solution

Q: IPM is a system approach and at the same time, it is region- and crop-specific. Is there a conflict handling this at the EU level, although the problem is regionalised?

A: Per Kudsk agreed with the dilemma, giving the example of Denmark where they could have never achieved what they did without the Danish Advisory Service. Additionally, developing IPM indicators implies that a crop-specific and regionally applicable indicator needs to be adopted. And this should be adopted in a national approach.

Concluding remarks

- More comprehensive information is needed on what pesticides are being used for which crops, against which threats, and with what effects. The current data is inadequate to properly assess the state of crop protection.
- IPM is knowledge-intensive, but where is this knowledge coming from? Can the European Commission’s DG ENVI, DG AGRI and DG CLIMA provide a common understanding or even a common strategy? IPM is multi-dimensional, but we are not discovering this integration sufficiently because we do not have the right model to start with. What would be the service sector that could provide protection to the land? If we would have it, we would not have these fragmented businesses. Is a completely new approach needed?
- There is a clear signal from the European society to reduce the risks associated with pesticide use. Reducing the harm means reducing dependence on Plant Protection Products. Yet, the quantities used are not decreasing. Is the EU society asking for something that is not possible?
- Should we look at agriculture from a different perspective: from the organic, agroecology or agroforestry perspective?
- Do we have to go a lot further, looking at precision farming or even at new breeding techniques? Where in this picture do we want to be? We have been talking about where to improve, but is this sufficient?
- We have not talked about consumers and the food industry. Do they have a role in this?

“We welcome input and suggestions on all these questions, if you can provide it,” Allan Buckwell concluded.