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PART 1/2

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT REPORT

Accompanying the document

Proposal for a Regulation of the European Parliament and of the Council

on the sustainable use of plant protection products and amending Regulation (EU) 2021/2115

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Glossary

Term or acronym	*Meaning or definition*
ADI	Acceptable daily intake
BAT	Best available technology
BTSF	Better Training for Safer Food
CAP	Common Agricultural Policy
CAPRI	Common Agricultural Policy Regional Impact
CWP	Commission Work Programme
DG	Directorate-General
DG AGRI	Directorate-General for Agriculture and Rural Development
DG SANTE	Directorate-General for Health and Food Safety
ECA	European Court of Auditors
EEA	European Environment Agency
EFSA	European Food Safety Authority
EFTA	European Free Trade Association
EPRS	European Parliamentary Research Service
ESTAT	Eurostat: European Statistical Office
EU	European Union
F2F target 1	First Farm to Fork Strategy pesticide use and risk reduction target to reduce the use and risk of chemical pesticides by 50% by 2030
F2F target 2	Second Farm to Fork Strategy pesticide use and risk reduction target to reduce the use of the most hazardous pesticides by 50% by 2030
FADN	Farm accountancy data network
FAO	Food and Agriculture Organization of the United Nations
FAS	Farm advisory system

FSDN	Farm sustainability data network
FTE	Full-time equivalent
GAEC	Good Agricultural and Environmental Condition
GAP	Good Agricultural Practices
GIS	Geographic information system
GMO	Genetically modified organism
GNSS	Global Navigation Satellite Systems
GPS	Global positioning system
H2020	Horizon 2020
HBM4EU	Human bio-monitoring for EU
HRI	Harmonised risk indicator
HRI 1	Harmonised risk indicator 1
HRI 2	Harmonised risk indicator 2
iMAP	Integrated agro-economic modelling platform
IPCHEM	Information platform for chemical monitoring
IPM	Integrated pest management
ISSG	Inter-service steering group
JRC	Joint Research Centre of the European Commission
LUCAS	Land use/ cover area frame statistical survey
MRL	Maximum residue level
MS	Member State
NAP	National action plan
NGEU	Next Generation EU
NGO	Non-governmental organisation
NGT	New genomic technique
NSP	National strategic plan

OCR	Official Controls Regulation
OECD	Organisation for Economic Cooperation and Development
PAE	Pesticide application equipment
PBT	Persistent, bio-accumulative and toxic
PPP	Plant protection product
REACH	Registration, evaluation, authorisation and restriction of chemicals
RSB	Regulatory Scrutiny Board
SAIO	Statistics on agricultural inputs and outputs
SDG	Sustainable Development Goal
SME	Small and medium enterprise
SO	Specific objective
SPS	Sanitary and Phytosanitary
SUD	Sustainable use of pesticides Directive
TFEU	Treaty on the functioning of the European Union
UAA	Utilised agricultural area
UN	United Nations
USDA	United States Department of Agriculture
VAT	Value-added tax
WHO	World Health Organization

1. INTRODUCTION: POLITICAL AND LEGAL CONTEXT

1.1. Overall context

The European Green Deal[i] announced that all EU policies should contribute to preserving and restoring Europe's natural capital[ii], and that the Farm to Fork Strategy[iii] would reduce the environmental and climate footprint of the EU food system and lead a global transition to competitive sustainability of the food production system. Biodiversity[iv] loss and ecosystem collapse are one of the biggest threats facing humanity in the next decades. The world lost an estimated €3.5-18.5 trillion per year in ecosystem services[1] from 1997 to 2011 owing to land-cover change[v], and an estimated €5.5-10.5 trillion per year from land degradation[2]. Biodiversity is crucial for safeguarding EU and global food security, underpins healthy and nutritious diets and improves rural livelihoods and agricultural productivity[vi]. Biodiversity loss threatens food systems, putting food security and nutrition at risk[3]. The long-term trends observe a major decline in biodiversity in Europe. Agricultural intensification, intensive forest management and land abandonment or urban sprawl[4] lead to a loss, fragmentation and degradation of natural and semi-natural ecosystems. In a recent survey 65% of EU citizens identified the destruction of natural habitats or the loss of animals or plant species as an immediate and urgent problem for rural areas.[5]

Environmental (e.g. pollinator decline, biodiversity loss) and health (potential exposure to pesticides) problems identified at the time of adopting the Sustainable Use of Pesticides Directive (SUD)[vii] in 2009 have remained unchanged or even been aggravated[viii]. The SUD aimed to address these problems, by promoting a more sustainable use of pesticides in Europe. While pesticides are often considered a quick, easy, and inexpensive solution for controlling weeds and pests in both rural and urban landscapes, pesticide use comes at a significant cost. Pesticides have contaminated many parts of the environment with residues found in soil and air, in surface and ground water[ix]. The use of pesticides is a matter of strong concern for society and

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[1] Green Infrastructure - Environment - European Commission (europa.eu)

[2] Factsheet: Economic impact of biodiversity, (europa.eu)

[3] Factsheet: EU 2030 Biodiversity Strategy (europa.eu)

[4] Abundance and distribution of selected species in Europe (europa.eu), environmental indicators, designed by the European Environment Agency to support all phases of environmental policy making.

[5] A long term vision for EU rural areas - June 2021 - - Eurobarometer survey (europa.eu)

among European citizens[xxi]. A 2017 European Citizens Initiative[6] with more than one million signatures called on the Commission to propose to Member States a ban on glyphosate (a herbicide[xii]), to reform the pesticide approval procedure, and to set EU-wide mandatory reduction targets for pesticide use. While there will be cases where resort to the use of pesticides is necessary, EU policies are directed at protecting human and animal health, protecting the environment and ensuring a sustainable use of pesticides if they are needed[xiii]. The foresight study[xiv] accompanying this impact assessment highlighted the complex landscape surrounding pesticide use and confirmed the diverse and polarised views among stakeholders on this topic. The European Citizens Initiative "Save Bees and Farmers"[xv][7] calls on the Commission and European Parliament to act for the use of synthetic[xvi] pesticides to be gradually reduced by 80% in EU agriculture by 2030 and completely phased out by 2035. Not using any pesticides, such as fungicides[8], can jeopardise plant health and human health due to the development and effects of plant toxins and mycotoxins[9]. However, numerous experiences[xvii] show that it is possible to phase out chemical pesticides, or to reduce very considerably their use, without negative impacts on the economy. Moreover, a large amount of additional research is ongoing to find alternatives to chemical pesticides, which will facilitate the switch to non-chemical alternatives, and new legislation, announced under the Farm to Fork Action Plan, is also being produced to make the authorisation procedure for these products easier. In organic farming systems pesticide input can be reduced by 97% and enhanced soil fertility and higher biodiversity may render these systems less dependent on external inputs[xviii]. The European Commission target to have at least 25% of the EU's agricultural land under organic farming and a significant increase in organic aquaculture by 2030[xix] is relevant in this context.

The European Green Deal announced the aim of reducing the use and risk of chemical pesticides in general, and the use of more hazardous pesticides in particular. In the Farm to Fork Strategy[xx], Biodiversity Strategy[xxi], the Zero Pollution[xxii] Action Plan, and the Soil Strategy[xxiii] the Commission committed to take action to reduce by 50% the overall use of and risk from chemical pesticides by 2030 and reduce by 50% the use of more hazardous pesticides by 2030. The Biodiversity Strategy aims to protect nature

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[6] Stop Glyphosate - European Citizens' Initiative to Ban Glyphosate,

[7] 1,2 million signatures counted.

[8] Fungicides are chemical compounds or biological organisms used to kill parasitic fungi or their spores.

[9] Mycotoxins are toxins produced by fungi which are capable of causing disease and death in both humans and animals.

and reverse the degradation of ecosystems. Biodiversity is suffering from inputs of nutrients, chemical pesticides, pharmaceuticals, hazardous chemicals, urban and industrial wastewater, and other waste including litter and plastics into the environment and all of these pressures must be reduced. The pesticide reduction targets are also relevant for meeting the objectives of the EU Pollinators initiative[xxiv].

As outlined in the Commission's Zero Pollution Action Plan for water, air and soil, pollution must be better prevented, remediated, monitored and reported. The EU Chemicals Strategy[xxv] for sustainability is a central element of the EU's zero pollution ambition. It aims to better protect citizens and the environment and boost innovation for safe and sustainable chemicals as well as better accounting for the cocktail and combined effect of chemicals when assessing their risks[10]. Council conclusions on the Farm to Fork Strategy[xxvi] called for the prudent and responsible use of pesticides. A European Parliament Resolution[xxvii] of February 2019 stated that the EU "*must act without delay to transition to a more sustainable use of pesticides*" and called on the Commission to propose an ambitious EU-wide binding target for the reduction of pesticide use. The European Parliament re-affirmed its call for binding reduction targets in its resolution of 20 October 2021 on a Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system[xxviii].

The foresight study accompanying this impact assessment explored possible future scenarios on the use of pesticides considered to represent plausible scenarios. Key insights included that policy strategies need to be equipped with adequate incentives as well as implementation and monitoring strategies. Pesticide use needs to be managed in the longer term, considering innovation, public understanding and consumer demands. Regulations should support a level playing field for farmers across the EU aiming to build a consensus among stakeholders concerning the use of pesticides in the future.

1.2. Specific context

Plant protection products are pesticides that are used to protect crops against pests, diseases, or competing plants with the aim of optimising food production in conventional or organic farming[xxix]. Pesticides are also used to maintain food quality (e.g. during storage) or to maintain certain areas in the condition needed for their proper functioning (e.g. railways, golf courses). Pesticides can be of chemical or non-chemical origin (e.g. micro-organisms) and their residues in food and feed can be harmful to consumers.

[10] Combination effects of chemicals - Environment - European Commission (europa.eu)

Sales and use of pesticides across Europe vary greatly depending on the type and level of agriculture, with France, Germany, Italy and Spain being the highest users with 68% of the total EU sales market for pesticides. A breakdown of pesticide sales by Member State is presented in Annex 5 (Table 21). The European crop protection market is also highly consolidated, with the major companies accounting for more than 50% of the market share[xxx]. It is estimated to have an annual growth rate of 4.1% during a forecast period of 2021-2026[xxxi]. Industry is expecting a higher demand for biopesticides due to an increasing demand for organic and sustainable foods. The market in biocontrol agents is growing rapidly. Between 2016 and 2019 the EU market for macroorganisms increased by 70%, for microbials by 228% and other substances 3-400%[xxxii]. Between 2020 and 2025 an annual growth rate of 11.3% is predicted[xxxiii] and between 2011 and 2017 this category represented around 50% of new applications for approvals of active substances received by the European Commission (see also Annex 5, Figures 16-18). Evidence is accumulating that in many cases such alternative products can effectively substitute the use of chemical pesticides. Data from Spain[xxxiv] show that the use of chemical pesticides in vegetable production in Almeria has been reduced by approximately 55% and that over 80% of crops grown in winter now depend on biological control to solve pest problems Almeria has more than 30,000 hectares of vegetable production and since 2005, the area of crops using biological methods against pests has increased from around 120 ha to 26,500 ha in 2021.

Due to their potentially harmful effects, plant protection products are strictly regulated in the EU to provide a high level of protection to the environment and to the health of everyone in the EU. The SUD forms together with legislation on pesticide authorisation[xxxv], residues[xxxvi] and statistics[xxxvii] a framework which is considered to be amongst the most stringent systems in the world[xxxviii].

Pesticide authorisation

Pesticides are authorised in a two-step system that reflects the principle of subsidiarity (see Annex 6). In the first step, the active substance of a pesticide is approved at EU level, provided it is demonstrated that at least one use with a formulated product is safe. In the second step, Member States authorise plant protection products containing the active substance for specific uses, according to specific standards (the so-called uniform principles[xxxix]) and good agricultural practices (GAP). The Member States consider local agricultural and geographical/climatic differences when authorising PPPs.

Pesticide use

The SUD provides the framework rules on the use of pesticides. It aims to reduce the risks and impacts of pesticide use on human health and the environment. It also aims to

promote the use of integrated pest management (IPM) and alternative approaches or techniques, such as non-chemical alternatives to pesticides. The use of pesticides at farm level should be recorded in line with Article 67 of Regulation (EC) No 1107/2009[xl].

The application of IPM is a legal requirement under the current SUD but is not systematically recorded nor required to be recorded in most Member States. The level of official controls on pesticide use in Member States is limited. Even though the use of pesticides is legally required to be recorded at farm level, these data are not systematically collected or analysed leading to the lack of available comparable data on the use of specific plant protection products (e.g. how, when, where, why they are used, and the exact products used).

Pesticide statistics

Statistics on the placing on the market of pesticides based on data collected at Member State level are transmitted to ESTAT which validates those data and produces annual statistics on pesticide sales, and every five years on pesticide use, in agriculture in accordance with Regulation (EC) 1185/2009[xli]. In February 2021 the Commission adopted a proposal for a Regulation on statistics on agricultural inputs and outputs (SAIO) of the agricultural sector to inter alia replace the existing Regulation (EC) 1185/2009 . The proposal is pending adoption by the legislators. The main changes, if compared to Regulation (EC) No 1185/2009, are the annual collection of the data on pesticide use in agriculture and removal of the obligatory aggregation of active substances into major groups, categories of products and chemical classes before publication. SAIO would allow the Commission to publish data on the sale and use of pesticides, at the level of individual active substances provided that regular statistical confidentialty allows this.

Consequently, the Commission would have accurate data on:

- Annual sales of pesticides, broken down by active substance,
- Annual use of pesticides in agriculture, broken down by active substance.

Pesticide residues

Finally, the Regulation on pesticide residues regulates the residues that are left on crops. It does this by setting maximum residue levels (MRLs) at EU level to protect all consumers, including vulnerable groups. MRLs apply to all products placed on the EU market, including imports.

Pesticide enforcement and control

Member States enforce compliance with the legislation in line with the Official Controls Regulation[xlii]. Illegal import and use of EU-banned pesticides from abroad and residues of EU-banned pesticides in imported foodstuffs are addressed via the legislation on pesticide authorisation and legislation on residues. The European Commission performs audits in Member States to check implementation and national control systems[11].

Specific requirements of SUD

The SUD[xliii] sets out requirements to reduce the use and risks of pesticides, introducing specific provisions such as:

- Establishment of Member State national action plans (NAPs) to set objectives to reduce hazards, risks and dependence on chemical control for plant protection;
- Union-wide principles on IPM, and establishment of necessary conditions for implementation of IPM[12];
- Specific measures to protect the aquatic environment from pollution by pesticides and defining areas of significantly reduced or zero pesticide use and to protect sensitive groups;
- Measuring progress in risk reduction through appropriate harmonised indicators;
- Creating a system of training and awareness-raising for distributors and professional users of pesticides;
- Appropriate handling and storage of pesticides and their packaging and remnants;
- Regular inspection of pesticide application equipment (PAE) in order to reduce adverse impacts of pesticides on human health (in particular as regards operator exposure) and the environment during application;
- Prohibition of aerial spraying of pesticides, with derogations being possible, aiming to limit the risks of adverse impacts on human health and the environment, in particular from spray drift.
- Distributors selling pesticides to non-professional users need to provide general information to such users regarding the risks for human health and the environment of pesticide use.

Domestic use of pesticides by non-professional users is covered by the current SUD.

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[11] Health and Food Audits and Analysis (europa.eu)

[12] The SUD defines IPM as careful consideration of all available plant protection methods and subsequent integration of appropriate measures that discourage the development of populations of harmful organisms and keep the use of plant protection products and other forms of intervention to levels that are economically and ecologically justified and reduce or minimise risks to human health and the environment. IPM emphasises the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms.

1.3. SUD's interaction with other EU policies and instruments

This impact assessment takes place in the context of several parallel strategies at EU level. Concerning coherence, the evaluation accompanying this impact assessment found that the internal and external coherence of the SUD with other EU policies and instruments is generally strong with no major inconsistencies or overlaps. The evaluation found that the objectives of the SUD were, and still are, highly relevant to address the risks posed by pesticide use to the environment and human health. A large number of current or upcoming Commission initiatives link to the objectives of the SUD (see Annex 5 and in particular Table 25).

Common Agricultural Policy (CAP)

The evaluation found that the link between the SUD and the CAP is strong in theory, but weak in practice. Measures under the CAP could incentivise farmers to use pesticides more sustainably but have only been used to a limited extent. Under the new CAP (due to be implemented from 1 January 2023) Member States will set out National Strategic Plans (NSPs) which shall contribute to achieve the ambitions from the Green Deal and the linked strategies on Farm to Fork and Biodiversity. Member States will be able to fund actions in line with the Farm to Fork Strategy pesticide reduction targets, for example, on IPM. Member States can provide financial support to sustainable farming practices[13]. All CAP payments received by the farmer are linked to complying with basic EU legal requirements including the SUD, with 90% of farmers and agricultural area, and thus the majority of professional pesticide users, being covered under the CAP. Non-compliance leads to possible reductions of CAP payments in case of infringement. Eco-schemes of voluntary support to be offered by Member States to farmers will represent 25% of the total CAP direct payments budget. The level of support will be decided by the Member States. Such eco-schemes can be used to better achieve the objectives of the SUD. Financial incentives are also possible with rural development instruments and market measures, e.g. for practices, investments and risk management. The CAP also foresees technical support to farmers through knowledge exchange (e.g. European Innovation Partnerships) and advice (Farm Advisory Services). The Commission aims to facilitate the identification of farming practices which must or may be implemented by farmers to comply with IPM principles. This will also facilitate making the link with the CAP and in particular Good Agricultural and

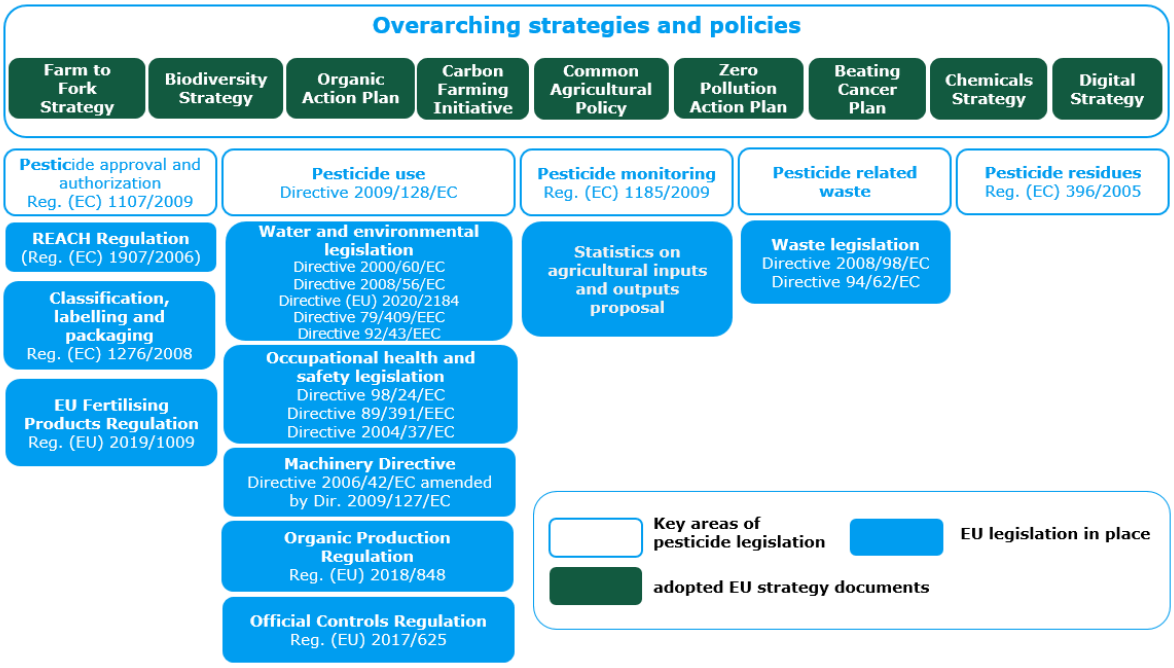
[13] Reduced or ban of use of pesticides – Use of Integrated Pest Management beyond the obligations under the SUD – Longer multiannual rotation and diversified crops – Payments for investments for pesticides management and localized spraying – Payments for training and advice – Conversion to organic farming, etc… But also – Investments for precision spraying equipment – Financing risk management – Contributing to advice, cooperation and monitoring systems, etc.

Environmental Condition (GAEC) 8, which provides for farming practices relevant to IPM, such as biodiversity areas. The CAP is implemented by NSPs, which must describe the implementation of GAECs, the support schemes and their baseline.

Environmental and chemicals policy

The SUD interacts with a number of environmental policies and legislative acts, for example planned nature restoration targets[14], pollinators initiative[xliv] to address the decline of pollinators in the EU and contribute to global conservation efforts, the lists of pollutants and regulatory standards in the Environmental Quality Standards[xlv], Groundwater[xlvi] and Water Framework Directives[xlvii]. Possible contamination of water by pesticides is also a relevant issue for the planned revision of the Urban Waste Water Treatment Directive[xlviii]. Associated objectives are also furthered by EU rules dealing with the health and safety of workers, pesticide users and bystanders, protection of the environment, habitats, birds and water etc. (see Figure 1).

Figure 1. Interaction of the SUD with other EU legislation and policies relevant to plant protection products (under the responsibility of various Commission DGs)



[14] EU nature restoration targets (europa.eu)

1.4. Link with the UN Sustainable Development Goals

The objectives of reducing the use and risk of pesticides, to protect health[15] and the environment, are relevant to the Commission's ambition[xlix] to deliver on the UN Sustainable Development Goals[16] (SDGs). With cross-cutting policy areas related to the sustainable use of pesticides, direct links to SDG goals 3 (health and wellbeing), 6 (clean water), 8 (decent work and economic growth), 11 (sustainable cities) 12 (sustainable consumption and production), 14 (life below water) and 15 (life on land) can be demonstrated. At a global level, the Food and Agriculture Organization of the United Nations (FAO) published the first global assessment of biodiversity for food and agriculture in 2019, which stresses the international level of concern for biodiversity loss. FAO also support a vision of sustainable agriculture supported by the IPM approach[17].

2. PROBLEM DEFINITION

2.1. What are the problems

The evaluation[l] of the SUD found that the SUD has not achieved its overall objectives to the extent envisaged in the impact assessment accompanying the Commission proposal[li] in 2006. Reports from the Commission to the European Parliament and Council in 2017[lii] and 2020[liii] identified significant shortcomings in the implementation, application and enforcement of the SUD in Member States. While the objectives of the SUD were, and still are, highly relevant to address the risks posed by pesticide use to the environment and human health, its relevance is hampered by its uneven implementation and limited effectiveness. A study[liv] by the European Parliament Research Service (EPRS) found progress in many Member States but a limited overall achievement of the SUD's objectives. A recent special report[lv] from the European Court of Auditors (ECA) on the sustainable use of plant protection products found that there is limited evidence of risks from the use of pesticides being reduced. The European Green Deal, Farm to Fork Strategy, Biodiversity Strategy and Zero Pollution Action Plan have all acted to highlight and even increase the relevance of the SUD to reduce the impacts of pesticides across air, water and soil that lead to harm to both health and biodiversity. These strategies also highlight the need to transition to a sustainable food system with resulting environmental, health and social benefits, while offering

[15] Both human health and animal health are considered relevant.

[16] Department of Economic and Social Affairs Sustainable Development, United Nations, https://sdgs.un.org/goals

[17] Plant Production and Protection Division: What is Integrated Pest Management (fao.org)

economic gains and ensuring a sustainable livelihood for primary producers. Consumers primarily see 'sustainable' as a synonym for environmentally friendly, without genetically modified organisms (GMOs) and pesticides, and produced locally, with some specificities across countries[lvi].

As described in Annex 5, the negative impacts of using chemical pesticides include;

1. Environmental contamination of air[lvii], water (including coastal water[lviii]) and soil[lix][lx],
2. Negative impacts on a range of non-target organisms, including in soil and water, with corresponding biodiversity loss.
3. Possible negative health impacts caused by exposure of operators, residents, bystanders and consumers,

Environmental impacts

Water pollution

Pesticides can get into water due to spillages, application at or near watercourses, or through surface runoff or seepage into groundwater. Studies have shown an increase in the toxicity of applied insecticides to aquatic invertebrates[lxi] (see also Annex 5). Effects can be on watercourses or in groundwater potentially used for human consumption. In European countries, for rivers and lakes, one or more pesticides were detected above their effect threshold at 13 to 30% of all surface water monitoring sites each year between 2013 and 2019[lxii]. Exceedances of one or more pesticides were detected between 3 to 7% of groundwater monitoring sites. A study across 101 sites of small lowland streams in Germany revealed that 83% of agricultural streams did not meet pesticide-related ecological targets and that agricultural non-point-source pesticide pollution was the major driver in reducing vulnerable insect populations in aquatic invertebrate communities[lxiii]. Water industry case studies refer to examples of additional activated carbon filtration and ozonation due to pesticides in drinking water resources costing a water processing company EUR 50 M in the period 2018-2020[lxiv]. Another case study[lxv] examined the case of a UK water operator which found the pesticide metaldehyde in its treated drinking water and failed to meet the drinking water Directive limit value for the indicated pesticide threshold. Treating the water for metaldehyde would have cost €612.4M, entailing a 21% increase in consumer water bills. As an alternative to treating the water, the company used financial incentives to address the cost barriers to farmers to use an alternative to metaldehyde. This alternative cost €16.6M, 3% of the alternative cost of treating the water. A recent paper[lxvi] claims that various infrastructural, institutional and behavioural "pesticide lock-ins" hamper more effective actions being taken in this area.

Air pollution

Airborne levels of pesticides are also a concern[lxvii]. A recent study[lxviii] has shown for example that airborne pesticide mixtures are ubiquitous in Germany. Samples were collected in 2019 and analysed for over 500 substances, 109 substances were detected, including 28 that are not authorised for use in Germany. There is evidence that pesticides and their related substances can travel through the air at least in the medium and possibly also in the long range (see further details in Annex 5).

Soil pollution

Soil hosts more than 25% of all biodiversity on the planet[lxix] and is the foundation of the food chains nourishing humanity and above ground biodiversity. An estimated 60 to 70% of soils in the EU are not healthy[lxx]. Land and soil continue to be subject to severe degradation processes[lxxi] mainly due to unsustainable land use and management, overexploitation and emissions of pollutants including pesticides[lxxii]. Pesticide levels in EU soil samples are significant[lxxiii] and of concern.

In a 2015 study[lxxiv], the distribution of 76 pesticide residues was evaluated in 317 agricultural topsoil samples from across 11 EU Member States and 6 main cropping systems. Over 80% of the tested soils contained pesticide residues (25% of samples had 1 residue, 58% of samples had mixtures of two or more residues), in a total of 166 different pesticide combinations. Glyphosate and its metabolite AMPA, DDTs (DDT and its metabolites) and the broad-spectrum fungicides boscalid, epoxiconazole and tebuconazole were the compounds most frequently found in soil samples and the compounds found at the highest concentrations. The need for strategies to reduce the load of pesticides on agricultural soils, as well as for systematic pesticide monitoring, is the conclusion of another study[lxxv] carried out in 2015 in the Czech Republic, where arable soils were found to frequently contain multiple residues of pesticides at noticeable levels several months following the last possible application. A recent study[lxxvi] concludes that the occurrence of currently used pesticides in the soil of agricultural regions is alarming in many countries.

Biodiversity

The evaluation of SUD concluded that, while it has contributed to reducing the risks of using pesticides to human health and the environment, there is a continuing trend of a decline in biodiversity. Biodiversity is declining across the EU[lxxvii,lxxviii] and chemical pesticides contribute to this biodiversity decline[lxxix]. In the EU, a reduction of species, in particular insects and pollinators has been observed[lxxx] (see also Annex 5). It is estimated that 75% of global food crop types rely on animal pollination and 50% of land in the EU cultivated with crops dependent on pollinators faces a pollination

deficit[lxxxi] [lxxxii]. A study[lxxxiii] on the effects of agricultural intensification on biodiversity carried out in eight European countries concluded that out of the 13 studied components of agricultural intensification, use of pesticides, especially insecticides and fungicides, had the most consistent negative effects on the species diversity of plants, ground beetles and ground-nesting farmland birds, and on the potential for biological pest control. In agricultural areas, there is a negative relationship between pesticide use and pollinator abundance, group richness, and diversity[lxxxiv]. Certain pesticides not only affect pollinators but ultimately crops that depend on them for pollination. Pesticides were found to affect their productivity, the abundance of floral visitors, and the mass of fruits; seed quantity and quality were significantly lower after treatment with pesticides. Exposure to such pesticides can be lethal or sublethal with chronic detrimental effect on the individual pollinator and the colony. What pesticides do to pollinators not only impacts their health and life span but also their abilities to function and live together due to several impairments resulting ultimately in colony collapse. Biodiversity enables farmers to produce safe, sustainable, nutritious and affordable food, providing them with the income they need to thrive. The ongoing decline in biodiversity and the degradation of ecosystems in the EU in the last ten years, poses threats to food production systems, and ultimately to food security.

Health effects

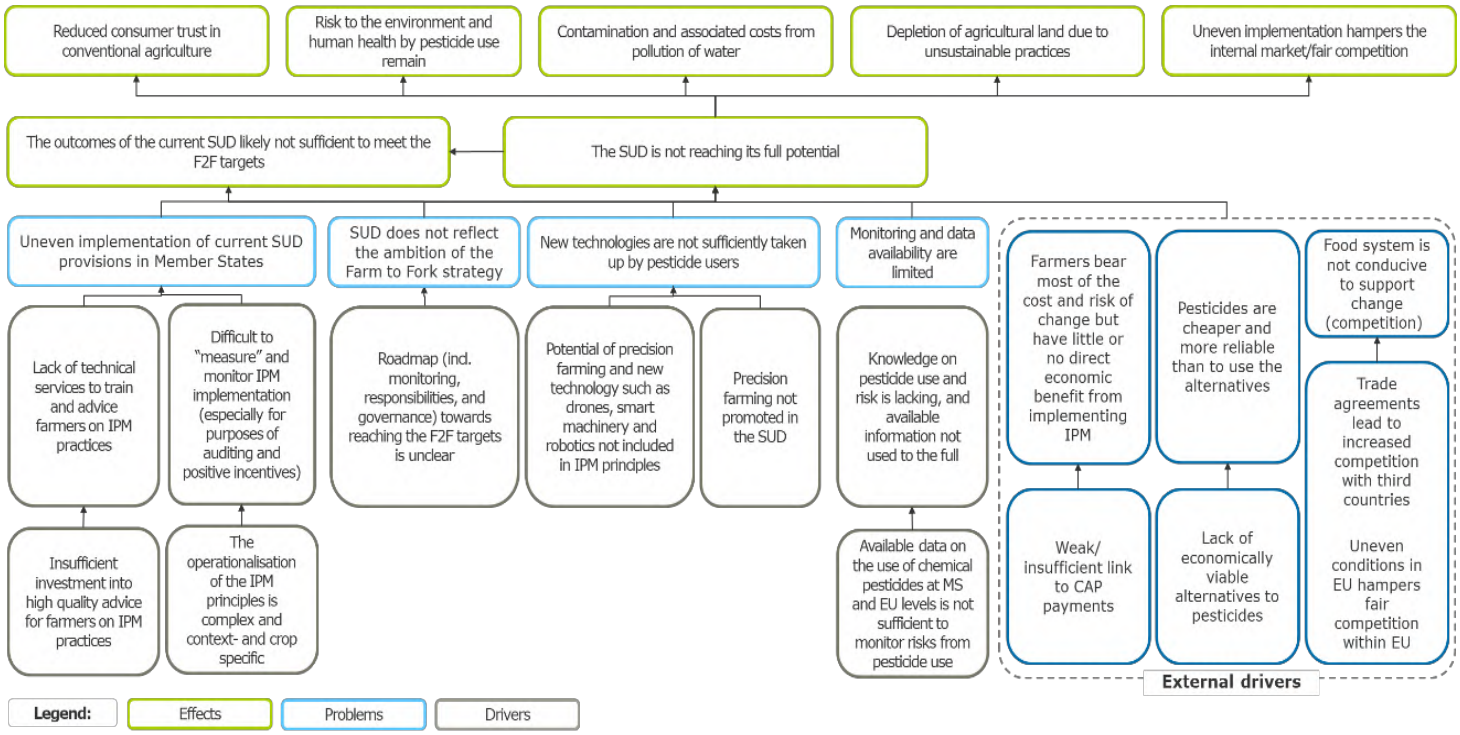
Pesticides can cause both acute and long-term health impacts. Chemical pesticides can have dermatological, gastrointestinal, neurological, carcinogenic[lxxxv], respiratory, reproductive, and endocrine effects.[lxxxvi][lxxxvii] High occupational, accidental, or intentional exposure to pesticides can result in hospitalisation and death. Already in 1990, the World Health Organization (WHO) estimated that about one million cases of unintentional pesticide poisonings occur annually, leading to approximately 20,000 deaths[lxxxviii]. Occupational exposure is likely to be the most common source of exposure that results in unintentional acute intoxication. A recent review estimates that about 385 million cases of unintentional acute pesticide poisonings occur annually world-wide including around 11,000 fatalities[lxxxix]. As described in Annex 5, there are a number of cases in which chemicals, initially believed to be safe, ultimately proved to be harmful for human health and / or the environment and their use had to be restricted or forbidden[xcxci]. As an example, a recent decree in France has now classified prostate cancer after exposure to chlordecone as a professional/occupational disease[18].

The problem tree

[18] Décret n° 2021-1724 du 20 décembre 2021 révisant et complétant les tableaux de maladies professionnelles annexés au livre VII du code rural et de la pêche maritime - Légifrance (legifrance.gouv.fr)

The problem tree (Figure 2) provides the graphical representation of the problem analysis, focussing mainly on the risks from pesticides used in agriculture. The SUD regulates the use of pesticides, while the current monitoring framework does not collect, at EU level, data on the use of pesticides. Therefore, the exact proportion of total pesticide use at EU level within agricultural production, as opposed to other uses, is not known[xcii]. However, based on stakeholder consultations[xciii], it is assumed that approximately 90% of total pesticide use in the EU is in agriculture, with the rest in other areas such as forestry, urban green areas, sports grounds, and along roads and railways.

Figure 2. Problem tree



The evaluation of the SUD identified four main problems

1) The SUD does not reflect the ambition of the European Green Deal, Farm to Fork Strategy, Chemicals Strategy and the Zero Pollution Action Plan

The SUD did not include an overall pesticide use and/or risk reduction target. In 2017 the Commission[xciv] encouraged Member States to review and improve the quality of their NAPs, by establishing specific and measurable targets and indicators at national level, which they had been required to do in the SUD. These targets would then allow Member States to monitor progress in the implementation of the SUD, and to adjust their strategy where necessary. The Commission's 2020 report found that only three Member States identified useful targets based on a review of their initial NAPs. It is

clear that the SUD does not reflect the strengthened ambitions in the Farm to Fork Strategy to achieve specific pesticide use and risk reduction targets by 2030, as well as to accompany farmers in the transition towards a more sustainable production system. Similarly, it does not do enough to support the long-term objective for a zero pollution ambition for a non-toxic environment. It is therefore unlikely, as confirmed by stakeholder views,, that the ambition of the European Green Deal can be achieved with the current provisions of the SUD[xcv].

2) Monitoring and data availability are limited

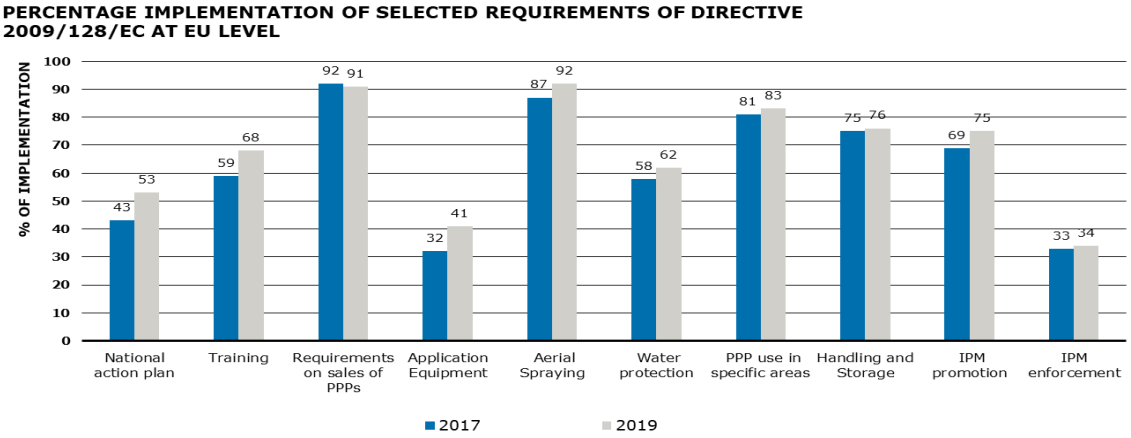
Limitations on pesticide use data arise in part from the lack of (1) systematic data transfer between professional pesticide users required to record such use and Member States, and subsequently between Member States and the EU level; (2) harmonisation in the aggregated dataset that would allow an analysis of trends overtime at the EU level. While professional users are required to keep records on pesticide application under the legislation on pesticide authorisation[xcvi], these records are not collected in most Member States. Currently pesticide use statistics collected at EU level are based on statistical surveys. Pesticide sales and use statistics available at EU level[xcvii] are aggregated by chemical classes, categories of products and major groups and confidentiality and aggregation requirements prevent disaggregating them at EU level to the level of individual active substances. The usefulness of the survey-based pesticide use statistics is limited also by a lack of harmonisation of the reference year and crops for which data are collected[xcviii]. The pesticide use statistics are collected only once in a 5-year period. Analysis of the data[xcix] showed that the currently available pesticide statistics are not sufficient to effectively monitor the progress on the sustainable use of pesticides. Improved data related to use is seen as necessary to develop meaningful indicators related to the environmental impact of pesticide use, to facilitate the identification of specific sectors, substances and practices that may need specific measures at Member State and EU level and to enhance monitoring of implementation at both Member State and EU levels.

3) Uneven and incomplete implementation of the SUD provisions in Member States

Deficiencies persist in the implementation of numerous key aspects of the SUD such as national action plans (NAPs), integrated pest management (IPM) and pesticide application equipment (PAE)[c]. IPM is not implemented comprehensively by most farmers, even though in many cases it offers not only environmental, but also economic advantages. This may be due to a lack of sufficient incentives, training and advice offered to farmers in some Member States[ci], or potentially because of a lack of available alternatives in some crop-pest combinations. The Commission's compliance-

monitoring index[cii] to quantify progress in the implementation by, and between, Member States revealed a particularly poor implementation of the SUD provisions with regard to IPM enforcement (34 % implementation by 2019), PAE (41 %) and NAPs (53 %). Qualitative assessments from stakeholders pointed to agreement with the Commission assessments of the deficiencies in implementation of the SUD[ciii]. The conclusions of the EPRS report[civ] concurred with this view.

Figure 3. Overview of implementation status of the provisions of the SUD



Source: European Commission (2020). COM(2020) 204 final, Annex. Available at: https://ec.europa.eu/food/sites/food/files/plant/docs/pesticides_sud_report-act_2020_annex_en.pdf

This lack of implementation of the SUD was also raised in public feedback[cv] on the evaluation roadmap/inception impact assessment and interviews with stakeholders[cvi]. However, as shown in Figure 12 in Annex 2, cross-targeted surveys illustrate very contrasting views among different stakeholders on the extent to which they consider that different elements of the SUD are currently implemented.

4) New technologies are not sufficiently taken up by pesticide users

Since the adoption of the SUD in 2009, various advances on precision farming techniques offer the potential to better achieve the objectives of the SUD and reduce the use and risk of pesticides. As described in Annex 5, precision farming or precision agriculture refers to agricultural management systems carefully tailoring soil and crop management to fit the different conditions found in each field[cvii]. Many technologies are now available for assessing and managing the spatial and temporal variability of the physical, biological, and chemical properties of soils. Global positioning systems, geographic information systems, yield monitors, and remote and proximal sensors can be used to identify crop variability possibly linked to pests, while automatic guidance of farm machinery and variable rate pesticide application technologies are used to target application and reduce the amount of inputs, including pesticides. The application of existing technology is seen as having the potential to significantly reduce pesticide

usage. A consensus exists among stakeholders that new technologies that could help to reduce the use and risk of pesticides should be promoted[cviii]. A recent paper[cix] concluded that decision support systems could halve fungicide use, compared to calendar-based strategies, without increasing disease risk. According to pesticide users and industry the SUD acts as an impediment to the use of such new technologies. Stakeholders[19] see a need for promotion of the uptake of technological developments in the area of digitalisation and precision agriculture[cx], as this market is expected to grow and provide new ways of detecting and controlling pests. These developments are predicted to assist in the reduced risk and use of pesticides, providing farmers with the tools to prevent and control pests in a more sustainable way.

2.2. What are the problem drivers?

The continued use of chemical pesticides to control pests is linked to multiple factors, including the well-established effectiveness and ease of use of chemical pesticides versus less hazardous and non-chemical alternatives and the overall economic pressures in the farming sector which may lead to an overreliance on pesticides as a pest control tool. Furthermore, EU farmers are subject to competition from other farmers and crop growers outside the EU who might use pesticides which are not or no longer authorised or used in the EU. While contested by environmental organisations, the prevalent perception among pesticide users appears to be that there is a lack of viable or equally efficient less hazardous and non-chemical alternatives and that chemical pesticides are cheaper and more effective or reliable than alternative methods[cxi]. This may act as a brake on the ambitions of individual Member States to pursue more strict and ambitious policies on the sustainable use of pesticides, in particular as regards alternative plant protection practices. Farmers consider that they could be exposed to risks of crop damage or pest control failures and associated financial losses if they switched to an alternative control tool which might or might not be as effective as the more hazardous pesticides that they are accustomed to using. There are 33 low-risk active substances approved for use in pesticides, and pesticides containing 23 of these substances are authorised in at least one Member State. The Commission does not currently have data on the total number of pesticides containing low-risk substances authorised in the Member States, the crops on which they are approved for use, or the proportion of pests against which pesticides containing low-risk active substances provide effective control, which is a significant limitation for

[19] 1 interviewee each from pesticide users, pesticide producers or distributors and Member State authorities, Ramboll, Study supporting the evaluation of Directive 2009/128/EC on the sustainable use of pesticides and impact assessment of its possible revision, Final Evaluation Report, Publications Office of the European Union, 2022, DOI: 10.2875/924365 p.85.

monitoring implementation and progress. While financial support is available (e.g. through the CAP), there is a perceived absence of financial or other mitigation incentives to promote the sustainable use of pesticides[cxii]. Public feedback on the evaluation roadmap and inception impact assessment[cxiii] pointed to serious deficiencies in the implementation of the SUD in some Member States and urged the Commission to introduce stricter rules, for example in the form of a regulation at EU level to increase coherence and have more binding effects on policies in individual Member States. An apparent lack of ambition is illustrated by the delays of numerous Member States to prepare and subsequently review[cxiv] and update their NAPs[cxv] and the absence of quantitative targets or objective progress indicators for the reduction of risk in these NAPs[cxvi], as required under Article 4 of the SUD. This is exacerbated by the limited human and financial resources allocated by some Member State authorities to implement the SUD nationally[cxvii]. Member States show differences with respect to the level of cooperation at different governance levels[cxviii], which is a significant issue on a cross-cutting topic such as the sustainable use of pesticides.

Although IPM is seen as a key element in the sustainable use of pesticides, and many local examples of good practice can be seen[cxix], the assessment of the actual implementation of IPM through Member State controls and corresponding enforcement has been weak[cxx]. This results in limited evidence on the effective implementation of IPM across the EU. A number of drivers could be contributing to this, for example a need for more incentives, training and advice to pesticide users on how to successfully and effectively apply IPM, a lack of clear tools to monitor the implementation and enforcement of IPM, a view among mainly pesticide users and industry stakeholders that pesticides on the market are safe and effective and that no specific actions are required to reduce their use and/or that no equally effective alternatives to chemical pesticides exist, or a wish not to disadvantage pesticide users in an individual Member State compared to other Member States or non-EU countries which have potentially less restrictive policies on pesticide use. One of the reasons cited by Member States for a poor implementation of IPM is that they have not converted the IPM general principles into prescriptive and assessable criteria to be applied by users. It should be noted that pesticide user respondents to the public consultation[cxxi] stated that, following participation to a training course, their knowledge improved considerably. Additional training could therefore also be a viable tool to improve the implementation of IPM by pesticide users.

Many of the problems which were identified with the SUD are also impacted by other pieces of EU legislation. For many stakeholders, especially researchers, the seed industry and farmers, the choice of crop varieties is important, including conventional selection, but New Genomic Techniques (NGTs) are also perceived by some farmers

and industry as potential tools to create new crop varieties relatively quickly that would be resistant to certain pests. However, the development of such technologies is equally opposed by others including farmers, civil society and environmental NGOs. Stakeholders such as pesticide users and the pesticide industry consider that the SUD generally acts as a barrier to the use of new technologies such as precision farming and more targeted application of pesticides as part of precision agriculture (e.g. using drones, as they are considered to fall under the current general prohibition of aerial spraying under the SUD unless derogations are issued at a Member State level)[cxxii].

2.3. How will the problem evolve?

Most of the environmental and health issues identified at the time of adopting the SUD have remained unchanged or even been aggravated. A stronger awareness among consumers and society at large may act as a driver for change, although these aspects vary considerably among Member States[cxxiii]. Increasing concerns about the negative consequences of hazardous chemicals on the environment and health, and an awareness of chemical residues in food have increased the demand for products with higher environmental and health standards[cxxiv]. Future food production in the EU will be influenced by climate change, extreme weather events and altering pest pressures[cxxv]., which in turn may influence pesticide risks and use, and the SUD will likely only be moderately relevant to address such future issues and needs

Without an improved monitoring framework, supported by appropriate and timely data availability, it will be difficult to assess the effectiveness of policies to reduce the use and risk of pesticides (and adapt planned actions accordingly). Moreover, the objectives of better protecting health and the environment from the risks of pesticide use and meeting the specific pesticide targets included in the Farm to Fork and Biodiversity Strategies and the Zero Pollution Action Plan will likely not be achieved in the absence of any changes to the current policy framework. If the SUD was left unchanged, the current differences between Member States would be expected to remain or intensify, driven by such factors as political will and governance, market drivers, uneven effects from climate change and public opinion/consumer attitudes. These are expected to continue to differ between Member States leading to varying levels of pesticide use and risk, different levels of protection of human health and the environment and uneven competition on the internal market. As the situation currently stands, following 10 years since the deadline given to Member States for transposing the SUD, there is no indication that the identified problems would not persist in case of a “no-change” policy decision[cxxvi].

3. WHY SHOULD THE EU ACT?

3.1. Legal basis

The legal basis for action in this area is Article 192(1) of the Treaty on the Functioning of the European Union (TFEU), which empowers the European Union to take action in order to preserve, protect and improve the quality of the environment and to protect human health. EU action in this area is justified by the environmental, public health and Single Market issues at stake. If some Member States do not take action to reduce the use and risk of pesticides, this could negatively affect biodiversity, water and soil quality and human health in the whole EU. In addition, different rules on pesticide use across Member States might create unfair competition and undermine the proper functioning of the Single Market for food commodities, while recognising that Article 193 of the TFEU allows Member States to adopt more stringent provisions than the SUD. The variation in efforts across Member States to achieve the sustainable use of pesticides in practice underlines a need for more coordinated and uniform measures at EU level to drive progress in this area and respond to long-standing societal concerns concerning the use of pesticides.

3.2. Subsidiarity: Necessity of EU action

The SUD established a framework to achieve a sustainable use of pesticides by reducing the risks and impacts of pesticide use on human health and the environment and improving the uptake of IPM. A continued divergence of measures taken in Member States would lead to different levels of protection of health and environment and diverging conditions for the main users of pesticides which would be against one of the fundamental objectives of the Treaties[cxxvii]. The threat to biodiversity and ecosystems crosses boundaries and necessitates a strong and EU-level action. A level playing field across the internal market, for example for pesticide users, is hampered by current varying levels of action in different Member States to reduce the risks for health and the environment linked to pesticide use. Moreover, pesticides pollution is transboundary and affects waters and the marine environment downstream in one Member State whilst the pesticide use may have taken place upstream in another Member State. Stakeholders' views differ, but tend to call overall for a stronger EU action on the sustainable use of pesticides[cxxviii]. Several Member State authorities point out that the effectiveness of a subsidiarity approach depends on the national transposition and implementation, which can differ substantially between Member States[cxxix]. This variation means that the potential for harmonisation of rules is not fully realised and varying competitiveness in the single market continue to exist. The deficiencies in implementing the SUD in some Member States suggest that the previous

approach of leaving the detailed rules to national transposition under a Directive has not worked. For example, the European Court of Auditors found a need for clearer criteria and more specific requirements in relation to IPM to help ensure enforcement and assess compliance[cxxx]. With so many complex agricultural variables in pest management, clear, uniform rules should reduce the compliance burden and improve enforcement.

3.3. Subsidiarity: Added value of EU action

Coordinated EU action can effectively supplement and reinforce national and local actions on the sustainable use of pesticides. Coordination of action at EU level and, where possible, at global level, can contribute to achieving the relevant UN SDGs. EU action is compatible with the principle of subsidiarity. Consequences of more effective policies in this area could ultimately lead to improvements in biodiversity, water and soil quality, other environmental parameters and human health. Moreover, because of the cross-border and transboundary dimension of pollution, coordinated actions between upstream and downstream Member States are needed. The EU also possesses other key instruments in agricultural and food policies with which synergies exist and can be further improved, including by increasing legal and policy clarity and coherence, especially the CAP[cxxxi]. Linked to incentives and possible mitigation measures, it is expected that stronger action at EU level, including in association with related policies such as the CAP, can help to reduce currently varying national approaches and contribute to a more homogenous approach in the future. Other initiatives foreseen under the Farm to Fork Strategy are complementary, for example the organic farming action plan, research and innovation policies and planned Commission implementing acts revising the data requirements and assessment rules for pesticides containing active substances that are micro-organisms (as alternatives to chemical pesticides), specifying the approval criteria applying to them and updating uniform principles to assess and authorise plant protection products containing micro-organisms. These initiatives aim at facilitating the placing on the market of these products and increasing their availability to farmers (see Annex 5, Table 25 for further details of these initiatives).

Several stakeholders in various consultations expressed the view that the legal instrument of a Regulation rather than the current Directive might contribute to a more harmonised and binding approach in this policy area in the future[cxxxii]. The reduction of current national differences in pesticide use policies could contribute to a better functioning of the internal market and a reduction of competitiveness differences which are exacerbated by pesticide use policies varying at Member State levels. The SUD is also relevant to the development of organic farming and achieving the Farm to

Fork Strategy target of at least 25% of the EU's agricultural land under organic farming by 2030

4. OBJECTIVES: WHAT IS TO BE ACHIEVED?

In May 2020 the Farm to Fork Strategy and Biodiversity Strategy announced that the Commission will take action to reduce by 50% the overall use of and risk from chemical pesticides by 2030 and reduce by 50% the use of more hazardous pesticides by 2030. This commitment was re-stated by the Zero Pollution Action Plan in May 2021. The planned revision of the SUD announced in the Farm to Fork Strategy intends to make a substantial contribution to achieving these targets and to EU efforts to continue to reduce the use and risk of chemical pesticides as well as addressing the various problems identified as part of the evaluation concerning current policies and the present implementation of the SUD. A revised SUD should also aim to increase availability of alternatives to chemical pesticides and encourage use of these, therefore supporting farmers in the transition towards a more sustainable food production system.

The levels of these targets were chosen to be both technically feasible and economically viable. The planned 50% targets allow substantial progress towards greater environmental and human health protection against the trade-off of increased challenges in political feasibility and economic viability. These challenges can be mitigated by additional actions while still addressing the negative impacts of pesticides on the environment and human health. While comparatively a lower ambition would make the targets more politically feasible with Member States and indeed be likely achieved as part of the baseline scenario without additional policy measures, they would likely fail to protect the environment and human health in a meaningful way. It is nevertheless acknowledged that, due to limitations in the quantity and quality of pesticide use and risk data currently available at EU level, the level of ambition of these targets can be objectively criticised as being of either an insufficient[cxxxiii] or excessive[cxxxiv] level of ambition. Limitations of available data and modelling and assessment tools[cxxxv] also make it difficult to comprehensively and holistically assess the impacts that a transition to more sustainable food systems (including reduced use and risk of pesticides) will have on the agricultural sector in particular and overall society more generally. The chosen reference period for the targets of 2015-2017 can also be challenged as regards Member States who may have made specific national progress in reducing the use and risk of pesticides either before, during or after this period[cxxxvi]. The reference period of 2015-2017 was chosen in order to take account of the most recent data available when the targets were announced in the Farm to Fork Strategy in 2020 and to provide for an average figure over a three year period,

recognising the annual variation in pesticide use due to factors such as weather, pest and crop conditions. This is further expanded on in chapter 8 as regards the preferred option.

4.1. General objectives

The SUD contributes to the overall EU goals of preserving, protecting and improving the quality of the environment as well as protecting human health and contributing to the completion and proper functioning of the internal market.

4.2. Specific objectives

In line with the European Green Deal, the Zero Pollution Action Plan[cxxxvii] and the Farm to Fork Strategy to ensure a fair, healthy and environmentally-friendly food system, and Biodiversity Strategy for 2030, this policy intervention aims to significantly reduce the use and risk of chemical pesticides. This initiative will address the following specific objectives:

1. ensuring that current and future policies reflect the zero pollution ambition of the European Green Deal, Farm to Fork Strategy, Biodiversity Strategy and the Zero Pollution Action Plan, in particular to reduce the use and risk of chemical pesticides, in particular those containing more hazardous active substances, increase the application and enforcement of IPM and less hazardous and non-chemical alternatives to chemical pesticides for pest control;
2. improving the availability of monitoring data, e.g. on the implementation and application of the SUD, use and risk of pesticides and health and environmental monitoring, to ensure a better framework to implement, monitor and adjust, where appropriate, future policies;
3. improving the implementation, application and enforcement of the provisions of the SUD across all Member States with a view to improving the effectiveness and efficiency of current policies, including possible simplification and reduction of administrative burden where possible;
4. promoting the application of new technologies such as precision farming by pesticide users with the aim of reducing the overall use and risk of pesticides[20].

[20] The potential of precision farming techniques such as variable rate pesticide application to reduce the use and risk of pesticides are described in more detail in annex 5. Precision Agriculture is a farming management concept based upon observing, measuring and responding to inter- and intra-field variability and needs in crops.

5. WHAT ARE THE AVAILABLE POLICY OPTIONS?

5.1. What is the baseline from which options are assessed?

The baseline describes the likely development where the SUD remains unchanged and is projected to the year 2030, i.e. the year by which the two pesticide-related Farm to Fork Strategy targets should be achieved. This scenario includes the main drivers that may impact the sustainable use of pesticides until 2030 and beyond. The development will be influenced by other parts of the EU pesticide legislation[cxxxviii], EU legislation on agricultural statistics[cxxxix] and the CAP post-2020[21]. These have been taken into account in the baseline assessment, apart from the Commission's proposal for a nature restoration law which is not yet adopted.

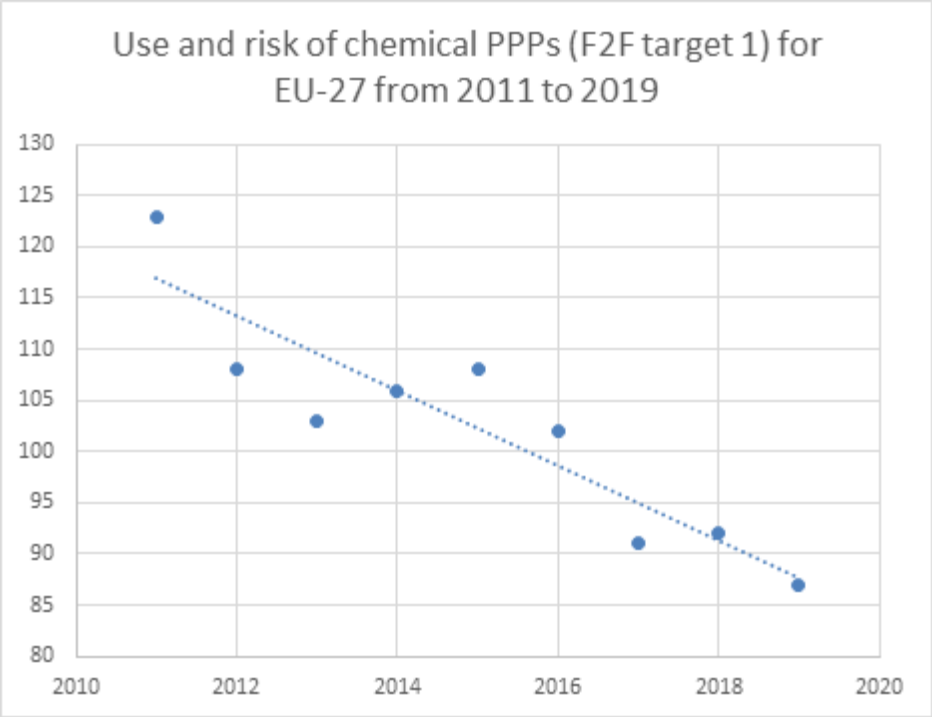
How will the use of chemical pesticides evolve in a no-change scenario?

The evolution is discussed for each target separately. For the F2F target 1, (first Farm to Fork Strategy pesticide use and risk reduction target to reduce the use and risk of chemical pesticides by 50% by 2030) an extrapolation of the current trendline taking into account the historical data, shows that further reductions can be expected in a no-change scenario, in the range of 1 and 5%[22] per year, at an EU level. As an example of current trends, consumption of pesticides in the Czech Republic is reported to have already declined by 32% in the last 10 years[cxl]. Figure 4 presents the available data and trend line for F2F target 1 for EU27[cxli].

Figure 4 Data and trends for F2F target 1 for EU27 from 2011 to 2019

[21] Development and influence of these key drivers in annex 5 of this document.

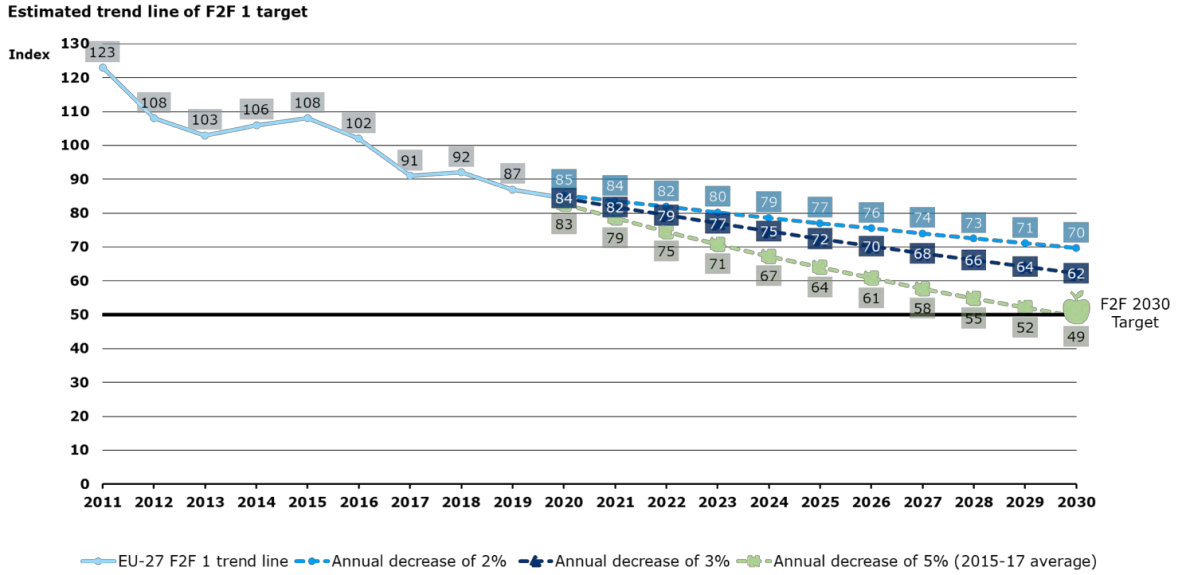
[22] Based on an extrapolation of the trendline observed on HRI 1, from 2011 to 2019



It is expected that Member States will continue to make efforts in line with the current SUD. These efforts include funding research into alternative pest control techniques and funding systems to disseminate these alternative techniques to farmers, such as demonstration farms. The CAP provides a range of incentives to reduce the use of chemical pesticides and these will be reinforced in the new CAP applying from 2023. These measures include area-based payments for participating in voluntary schemes to switch to organic agriculture, devoting a share of farm area to biodiversity and making support schemes conditional to those, to protect water courses, to establish wildlife refuges etc., grants towards the purchase of specialist equipment e.g. precision spraying and mechanical weeding equipment and the Farm Advisory System. This system, which all Member States must establish, helps farmers to meet EU requirements in a range of areas, including the safe use of pesticides and IPM. The development of cultivars resistant to pests, disease and environmental variations would also reduce need for pesticide use, and the possible use of NGTs could expand this potential. The share of improved, lower-risk plant protection products is anticipated to increase gradually in the baseline scenario thanks to investments in research and development to meet productivity gains and environmental standards and amendments to rules supporting their approval-authorisation before their placing on the market. Switching to organic agriculture and devoting area to biodiversity will reduce the use of pesticides in these areas. Some precision farming techniques continue, and will continue, to be adopted by an increasing number of farmers each

year. Advances in the uptake of additional precision agriculture techniques will continue to contribute to reducing the use and risk of pesticides. These measures, while perhaps not leading to sudden or dramatically large changes in pesticide use, such as when existing substances are not re-approved, are cumulative over time and help users to transition away from chemical pesticide use. Finally, it is expected that under Regulation (EC) No 1107/2009[cxlii] some substances classified as candidates for substitution[23] will not be (re)approved and may be replaced by low risk alternatives.

Figure 5. Estimated trends in the F2F target 1



The baseline annual level of reduction is considered to be attributed to, and mainly driven by, some substances losing their approval and therefore no longer being sold/used and an expanded portfolio of, and hence increased sales/use of, low-risk substances and products. For the F2F target 1 it is expected that the positive reduction trend at the EU level would continue. Still, at a medium reduction rate of 3% per year, this would leave a "gap" of 12 index points, towards reaching by 2030 the 50% reduction target expressed in the Farm to Fork strategy.

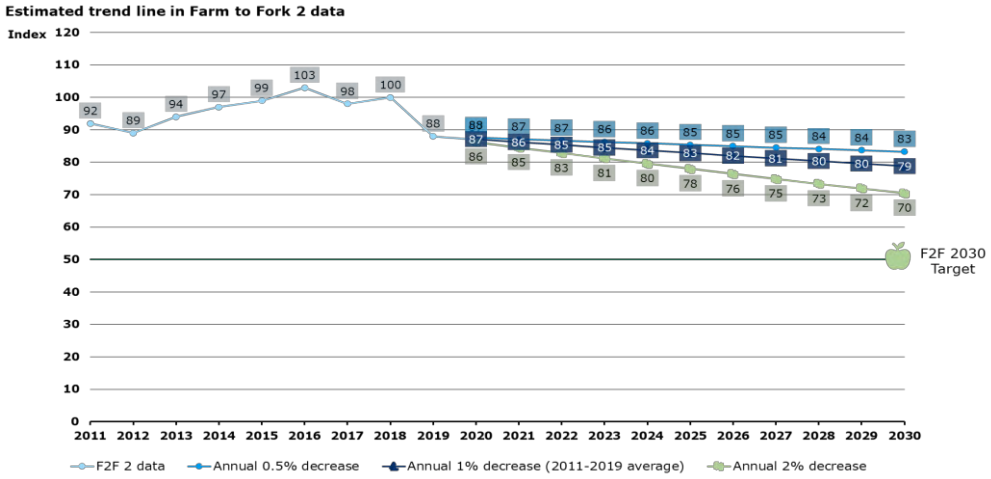
The F2F target 2 (second Farm to Fork Strategy pesticide use and risk reduction target to reduce the use of the most hazardous pesticides by 50% by 2030) will be influenced by the same mechanisms, actions and initiatives as the F2F target 1. The sales and use of these substances were broadly stable in the 2011-2018 period. Under the ongoing

[23] Active substances are identified as candidates for substitution when they have certain more hazardous properties as specified in point 4 of Annex II to Regulation (EC) No 1107/2009.

renewal programme, some substances classified as candidates for substitution[24] will not be (re)approved and will thus not be available for use. The impact of this process first manifested itself in the reduced use of these pesticides in 2019, and it is likely to result in further declines in the sale and use of these products over time. Consequently, pesticide users will be forced to shift to alternative substances or methods. While in the short term, some professional users may switch to another candidate for substitution product rather than a low-risk alternative, the diminishing pool of these substances (due to further non-renewals) should lead to the continuation of the trend starting from 2019 of a steady reduction in the use of more hazardous substances over time. Substitution rate until now was based on "easy wins" leading to a decline rate of 5% between 2015-2017. This process is expected to slow down as further substitutions will be more difficult to achieve and is expected to be between 2 and 3% annually.

The efforts made by Member States to restrict use of more hazardous substances (for example restricted to only professional use and/or banning of their use in public areas) will likely continue, leading to further reduction. Based on current and historic trendlines, it can be expected that use of more hazardous substances would reduce by between 0.05 and 2%[25] per year until 2030. As illustrated by the estimation, the F2F target 2 of reducing the use of more hazardous substances by 50% in 2030 will likely not be met in a no-change scenario. Only limited progress can be expected towards this target if the situation remains unchanged, and thus an accelerated reduction in F2F target 2 is needed.

Figure 6. Estimated trends in the F2F target 2



[24] Active substances are identified as candidates for substitution when they have certain more hazardous properties as specified in point 4 of Annex II to Regulation (EC) No 1107/2009.

[25] Based on an extrapolation of the HRI 1 trend for Group 3 (CfS), from 2011 to 2019.

The gains manifested at EU level towards reaching the F2F target 1 in the baseline scenario, would risk being offset by a continued high variation at Member State level. As shown in the evaluation of the current SUD, the ambition and progress on reducing the risk of pesticides use varies strongly between Member States. The available evidence on trends illustrates the uneven progress in Member States up to the present day which would likely continue in a no-change scenario. This could impede the even playing field for professional users, and in particular farmers, if some Member States restrict access to pesticides (in particular more hazardous pesticides), thereby leading to a situation where farmers compete on the internal market under different conditions (costs of production, risk of yield losses). The magnitude of these impacts is not possible to quantify.

How will environmental, economic and social/health impacts of pesticide use evolve in a no-change scenario?

In a no change scenario it is expected that **environmental status and eco-system services** will further decline. While the current negative trends are not solely attributable to use of pesticides for plant protection, it is one of the environmental pressures contributing to a decline in biodiversity, soil quality, pollinators, and water quality[cxliii]. The baseline scenario estimates that the use of more hazardous substances will decrease at a slower rate than the uptake of low-risk substances, thereby posing a continued risk to the environment.

Use of pesticides is also an enabler of intensive mono-culture practices which further limits habitats and opportunities for nature to flourish. While a (quantified) causal link cannot be established between pesticide use and deteriorating environmental status, intensive farming prioritises food (and biofuel) production over environmental considerations. Intensification of agriculture has a range of negative consequences for the health and quality of natural ecosystems. Partly, this arises from the use of intensive inputs such as pesticides and chemical fertilisers, and partly it is a function of the prevalence of 'monocultural landscapes' in which there is little opportunity for nature. In turn, the loss of biodiversity leads to a need to intensify agriculture further[cxliv], as natural predators decline. The planned nature restoration law may address these issues through mandatory targets for nature restoration, however the legislative proposal has not yet been adopted and therefore its potential impacts are not estimated or quantified here.

The **economic impact** in terms of agricultural income in the baseline is uncertain, with variable decrease percentages by crop category anticipated in the various policy reviews and impact assessments. According to the latest EU Agricultural Market Outlook (EC, 2021)[cxlv], total farm income at constant (2010) prices is projected to

decrease by 1.2% per year during the period 2021-2031, compared to the previous decade. Overall use of chemical pesticide is expected to decrease in the baseline scenario, which could lead to input savings, however these may be offset by the need to invest in IPM and alternative methods, including precision agriculture. The economic impact of the (continued) decline in eco-systems services and biodiversity is not possible to quantify but would be very high if the lack of progress to reverse the development leads to system collapse. In this respect the continued use of more hazardous substances, classified as Persistent, Bioaccumulative and Toxic (PBT) is likely to pose higher risks than more low risk chemical pesticides in the long term. Other uncertainties in the baseline relate to climate change and the impact of adverse weather events on food production.

In the no-change scenario **health impacts** are difficult to assess precisely and with certainty. Harmful effects on human health from pesticides have been established, such as acute and chronic poisoning, links to certain types of cancer and Parkinson's disease. However, across these identified diseases, evidence from academic studies[cxlvi] and EFSA annual reports conclude that it is difficult to categorically link specific pesticides with increased risk to human health. Currently available data from meta-analysis by Inserm (2021) points to greater links between risk of diseases and the use of herbicides and insecticides compared to other categories. Among the 57 active substances that are currently classified as candidates for substitution there are 8 substances that are identified on human health grounds, based on their carcinogenic, repro-toxic and endocrine disrupting properties, 10 substances are identified based on their low acceptable daily intake (ADI) and 38 substances are identified based on the PBT criteria (4 active substances are classified as candidates of substitution on several of the criteria). Due to limits in the current state of knowledge, it is not possible to estimate the impact on human health of a no-change scenario where the use of the candidates for substitution remains on the current trend-line (see Annex 5), but it is apparent that there would be no improvement over the current situation.

5.2. The pesticide reduction targets

As described in the Farm to Fork Strategy, the EU Biodiversity Strategy and the Zero Pollution Action Plan, the European Commission announced two pesticide reduction targets:

- Target 1: to reduce by 50% the use and risk of chemical pesticides by 2030
- Target 2: to reduce by 50% the use of more hazardous pesticides by 2030

An important issue to be considered is **whether the setting of targets of a lower or higher ambition than 50% would be appropriate**. Currently, in the absence of

pesticide use data at EU level, the F2F target 1 for the use and risk of chemical pesticides is calculated using a modified version of the current harmonised risk indicator 1 (HRI 1) methodology, based on sales of different hazard categories of pesticides (see Annex 4 for a detailed description of the harmonised risk indicators and methodology for their calculation). F2F target 2 was chosen to specifically reduce the use of these more hazardous pesticides, given that their use increased by 9% in the six year period from the 2011-2013 period to 2018, whereas it was expected they would have reduced. 57 of the approximately 450 active substances approved for use in the EU, approximately one seventh of active substances, fall into this category and because of their inherent hazard characteristics they are given a high hazard weighting of 16. Achieving the second target would correspond to reducing the F2F target 1 by only around 8-10%, according to ESTAT estimates and thus is seen as complementary to F2F target 1, but, given the specific hazard of this group of pesticides, it is considered fully justified to set a separate reduction target for these more hazardous products.

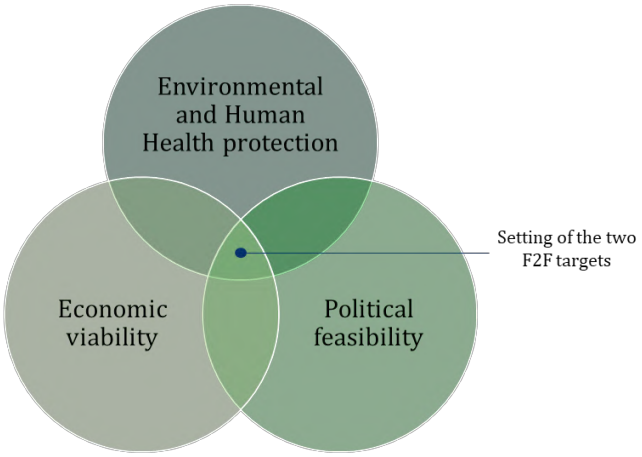
The Commission does not have robust use data on the crops and pests on which these pesticides are used. However, for each of the main product types (herbicides, fungicides and insecticides), there are some active substances that fall into the more hazardous group and some less hazardous, meaning that in some situations the possibility to switch to lower risk alternatives already exists. For some others there are not currently available alternatives and thus the gradual trajectory towards achieving this 50% target for F2F target 2 by 2030 allows time to bring such alternatives to the market.

The Commission intends to monitor the progress in each of the targets annually. This will enable the progress and relationship/articulation between the two targets to be more specifically assessed over time. Along with the new data provided for by the proposed policy options, it will allow for the consideration of setting further and possibly more differentiated targets for different groups of substances (and hazard categories) beyond 2030.

The setting of any EU level targets in the field of the environment involves the trade-off between three interconnected factors: environmental and human health protection, political feasibility and economic viability. This is particularly true for the setting of the Farm to Fork Strategy pesticide targets which operates at the intersection between these three interlinking factors (as demonstrated in figure 7 below). The demonstrated effect of pesticide use on health and the environment necessitates a change in approach and means no-change is not seen as an option. This has to be offset against consideration for actions being proportionate and viable, and for mitigating actions to reduce the economic impact at both a micro (farm) and macro (global) level. The

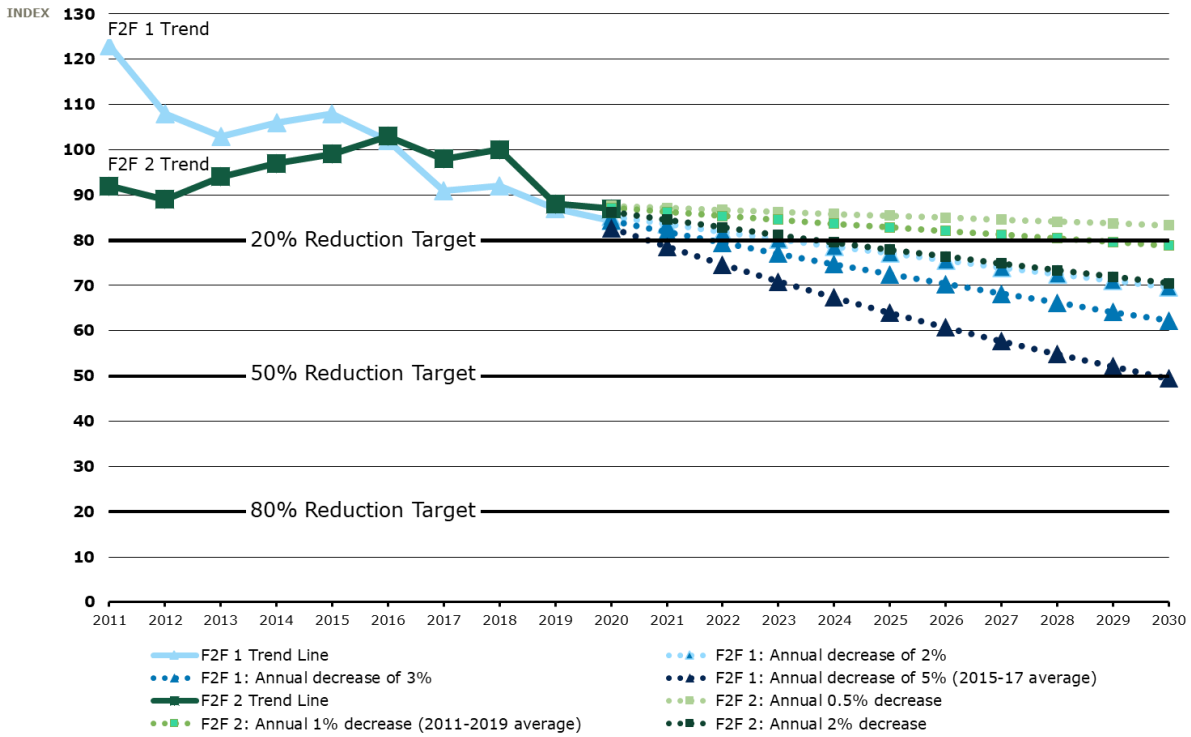
potential negative economic effects of further biodiversity decline must also be considered. Political feasibility has to consider this trade off with additional considerations of context, implementability and enforcement.

Figure 7. Intersection of factors influencing the setting of the farm to fork pesticide targets



To provide further context, the graph below presents the Farm to Fork Strategy first and second pesticide use and risk reduction targets and the estimated decreases based on the baseline.

Figure 8. Farm to Fork 1&2 Indicators and plotted estimated annual decreases in a no-change scenario



As the above diagram shows a 20-30% reduction would be expected to occur with the existing projected reduction rate, without significant changes to the SUD. This can be seen as easily achieved and without significant additional economic cost, thus having little economic impact. It would not have the required positive impact on human health and the environment, thus not achieving the overall policy objective.

A 40-60% reduction target would represent a medium level of ambition compared to the no-change scenario. Given the current no-change estimates, the baseline assumes that this target would not be met without significant changes in the SUD legislation. A reduction ranking between 40-60% is likely to be challenging yet achievable, requiring in the region of a 10-30% reduction beyond the baseline scenario. It would require additional actions by professional users and Member States and is thus seen as having a positive impact on human health and the environment, and particularly so in the reduction of the more hazardous substances under F2F target 2. Politically, this should allow those Member States with existing ambitions to still achieve these, while allowing those Member States with lower ambitions to improve. Whilst there would be some likely economic impact, this is seen at a level at which support such as the CAP, changes in support through advisors and availability of alternatives would mean the effect is lessened to one which is politically acceptable.

The uptake of precision agriculture and organic farming is also seen to have a quantifiable positive impact with an estimated 20% reduction in pesticide use by 2030 due to these changes if predicted expansion is achieved (see also analysis in Annex 5). Additional factors can also be considered such as changes in consumption patterns, reduction in food waste and increased demand for sustainable foodstuffs that will also mitigate the current foreseen impacts, but these are uncertain and difficult to quantify.

Whilst the impact cannot currently be quantified, the potential for NGT to provide varieties resistant to pests is also considered to offer potential for pesticide use reduction, alongside reducing other agricultural inputs. The JRC supported the European Commission *Study in Light of the Court of Justice's Judgment in Case C-528/16 regarding the Status of New Genomic Techniques under Union Law* [cxlvii]through reports on the scientific and technological state-of-the-art as well as on current and future market applications of NGTs[cxlviii]. In the context of the latter study, a database was compiled to provide a general overview of NGT products under development globally. The database currently has 113 entries of a broad range of crops with an improved pest and disease tolerance. Of these 37 are already in an advanced development stage and at least two have been reviewed by regulatory bodies in other countries. An impact asessement is ongoing to decide on the appropriate regulatory oversight for the concerned plant products, ensuring a high level of protection of human and animal health and the environment.

Taking a higher scenario of 70-80% reduction in pesticide use and risk presents the most ambitious range of reduction, and would require a significant annual decrease in pesticide use and risk. It would have the greatest effect on human health and environmental protection but, as it would require rapid and drastic changes to farming practices before alternatives are available, it is likely to have a greater effect on crop yield, and subsequently the greatest economic cost both for farmers and for the whole economy. It would be politically difficult to accept therefore for Member States. Given the trade-offs between each of the scenarios, the 40-60% target range presents the most balanced and realistic option in working towards increased protection of the environment and human health while balancing the political and economic challenges that would likely occur, within the given timescale. If criteria influencing this rationale, such as developments in IPM uptake supported by CAP and technology, trends in organic farming uptake and development of precision agriculture become clearer and more certain closer to 2030 then consideration should be given to reassessing the targets beyond that timeline.

5.3. Description of the policy options

The policy options considered include a variety of regulatory and non-regulatory approaches of varying levels of ambition. Annex 7 outlines in detail the various policy options which have been subject to impact assessment. These have been classified as being of either least/lowest ambition (Policy option 1), moderate ambition (Policy option 2) or highest/most ambition (Policy option 3) in addressing the identified problems and objectives. Where compatible, the more ambitious policy options build on those of a lower ambition. Pesticide reduction targets of either a lower or higher ambition than those specified in the Farm to Fork Strategy and Biodiversity Strategy have been analysed in section 5.2 above and in Annex 5. Potential costs, benefits and changes in administrative burden for affected stakeholders have been specifically taken into account in the impact assessment[cxlix.]

5.3.1. Specific objective (SO1): Pesticide reduction targets reflected in SUD

The operational objective pursued is to establish a roadmap for reaching by 2030 the F2F targets. In option 1 (least ambitious) the targets would remain non-legally binding, the Commission would monitor progress towards reaching the targets at EU and Member State levels annually, supported by mandatory reporting of corrective measures taken in each Member State in case of underperformance towards reaching the targets. It also includes prohibiting the purchase and use of more hazardous

pesticides by non-professional pesticide users, as is already the case in several Member States[26].

Option 2 (moderately ambitious) would set the 50% reduction targets in legislation as mandatory targets to be achieved at EU level, with Member States setting their own national reduction targets where they can justify a reduction from the 50% target taking into account a formula considering their existing national situation and level of progress in reducing the use and risk of pesticides. There would be a limit on the reduction in ambition permitted and the Commission would make recommendations on any targets not meeting the required ambition and would identify corrective measures to be taken in case of underperformance towards reaching the EU targets with regular monitoring. Once established, these national targets would become legally binding. To reduce the use and risk of pesticides, the use of more hazardous pesticides in sensitive areas such as urban green areas would be prohibited.

Option 3 (most ambitious) would establish the 50% reduction targets as mandatory legally binding targets to be achieved both at EU and Member State levels, with the Commission identifying corrective measures in case of underperformance towards reaching the targets and taking account of the different starting points of Member States. The use of all chemical pesticides would be prohibited in sensitive areas such as urban green areas.

5.3.2. Specific objective (SO2): Monitoring and data are widely available

The operational objectives pursued are to ensure that pesticide use data is sufficient to monitor risks from pesticide use and that knowledge on pesticide use and risk is improved and available data used to the full.

In option 1, Member States would share with the Commission detailed information on existing health and environment monitoring indicators which are already used at a national level concerning the use of and/ or risks from pesticides, with a view to examining if it would be appropriate to apply such indicators at EU level.

In option 2, records of pesticide use already required to be kept by pesticide users under Regulation (EC) 1107/2009[27] would be required to be kept in electronic form[28]

[26] In Belgium, Cyprus, France, Greece, Hungary, Ireland, Malta, Sweden, and foreseen in draft legislation in Luxembourg. Ramboll, Study supporting the evaluation of Directive 2009/128/ec on the sustainable use of pesticides and impact assessment of its possible revision, Final report – impact assessment part, Luxembourg: Publications Office of the European Union, 2022, doi: 10.2875/074218, p. 249.

[27] Records of purchase of plant protection products are currently required to be kept for 5 years and professional pesticide users are required to keep records of the use of such products for the most recent 3 year period.

and in a more granular format to facilitate the collection and analysis of these data. This information could support the development of future monitoring and risk indicators and allow realistic use and exposure assessments. This would be combined with an obligation for Member States to analyse these pesticide use data and to report annually to the Commission on trends in such data. Building on option 1 and based on the additional data available, the Commission would propose in the future possible new additional harmonised risk indicators concerning pesticide use and risk at EU level.

Option 3 would be identical to option 2.

5.3.3. Specific objective (SO3): Strong implementation of clearer SUD provisions in Member States

Operational objectives here included to improve technical advisory services to train and advise farmers and other professional pesticide users on IPM practices, promote crop-specific IPM rules, improve the implementation of IPM, strengthen the effectiveness of Member State NAPs and also address identified deficiencies in the current testing of PAE.

Option 1 would require additional training for advisors on IPM, clarification of SUD text on IPM principles including by highlighting the potential role of new practices and technologies, request Member States to develop or approve (including at regional levels) mandatory crop-specific IPM rules covering at least 90% of utilised agricultural area (UAA) nationally. These changes would be reflected in the CAP as regards the better implementation and enforcement of IPM through obligations on, and potential financial incentives for, pesticide users. This could be complemented by the Commission taking action (including through available financial support and/or training) to support the development of any necessary guidelines, standards and promotion of knowledge-sharing for the testing of PAE. The registration of PAE in registers (already implemented in some Member States) could be introduced as a recording, monitoring and enforcement tool[29] and a mandatory training certificate could be required for PAE operators and not just for purchasers of pesticides as under the current SUD. The Commission would also outline clearer specifications concerning expected mandatory content of Member State NAPs, especially as regards steps to

[28] The Commission has been informed by a number of Member States that such electronic systems have already been introduced nationally, for example in Denmark, Spain and Slovakia.

[29] Already a requirement in Spain and Cyprus, and a system linked to PAE inspections in Sweden, Ramboll, Study supporting the evaluation of Directive 2009/128/ec on the sustainable use of pesticides and impact assessment of its possible revision, Final report – impact assessment part, Luxembourg: Publications Office of the European Union, 2022, doi: 10.2875/074218, p. 294-295.

progressing towards indicators and targets, with a view to making NAPs more effective tools to achieve the reduced use and risk of pesticides.

Option 2 would require an obligatory independent advisory service to professional pesticide users (decoupled from an economic interest of selling pesticides and PAE) to ensure the promotion of increased use of alternatives to chemical pesticides as they are available[30]. A compulsory electronic IPM record-keeping by professional pesticide users would also be considered, with possible links to the electronic record-keeping of pesticide use data mentioned under SO2. The Commission would take further action to promote the application of best available technologies (BATs) and support the development of any currently missing standards for PAE. The more detailed Commission guidance for Member State NAPs under option 1 would be supplemented by annual reporting to the Commission by Member States on progress in implementing their NAPs, rather than the current requirement of a review of NAPs by Member State competent authorities only every 5 years. Member States would also set their own targets of specific actions such as percentage sales of biocontrol agents, to contribute towards the targets. This would create a direct link between the NAPs and the progress to achieving the targets, and allow greater accountability for Member State actions. Annual reporting would relate to progress towards achieving all national targets and other quantitative data relating to implementation of the revised legislation. An additional element would be an increased emphasis on the existing framework of Member State risk based controls, enforcement and penalties (where relevant), and control systems such as internal audits, making full and detailed use of the various existing mechanisms already offered under the Official Controls Regulation[cl] with the aim of improving overall implementation of the SUD in general, and IPM in particular.

Option 3 would be identical to option 2.

5.3.4. Specific objective (SO4): new and more efficient techniques are taken up by pesticide users

Operational objectives under this heading would be to promote the implementation of precision farming and new technologies, including monitoring technologies, big data supporting the decision-making process to apply pesticides only when strictly necessary, such as more targeted pesticide application as part of precision agriculture (e.g. by sensor-assisted sprayers), smart machinery and robotics, pesticide applications in limited areas of fields and ensure that the potential of such technologies to reduce

[30] In France advisory systems have been assessed to reduce the use of pesticides and result in overall cost savings for pesticide users.

the overall use and risk of pesticides would be properly reflected in the IPM principles currently outlined in the SUD and implemented through the activities foreseen under SO3 regarding IPM (e.g. training, IPM record-keeping).

Option 1 would make these changes to the SUD to emphasise the potentially important role of these technologies to reduce the use and risk of pesticides. The current SUD definition of "aerial spraying" in Article 3 of the SUD would be amended to make clear whether spraying by drones falls under the SUD general prohibition of aerial spraying, given the uncertainty among stakeholders linked to fact that this Article refers in general to "aircraft (plane or helicopter)" and the term drones is not mentioned in the SUD provision currently in force[cli]. This would be combined with the Commission, together with Member States, promoting targeted training and advice measures for precision farming to professional pesticide users, promote the use of pest forecasting tools and prediction models which could potentially reduce the overall use and risk of pesticides and continue to support the development of alternative methods to chemical pesticides.

Option 2 would build on option 1 and foresee to amend the SUD to allow more targeted pesticide application as part of precision agriculture within certain parameters, to be defined in a future annex to a legislative EU act based on advances in the underlying scientific data concerning associated pesticide use and risk.

Under option 3 any type of more targeted pesticide application as part of precision agriculture, for example spraying by drones, under certain specifications would be allowed and the Commission would propose additional relevant delegated acts to amend or supplement the legislation, as required, to account for future technological progress.

5.4. Legal instrument

Given the complex variety of factors influencing the sustainable use of pesticides under different national and regional agronomic and climatic conditions, it might be thought that a Directive better satisfies the principle of subsidiarity. However, as confirmed by the evaluation, the approach of leaving detailed rules to national transposition of the SUD has yielded inadequate results in many cases. As more extensively described in the evaluation[clii], audits, fact-finding missions and implementation reports by the Commission, the EPRS study on the implementation of the SUD, and a recent report of the European Court of Auditors on plant protection products all point to weaknesses in the implementation, application and enforcement of the SUD and a failure to sufficiently achieve its overall objective. The generally looser language of a Directive has been insufficiently precise to ensure an adequate level of compliance. Thus, a

Regulation is considered to be a better instrument in order to provide for more binding and uniform rules.

5.5. Options discarded at an early stage

Policy options considered by the Commission but discarded at an early stage included:

- *Colour-coded labelling of pesticides to reflect their hazard profile, e.g. as in a traffic light system (green, amber, red).*

  Based on consultation with Member State competent authorities and stakeholders, this option was considered to have limited effectiveness potential, as well as being considered difficult to establish objective risk criteria for the categorisation of all pesticides into three simple hazard categories. Feedback received stated that such a colour-coded categorisation could be misleading and that, if it was the objective to reduce or prevent the use of certain pesticides, other more effective tools are available for that purpose.

- *Strengthened provisions on the collection and recycling of empty pesticide containers or packaging, in line with objectives of the Circular Economy Action Plan*

  Feedback from Member State competent authorities and stakeholders was that this issue should be best left to Member States to address nationally and that in many Member States official or industry schemes are already in place and operating quite effectively on this issue.

- *Require the testing of new PAE prior to being placed on the market to identify and address any defects before the PAE enters into use, with the objective to better protect health and the environment*

  The Commission considered that such a provision would be legally incompatible with the provisions of the EU Machinery Directive[cliii] (and proposed Regulation[cliv]) that no extra barriers shall be placed to such new PAE being placed on the market. Feedback from Member States and stakeholders indicated that any defects in new PAE occur at quite a low frequency and would be identified subsequently when PAE is subject to a regular routine test in any case.

- *Include PAE within the scope of Official Controls Regulation (EU) 2017/625 with the aim to make use of relevant enforcement and reporting tools and potentially improve implementation of SUD provisions related to PAE*

  Member States specifically opposed and insisted on the exclusion of PAE from the scope of the Official Controls Regulation when it was originally agreed, based on concerns concerning subsidiarity and potential conflict of interest related to control of private sector bodies involved in the testing of PAE in some Member States. The Commission considered that such a policy option could offer the

potential to improve controls, enforcement and reporting tools, but consultation with Member State competent authorities demonstrated that the views prevailing at the time of the adoption of the Official Controls Regulation persist. Member States continue to oppose such a provision and therefore it was discarded as a policy option.

- *Delete the requirement for Member States to develop SUD NAPs, in an effort to reduce potential administrative burden, especially if these are seen as being not very effective tools in any case and potentially duplicating the obligation on Member States to prepare CAP National Strategic Plans (NSPs)*

  Member States and stakeholders generally consider that NAPs are not overly burdensome to prepare and update and provide a useful opportunity for relevant stakeholders to input to national policies on the sustainable use of pesticides. Furthermore, not all pesticide use would be captured in CAP NSPs which would only cover the agricultural use of pesticides linked to specific CAP provisions.

- *Adapt the taxation of pesticides at EU level, whether through value-added tax (VAT) or excise taxes to discourage the use of all or more hazardous pesticides*

  Several Member States[31] have introduced specific national taxes on pesticides. Member State competent authorities and pesticide users and industry expressed opposition to such an idea, while environmental NGOs supported it. Given that agreement on taxation at EU level requires unanimity among Member States and is based on a separate Treaty legal base compared to the environmental legal base of the SUD, it was concluded that it would not be legally or practically possible to include this element in a potential revision of the SUD. A proposal to phase out currently applied reduced VAT rates for pesticides has been discussed in Council and agreed in April 2022[clv] (see Table 25 in Annex 5).

- *Prescription system for the purchase by professional users of more hazardous pesticides*

  A national prescription system for pesticides has been introduced in countries such as Hungary, Greece and Switzerland[clvi]. However such prescription systems impose high costs and administrative burden both on pesticide users, prescribers and competent authorities and have a generally low efficiency and effectiveness in changing pesticide use and risk patterns[clvii]. Introducing a prescription system in each Member State was therefore discarded as a policy option

[31] Belgium, Denmark, France, Italy, Sweden as well as Norway.

6. WHAT ARE THE IMPACTS OF THE POLICY OPTIONS?

This section will discuss and assess the social, environmental and economic impacts of the proposed policy options.

For each type of impact, the assessment discusses who (or what) will be affected and how, what magnitude of effects can be expected and what conditions or mitigating actions may be necessary to offset undue negative effects of the policy options. A transversal assessment across social, economic and environmental impacts needs to consider the inherent tradeoffs of the initiative for different stakeholder groups.

It should be noted that small and medium enterprises (SMEs) would be specifically affected by several potential changes to the SUD. These SMEs would include agricultural advisers, handlers of agricultural produce and pesticides, food processors and intermediaries, agricultural contractors, farmers and other SMEs using pesticides.

6.1. Social impacts

Social impacts include the direct effects from pesticide use on people, including those operators and workers in direct contact with pesticides or pesticide treated areas, bystanders indirectly exposed to them and the public including vulnerable groups, as consumers of food/water containing residues of pesticides. More indirect effects include access to affordable and nutritious food and raw materials as well as access to recreational space and nature and other ecosystem services.

6.1.1. Health impacts

Reductions in the use and risk of chemical pesticides in line with the targets announced in the Farm to Fork Strategy would have a direct impact on the level of exposure to pesticides. It is important to separate the risks to human health for 1) the users of pesticides (professional and non-professional) and 2) citizens living close to areas where pesticides are applied as well as 3) consumers of food products. Reaching both Farm to Fork targets would lead to a reduction in exposure, in particular for professional pesticide users (handling and applying less pesticides) and by-standers (through reduced spray-drift from treatments)[clviii]. There are no clear aggregated data at the EU level on the level of risk related to current exposure, but meta-analysis of academic and scientific literature point to similar and recurring conclusions on the risks and possible impacts and strong presumed links for several exposure–disease combinations [clix] (see also Annex 5).

A 2016 review[clx] suggested that the economic costs of pesticide use have been underestimated and that the benefit-cost ratio of pesticide use may have fallen below 1 if the cost of illnesses and deaths triggered and favoured by chronic exposure to pesticides was taken into account. An assessment focussing primarily on the US, estimated the total losses from pesticides use for public health at $1.1 billion per year in the US (2009)[clxi].

In relation to health impacts from exposure through consumption of food, the current limits on allowed maximum pesticide residues on food are set for single substances[clxii][clxiii] and the current measures to protect human health do not adequately address potential for mixture effects. Studies on consumer risks from the combined exposure to multiple chemicals have been performed focusing on prioritised toxicological effects (neurotoxicity and thyroid mediated toxicity). EFSA has concluded that cumulative dietary exposure is, with various degrees of uncertainty, below the threshold that triggers regulatory action for all population groups[clxiv]. Overall, most epidemiological studies point to evidence of presumed links (or statistical associations), but so far regulatory risk assessment approaches, including some on mixtures, point to low risk. This is a significant scientific challenge which makes it difficult to conclude on the causality of observed links (or statistical associations) and the potentially differing conclusions of risk assessment methodologies and epidemiological studies. However, if confirmed as causal relationships, the observed links carry major societal and health costs which support the case for reducing exposure and risk. It has been shown that combinations of chemicals present at even low levels may contribute to the overall risk of adverse health effects such as cancer and reproductive toxicity[clxv] and the majority of epidemiological studies point to several statistically significant associations or presumed links.

There are no studies available linking exposure and health effects to specific currently approved substances and it is not feasible to differentiate the impact between the two Farm to Fork Strategy pesticide reduction targets. It could be that achieving the second Farm to Fork Strategy pesticide target on the reduction of more hazardous substances by 50% would yield higher health benefits, but current evidence does not allow for this to be established. More hazardous substances generally have a broader spectrum of action (different types of pests, types of crops), hence replacing a more hazardous substance with low-risk substances may require higher dosages and multiple substances, thus potentially leading to an increase in pesticide use (albeit with lower risk). In the way the Farm to Fork Strategy targets are measured, these aspects would only be captured by the first Farm to Fork Strategy reduction target.

Impacts on human health are considered greater for vulnerable groups, and some specific actions are linked to these. Studies have shown that pesticide residues are present in children's playgrounds and other public spaces in areas surrounded by intensively managed agriculture, including pesticides that are classified as potential endocrine-active substances, considered to be of particular concern for children (see Annex 5 for further details).

The expected reduction of exposure to pesticides as compared to the baseline will be limited in **Option 1** due to the high uncertainty of reaching the 50% reduction targets, in particular for the target on more hazardous substances. Thus, health impacts are not expected to differ substantially from the baseline and affordability of food would likely remain unchanged. It can be expected that the continued decline in biodiversity may influence affordable food and access to nature in a long-term perspective, due to unsustainable practices.

In **Option 2** a 50% EU target, to be adapted at Member State level, will likely increase the ambition in national actions compared to the baseline, in particular for the second target on more hazardous pesticides. Under this option the positive impacts on the general public and vulnerable groups such as children are expected to be higher through prohibiting the use of the more hazardous pesticides in urban areas, in particular playgrounds, schoolyards or other recreational areas, including sensitive natural areas.

Option 3 would be expected to have the highest certainty to reach the 50% reduction targets, however the option may lead to adverse effects in terms of higher food prices which could lead to inequalities in access to nutritious and affordable food, affecting more vulnerable groups in society. The positive impacts on the general public and vulnerable groups such as children would be increased by prohibiting the use of all chemical pesticides in urban areas in particular playgrounds, schoolyards or other recreational area, including sensitive natural areas.

6.2. Environmental impact

Environmental impacts include the effect of policy options on biodiversity and in particular impact on pollinators, soil, water and marine species through environmental pollution caused by pesticides. Preventing negative environmental impacts is in line with EU ambitions to restore ecosystems and fully address the biodiversity decline. Reducing the use and risk of pesticides should protect pollinators, soil and water quality in particular. There are challenges to attribute unwanted environmental impacts directly to the use of pesticides because of the interaction of multiple

substances and their possible accumulation in organisms which creates a time lag between their use and impact.

All targets and actions in the European Green Deal will need to work together to reverse the expected declines on biodiversity and related ecosystem services[clxvi] (see also Annex 5), in particular, in addition to the SUD, those on pesticides (e.g. removal of more harmful substances from the market through non-renewal of approval, Member States refusing authorisations for products containing candidates for substitution after a comparative assessment, facilitating availability of pesticides containing micro-organisms etc.). The environmental impact of the two pesticide targets, therefore, has to be seen in combination with the existing policy instruments and also other initiatives that will improve soil quality, such as the EU Soil Strategy, considering a range of biological and physico-chemical indicators. Studies[clxvii] have shown that making both pesticide targets legally-binding would reduce an important pressure for biodiversity decline. Even if measures on reducing land use intensity and increasing habitat diversity are just as urgently needed to protect biodiversity, pesticide use reduction would be beneficial for pollinators and other farmland and aquatic species[clxviii,clxix].

Additional environmental benefits can be achieved in relation to reduced risks to water quality through the reduction in use of pesticides. Water industry and environmental NGOs are specifically concerned on the impact on water courses[clxx], both recreational and for drinking, and the potential impact of chemical pesticides on pollinators (see also Annex 5).

Moreover, a stronger role of organic farming and IPM solutions can be expected, strengthening the resilience of ecosystems and agricultural production[clxxi] (see also Annex 5).

In particular the target to reduce by 50% the use of more hazardous pesticides by 2030 would create environmental benefits as it limits the use of substances that are highly toxic, persistent and bioaccumulating[32], which result in the most important negative impacts on the environment. Additionally, similar to social impacts, mixture effects may cause impacts beyond the characteristics of any specific substance. These impacts are mitigated by the target to reduce the risk and use of all pesticides by 50% by 2030. Therefore, both targets are relevant to realise the environmental impacts.

The ability to quantify the impact of the prescribed options is limited as they are also likely impacted by other policy actions (such as the update of the list of priority substances in surface and groundwaters under the EU Water Framework Directive).

[32] See definition of candidates for substitution in Art. 24 and Annex II of Regulation (EU) 1107/2009.

The revised SUD will, however, be essential to achieve the environmental quality standards set under the Water Framework Directive which will significantly reduce costs for drinking water treatment (see section 1.1) and protect aquatic ecosystem services. This is in line with the polluter pays and prevention principles which need to be emphasised, linking to the costs of remediation where water treatment (e.g. for drinking water) has to be treated with high costs or when groundwater or surface waters used for drinking water are polluted. Reducing pesticide use, in particular of key insecticides and herbicides is also found to reduce risks to aquatic ecosystems, such as freshwater or marine water ecosystems, and species which are particularly vulnerable to toxic chemicals[clxxii] (see also Annex 5).

Environmental impacts of **Option 1** would result mainly from the extent to which the reduction targets are being achieved. The relevant specific measure under SO1 would be to limit the purchase and use of more hazardous substances, which represent only a small change towards achiving the second pesticide target. Therefore, similar considerations as for the health impacts apply on the high uncertainty of reaching the targets. From the specific measures under SO3, training requirements for the use of more hazardous pesticides can be expected to improve conditions of use but also puts a barrier to non-professional use of such products and thus leads to a shift in attitude towards alternative pest and weed control in non-professionally used areas with the resulting effects on the environment. The obligation for all operators to hold a certificate of training, instead of only the purchaser of pesticides, is expected to increase knowledge and better adherence to restrictions with a resulting reduction in risk to the environment. Both environmental NGOs and civil society organisations (18 out of 22)[clxxiii] considered this element would be effective to a major/moderate extent in reducing the use and risk of chemical pesticides. This view was also shared by pesticide users and industry (108 out of 151)[clxxiv]. This option contains several mechanisms through which the IPM uptake by professional users is expected to increase. Both more clarity on IPM principles and the strengthening of advisory services could remove barriers to the uptake of IPM practices by professional pesticide users. More tailored IPM guidance was viewed as positive by pesticide users and industry (110 out of 151) as well as NGOs and civil society organisations (21 out of 22) considering it would have an impact to a major/moderate extent on reducing the use and risk of pesticides in line with the farm to fork targets. Testing and inspections as specific measures under S04 can ensure that pesticide application equipment are well functioning and have minimal spray drift, thus limiting effects on the environment[clxxv]. NGOs, environmental organisations and consumer organisations (14 out 22 organisations) found general agreement that the implementation of this option could

help to lead to a reduced use and risk of chemical pesticides to a major/ moderate extent[clxxvi].

Environmental impacts of **Option 2** would be related to the additional measures taken to reach the pesticide targets. Further restrictions on the use of more hazardous pesticides would protect sensitive natural areas from the effect of those substances. Possible mixture effects from other pesticides not classified as more hazardous would be reduced to a lower extent.

Among the specific measures under SO3, recording their IPM practices would increase the farmers' awareness of the IPM principles and in the long term the uptake of IPM because farmers would more easily see the benefits of IPM and evaluate their IPM strategy[33]. Member States were largely of the view that the introduction of electronic IPM record-keeping would help to improve measurability and monitoring of implementation of IPM (11 out 27)[clxxvii]. Users and pesticide industry also see the benefits of increased data availability. An independent advisory service is expected to lead to higher quality advice to professional users of pesticides. Environmental impacts from pesticide use recording and collection by Member States are indirect as they would lead to strengthening the evidence base and thus taking better informed decisions ultimately having a positive effect on the environment.

Additionally, specific measures under SO4 create environmental impacts in the long run. Divergent views are held on the environmental effect from using drones for more precise pesticide application. According to an OECD study, the use of drones has the potential to produce benefits for sustainable pesticide use, but these potential benefits cannot be realised without further improving knowledge and data on application of pesticides with drones[clxxviii]. Some respondents to the Commission's supporting external study survey argued it could lead to a reduction in quantity of pesticide applied through targeted and early or more timely spot treatment of pests, as well as other benefits such as less compacted soil by engines or intervention after severe climatic conditions preventing the use of ground-operating machinery. Other stakeholders argued that it may lead to an increase in spray drift, depending on what type of sprayer the drone replaces and consider the risk of misuse high. Allowing the use of drones without any further specification is expected to lead to negative environmental effects.

Additonal environmental impacts of **Option 3**, compared to options 1 and 2 would result mainly from the increased obligation to achieve the pesticide targets. Also,

[33] Input from survey with national authorities as well as from the IPM focus group in Ramboll supporting study.

banning all chemical pesticides from sensitive areas and therefore also mitigating the mixture effects would see higher impacts than previously described for the other two options. From the specific measures under SO1, a complete ban of chemical pesticides in sensitive areas including urban green areas would amplify the environmental benefits. In the urban context, it would avoid the risk of accidental chemical contamination from pesticides for the public and in particular vulnerable groups such as children. NGO respondents to the targeted survey expect this option to lead to a major reduction in risk[34], which is largely supported by user respondents[35]. However, three Member State respondents express concerns about the control of invasive species and new pests, if no control substances are available.

For the specific measures under SO3 and SO4, environmental impacts stemming from IPM implementation and improved monitoring would be identical to option 2. Allowing aerial spraying only under defined parameters would only change the environmental impacts once defined conditions are established in a delegated act.

6.3. Economic impact

The quantification of economic impacts is complex and diverse given the breadth and intricacies of agriculture in Europe. This is exemplified in the assessment of implementation of the existing Directive which outlined a wide range of differences between Member States. In order to mitigate against these inherent complexities, a mixed qualitative and quantitative assessment has been carried out, with those policy elements which have potentially direct economic costs (such as administrative costs) being quantitatively assessed as far as possible. Similarly, the baseline is also affected by a large number of drivers (such as the CAP, changes in technology, changes in availability of lower risk pesticides). Many of the problems defined are also affected by a range of different policy actions, many complementary to the SUD, making it challenging to directly attribute the effect of the SUD directly.

6.3.1. Overarching economic impacts

As described in Annex 5, several recent publications have tried to provide estimates of the economic impacts of achieving the Farm to Fork Strategy targets, including the pesticide reduction targets which are within the scope of this Impact Assessment. None of these publications can be considered a fully-fledged impact assessment of the policy,

[34] 90% (20 out of 22) of NGO respondents answer "to a major extent", while the remaining 2 answer "to a moderate extent" in Ramboll supporting study.

[35] 33% (44 out of 131) of user respondents answer "to a major extent", 31% (31/131) answer "to a moderate extent", 25% (34/131) answer "to a minor extent" and 9% "not at all" in Ramboll supporting study.

but their results provide some insights into the economic impacts of policy decisions limiting the use of pesticides. The range of impacts reported is large, but in general the impact of reducing pesticide use is that of a reduction in production in the EU with associated reductions in net exports (i.e. higher imports and lower exports). Most of the studies do not consider how the impacts could be readily mitigated by additional actions on the demand side such as food waste reduction or added value chains for sustainable food. Nor do they consider the support actions, such as breeding of resistant cultivars and biopesticides, which can reduce the dependence on plant protection products thus limiting the negative productivity impacts of achieving the pesticide-related targets announced in the Farm to Fork Strategy. Moreover, the simultaneous achievement of different policy targets shows that some of these (e.g. increased land under high-diversity landscape features and organic farming) will contribute to the achievement of the reduction in pesticide use and risk.

As the mentioned studies do not consider positive changes that are likely to occur (even as part of the baseline) to mitigate the economic cost, such as availability of alternatives to chemical pesticides and application of precision farming techniques, they qualify their results as an upper-bound of the expected production impacts of meeting this target on the agricultural sector. The positive effect that support through the CAP can have in reducing the economic impact is in particular demonstrated by the JRC study.

In most cases these studies are limited to economic modelling that do not assess either qualitatively or quantifiably the significant positive environmental impact expected from a more sustainable agriculture. A paper[clxxix] published in January 2022 argues that the narrow focus of the analysis undertaken in such studies is the main driver of the reported reduction in agricultural production in the EU, its deteriorating trade balance and increased prices. However policies such as the Farm to Fork Strategy, encompassing the planned SUD revision initiative associated with this impact assessment, include a much broader set of interventions that are not fully accounted for in these analyses and the tools used have limitations preventing them from capturing the full scope of potential impacts. The afore-mentioned paper concludes that reported impacts from such economic analyses are a higher bound of the potential impact of the input reduction targets, compounded by the limited evidence available on the co-benefits of improved environmental quality the strategies aim to attain. The paper highlights the challenges of comprehensively assessing the impacts that a transition to more sustainable food systems, including reductions in the use and risk of pesticides, will have on the agricultural sector.

Using the methodology of the JRC study it is possible to demonstrate that the economic impact would be significantly less considering the current trend in pesticide reduction forecast as part of the baseline and when considering the contribution that organic farming and improved precision agriculture application can make. Assuming application of existing precision agriculture methods can provide on average a reduction of pesticide use of around 20%, the adoption of precision farming techniques on 35% more land by 2030 (as presumed in the JRC model) would deliver an additional 7% reduction of pesticide use without impacts on yields. An increase of organic farming area to 25%, assuming a cross-section of agriculture, could achieve a further 13% in pesticide reduction. When incorporated into the model this equates to a 6% rather than a 10% yield loss and a significantly lower economic cost to farmers. The interaction and articulation between the two targets should also be considered. A 50% reduction in F2F target 2 is expected to lead to a reduction of approximately 8-10% in F2F target 1, based on assumptions concerning changes in grower practices, and whether the higher risk substances are substituted with less hazardous chemical pesticides or with non pesticide controls.

The target on reducing more hazardous pesticides implemented individually would leave more options on alternatives to users and therefore overall result in lower economic impacts on farms, value chains and trade. However, for some more hazardous pesticides low-risk alternatives are not yet available, which represents economic risks from pests that cannot be controlled without these more hazardous pesticides. Nevertheless, a 50% reduction target would still allow these more hazardous pesticides to be used in many cases under emergency authorisations granted by Member States and where specifically required in the possible absence of effective alternatives.

6.3.2. Specific Economic Impacts

Changes in farm income driven by a reduction in pesticide use and risk are complex and highly dependent on a range of interconnected variables (i.e. crop allocation choices, productive orientation and farm management practices). Moreover, other external drivers such as climatic variability, incidence of pest and diseases, the evolution of oil prices, together with the extent and pace of adoption of IPM and the application of ecological principles in diversified systems, will influence pesticide dependence and the economic performance of farms. As highlighted in a March 2020 opinion of the EU Group of Chief Scientific Advisors, although intensive farming to produce high yields is synergistic with economic competitiveness, leading to low prices, there are relevant trade-offs to be made between overall competitiveness goals

and other social and economic considerations, including low environmental sustainability and resilience[clxxx].

Looking at the impact to plant protection products and the plant protection product application value chain, economic operators involved in the distribution and use of pesticides comprise agricultural inputs, machinery and services (e.g. agricultural contractors, extension services and crop marketing). Overall, the EC (2020)[36] projects nominal farm intermediate input costs to increase by 16%, reaching EUR 251 billion in 2030. Following current inflationary pressure, the increase in intermediate costs is expected to slow down, from 1.8% per year in 2011-2021 to 0.7% per year in 2021-2031. The share of improved, lower-risk plant protection products is anticipated to increase in the baseline thanks to continuous investments in R&D to meet productivity gains and environmental standards. The demand for and production of biopesticides is also projected to increase in the baseline. Overall use of pesticides is expected to slow down, thanks to better targeting and improved management through digital technologies, together with the projected increase in organic farming.

For the **Agri-Food value chain** however, the food supply chain is highly consolidated, characterised by a power imbalance between strong agents operating in concentrated sectors in the downstream stages (i.e. industrial and retailing) and weaker agents in highly disaggregated sectors such as small farmers and consumers. Whilst farmers are more exposed to supply and demand shocks of agricultural products given that both are highly inelastic[37], increasingly, the impacts of climatic events, environmental disturbances, technological developments and price volatility are not limited to local producers but spread through longer supply chains.

With regards to the **impacts on trade**, research carried out in this field is often inconclusive, however it points to potential impacts on the trade balance from increased dependency on imports (e.g. cereals, oilseeds) and a decline in exports (e.g. wheat, and specialised crops such as olives and wine) brought about by reduced yields due to a reduction in pesticide use. However other analysis[clxxxi], based on a biomass equilibrium model (and not a market equilibrium model), shows that a food system scenario that is even more ambitious than the Farm to Fork Strategy would enable the EU to move from being a net importer of calories and proteins– which it is today– to being a net exporter, despite a reduction in production. Any changes in food prices

[36] EU agricultural outlook for markets, income and environment, 2020-2030. European Commission, DG Agriculture and Rural Development, Brussels. agricultural-outlook-2020-report_en.pdf (europa.eu)

[37] i.e., a small reduction in demand or a small increase in supply can lead to a significant reduction in prices and, consequently, incomes - high income volatility

could have impacts on food availability and nutrition, with disproportionate effects on developing economies.

Total import of agricultural products in the EU, in physical terms, is greater than that of total export (Eurostat, 2021). Achieving the pesticide targets announced in the Farm to Fork Strategy is anticipated to lead to positive human health and environmental outcomes from a reduced environmental presence of pesticides and lower pesticide exposure for plant protection product users and food consumers. However wider environmental, social and economic trade-offs in the export countries may occur due to possibly resulting changes in production and trade-flows, with developing economies being most at risk of disproportionate effects. On the other hand, a continued reduction in the number of pollinators linked to the use of pesticides could also have a detrimental effect on food security and nutrition. Environmental impacts through land use changes and biodiversity degradation may follow if additional agricultural land is required to compensate for a reduced productivity or to address an increase in EU demand for certain crops.

Potential off-setting and mitigation measures would be needed to counter any undesired negative consequences for such non-EU countries, especially developing countries, while also recognising that such EU policies could support the FAO's work towards achieving pesticide risk reduction through a sound lifecycle management approach[clxxxii]. There is also an ambition to create a bigger market for sustainably produced goods, thus leading to better environmental and health protection in third countries as well as higher returns due to higher prices. With EU support and in collaboration with the UN Environment Programme and the Secretariat of the Organization of African, Caribbean and Pacific States, FAO is working to build capacities to adopt ecosystem-based practices and improve the management of pesticides in agriculture globally[clxxxiii]. The Commission offers a range of technical assistance programmes in the sanitary and phytosantitary (SPS) area, recognising that protecting human, animal and plant health is fundamental to any agri-food value chain, but that SPS measures may also have a direct or indirect impact on domestic, regional and international trade. The Commission's SPS activities aim to ensure that evolving EU SPS measures do not have a negative impact on trade from third countries. Private voluntary standards required by global buyers such as GLOBAL G.A.P. (Good Agricultural Practices) are also evolving and extending to target the environment and sustainable production in a far more comprehensive way, for example including a new module on environmental sustainability including requirements covering biodiversity, ecological upgrading, water management, soil management and conservation, integrated pest management (IPM), and managing pesticides to protect the environment.

6.4. Economic impacts of the proposed policy options

6.4.1. Specific objective 1 (SO1): Pesticide reduction targets reflected in SUD

Baseline: Achievement of the targets under the baseline scenario, primarily driven by the renewal programme for active substances under Regulation No. 1107/2009 and other policies, is not considered probable. Costs for farmers are assumed to be increasing and the decrease in pesticide costs (through reduced purchase and use of pesticides) not sufficiently mitigated by the availability and price of alternatives.

Option 1 will not differ substantially from the baseline. Overall the economic impact on the farmer would be limited. Administrative costs would mainly increase for national and EU authorities stemming from an increased frequency of reporting. Only for Member States that do not have training obligations for the purchase of pesticides containing more hazardous substances would more substantial impacts be expected.

In **Option 2**, targets would be set within the parameters of a formula. Member States could deviate by set amounts where they have made historical progress prior to the adoption of the Farm to Fork Strategy. They could further deviate where they provide data showing changes in climatic, agronomic and pesticide market conditions compared to when the harmonised risk indicators were first set[38]. To avoid large variations in ambition, there would also be a minimum percentage of reduction for both targets that all Member States would have to achieve regardless of the historical and other factors.

The targets set by Member States would become binding after Member States have had time to consider any Commission recommendations to increase their level of ambition. Member States would report annually on progress towards their achievement and the Commission would publish an analysis every two years, which could include recommendations to the Member State for additional actions.

Tensions among environmental and economic objectives in the EU policy are already one of the drivers of evolution in the EU agricultural sector towards outsourcing of commodity production through trade. EU agriculture has been able to develop its activities on high-value product chains. Achieving the pesticide reduction targets could accelerate such an already existing trend in EU agriculture. Any higher costs for EU producers resulting from the implementation of the targets could erode the

[38] When the harmonised risk indicators were first set in 2011, each Member State was allocated the same number of 100, which means that differences between the climatic and agronomic conditions between Member States were already accounted for at that time.

competitiveness of EU-farming and the agri-food sector. This has driven calls for the application of the reciprocity principle to agri-food products from third countries, to ensure they have not been treated with pesticides that are not authorised in the EU[clxxxiv]. Possible mitigating financial support under the reformed CAP to apply from 2023 could take the form of many actions going beyond conditionality and other relevant obligations, such as longer multiannual crop rotation and diversified crops, payments for investments for pesticides management and localized spraying, payments for training and advice, conversion to organic farming, investments for precision spraying equipment, financing risk management and contributing to advice, cooperation and monitoring systems, etc.

More frequent reporting on data would be considered key to the success of legally binding targets, with annual reporting in an adapted format with national progress reports to the European Commission likely playing an important role in ensuring successful achievement of the targets. It is not possible to foresee how Member States would work to achieve the targets set, since this would likely depend on the national context, capacity, economic situation etc. and thus direct costs cannot be estimated. Additional direct costs for Member States would result from putting in place data collection and regular reporting on progress, a pre-requisite to enable effective monitoring and enforcement. As most Member States prohibit use of more hazardous pesticides in sensitive area, there could be minimal addition cost for the user. Additional administrative costs would be incurred by the Commission in assessing reporting and monitoring progress to the targets but not substantially greater than the baseline.

For **Option 3**, with uniform legally binding targets at Member State level in addition to policy options under Option 2 the economic costs described above would be repeated and to some extent greater in certain Member States. There would be the clarity of each Member State applying a consistent 50% reduction target based on their individual national starting points with the objective of ensuring that effective actions are taken in each Member State to reduce the use and risk of pesticides in order to protect health and the environment.

Considering prohibition of all chemical pesticides in sensitive areas, the main determining factor for the impacts of this option is the definition of sensitive areas as well as urban green areas. In addition to sensitive natural areas, urban green spaces could include all publicly owned green spaces open to frequent public visit. This could include playgrounds, parks, school yards and urban roadside greenery.

Depending on the actions taken by individual farmers and other pesticide users, such a prohibition on the use of chemical pesticides can lead to higher costs for pest and weed

management for the users maintaining or cultivating these areas, the extent of which is highly uncertain, and is mitigated by reduced chemical pesticide expenditure.[clxxxv] The ban on use of pesticides in urban public areas mainly affects public bodies in their practices and spending on managing these areas. Six Member States[clxxxvi] report in the Ramboll supporting study targeted survey that they would see no impact as more hazardous substances are not used in parks, sport, school and recreational grounds. The other Member States expect increased costs of pest and weed management by other available means. Several Member States also report that the use of pesticides in public urban areas is minor, resulting in limited costs. A study on a selection of French municipalities[clxxxvii] found that costs for the management of green spaces increase in the first phase of a zero-pesticide management, but fall after adjustments to the management approach have been made.

6.4.2. Specific objective 2 (SO2): Monitoring and data are widely available

Baseline: In the current situation, electronic record-keeping for the collection of data from professional pesticide users regarding pesticide use was found to be in place in six Member States. A further six Member States were found to have record-keeping systems under implementation.[clxxxviii] The transition towards electronic record-keeping was seen to bring about compliance cost for farmers, estimated to be between 27 and 74 Euro per farmer per year on average. It should be noted however that this cost could be offset by the development of systems for data capture and electronic transfer by Member States and industry, thus reducing administrative costs in the long term. If electronic IPM record-keeping was also introduced there could be some commonality or synergies between the electronic record-keeping systems to limit overall compliance costs.

There are also additional compliance costs for the Member States which vary depending on the existing level of implementation. The cost for Member States without an existing system is estimated at 500,000 EUR for the development of an electronic system with annual monitoring costs estimated as two full time employees or 100,000 EUR. Costs for Member States to share with the Commission information on monitoring data already collected and indicators developed nationally are considered to be limited. Costs for the Commission in collating and reporting on the data are currently considered to be feasible. The potential electronic record-keeping for pesticide use and IPM implementation data requirements are not seen as directly affecting the achievement of the Farm to Fork targets but would provide a means for the development of future targets or indicators and provide data for Member States to take specific and targeted actions towards the existing Farm to Fork targets.

Considering that **Option 1** simply provides a greater mandate for Member States to provide existing data, it is foreseen that there would be no additional impacts compared to the baseline.

For **Option 2,** taking into account that almost half of Member States have in place or are implementing an electronic record system, it is foreseen that possible impacts to plant protection product users would be comparable to the baseline. This is also assuming that electronic data recording under Regulation 1107/2009 is implemented. For Member States without an electronic record system the cost to users of plant protection products would be limited with some increase in administrative burden. This additional burden could be mitigated with the support of advisory services, however, in uploading data onto electronic systems as is already happening in countries with existing systems (e.g. in Denmark). Implementation of electronic record-keeping techniques should in the longer term promote innovation, competitiveness and added value and reduce comparable administrative burdens of alternative non-electronic systems[clxxxix].

The main additional costs would be administrative and compliance costs in the analysis of data and indicators by Member States and the European Commission. Given that comparable systems have been implemented in the region of EUR 500,000, this one-off implementation cost would be borne by Member States with no comparable systems. Administrative costs need to be balanced against the potential environmental and health benefits expected from better data and monitoring helping to reduce the overall use and risk of pesticides. There could be economic benefits of a better knowledge of pesticide use as regards more efficient risk management and decision-making for placing on the market and use of pesticide, with less effects on health in the long-term as indirect long-term consequence. The increased application over time of precision agriculture techniques and digital technologies, including for data collection and monitoring, could also help to limit or reduce the administrative burden on individual professional pesticide users and/or businesses.

Option 3 is the same as Option 2.

6.4.3. Specific objective 3 (SO3): Strong implementation of clearer SUD provisions in Member States

Baseline: The assessment of impact is based on current evidence concerning the state of implementation of the SUD, which is variable between Member States who have failed to reach the ambitions of the SUD, in particular with delays in production and reviewing of NAPS. It is expected that implementation of the existing IPM requirements would improve piecemeal, based on engagement of farmers and the agricultural support industry, but be supported by the provisions of the newly reformed CAP,

another important contextual factor for the baseline. Enhanced implementation of IPM is seen as a cornerstone of the legislation, a stated intention of the Farm to Fork actions, and a core driver in achieving the Farm to Fork targets.

Option 1 would result in further clarifications and guidance on the SUD provisions (on e.g. IPM principles, NAPs, standards for testing of PAE). The impact of these elements would lead to low costs to users and the Member States as they are close to the baseline and continue to leave Member States high flexibility in their approach to implementing their local policies on the sustainable use of pesticides. The greatest cost would be incurred by Member States in developing or approving crop-specific IPM rules. The cost would vary greatly between Member States depending on the level of practical implementation of IPM principles as a local baseline. IPM crop-specific guidelines already exist in some Member States for many crops (see Annex 4). There would only be minimal additional administrative costs for the Commission, for example in clarifying the mandatory content of NAPs. However, these least ambitious policy elements would not represent an effective response to the overall identified problems or in achieving the pesticide targets.

Option 2 would significantly enhance the role of independent advisors, particularly in IPM. This would incur a significant cost for farmers (between 180-540 EUR per farm annually)[cxc], as would a requirement for electronic IPM record-keeping (estimated at 74 euro per farmer annually). These costs may be supported by the CAP, should the Member States decide so. This is offset partially by a decrease in costs for chemical pesticides, and an increase in business for consultancies and agronomic advisors. Member States would see increased administrative costs in annual updating and reporting of their NAPs, and an estimated 800,000 EUR to establish an electronic IPM record system. The cost of using these standards as a basis for controls and enforcement is estimated at 1.3 M EUR a year. The Commission would, in general, face limited costs and mostly related to providing guidance and assessment of data.

To link the NAPS to the achievement of targets, it is intended they be more structured and linked to annual progress and implementation reports to the Commission, linking the NAPs to actions to achieve Farm to Fork targets. It is also proposed to require Member States to include positive indicative targets for increasing the percentage of biological pesticides on the three most widely-grown field crops and the percentage of non-chemical methods that can be used on pests on key crops on which the active substances most responsible for the change in index value in relation to both of the national Farm to Fork targets are used. This would help to make the analysis of efforts to encourage non-chemical alternatives in National Action Plans more detailed and uniform.

Option 3 does not add significant policy elements to option 2.

6.4.4. Specific objective 4 (SO4): new and more efficient techniques are taken up by pesticide users

Baseline: The baseline scenario operates on the basis that the reference to precision farming and the development of alternatives to chemical pesticides are not defined in the SUD. In particular, one area that is seen as inhibiting more efficient techniques is the lack of clarity on the legal status of drone use for pesticide application.

For Option 1, the main elements would include to clarify the status of more targeted pesticide application as part of precision agriculture (see Annex 5). Given that this option simply adapts the wording of known techniques, it is foreseen that no cost to professional users and very minor costs for Member States would occur. Under **Option 2**, building upon option 1, it would entail allowing more targeted pesticide application as part of precision agriculture, for example spraying by drones. Similar to option 1, this would not occur any required cost on users and could conversely provide potential economic benefits to both users, equipment manufacturers and specialist service providers. There would be minor costs for the Member States to include new technological aspects in controls and develop specific methodologies for conducting risk assessments, and for the Commission in developing a set of criteria. Automation would result in potentially reduced labour costs.

7. HOW DO THE OPTIONS COMPARE?

The comparison of proposed policy options is structured around the groups of policy elements being assessed, i.e. the following:

- Policy elements strengthening current SUD provisions;
- Policy elements addressing data availability and monitoring;
- Policy elements addressing alignment with pesticide-related targets announced in the Farm to Fork Strategy; and
- Policy elements addressing new technologies.

An overview is presented below summarising the rating of the impacts of each of the policy options against a series of assessment criteria covering effectiveness, coherence, efficiency, subsidiarity and proportionality[cxci].

For the specific objective "achievement of the pesticide targets", Policy Option 3 including fixed uniform 50% legally-binding Member State targets is indicated as being the most effective, with stronger actions reducing the sales and use of more hazardous pesticides having the highest and most certain effectiveness. However, while this higher ambition would be expected to be more effective in realising the Farm to Fork

targets, due attention would need to be given to subsidiarity aspects if setting fixed 50% reduction targets as standard for all Member States.

It should be noted, however, that in related policy areas Member States have failed to take sufficient measures at national level to comply with existing EU environmental law (e.g. Water Framework Directive) and hence setting EU obligations will help making implementation more effective[cxcii]. Policy Option 2 where Member States set their own legally-binding national targets to contribute to achieving an overall EU legally-binding target will be more effective than Policy Option 1. For the other specific objectives, there are also differences in effectiveness between the different policy options; however, the difference is less pronounced than for the first specific objectives. The specific measures summarised under Policy Option 1 mainly provide guidance, clarification and steps to improve implementation of existing SUD provisions. They continue to leave Member States high flexibility in their approach and thus are likely to result in greatly varying effectiveness.

A range of effectiveness is indicated for actions to strengthen the SUD provisions, which is again variable depending on the combination with other actions and the current variable level of application across Member States. The effectiveness of all actions is nevertheless assessed positively and the record-keeping for IPM, in conjunction with the use of these records and crop-specific rules is seen as having the potential to be highly effective, as is the register of PAE.

These elements can be expected to lead to higher levels of implementation and therefore better achievement of the objectives. For monitoring of use of pesticides the effectiveness of all policy options is assessed positively. These policy options would clearly improve measurability and coherence across Member States. In other cases, however, assessing the impact on effectiveness is not always possible, and effectiveness may vary according to the existing national ambitions and actions. For example, concerning new technologies, the assessment is difficult due to the uncertainty of the development and use of technology in the future, this particularly in relation to the potential use of drones for aerial spraying if future scientific evidence and consensus confirms their potential to reduce the use and risk of pesticides[cxciii].

In terms of coherence, almost all of the proposed measures under the different policy options are assessed to be coherent with other objectives of EU policy. The generally high rating is due to the fact that the measures, in short, aim at reducing the health and environmental risks from the use of pesticides. Exceptions include the different policy measures proposed for the specific objective “clarifying use of drones”, given that they suggest future legislative action once relevant scientific evidence and consensus are more fully developed which cannot be assessed yet; however, it is assumed that a

potential legislative act or parameters would be designed to not lead to any negative health and environment impacts. Another instance where coherence is less pronounced is for policy option 1 under specific objective "Alignment of the SUD with the pesticide targets"; given that the effectiveness of this option is expected to be low this could lead to limited alignment with health and environmental objectives of the EU legislative framework. The more ambitious options are designed to harmonise actions, to align the SUD with recent policy actions such as the Farm to Fork Strategy, Biodiversity Strategy, the Zero Pollution Action Plan and CAP, and to harness the benefit of synergies with other policies. They also provide for a more coherent action across Member States and remove some of the variations in implementation resulting in better coherence at national level. This is seen as contributing to the single market and reducing variations in production costs that vary significantly at present across Member States.

Concerning efficiency, for the measures under the different policy options there is more certainty in the assessment for the more ambitious options, while overall there is less variation in the difference in assessment between lower and more ambitious options as compared to effectiveness. For the proposed measures to align the SUD with the announced Farm to Fork Strategy pesticide reduction targets, the clearest efficiency gain is seen in limiting the use and risk of more hazardous pesticides. For the consideration of making the pesticide targets mandatory, it is considered that the setting of fixed 50% mandatory targets at Member State levels would have a negative effect on efficiency and proportionality, based on the targets requiring the same reduction for each Member State. The medium option is described as better reflecting past achievements, national circumstances and a more proportionate response based on 'effort sharing'.

For the strengthening of SUD provisions there is little difference presented between the level of ambition of the actions described, and a positive assessment for the efficiency of the options. The large range in the issues around IPM application link to a described uncertainty of the economic support (including potentially via the CAP) for the implementation particularly at farm level but are seen as having the potential to be highly efficient. For monitoring, the efficiency is based on Member States already having some systems in place. The slightly lower rating for policy option 2 is based on the upfront investment needed for the farmer, but the recurring burden is seen as minimal. As with the assessment of effectiveness the assessment of efficiency for technology is limited by a described uncertainty as to the range, availability and cost of technological advances.

Concerning proportionality, the majority of single measures under all policy options for the different specific objectives are seen as being highly proportional. This is due to the fact that in most cases only limited effort is expected for different stakeholder groups on implementation of the proposed measures towards reaching the specific obejctives. There is one notable exception, concerning the proportionality of policy option 3 of fixed 50% legally-binding Member State targets for the specific objective of achievement of pesticide targets. In this case, there might be proportionality issues given that the baseline of current use of pesticides varies widely between Member States. Also, in order to ensure proportionality, the differences between the agricultural sectors in the Member States would need to be taken into account.

The table below shows summarises the assessment of all criteria.

Table 1. Evaluation of the policy options per specific objective against all criterion

Effectiveness	**Criterion**	Policy Option 1	Policy Option 2	Policy Option 3
		Least ambitious	Medium ambitious	Most ambitious
Alignment of SUD with pesticide targets				
Achievement of pesticide targets	Effectiveness	-	++	+++
	Coherence	-	+ to ++	+++
	Efficiency	-	+	/
	Proportionality	/	+++	-
Limit the use and risks from pesticides, particularly more hazardous ones	Effectiveness	+ to ++	++	+++
	Coherence	+++	+++	+++
	Efficiency	/ to +	+	++
	Proportionality	+++	+++	+++
Strengthening SUD provisions				
Improved operationalisation of IPM principles	Effectiveness	+ to ++	+ to +++	++ to +++
	Coherence	+++	+++	+++
	Efficiency	+ to ++	/ to ++	+ to ++
	Proportionality	++	++	++
Improve controls and apply harmonised standards	Effectiveness	++	+++	
	Coherence	+++	+++	
	Efficiency	++	++	
	Proportionality	+++	+++	
Strengthen	Effectiveness	+	++	

Effectiveness	Criterion	Policy Option 1	Policy Option 2	Policy Option 3
		Least ambitious	Medium ambitious	Most ambitious
effectiveness of NAPs	Coherence	+++	+++	
	Efficiency	+	+	
	Proportionality	+++	+++	
Improve expertise of pesticide users	Effectiveness	+		
	Coherence	+++		
	Efficiency	/		
	Proportionality	+++		
Monitor the use as well as the risk of use from pesticides				
Monitor the use as well as the risk of use from pesticides	Effectiveness	+	++	
	Coherence	+++	+++	
	Efficiency	++	++	
	Proportionality	*+ to +++ (Proportionality for monitoring acute poisoning is considered high. For chronic poisoning the proportionality can be considered to be lower since the assessments would be complex and resource intensive)*	+++	
New technologies				
Promote precision farming and develop alternatives	Effectiveness	*n.a.*		
	Coherence	+++		
	Efficiency	*n.a.*		
	Proportionality	+++		
Clarifying on use of drone for pesticide application	Effectiveness	/	*n.a.*	
	Coherence	/	*+++ (assuming that a future potential legislative Annex or specific use parameters to be defined and agreed in the future would be designed to not lead to any negative health and environment impacts)*	
	Efficiency	/	*n.a.*	
	Proportionality	/	+++	
Emerging technologies for	Effectiveness	+	+	

Effectiveness	Criterion	Policy Option 1	Policy Option 2	Policy Option 3
		Least ambitious	Medium ambitious	Most ambitious
sustainable use of pesticides	Coherence	+++	+++	
	Efficiency	+	+	
	Proportionality	+++	+++	

Concerning subsidiarity, the actions are seen as retaining the flexibility to allow Member State-specific and regional circumstances and the variability of agriculture and pesticide use to be taken into account, apart from the most ambitious Policy Option 3 as regards targets of the Commission defining fixed 50% pesticide use and risk reduction targets to be made legally binding in each Member State based on the average for each Member State of the same fixed baseline period of 2015-2017.

Overall Comparison

The comparisons made of effectiveness and coherence, efficiency and proportionality and of subsidiarity of the policy options provides support for the preferred options, although with variation in scoring in some areas because of the variable baseline among Member States. The preferred option for most objectives is Policy Option 3, with notable exceptions on targets (in particular fixed legally-binding 50% Member State targets) and aerial spraying by drones where Policy Option 2 is most adequate.

8. PREFERRED OPTION

The preferred option is a combination of elements from the options described above that are expected to be most effective and efficient to achieve the objectives, while being coherent with the overall policy objectives and respecting proportionality and subsidiarity. These individual elements forming part of the preferred option are indicated in Tables 30-33 in Annex 7 (under the respective headings of least, medium and most ambitious options). The proposed Regulation accompanying this impact assessment contains very detailed rules relating to the setting of targets and binding, directly applicable obligations on economic operators in support of Specific Objectives 2 and 3. Where Member States have some flexibility to derogate, this is subject to strict binding conditions. All of these measures are most appropriately provided for in a Regulation that can provide greater precision for uniform binding rules.

Specific objective 1: Pesticide reduction targets reflected in SUD

As already applied in other EU policy fields such as renewable energy[cxciv], climate action[cxcv] and planned nature restoration targets[cxcvi], targets are considered to be an objective, clear and transparent tool to measure progress in reducing the use and risk of chemical pesticides and use of more hazardous pesticides. The options of aspirational EU-level targets, legally binding EU-level targets and legally binding Member State targets have been considered. As a non-legally binding EU-level 50% pesticide target would likely be ineffective[cxcvii], mandatory targets will be better suited to achieve agreed EU policy and legally-binding objectives. However, for the Commission to define a fixed and inflexible 50% legally-binding target for each Member State (Policy Option 3) is considered not to fully respect the subsidiarity principle and to be of low political viability based on feedback received from Member States and stakeholders and is, therefore, not preferred. Option 2 involves targets which are legally-binding and to be achieved at EU level, with Member States setting national binding targets to contribute to achieving the overall EU target. Once the Member States define the level of those national targets (after considering any recommendations from the Commission), those national targets become binding. In order to ensure a fair burden sharing, Member States will be allowed to take account of historical progress and changes in national circumstances since when the baseline period was set[39]. Member States will be permitted to set national targets that are lower than 50%, but not lower than 40%, on the basis of such changes. A Member State that has made historical progress through above-average reductions in pesticide usage can propose national targets below the EU 50% target in the range of 40-50%. Conversely, a Member State with poor historical performance will be asked to set proportionately higher targets for use and risk reduction.

Assuming that Member States will avail of the derogations under the Regulation to set targets below 50%, achievement of the twin EU binding targets cannot be guaranteed by the achievement of Member State targets alone, except in the unlikely event that targets set below 50% are balanced by those set above 50% (either due to poor historical performance or because Member States opt for this higher level of ambition on a voluntary basis and taking into account possible societal demands to further reduce the use and risk of pesticides). However, this takes no account of the impacts of removing active substances currently approved for use in pesticides from the market which may occur at an accelerated rate, which will be an additional contributing factor

[39] When the baseline period was set, each Member State was allocated 100, so the differences in national circumstances at that time were already accounted for.

in helping to meet the twin EU binding targets. Quite apart from the formal national reduction target set by each Member State, it should be noted that other separate initiatives either by competent authorities or stakeholders (such as the food industry) may also account for supplementary progress towards achieving the overall EU targets, for example by the promotion of sustainable food systems[cxcviiicxcix], organic farming, urban greening initiatives under the Biodiversity Strategy[cc] etc. The upcoming legislative initiative on a horizontal EU framework for sustainable food systems will help anchor the Farm to Fork Strategy and integrate sustainability into all food related policies. As a lex generalis it will lay down general definitions, principles and objectives, together with the requirements and responsibilities of all actors in the EU food system, which are expected to be complementary and supportive to achieving the targets set by the Farm to Fork Strategy. It is, however, difficult to precisely quantify at this time the contributions and impacts these ongoing and future initiatives will make to achieving the overall EU binding targets. It is also clear that the targets set by those Member States accounting for a high proportion of total EU sales (use) of pesticides will have a strong influence on expected progress towards reaching the overall EU targets (e.g. Germany, Spain, France and Italy accounting for over two thirds of the total EU pesticide sales[cci]).

A Regulation is the preferred legal instrument to provide sufficiently precise and binding obligations in relation to targets given the need to provide very clear parameters for how targets should be adapted to national circumstances.

Flanking policies will also be an effective means of fostering and guaranteeing compliance at EU level. For example, more specific IPM requirements in crop-specific rules will facilitate rewarding farmers who go beyond compliance with IPM requirements through incentives under the CAP that provide for farming practices relevant to IPM, such as biodiversity areas. Financial support is available in the CAP to help farmers adapt their practices to the transition to less dependency on chemical pesticides. The available financial means are within the national envelopes that Member States have in the CAP budget and these Member States are free to target the priorities in the framework defined at EU level. However these national envelopes are set at the beginning of the programming period and Member States are limited to the available funds in these envelopes.

The mandatory EU-level targets will be combined with annual monitoring of progress at both EU and Member State levels and Commission recommendations of possible additional measures if the level of progress of individual Member States in reducing the use and risk of pesticides is considered as not being sufficient. It should also be noted that trends in the use and risk of pesticides will be influenced by many factors outside

the scope of this initiative, for example trends in organic farming production in the EU and whether candidate for substitution pesticides are renewed under Regulation (EC) No 1107/2009 in the period up to 2030 covered by these targets.

In order to achieve the necessary pesticide use and risk reductions the following measures would accompany the targets; (1) The purchase and use of more hazardous pesticides by non-professional users would be prohibited, unless these users were trained as professional users. Such a requirement already applies in some Member States and is considered a preferred option based on the greater risks to health and the environment posed by the use of more hazardous pesticides. This approach is preferred over a potential prescription system given that such a prescription system would be very costly and impose a high administrative burden on pesticide users, advisers and Member States to implement without resulting in a significant reduction in pesticide use and risk[ccii]. (2) In sensitive areas, including in urban green areas the use of all chemical pesticides would be prohibited. This responds to stakeholder concerns on the need to reduce pesticide use in sensitive areas and for vulnerable groups[cciii] and links to relevant specific ambitions under the Biodiversity Strategy to protect nature and reverse the degradation of ecosystems[cciv]. Professional pesticide users[40] would face costs and an administrative burden to submit derogation applications if they needed to use chemical pesticides in such sensitive areas.[41]

Specific objective 2: Monitoring and ensuring that relevant data are widely available

To strengthen data availability[42] on pesticide use, Member States should systematically collect, in an electronic form, information on pesticide use that professional pesticide

[40] Number of professional pesticide users in the EU has been estimated based on Eurostat data reported under Commission Implementing Regulation (EU) 2019/1975 of 31 October 2019: Eurostat - Data Explorer (europa.eu). Backyard flocks consuming more than 50% of their own production are not assessed as likely to be professional pesticide users. 100% of plant-growing and mixed farms are included in the estimated maximum total of 5.6 million professional pesticide users in the EU along with 40% of livestock-only farms.

[41] It is assumed that preparing and submitting such a derogation application to use chemical pesticides in sensitive areas could take professional pesticide users 1 hour to complete at an hourly tariff of 16.10 Euro and that such a derogation might be submitted twice a year by an individual professional pesticide user. Number of potentially affected professional pesticide users has been extrapolated from the national situation of Slovenia which has a very high proportion of its territory covered by Natura 2000 areas for example and a relatively low average farm size. For the purpose of calculating associated administrative burden, it is estimated that 3.74 million farms in the EU are located in sensitive area and that all of these farmers are professional pesticide users.

[42] It should also be noted that there is an empowerment in Art 67(4) of Regulation (EC) No 1107/2009 for the Commission to set implementing measures to ensure the harmonized implementation of record-keeping obligations.

users are already required to keep recorded in line with the plant protection products Regulation[43]. Member States should report to the Commission annually on this data in order to identify trends in the use and risk of pesticides. Combining data on actual use of pesticides[44], with other data collected via relevant research projects[45] monitoring the presence of pesticides and metabolites in human and environmental samples would allow the Commission to develop more precise harmonised risk indicators in the future. Experiences concerning the development of other indicators would also be taken into account, for example water quality indicators developed by the EEA[ccv].To improve enforcement, monitoring and control of PAE, a better overview on PAE in use in Member States should be ensured through a preferred option of establishing national PAE registers[46] in each Member State. Data indicates that, depending on the PAE type, an inspection reduces 6 to 12% of the technical risk involved using a single PAE machine of the overall risk of plant protection products for the environment and human health[ccvi]. It is therefore preferred and considered appropriate and justified to have better overview data available on the inspection of PAE across all Member States, also taking into account the PAE inspection implementation shortcomings identified in the evaluation accompanying this impact assessment. A Regulation is the best legal instrument to address this policy option given that it requires detailed obligations that are directly enforceable on individuals (for example in relation to records on pesticide use or notify sales of application equipment). This is more appropriately dealt with in a uniform manner in a Regulation.

Specific objective 3: strong implementation of clearer SUD provisions in Member States

Given that the CAP is expected to create a strong link between NAPs and CAP payments, the content, development and review of the NAPs would be further specified in detail in the SUD and should be linked to the future NSPs to be prepared under the CAP.

[43] Article 67 of Regulation (EC) 1107/2009.

[44] Which would help to demonstrate the effectiveness of the use legislation by looking at the concentrations of pesticides in fresh and marine waters or soils and comparing them with limit values.

[45] e.g. HBM4EU, LUCAS: Land Use and Coverage Area frame Survey.

[46] The administrative burden for a PAE owner to register their PAE in the register is estimated at 1 hour at an hourly tariff of 16.10 Euro. Based on surveys completed by SPISE working group, number of operational PAE in the EU required to be registered is estimated as 1,172,300. Linked to the regular annual turnover of PAE (purchase of new PAE and sale of existing PAE) it is estimated that an additional 175,000 PAE units would need to be registered annually.

Conditionality under the CAP will be an important flanking measure to achieve this specific objective. Even though deleting the requirement for NAPs would reduce potential administrative burden for Member State competent authorities, this current requirement is kept as Member States and stakeholders feedback confirm that NAPs still represent a useful tool to direct and engage on national policies to promote the sustainable use of pesticides, also considering that not all national pesticide use would be covered under the CAP or NSPs. Member States should make better use of the existing provisions under the Official Controls Regulation on controls, enforcement and penalties relevant to the SUD. National and/or regional crop-specific IPM rules should assist pesticide users. Together with electronic IPM record-keeping[47] this would also facilitate controls and enforcement. This should be accompanied by an independent advisory systems, for professional pesticide users responding to specific stakeholder demands[ccvii]. The advisory systems are expected not only to reduce the use and risk of pesticides but also help to reduce costs for pesticide users[ccviii], by reducing amounts spent on pesticides. The promotion of the use of harmonised standards on PAE where they exist and support their development where they currently do not exist should lead to improved controls and reduced pesticide use[ccix].

Implementation is greatly strengthened by providing more detailed rules in the form of a Regulation. For example, in relation to integrated pest management, while it is impossible to provide for sufficiently specific rules for each local crop and region in one text given the numerous geographic, climatic and crop-specific variables, the Regulation can provide for the Commission to object to crop-specific rules that do not follow legal requirements as to contents and subject the method of development and implementation of crop-specific rules to audits. In addition, a Regulation is the most appropriate legal instrument to ensure uniform, streamlined NAPs, which have often lacked quantitative data or adequate levels of detail under the SUD.

Specific objective 4: new and more efficient techniques are taken up by pesticide users

Possible measures to be taken under the CAP will be a most relevant flanking measure to promote that new and more efficient techniques are taken up by pesticide users. Nevertheless, it should be noted that not all pesticide (or even agricultural) use would be covered under the CAP. Given that the SUD does not impede, in principle, the application of precision farming techniques[ccx], changes would be limited to providing

[47] It is estimated that the administrative burden for IPM record-keeping for each professional pesticide user would be 6 hours per year on average at an hourly tariff of 16.10 Euro.

provisions to describe and encourage the role of precision agriculture as a tool to achieve the objective of pesticide use and risk reduction, encouraging the availability of alternatives to chemical pesticides and in clarifying on aerial spraying and the use of more targeted pesticide application as part of precision agriculture, for example spraying by drones, since drones are not currently explicitly mentioned in the definition of aerial spraying in the SUD[ccxi]. In line with the SUD's current prohibition on aerial spraying and the Commission's over-arching ambition to reduce the use and risk of pesticides, more targeted application of pesticides as part of precision agriculture should be encouraged within clearly defined parameters. However, concerning aerial spraying by drones, due to current limitations and consensus on available scientific data[ccxii], those parameters should be defined in a future annex of the legislation based on advances in the underlying science and where demonstrated to reduce the overall use and risk of pesticide. Concerning drones the preferred option is therefore to explicitly include drones in the legal definition of aerial spraying of pesticides, maintain the current general legal prohibition of all forms of aerial spraying, including by drones, except under strict conditions (no feasible alternative and less negative impact on human health and the environment than any alternative) and technical requirements. The Commission will plan to adopt more detailed future rules on aerial spraying via drones once the scientific evidence and consensus on the benefits or risks of this practice are more advanced.

The **impacts of this preferred option** are mainly shaped by the impacts of the various elements it combines.

Achieving the pesticide targets would generate environmental and social/health benefits, and contribute to a sustainable and safe food production in the EU. Professional users would face additional costs compared to the status quo from the time spent for data recording. A ban of chemical pesticides in sensitive areas could result in a reduction of relevant crop yields from those areas. Professional users being obliged to use independent advisory services better promoting IPM would have a direct additional cost, but could be offset by the savings of using less pesticides as a result. Member State authorities would mainly be impacted by planning and reporting requirements on the elements. The main costs would arise from revising the NAPs to reflect the specifications, setting up electronic data collection systems, analysing the data recorded by pesticide users, and preparing annual reports to the Commission on progress towards reaching the Farm to Fork Stratgey pesticide targets. The additional costs depend on the current level of implementation and can overall be expected to be at a medium level.

Non-professional pesticide users would face costs in order to be trained as professional users if they wished to purchase and use more hazardous pesticides. The overall extent of these costs is unknown as statistics on the number of non-professional pesticide users do not exist and their user profiles differ substantially. Pesticide producers would likely see a change in demand for their products because of the ban of use of chemical pesticides in sensitive areas. There could be a change from the use of chemical pesticides to alternative techniques, including microbial pesticides, with a consequent impact on the product portfolio of pesticide producers. There could also be impacts on the level of international trade[ccxiii] of particular pesticides into, or out, of the EU, in line with adjustments in pesticide use rules and policies within the EU. EU consumers could see increasing food prices because of the higher production costs and reduced yields of agricultural production. There could be an impact on the EU trade balance from increased imports (e.g. of oilseeds, cereals) and decline in EU exports of agri-food products to third countries, although, as described earlier and in Annex 5, economic analyses of these aspects differ on the overall impacts and their scale.

The costs are contrasted by **benefits** for different groups. For society in general, benefits arise from reduced risk for human health and for the environment. The main contribution to this benefit is achieved from the ban of chemical pesticides in sensitive areas, which includes green urban areas close to a large number of people and to vulnerable groups such as children. In addition, a training requirement for non-professional users if they wished to purchase and use more hazardous pesticides and a better implementation of harmonised testing of PAE can be expected to reduce the exposure of pesticide users and bystanders. The impact assessment also found that environmental benefits from legally binding pesticide targets, supported by mechanisms such as the ban of chemical pesticides in sensitive areas, would increase soil and water quality, particularly in such areas that have high environmental value as habitats or for ecosystem services. There would be benefits to biodiversity, and the ecosystem services it underpins such as pollination services, but quantifying these benefits or monetising them is not possible. In the longer term, there could be positive impacts on businesses that directly depend on biodiversity and healthy ecosystems such as in the agriculture, water and food sectors, as well as the tourism industry. Policies to reduce pesticide use and risk in the EU could lead to a promotion of such policies in non-EU countries, with training and knowledge-sharing activities potentially contributing to such positive spill-over effects and the promotion of positive practices to reduce the use and risk of pesticides globally. Professional pesticide users can potentially reduce expenses for pesticides through better implementation of IPM principles. Member State authorities would benefit from improved clarity on requirements towards their NAPs and reporting obligations. Other industries and some

specific parts of the food production value chain would benefit from the efforts to achieve the pesticide targets. This applies to farmers practising agroecology, beekeepers, agricultural machinery producers, the biocontrol industry and advisors but also to drinking water suppliers for example (less costs from pesticide pollution).

The potential impacts on production costs and higher risks of loss of yields remain. The benefits of the option relate to the reduction of risk for human health and protection and restoration of biodiversity, natural compartments and ecosystem services.

REFIT (simplification and improved efficiency)

Based on consultations with stakeholders[ccxiv], including Member State competent authorities and other stakeholders via the Advisory Group on the Food Chain and Animal and Plant Health[ccxv], **no legislative simplifications or reductions of administrative burden** have been identified that would not jeopardise the objectives of the SUD to protect health and the environment or the ambition of the European Green Deal, Farm to Fork Strategy, Biodiversity Strategy and Zero Pollution Action Plan to reduce the use and risk of chemical pesticides.

9. HOW WILL ACTUAL IMPACTS BE MONITORED AND EVALUATED?

The existing indicator to measure the achievement of the two pesticide targets[ccxvi] will form the basis of the annual central monitoring of the progress towards the two Farm to Fork pesticide targets at the EU and at Member State levels. Furthermore, the indicator will be used to evaluate and measure the success of this initiative. The importance of this initiative, and the need to ensure that all Member States stay on track to achieve the two pesticide targets, coupled with the availability of the necessary data to measure progress towards the two targets each year, justifies and explains the annual monitoring cycle.

The assessment of progress towards the targets will, in particular, be supported by the availability of annual, harmonised, aggregated data on the sales and use of pesticides under the Commission's proposed Regulation on Statistics on Agricultural Inputs and Outputs. The resultant data will provide an annual national level overview of sales by active substance and use in agriculture for representative crops by active substance. A planned Implementing Regulation under Article 67 of Regulation (EC) No 1107/2009 will better define the content and format of records that professional users must maintain, which will facilitate the collection of this detailed data by Member State competent authorities. Furthermore, data on pesticides in water (reported by Members States to the European Environment Agency under Directive 2000/60/EC), data on pesticides in soil (under the LUCAS project), and data on farm practices collected under

the Farm Sustainability Data Network (FSDN) will also support the evaluation of the success of this initiative.

Additionally, relevant indicators for the operational objectives under each specific objective are proposed and presented in Table 2 below. To supplement this annual monitoring, and making use of all relevant data that will be available, the initiative is proposed to be formally evaluated at the earliest 7 years after the planned legal proposal becomes applicable. This is considered appropriate in view of the time that will be needed for the monitoring data and indicators in below-mentioned Table 2 and for comparative years to become available and to avoid that the evaluation takes place prematurely before sufficient data and monitoring information are available on the implementation, application and enforcement of the expected legal provisions. It should also be noted that data on whether the 2030 pesticide use and risk reduction targets have been achieved will likely only become available in 2032. As part of its monitoring and evaluation activities and making use of the more granular pesticide use data expected to be available, the Commission will consider whether new pesticide use and risk reduction targets will be appropriate for the period beyond 2030, which could also be more specifically differentiated and targeted towards individual and more hazardous categories of plant protection products.

Moreover, these monitoring data can also be used directly in the monitoring of the overall policy objectives set out under the European Green Deal and the 8th Environment Action Programme, including the Farm to Fork Strategy, the Biodiversity Strategy and the Zero Pollution Monitoring and Outlook.

Table 2. Relevant indicators for monitoring of operational objectives[ccxvii]

Operational objectives	Relevant output indicators	Collection
Stronger and more even implementation of the SUD provisions in the Member States		
The implementation of IPM is supported with independent technical advisory services (Data collected under planned revised SUD provisions).	Share of farmers using independent advisory services	Annual Progress and Implementation Reports under NAPs will require Member States reporting to Commission on the % of professional users using independent advisory services Auditing under framework of Officials Controls Regulation (OCR) of controls by Member State competent authorities to ensure that each farmer uses independent advisory service at least once a year and controls of records of advice kept by professional users

Operational objectives	Relevant output indicators	Collection
IPM implementation is controlled and enforced (Data collected under planned revised SUD provisions).	Share of UAA of the EU for which crop-specific IPM rules are available Share of professional users controlled for IPM implementation per year	Annual Progress and Implementation Reports under NAPs will require Member States reporting to Commission on the following: % of UAA in each Member State that is covered by crop-specific rules that are legally binding in national legislation Notification of whether electronic integrated pest management (IPM) register has been established % of professional users controlled for IPM implementation Auditing under Official Controls Regulation to verify Member State controls in ensuring information entered in electronic IPM register Member State reports to Commission in relation to rules on penalties for legislative infringements
Testing of PAE is further harmonised and monitored (Data collected under planned revised SUD provisions).	Number of Member States with PAE registers and completeness of the registers Number of harmonised inspection standards developed in accordance with Article 10 of Regulation (EU) No 1025/2012	Annual Progress and Implementation Reports under NAPs will require Member States reporting to Commission on the following: Notification of whether electronic register of application equipment in professional use has been established Member State data on % of PAE registered Member State data on % of PAE inspected Whether Member States have applied derogations allowing for a) different inspection requirements to application equipment that represents a very low scale of use or b) exemptions for handheld equipment or knapsack sprayers Commission records information on harmonised inspection standards developed and published

Operational objectives	Relevant output indicators	Collection
Professional users, advisors and distributors are trained in a systematic way **(Data collected under planned revised SUD provisions).**	Number of professional users, advisors and distributors trained	Annual Progress and Implementation Reports under NAPs will require Member States reporting to Commission on % of professional users, advisers and distributors trained broken down by professional user, advisers and distributors
Monitoring and data are widely available		
Improved data availability on use of pesticides, IPM implementation and policy impacts **(Data collected under planned revised SUD provisions and under the planned Farm Sustainability Data Network).** **Data on annual use of pesticide in agriculture is available at Member State and EU level** **(Data collected under the proposed Regulation on Statistics on Agricultural Inputs and Outputs (SAIO) and building on planned revised SUD provisions).** **Targets set by Member States make use of collected use data** **(Data collected under planned revised SUD provisions).**	Share of professional pesticide users keeping electronic records on IPM implementation with resulting data then collected by Member State authorities Share of professional users keeping pesticide use data electronically with resulting data then collected by Member State authorities Information on derogations granted in relation to aerial application, use of PPPs in sensitive areas and inspection of application equipment in professional use	Annual Progress and Implementation Reports under NAPs will require Member States reporting to Commission on the following: Number of aerial application derogations and reasons given % of UAA covered by aerial spraying derogations Number of derogations for use of PPPs in sensitive areas % of UAA covered by derogations for use of PPPs in sensitive areas % of professional pesticide users keeping electronic records on IPM implementation % of professional users keeping pesticide use data electronically
Knowledge on pesticide use and risk is available, and the information is used to the full **(Data collected under planned revised SUD provisions).**	Number of Member States adapting their NAPs on basis of collected use and risk data	Member States to submit annual report on cases of acute poisoning and chronic poisoning arising from exposure of persons to PPPs
The SUD reflects the ambition of the Farm to Fork Strategy and Biodiversity Strategy		
Member State progress towards the two Farm to Fork Strategy pesticide targets **(Data collected under existing Regulation (EC) No 1185/2009 concerning statistics on pesticides and under the proposed Regulation on Statistics on Agricultural Inputs and Outputs (SAIO)**	Continous reduction in trend of pesticide use and risk at national level Member States achieve progress they set in binding national targets (which may deviate, within set parameters, from 50% EU target levels to varying degrees, depending on historical progress)	Annual Progress and Implementation Reports under NAPs will require Member States reporting to Commission on progress towards targets set by Member States

Operational objectives	Relevant output indicators	Collection
provisions.		
Use and risk of pesticides are reduced as captured by the Farm to Fork Strategy targets (Data collected under existing Regulation (EC) No 1185/2009 concerning statistics on pesticides and under the proposed Regulation on Statistics on Agricultural Inputs and Outputs (SAIO) provisions.	Continous reduction in trend of pesticide use and risk at EU level 50% reduction of use at EU level	Commission report annually on the basis of national reporting
Use of non-chemical alternatives to key active substances and to chemical PPPs on key crops is increased	Progress towards national targets set by each MS in National Action Plans	Annual Progress and Implementation Reports under NAPs will require Member States reporting to Commission on Progress towards the national Farm to Fork targets set in NAPs Progress towards all targets for increasing the % of non-chemical alternatives to each of the pests found on each crop on which the active substances that are most responsible for the change in index value in relation to both of the national targets are used Progress towards all targets for increasing the % of biological PPPs used on at the three most widely grown field crops
Presence of pesticides in the environment and risks to biodiversity (Data collected under a range of initiatives including the proposed Regulation on Statistics on Agricultural Inputs and Outputs (SAIO) provisions, data on pesticide findings in water reported to the EEA under Directive	Continuous reduction in trend of pesticide use and risks to pollinating insects at EU level	Commission reports annually based on the protocol for environmental monitoring of pesticides using the honey bee (*Apis mellifera*) as a bioindicator, following the implementation of the European Parliament's Preparatory Action[48].

[48] Pesticide monitoring (Insignia) - EU Pollinator Information Hive - EC Public Wiki (europa.eu)

Operational objectives	Relevant output indicators	Collection
2000/60/EC, data on pesticide residues in soils collected under the Land Use/Cover Area frame statistical Survey Soil (LUCAS).		
Representative and harmonized monitoring data on the presence of pesticides in all relevant media is available (Data collected under a range of initiatives including the Regulation on Statistics on Agricultural Inputs and Outputs (SAIO) provisions, data on pesticide findings in water reported to the EEA under Directive 2000/60/EC, data on pesticide residues in soils collected under the Land Use/Cover Area frame statistical Survey Soil (LUCAS)	Reduction of presence of pesticides in the environment	Annual national reporting of monitoring data
New technologies that lead to a reduction in use and risk are developed and taken up		
Use of relevant new technologies and development of relevant new technologies is supported	Sales and use of relevant precision farming tools that can reduce the use and risk of pesticides Amount of financial support for research into new technologies and number of research programs or projects in the area of new technologies	Data to be collected via relevant market and sales indicators and possible surveys and other collection tools by the Commission (including JRC), Member States, industry and other stakeholders.

ANNEX 1: PROCEDURAL INFORMATION

Annex 1.1. Lead DG, Decide Planning/CWP references

DG SANTE, PLAN/2020/6975

Annex 1.2. Organisation and timing

A combined evaluation roadmap and inception impact assessment (ERM-IIA) for this back-to-back assessment was published in May 2020, remaining open for feedback until August 2020. Three Commission public remote stakeholder events took place in January, June and October 2021. An online public consultation/ Have your say took place from January to April 2021.

An external study[ccxviii] supporting the evaluation and impact assessment was contracted in December 2020 and concluded in October 2021. A supplementary foresight-on-demand study[ccxix] on future vision scenarios on the sustainable use of pesticides was contracted, commencing in March 2021 and concluding in October 2021.

Within the Commission, an inter-service steering group (ISSG) was set up, including DG SANTE, DG AGRI, DG CLIMA, DG DEFIS, DG EMPL, DG ENV, ESTAT, DG GROW, DG INTPA, DG JUST, JRC, DG MARE, DG MOVE, DG REGIO, DG RTD, SG, SJ, DG TAXUD, DG TRADE.

Five remote ISSG meetings were held between June 2020 and January 2022 to update on the planned work and discuss progress with the supporting external study and to discuss ISSG comments on the evaluation and impact assessment Commission staff working documents.

Annex 1.3. Consultation of the RSB

An upstream RSB meeting took place on 2 July 2021. The draft impact assessment staff working document was discussed at an RSB meeting of 24 November 2021 and a negative first RSB opinion issued on 26 November 2021. A revised draft impact assessment staff working document was submitted to the RSB and, by written procedure, a positive with reservations second RSB opinion was issued on 26 January 2022. Table 3 below outlines how the first RSB opinion comments on improvements needed to the impact assessment staff working document have been addressed.

Table 3. Amendments in response to the first 26 November 2021 RSB opinion comments

Points to improve in the impact assessment Commission staff working document as mentioned in RSB opinion	How these specific points have been addressed in the staff working document

1. The report should explain in more detail the limitations of data availability on pesticides sales and use for the initiative. It should present the shortcomings to be addressed, what the initiative will do to correct them, and how coherence and efficiency can be guaranteed with other parallel initiatives (in particular limiting administrative costs).	More explanation has been included on these aspects in the staff working document, including more explicit detail on the data which are expected to be collected and available in the future linked to this planned initiative and also links with Regulation (EC) No. 1185/2009 of the European Parliament and of the Council concerning statistics on pesticides and the Commission's proposal of February 2021 on a Regulation of the European Parliament and of the Council on statistics on agricultural input and output and inter alia repealing Regulation (EC) No 1185/2009. There is close coordination between relevant Commission DGs such as AGRI, ESTAT and SANTE to ensure coherence, efficiency and limiting administrative costs. The evaluation staff working document annexed to the impact assessment highlighted the dependency of the SUD on Regulation (EC) No 1185/2009 to provide relevant pesticide statistics for the assessment of progress towards the objectives of the SUD and numerous limitations in the pesticide statistics currently collected, for example: both the sales and use statistics are aggregated by chemical classes, categories of products and major groups. Data are not available by active substance level. The pesticide use statistics are collected only once in a 5-year period and the reference year can be chosen freely by the Member State, the Member State can choose the representative national crops for the pesticide use statistics. This limits the comparability of the data between the Member States. The lack of availability and harmonisation has limited the usefulness of these data for adopting relevant measures and for monitoring progress at the EU level.
2. The report should be clearer on the scope and scale of the problem. In particular, it should strengthen the presentation of available evidence on the environmental and health effects of pesticide use. It should clarify that the issues of illegal import and use of EU banned pesticides from abroad, and levels of residues of EU-banned pesticides in imported foodstuff is dealt with in related initiatives.	More data and supporting references have been included in the staff working document to clarify the scope and scale of the problem, especially as regards the environmental and health effects of pesticide use. It has been clarified that that the issues of illegal import and use of EU banned pesticides from abroad, and levels of residues of EU-banned pesticides in imported foodstuffs are dealt with in related initiatives, Regulation (EC) No 1107/2009 of the European Parliament and of the Council of 21 October 2009 concerning the placing of plant protection products on the market and Regulation (EC) No 396/2005 of the European Parliament and of the Council of 23 February 2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin respectively.
3. The common mandatory reduction targets at EU and Member State levels for the use of pesticides and the use of hazardous pesticides and how they interact should be better justified. This justification should fully respect the subsidiarity principle and reflect the significant variations in pesticide use and past reduction efforts in the Member States. The report should consider a broader range of possible values above and below 50%, explain why 50% is the appropriate	The preferred policy option regarding the pesticide targets has been re-considered and adjusted to policy option 2 (legally-binding EU level targets, Member States set national targets to contribute to achieving the EU targets). Extra explanation has been included on the articulation between the proposed legally-binding targets to be set at EU level and how nationally-adapted and indicative targets to be set by individual Member States will contribute to achieving this EU-level target, also respecting the subsidiarity principle, different levels of progress among Member States in reducing the use and risk of pesticides and the variation in plant pests,

level, and what the trade-offs are for higher or lower target levels.	crops, climate and topography between and within individual Member States. Alternative pesticide reduction targets of varying levels of ambition (e.g. 20-40%, 40-60%, 60-80%) have been explored as well as the necessary trade-offs on these policy aspects between different relevant and interconnected factors such as environmental and human health protection, political feasibility and economic viability. Relevant trade-offs have also been explored in the EU Group of Chief Scientific Advisors' opinion "Towards a sustainable food system" and relevant considerations have been included in the revised document.
4. The report should assess how the common EU targets can be disaggregated into Member State targets. It should explain how national efforts will contribute towards the common EU targets, how national targets will be agreed and implemented and what mechanism will be used to enforce and monitor them.	The preferred policy option has been clarified, taking into account experience in other EU policy fields such as renewable energy and climate action, as regards the setting of legally-binding pesticide use and risk reduction targets at EU level and how nationally-adapted and indicative targets to be set by individual Member States will contribute to achieving this EU-level target, also respecting the subsidiarity principle, different levels of progress among Member States in reducing the use and risk of pesticides and the variation in plant pests, crops, climate and topography between and within individual Member States. Specific monitoring and reporting measures have been briefly outlined in the staff working document and will be specifically described in the planned legislative proposal.
5. The report should present evidence on the current and future availability, feasibility and affordability of precision farming and alternatives to chemical pesticide use. The options should explore how to best stimulate innovation without opening the possibility for abuse (e.g. drone use effectively enabling aerial spraying).	Specific explanatory text has been included on current and expected availability of new technologies, precision farming techniques and alternatives to chemical pesticides. Data and supporting scientific references have been added on the demonstrated ability of such tools to reduce the use and risk of chemical pesticides and use of more hazardous pesticides. The potential of the reformed Common Agricultural Policy (CAP), applicable from 2023, to support investments for precision spraying equipment has been highlighted. Taking into account the OECD's Report on the State of the Knowledge – Literature Review on Unmanned Aerial Spray Systems in Agriculture published in November 2021, the preferred policy option as regards possible aerial spraying of plant protection products via drones is not to liberalise such aerial spraying but rather to define precise conditions concerning their possible use in the future once further scientific evidence and consensus are available on the risks or potential of such aerial spraying by drones to reduce the overall use and risk of pesticides.
6. The report should further develop the impact analysis. It should include the assessment of all significant impacts and clearly show the costs and benefits for all affected groups. It should complete the analysis of the economic impacts and strengthen the presentation of the environmental and health	The impact analysis sections of the staff working document have been further developed to more clearly explain the impacts, costs and benefits of policy options for affected groups, while acknowledging that due to data limitations and some scientific uncertainties the specific impacts or benefits on health and environmental aspects can be difficult to assess and in particular to quantify. A more detailed presentation of

impacts expected from this initiative. It should identify (and quantify – if possible) the trade-offs between the environmental and health benefits and the reduction in agricultural output (and income) and risks posed by third country agricultural imports. It should also discuss possible mitigating or compensatory measures. It should explain how the foresight study has informed the analysis.	available impact assessment and modelling studies concerning possible impacts of achieving the Farm to Fork Strategy pesticide use and risk reduction targets has been included in the staff working document. Possible impacts on non-EU countries and developing countries have been described as well as possible mitigation or compensatory measures that could help to address these or other potentially negative impacts. The need for trade-offs between economic, health and environmental aspects has been described. Relevant findings of the supplementary Foresight study on future scenarios on the sustainable use of pesticides which informed the overall analysis have also been outlined in the staff working document.
7. The report should specify when and how the initiative will be evaluated.	The evaluation and monitoring framework has been further detailed and elaborated, including broader monitoring activities in the environmental and water policy areas which can support the evaluation and monitoring of this initiative. It is considered appropriate to foresee a specific and formal evaluation of the policy not earlier than 5 years after the planned legislative proposal becomes applicable, also considering that, despite annual monitoring and reporting of relevant data and indicator trends, an overall assessment of whether the 2030 Farm to Fork Strategy pesticide use and risk reduction targets have been achieved will likely only be possible in 2032 once relevant data for 2030 become available.

Table 4 below outlines how the second opinion RSB reservations have been addressed in the revised impact assessment staff working document.

Table 4. Amendments in response to the second 26 January 2022 RSB positive with reservations opinion

Reservations expressed in second RSB opinion	**How these specific points have been addressed in the revised impact assessment staff working document**
1. The report does not explain clearly the lack of evidence on pesticide sales and use and the corresponding limitations for the problem definition, option formulation and impact analysis.	The background section on the specific context for this initiative makes clearer where there is lack of data or evidence Lack of EU-level data on how, why, when, where plant pesticide products are used, on which crops, against which pests etc. severely curtail the level of granularity which is possible to precisely define the problem definition, option formulation and impact analysis. A number of the proposed policy options, and parallel flanking measures in other EU policies such as the CAP and statistics legislation aim to help to address this current lack of evidence. This has been further clarified in the document.
2. The report does not sufficiently justify the choice for the twin 50% binding reduction targets and how they articulate.	The text concerning these targets has been further clarified in a number of sections of the document (including the preferred option section), especially the establishment, monitoring and application of the foreseen adapted Member States targets. Current data and monitoring limitations, as outlined in the

	evaluation and impact assessment, hamper the establishment at EU level of more precise and tailored targets aimed at the use of specific and individual plant protection products, given that EU sales data (as a proxy for use data) cannot be disaggregated to the level of individual substances due to confidentiality restrictions. As more detailed and specific data become available, and especially for the period beyond 2030, the Commission will examine whether more tailored targets could be established, focussing more precisely on the use of individual plan protection products, supported by the specific monitoring and evaluation framework outlined in this impact assessment and other complementary Commission flanking initiatives.
3. The report does not specify what level of progress from individual Member States is 'sufficient' to be compliant with the twin binding EU reduction targets, how this will be measured or allocated or result in a fair burden sharing. It is not clear what benchmark level and reference period the twin EU reduction targets and Member State reductions will be compared to and how binding national targets will be ultimately established.	More detailed references have been included in this document, including in the preferred option section. These aspects are also described precisely and in considerable detail in the Commission legislative proposal accompanying this impact assessment.
4. The report is not clear on which flanking initiatives are included in the baseline, and whether their current design is appropriate for supporting the objectives of this initiative. The report uses different baselines without explaining how they fit together coherently.	Extra details have been added in a number of sections of the document on some of the most relevant flanking Commission initiatives included in the baseline e.g. new CAP applying from 2023, existing Commission statistics on agricultural inputs and outputs (SAIO) proposal. A number of external economic studies have been referenced in the document, including the JRC CAPRI study. It is true (and outside the control of the Commission) that different baselines have been used in these studies. Some extra clarification has been added to the report to try to make this clear to the reader, also pointing out the limitations of such economic studies which are at risk of not taking a full and holistic account of the policy options proposed, especially the pesticide use and risk reduction targets.
5. The report does not set out a credible basis and timeframe for the evaluation of the initiative.	The evaluation timeframe has been amended to "at the earliest 7 years after the planned legal proposal becomes applicable". The Commission retains the flexibility to adjust the planned timeframe for the future evaluation of the initiative if this is considered appropriate and optimal and in line with the best principles of Better Regulation applicable to this future planned work. As part of its monitoring and evaluation activities, and making use of the more granular pesticide use data expected to be available, the Commission will consider whether new pesticide use and risk reduction targets will be appropriate for the period beyond 2030, which could also be more specifically differentiated and targeted towards individual and more hazardous categories of plant protection products, taking into account the more granular pesticide use and other data expected to be available at EU-level in the future.

Annex 1.4. Evidence, sources and quality

The evaluation and impact assessment rely significantly on the following sources:

Literature review

Directive 2009/128/EC on the sustainable use of pesticides - European Implementation Assessment, study, European Parliamentary Research Service, ISBN: 978-92-846-3330-2, October 2018.

Sustainable use of plant protection products: limited progress in measuring and reducing risks, Special Report European Court of Auditors, ISBN:978-92-847-4206-6, Publications Office of the European Union, Luxembourg, 5 February 2020.

Rand Europe, Development of future scenarios for the sustainable use of pesticides and, in particular, achieving by 2030 the pesticide use and risk reduction targets announced in the Farm to Fork and Biodiversity Strategies, RR-A1501-1 October 2021

Ramboll Arcadia International, Study supporting the Evaluation of Directive 2009/128/EC on the sustainable use of pesticides and impact assessment of its possible revision Rand Europe, October 2021.

Public feedback on combined evaluation roadmap and inception impact assessment May-August 2020, published on the Have Your Say Portal of the European Commission

Online public consultation published on the "Have your say" portal in January-April 2021, Factual Summary Report (Ref. Ares (2021)3138340 – 11 May 2021),

Better Training for Safer Food (BTSF) Workshop on the Sustainable Use of Pesticides Directive (SUD) 2009/128/EC - Experiences on its current implementation and possible future policy options. 17-19 November 2020.

Commission public stakeholder events held in 2021 on: 19 January, 25 June, 5 October.

Evaluation on Directive on the Sustainable Use of Pesticides, Information report, European Economic and Social Committee, NAT/805-EESC-2020, 27 April 2021.

ANNEX 2: STAKEHOLDER CONSULTATION

Annex 2.1. Introduction

This synopsis report presents the stakeholder consultation activities performed within the back-to-back evaluation of the sustainable use of pesticides Directive and the impact assessment of its possible revision. It contains a discussion and comparison of results of the different consultation activities, looking, inter alia, into interdependencies and in/consistencies, as well as a summary of how results have been integrated into the analysis for the responses to the evaluation questions and as part of the impact assessment process.

Annex 2.2. Consultation strategy

The stakeholder consultation activities cover the public feedback on a combined evaluation roadmap-inception impact assessment, a public consultation, three public stakeholder events, and interviews, targeted online surveys, focus groups, and stakeholder workshops undertaken by the consultant. The aim of the consultations were:

- to inform stakeholders on the ongoing evaluation and impact assessment mainly via the public stakeholder events and the combined roadmap/inception impact assessment;
- to get the views of the public on the sustainable use of pesticides and possible future options via the public consultation;
- to collect feedback from the authorities on the implementation of the sustainable use of pesticides Directive (what has worked well and not so well) and perspectives on possible changes to the legislative framework via a 'Better Training for Safer Food' workshop with Member States national competent authorities;
- to collect views on implementation and views and data on impacts from stakeholders through targeted interviews and surveys.

As an illustration, main stakeholders identified and addressed are shown in Table 5 below.

Table 5. Main stakeholder groups

Stakeholder Category	Exploratory interviews	Interviews	Case study interviews	Surveys	Focus Groups	Public Consultation	Total[49]
European Institutions	5	6	1	–	4	–	16
International organisations	–	2	–	–	4	–	6
Member State authority/Public authority	–	12	24	55	–	35	126
Civil society & NGOs							
EU citizen	–	–	–	–	–	1033	1033
Non-EU citizens	–	–	–	–	–	77	77
Consumer organisation	–	1	–	–	–	9	10
NGOs	–	3	–	–	2	45	50
Environmental organisation	1	–	–	17	1	16	35
Trade union/ Workers organisations	–	1	–	3	–	13	17
Business							
Company/ business organisation	–	–	–	–	–	233	233
Economic stakeholders - PPP users	–	4	–	61	–	–	65
Economic stakeholders - PPP producers and distributors	–	2	–	79	–	–	81
Other economic stakeholders impacted by SUD	–	8	–	49	–	–	57
Business association	6	–	–	–	–	88	94

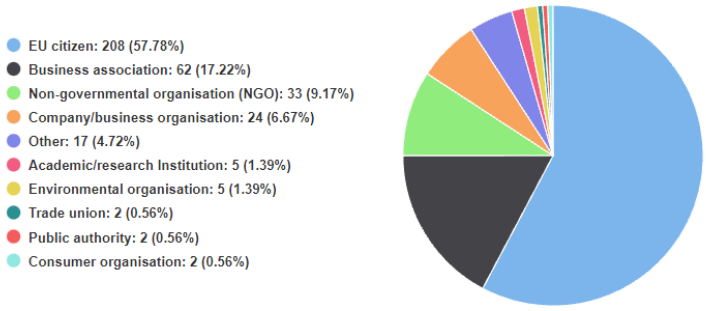
[49] In some cases, stakeholders took part in both the interviews and the surveys. Therefore, total numbers here represent an estimation of the overall number of stakeholders consulted per category.

Academic/research institution	–	1	5	–	15	27	48
Other	–	–	–	11	–	64	75
Total	12	40	30	275	26	1640	2023

Feedback to the roadmap

The roadmap was open for public feedback from 29 May to 7 August 2020. In total, 360 responses were received, originating from 26 countries, with the greatest number of responses originating from France (118 out of 360). As shown below, the main identified stakeholders which provided feedback were EU citizens and business associations.

Figure 9. Overview of respondents responding to the inception impact assessment (N=360)



European Commission (2021). Feedback and statistics: Inception impact assessment.

Feedback received represented a wide spectrum of views ranging from 'pesticides are all dangerous and must be banned' to 'pesticides are assessed as being safe for health and the environment before being placed on the market and their use is essential for food security and production'. Consensus among respondents existed on the view that increasingly strict rules in the EU concerning the use of pesticides will disadvantage EU producers and expose them to unfair competition from third countries. Companies/farmers and many citizens suggested that either EU farmers should be specifically compensated or food and agricultural product imports should respect our rules concerning the use of pesticides or otherwise be prohibited or heavily taxed. While some citizens and NGOs commented that more precise pesticide technology is not the answer to reducing associated risks and new technologies and innovation need to be avoided (including novel breeding and genomic techniques), other stakeholders such as pesticide users and industry considered that new technologies should be promoted.

Citizens and NGOs were mainly concerned about the risks of pesticides to health and environment, including links with the United Nations Sustainable Development Goals. Mainly farmers and industry considered pesticides safe and that not using them jeopardises human health (due to plant toxins and mycotoxins) and plant health. The machinery sector considered that harmonised rules and reinforced testing and inspections of pesticide application equipment are needed.

In general, all proponents and opponents of pesticides, including Member State authorities, agree that the current sustainable use of pesticides Directive is inconsistently and unevenly applied. Stakeholders from various groups see a need for harmonised implementation of the rules to level the playing field for all EU farmers but also enforce the existing instruments to reduce the risk of pesticide use for humans and the environment. Many stakeholders call for a stronger role of the Commission in this process.

Public consultation

The public consultation ran from 18 January to 12 April 2021 and received a total of 1699 responses. Two separate campaigns were identified. 30 identical responses from mainly NGOs linked to an online post[50] and 29 identical responses from Italian agricultural cooperatives. These responses were segregated from the original dataset and were analysed separately. The final pool of respondents' totalled 1640.

The large majority of responses were received from EU 27 (plus UK) countries (N=1570), especially Italy (N=480) followed by Germany (N=262).

The public consultation covered two areas (1) current use and attitude towards pesticides (2) views on options to improve the sustainable use of pesticides.

For professional users of pesticides the protection of crop yield (301 out of 373) and crop quality (298/373) are the most important factors in their use of pesticides. Similarly, private users mainly use pesticides to protect plants, fruits or vegetables that they grow (76/89). The majority of both private (64/79) and professional users (291/362) use pesticides instead of other control techniques, because pesticides are more effective (offer better/more reliable control) than other control techniques.

45% of respondents stated that they do not think there is a need to reduce the use of pesticides in the EU. This view was predominantly held by professional users of

[50] Online post concerning the selection of the policy options https://shaketonpolitique.org/wp-content/uploads/sites/25/2021/01/sud-eu-consultation_-final.pdf.

pesticides in agricultural setting, forestry or horticulture and pesticides manufacturers. The option that gathered the most support in all stakeholder groups was to introduce economic incentives and stimuli for the application of integrated pest management by pesticide users and other alternative methods for pest management. The option of 'increasing the price of more hazardous chemical pesticides to discourage and reduce their use' gathered the least support from respondents in all stakeholder groups.

In total 162 respondents submitted position papers. Following an initial screening identical (17), irrelevant and inappropriate (6) were removed resulting in 139 position papers analysed covering professional users (34), other industry impacted (26), NGOs (20), individuals not using pesticides (15), pesticide industry (8), pesticide advisors (8), public authorities (7) academia and research (7), trade unions (4), worker organisations (3), beekeeper/honey industry (2), international organisations (2).

The three main themes covered in the position papers were:

(1) The need for there to be more available alternatives to chemical pesticides on the market. This theme mainly originated from professional users of pesticides; however, it was a view that broadly shared across almost all stakeholder groups.

(2) The use of chemical pesticides. From the professional users' and advisors' point of view, many highlighted that there can often be implicit assumptions that are made that biological pesticides are innately safer than chemical pesticides. In particular, examples were provided where biological pesticides can sometimes contain similar toxicity and/or ecotoxicity profiles to other synthetic chemical pesticides. On the other hand, many NGOs, EU citizens and academia were of the view that regardless of whether they are chemical or biological pesticides, there is a clear need to reduce the use of pesticides across Europe. The main reason behind this view was for the growing concerns that pesticide use have on human and animal health, biodiversity and the environment and the development of resistance by pests/ weeds. Interestingly, one line of agreement between the two viewpoints was for there to be more research carried out to back-up the authorisation process of plant protection products.

(3) Environmental, human and animal health impacts of pesticde use mainly raised by NGOs, other industry impacted by the sustainable use of pesticides Directive (i.e. water industry) and environmental organisations. In particular, many of the respondents provided evidence of envrionmental and human health impacts from their specific region or local area.

Stakeholder events

In the stakeholder workshop on 19 January 2021 a representative of the Group of EU Chief Scientific Advisors placed the initiative in the context of achieving sustainable food systems. The Member State perspective focussed on the difficulties stemming from a reduced number of pesticides on the market while having to control a high number of pests under prevailing climatic conditions and the limited financial support under the Common Agricultural Policy for the implementation of integrated pest management. A farmer representative stated that the sustainable use of pesticides Directive should aim at meeting consumer demand and achieving a sustainable income for farmers. They stressed that pesticides are an indispensable tool for farmers and advocated for national/regional/local measures, reduced burden e.g. for aerial spraying exemptions, and technological innovations. According to the presenting agricultural machinery association, new technologies can help in reducing the use of pesticides and harmonisation in that area could help reducing barriers to new technologies. Fostering of innovative tools was supported by the pesticide industry, which also advocated for refining and better implementation of the sustainable use of pesticides Directive. Consumer representative asked for better protecting the health of consumers and workers and the environment by using as little pesticides as possible, banning aerial spraying, better integrated pest management implementation, enforcement and incentivising organic production. NGOs stressed the importance of achieving the European Green deal ambition and related targets, the need for adequate monitoring indicators, considering long term external costs and benefits. A water industry representative considered the ambition and enforcement of national action plans weak, thus impacting on the risks on water resources and imposing extra costs for water treatment for the sector and by extension for consumers and citizens. Beekeepers highlighted the detrimental effect of emergency pesticide authorisations on the environment and advocated for best practice in pesticide application, strengthened enforcement, improved monitoring and indicators and the promotion of alternatives to pesticides. EU research projects such as the Health Biomonitoring for EU project (HBM4EU) presented their aim of improving our knowledge on pesticides risks. An example for pesticide-free management in the non-agricultural sector, such as urban areas, sports grounds and along railways, was presented by a regional Member State environment agency.

In a second workshop on 25 June 2021 stakeholders were updated on the preliminary results of the evaluation and consulted on possible policy options. Stakeholder positions presented were in line with the first workshop. NGO and beekeeper organisations expressed their opposition to any policy options relaxing the current sustainable use of pesticides Directive general prohibition on aerial spraying.

In a third workshop on 5 October 2021 more advanced conclusions of the evaluation and draft findings on the impact assessment work of the supporting study were presented. Feedback from stakeholders was generally in line with the previous events. NGOs and beekeeper organisations expressed criticism that some of their more ambitious policy options (e.g. more ambitious pesticide reduction targets) raised at the June event and the subject of a European Citizens' Initiative which closed on 30 September had not been taken into account. A representative of the bioprotection and biocontrol industry also repeated their call for a definition of biocontrol to be included in the future SUD. Stakeholders generally agreed on the presented main evaluation findings. The importance of possible impacts of any policy changes on non-EU countries, including developing countries, was emphasised.

Targeted interviews and surveys

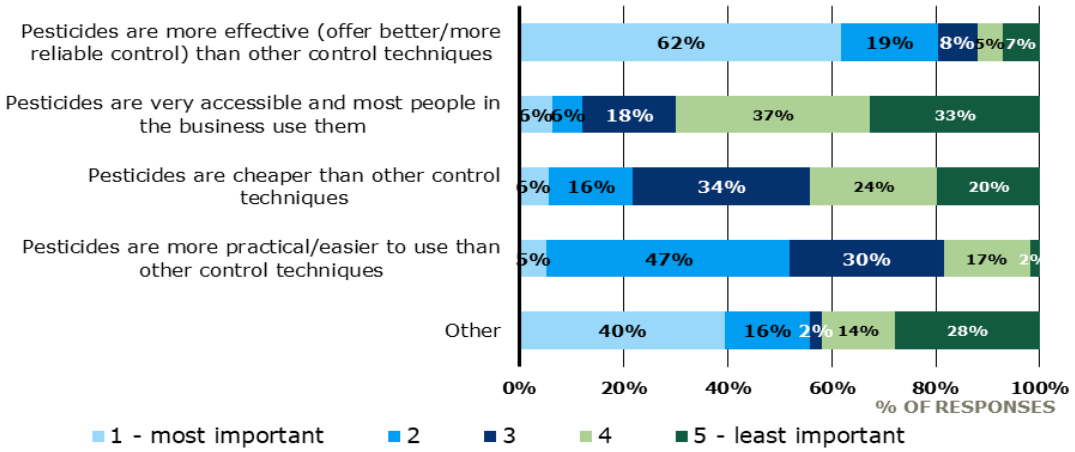
Summary of results

The following section aims to synthesise and present an overview of the main responses across each of the stakeholder consultation activities with regard to three core aspects which were central to the discussion of the evaluation and potential revision of the sustainable use of pesticides Directive. These include [1] the use of pesticides and contribution of the sustainable use of pesticides Directive, [2] the level of implementation of the provisions of the sustainable use of pesticides Directive, and [3] the future of the sustainable use of pesticides Directive and meeting the Farm to Fork targets.

Use of pesticides and the contribution of the sustainable use of pesticides Directive

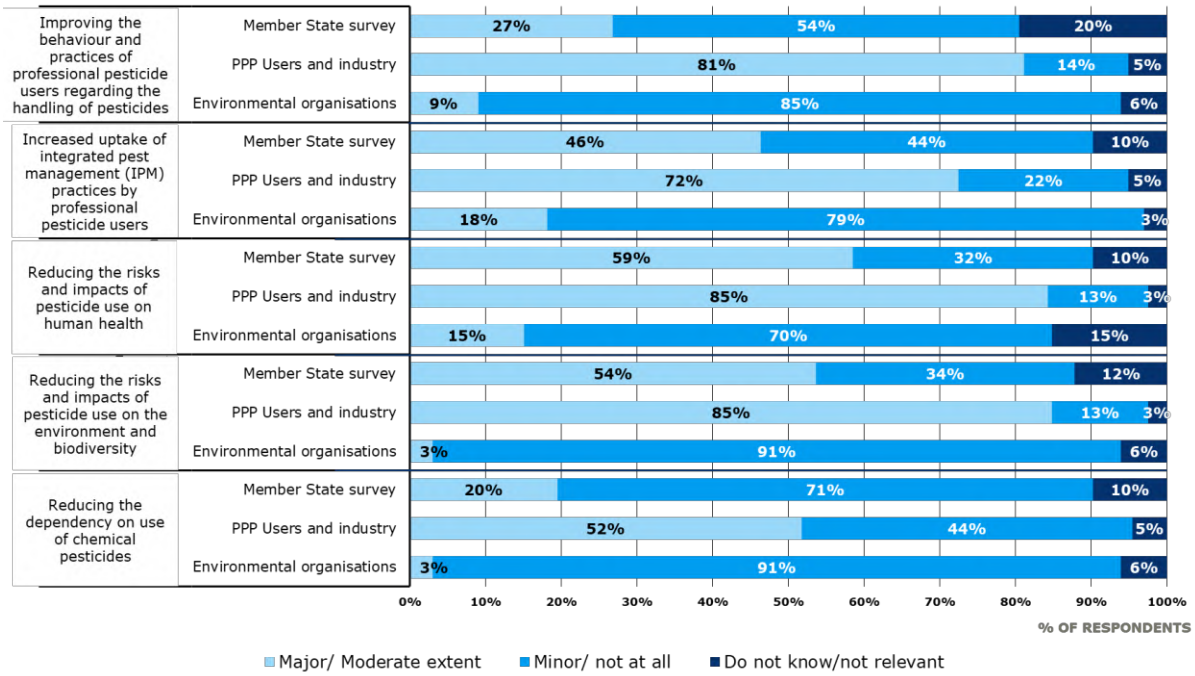
Results from the public consultation aimed to understand questions relating to why pesticides are being used and what were the main drivers in this regard. Figure 10 below presents the results on the reasons why pesticides are used instead of other control techniques.

Figure 10. Public consultation: As a professional user, why do you use pesticides instead of other control techniques? (n=362)



With regard to the sustainable use of pesticides Directive more specifically, in the targeted online surveys, the three main stakeholder groups of Member State authorities, plant protection product users and industry and environmental organisations were asked specifically on the contribution of the sustainable use of pesticides Directive across different objectives. As shown in the figure below, notable differences were observed with plant protection product users and industry generally providing a more positive view of the sustainable use of pesticides Directive's contribution, compared to environmental organisations which had largely opposite views. Member State views were generally balanced, with the exception of the sustainable use of pesticides Directive having contributed to improving behaviour of plant protection product users and reducing the dependency of chemical pesticides.

Figure 11. Cross targeted survey results: In your opinion, to what extent has the SUD contributed to the following objectives?



N.B. Member State survey (n=55), PPP users and industry (n=161), Environmental NGOs and civil society organisations (n=28)

From the external study interviews[ccxx], a more ambiguous picture was presented, with the sustainable use of pesticides Directive being seen to provide more indirect benefits rather than clear, measurable effects. The sustainable use of pesticides Directive was seen to have an important impact on informing and raising awareness of sustainable pesticide use, particularly through integrated pest management. This was confirmed in six interviews where it was noted in particular by one Member State authority that while the sustainable use of pesticides Directive does not have a clear impact on reducing human health risks of using professional plant protection products, it had helped in reducing the risk of plant protection productss for non-professional users by raising awareness on risk of pesticide use.

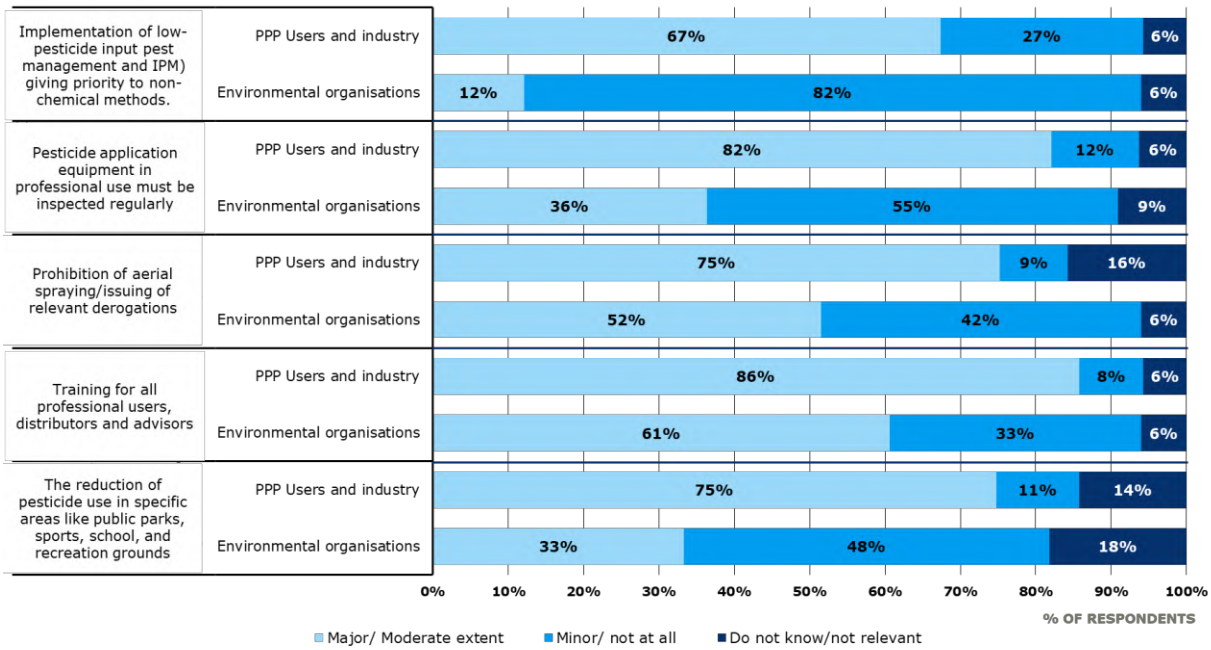
In addition, some stakeholders (primarily EU institution representatives and Member State authorities) acknowledged the sustainable use of pesticides Directive as being a key driver in raising the importance and overall relevance of pesticide risks across Member States and economic stakeholders. This was primarily achieved through raising awareness, dissemination of knowledge, and development of educational and training campaigns, as well as more guidance or controls on the use of plant protection productss. This point was contested, however, with some stakeholders (primarily environmental NGOs and other economic stakeholders impacted by the sustainable use of pesticides Directive) answering that there is a lack of understanding and/or

awareness of the risk of pesticide application for the users and the surrounding environment.

Level of implementation of the provisions of the SUD

As regards the level of current sustainable use of pesticides Directive implementation, the main results were obtained from the targeted survey to plant protection product users and industry and environmental organisations. As shown below, stark differences were found between the two groups, most notably on the option of integrated pest management impementation. From the perspective of the in-depth interviews the majority of interviewed stakeholders highlighted that the sustainable use of pesticides Directive had not been fully implemented.

Figure 12. Cross targeted survey results: In your opinion, to what extent are the following elements of the current SUD actually being implemented?[51]



N.B. PPP users and industry (n=161), Environmental NGOs and civil society organisations (n=28)

In exploring the potential drivers for reasons why certain aspects of the sustainable use of pesticides Directive have not been fully implemented, the in-depth interviews uncovered a series of possible issues. The most salient theme which emerged from the

[51] It should be noted that this graph only presents a "snap-shot" of the main provisions of the SUD, and other options are shown in more detail in the accompanying study report.

interviews was the absence of less hazardous alternatives to pesticide products. From the 19 responses to this theme, it was noted that while there has been a noticeable reduction in the number of hazardous pesticides being available on the market, it has not had a significant impact on reducing the reliance on such products.

The future of the sustainable use of pesticides Directive and meeting the Farm to Fork targets

Following questions on the contribution and implementation of the sustainable use of pesticides Directive (backwards looking elements), the consultation activities also sought to look to the future of the sustainable use of pesticides Directive and its role in the meeting the Farm to Fork pesticide targets[52]. From the public consultation, overall there is some agreement across stakeholder groups on the most effective option being to "introduce economic incentives" (9 out of 11 stakeholder groups).

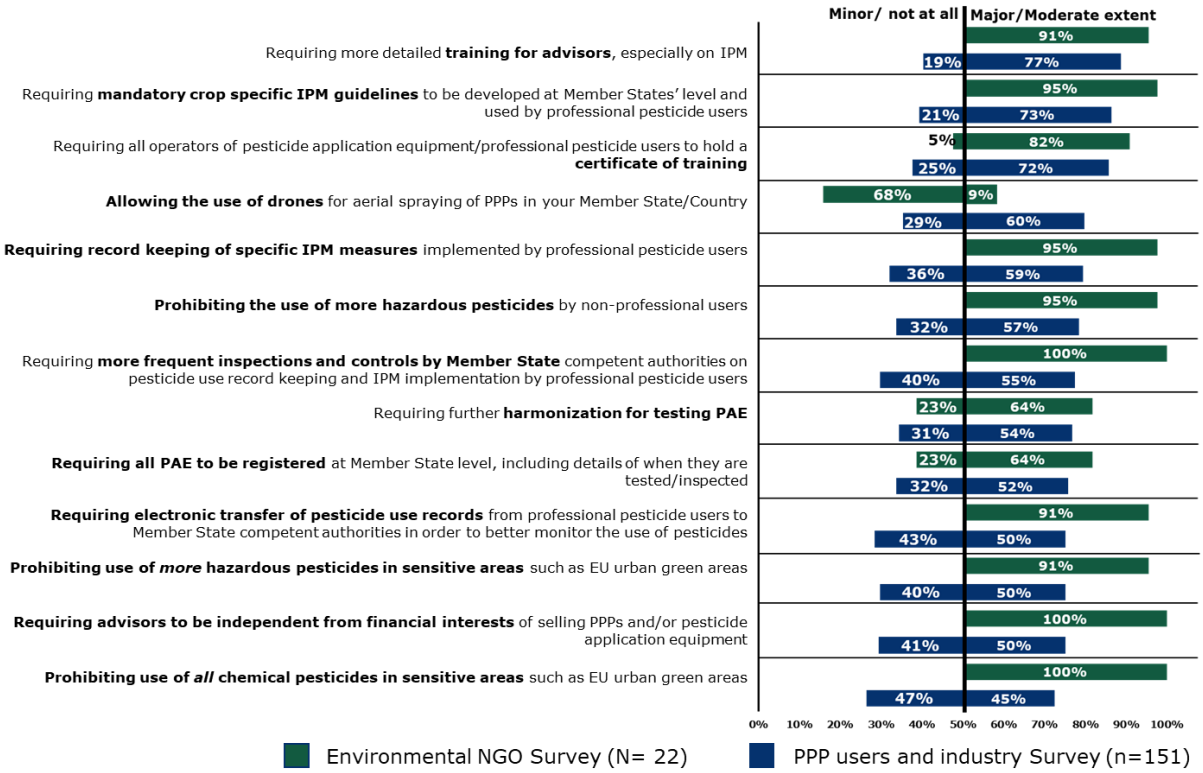
Figure 13. Public consultation: In your view how effective would the following options be to reduce the use and risk of chemical pesticides in the EU? (N=1640)

#	Option	% of responses answering *least* effective	% of responses answering *most* effective
1	Introduce economic incentives and stimuli for the application of integrated pest management by pesticide users and other alternative methods for pest management	29%	71%
2	Promote the expansion of organic farming in the EU	39%	61%
3	Increased sampling and inspection by Member State competent authorities of food imported from outside the EU for traces of pesticides	43%	57%
4	Promote information on the existence and availability of low-risk and non-chemical alternatives to more hazardous chemical pesticides	48%	52%
5	Restrict access to more hazardous chemical pesticides for example by introducing a prescription-like system to purchase them	52%	48%
6	Increase the price of more hazardous chemical pesticides to discourage and reduce their use	55%	45%
7	Introduce more detailed labelling or colour codes on pesticides packaging to inform users and purchasers on the hazards they may pose to human and animal health and the environment	56%	44%
8	Reinforce Commission oversight of the implementation of Member States' National Action Plans on the sustainable use of pesticides, including penalties for underperformance	57%	43%
9	Increased sampling and inspection of food produced in the EU for traces of pesticides	60%	40%
10	Set stricter rules for the use, handling and disposal of pesticides including the recycling of empty containers	61%	39%

[52] Target 1: to reduce by 50% the use and risk of chemical pesticides by 2030, Target 2: to reduce by 50% the use of more hazardous pesticides by 2030. More information available at: https://ec.europa.eu/food/plants/pesticides/sustainable-use-pesticides/farm-fork-targets-progress_en

Differences in stakeholder views arose from consumer organisations and environmental organisations, whereby consumer organisations ranked increased sampling and inspection of food produced in the EU as the most effective option, while environmental organisations ranked the promotion of the expansion of organic farming in the EU as the most effective. A similar projection was found in the targeted online surveys, where plant protection product users and industry and environmental organisations were asked to provide feedback on potential policy elements for the revision of the sustainable use of pesticides Directive. As shown below, there was general agreement for the options regarding more detailed training for advisors and users of plant protection products, however there was strong deviation on the options regarding the use of drones for aerial spraying and prohibiting the use of all chemical pesticides in sensitive areas.

Figure 14. Cross targeted survey results: In your opinion, to what extent would the following changes lead to a reduced use and risk of chemical pesticides, in line with the targets announced in the Farm to Fork Strategy?



Annex 2.3. Integration of consultation results and analysis of responses

While the number of stakeholders consulted differs significantly across the different levels of governance, a concerted effort was made to consult all relevant stakeholder groups. While all groups were contacted, there was a limited response from non-professional and non-agricultural users, limiting their contribution in the triangulation

of results. Isolating the responses by EU citizens gathered in the public consultation, the total number of consultations per stakeholder group is relatively balanced. In the case of the interviews, the main stakeholder groups targeted were Member State authorities, representative stakeholders as well as relevant representatives of EU institutions such as representatives of DG SANTE and relevant other Commission DGs which could provide insights into the functioning of the sustainable use of pesticides Directive. In terms of geographical coverage, overall, there is an even geographical distribution of respondents, however there is a noticeable geographical bias in the public consultation from the high numbers of respondents answering from Germany, Spain and Italy.

With regard to the surveys, a slight bias towards greater representation of users of pesticides and pesticide industry was found in the overall sample size compared to other groups. No weightings were applied in relation in the different sample sizes, but rather the data was triangulated, and biases were taken into account in the presentation of results. From the different activities described above, triangulation of the data uncovered that the stakeholder views were largely divided across two broad points of view: [1] pesticide use should be reduced in line with risk reduction in a manner which works with plant protection product users, and [2] pesticide use should be reduced significantly if not completely. While these differing views were found in each of the consultation activities, they have been taken into account and adequately represented in the analysis, taking into account any possible bias which may be incurred.

ANNEX 3: WHO IS AFFECTED AND HOW?

Annex 3.1. Practical implications of the initiative

Farmers would need to change their recording on pesticide use from paper records to electronic records. Depending on the national solution chosen, that digitalisation may include a change in format and record-keeping locally or centrally.

In addition to recording pesticide use they also need to record the integrated pest management approach they are following. The record-keeping could take the form of a decision tree based on IPM pyramid including pest/economic injury thresholds as applicable. It could mean to answer questions such as 'is a certain tool feasible: yes, no, if not, why not?', providing justification and evidence for this decision and then move to the next decision step in the pyramid. Guidance provided by Member States would help them to identify the pest management measure best suited to their circumstances. Advisory services will give them further independent advice.

The farmer's electronic records would be accessible to the local/regional/or national authority. The first time a farmer/pesticide user is going to have his pesticide application equipment inspected this will be entered in a local/regional or national register. Any changes in ownership of this equipment would need to be notified to the competent authority/ register.

National authorities would set up digital systems for collecting records both on pesticide use and IPM application. They would collect the electronic records from pesticide users. Alternatively they could foresee that records are stored centrally. They would annually analyse the data and transmit information to the European level. National authorities would use the data to assess progress towards their national targets and objectives of their national action plans and update their plans accordingly each year and submit those plans to the European Commission.

National authorities would set out the requirements for an independent advisory system and monitor the implementation of such a system. This could be linked with the existing farm advisory system under CAP. National authorities would inspect and control certificates and the system as needed on a risk basis.

Advisors would need to undergo a certification under the new system demonstrating their independence from pesticide and pesticide application equipment sales activities.

National authorities would establish national registers for pesticide application equipment. They would update the information on the equipment after inspection and

when the status of the equipment (e.g. ownership, or removal from use/ decommissioning) changes.

Annex 3.2. Summary of costs and benefits

Table 6. Summary of benefits

I. Overview of Benefits (total for all provisions) – Preferred Option		
Description	***Amount***	***Comments***
Direct and indirect benefits Estimates are relative to the baseline for the preferred option as a whole (i.e. the impact of individual actions/obligations of the preferred option are aggregated together). The comments column indicates which stakeholder group is the main recipient of the benefit.		
SUD reflects ambition of Farm to Fork Strategy		
a) Mandatory targets at EU and Member State levels	Possible reduction of compliance costs / economic benefits	Professional pesticide users: Potential reduction of costs for pesticides (up to 25%), health benefit National Authorities: N/A Other stakeholders: Increased sales of biocontrol and alternative methods (industry) Reduced costs for water providers – indirect benefit Society as a whole: health and environmental benefits
b) Prohibit the use of all chemical pesticides in sensitive areas	Reduction of compliance costs (water) Increased income for farmers (uncertain) Direct regulatory benefit in the form of improved health and well being for citizens, improved environment indicators; Indirect benefit in the form cost savings for chemical pesticides and assumingly incremental reduction of public health costs.	Other stakeholders: Reduced costs for water providers Professional pesticide users: Health benefits and higher prices on produce Society as a whole: health and environmental benefits
c) Restrict purchases of more hazardous pesticides to trained professional users	Reduction of compliance costs (water) Direct regulatory benefit in the form of better compliance with health and safety requirements,	Other stakeholders: Reduced costs for water providers Potential economic benefit to

	Direct regulatory benefit – a) reduced use of pesticides as a result of more professional and effective application of the suitable pesticides b) Cost saving incurred by the reduction of the pesticides used Indirect benefit – Member States optimise their monitoring costs for pesticides use	training providers Society as a whole: health and environmental benefits
Strengthen SUD provisions		
a) Electronic IPM record-keeping by professional pesticide users	Reduction of compliance costs Increased quality of collected data – timely, real time reporting, Direct regulatory - acts as an incentive for PPP users and farmers - level of granularity allows to make analysis of the effectiveness of IPM, documents the diligence of IPM application Reduction in pesticide use as a result of effective IPM application	Professional pesticide users: Potential reduction of costs for pesticides (up to 25%), health benefits Other stakeholders: Potential market for decision making software and application Increased sales of biocontrol and alternative methods
b) Development of crop-specific IPM rules	Reduction of compliance costs Improves effectiveness and efficiency of IPM application Reduces risk for potential losses for farmers' crops Direct benefit: Cost savings for farmers in the form of reduced quantities of pesticides Change in the mindset of agricultural producers – effective IPM guidelines incentivises farmers to use alternative pest reduction techniques, **possibly reduces enforcement and compliance cost for Member States** Indirect health and environmental benefits as a result of reduced pesticide use and sustainable production techniques	Professional pesticide users: Potential reduction of costs for pesticides (up to 25%), health benefits Other stakeholders: Consultancies and research institutes would receive funding and resources for development and revision of guidelines
c) Use mandatory crop-specific IPM rules as a basis for controls and enforcement	Reduction of compliance costs Cost savings for enforcement and compliance – clear rules will reduce the cost of audits and minimise compliance costs for pesticide users	Professional pesticide users: Potential reduction of costs for pesticides (up to 25%), health benefits

	Indirect health and environmental benefits in the form of reduced PPP use.	Other stakeholders: Increased sales of biocontrol and alternative methods
d) Strengthened role for independent advisory system		
e) Promotion harmonised standards for PAE testing	Reduced compliance costs? Indirect economic benefit – uniform standards reduce defragmentation of the internal market (all equipment characteristics will be standardised) and help PAE producers reduce production costs and increase sales	Professional pesticide users: Health benefits, less spillage of pesticides Other stakeholders: Better harmonisation of testing standards contributing to functioning internal market
f) More specific on NAPs and links to CAP	Reduced regulatory and enforcement costs? better effectiveness and efficiency of enforcement actions – clear and measurable objectives facilitates compliance, CAP financing targets specific actions and measures in the NAP Reduction of compliance costs for pesticide users Reduction of production costs for farmers, CAP financing can help mitigate loss of income from higher production costs and higher risks of reduction in output and substandard quality of produce	National authorities: Better policy implementation and follow up
Adapting new technology		
a) Allow more targeted pesticide application as part of precision agriculture, for example with drones, (also taking into account if such aerial spraying is permitted in individual Member States) by trained operators	Reduced compliance costs Direct health and environmental benefits as a result of reduced use of pesticides due to application of precision farming Reduction in enforcement costs for Member States – digital records of pesticide use can reduce the need of audits as real time reporting may become avalable	Professional pesticide users: Health benefits through less exposure and safer treatment in hard to reach areas Potentially less labour costs Potential reduction in pesticide use, due to spot treatments Other Stakeholders: Economic benefit to producers of drones and potential service providers
Indirect benefits		

Improved monitoring		
a) Member States to establish a register of PAE	- cost savings for enforcement for Member States - reduced health and environmental risk resulting from the application of tested PAE - increased sales potential for PAE producers – easier to foresee which and when PAE is nearing the end of life.	Other stakeholders: Environmental and social benefits, however only indirectly since this policy option is mainly related to improving knowledge base
b) Electronic data collection of pesticide use data held by professional users	- cost savings for compliance and enforcement actions for Member States -	National administration: Better evidence for base for policy actions Other stakeholders: Environmental and social benefits, however only indirectly since this policy option is mainly related to improving knowledge base

Table 7. Summary of costs

II. Overview of costs – Preferred option *Estimates provided with respect to the baseline.*							
		Citizens/Consumers		Businesses		Administrations	
		One-off	Recurrent	One-off	Recurrent	One-off	Recurrent
SUD reflects ambition of Farm to Fork Strategy							
a) Mandatory targets at EU and Member State levels	Direct costs	n/a	n/a	n/a	Professional pesticide users: Potential costs related to IPM measures Other stakeholders: Reduced sales of pesticides	n/a	Not possible to estimate
	Indirect costs	n/a	n/a	n/a	n/a	n/a	n/a
b) Prohibit the use of all	Direct costs	n/a		n/a	Professional pesticide users: Costs for farmers in protected areas to change	n/a	Labour cost and equipment to process the requests

chemical pesticides in sensitive areas						farming practices Potential lower crop yields Submitting requests for derogations to use chemical pesticides in sensitive areas may amount up to 120 million Euro [53] Other stakeholders: Reduced sales of chemical pesticides		Potential increased costs for alternative methods to pest control in sensitive areas
	Indirect costs	n/a		n/a	n/a	n/a	n/a	n/a
c) Restrict purchases of more hazardous pesticides to trained professional users	Direct costs	n/a	n/a	n/a		Other stakeholders: reduced sales of chemical pesticides Costs for non-professional users to become trained	n/a	cost control / enforcement of rules
	Indirect costs	n/a	n/a	n/a		n/a	n/a	n/a
Strengthen SUD provisions								
a) Electronic IPM record-keeping by professional pesticide users	Direct costs	n/a	n/a	Professional pesticide users: 495.7 million Euro per year (72 Euro per farmer and year on average) [54ccxxi]		n/a	800,000 Euro, if linked to Farm Sustainability Data Network (FSDN)	n/a
	Indirect costs	n/a	n/a	n/a		Other stakeholders: Reduced sales of pesticides	n/a	n/a

[53] Estimated 3,74 mio farmers affected requesting 2 derogations per year. Time spent on derogation 1h @EUR16.10.

[54] Number of farmers based on statistical data reported under Commission Implementing Regulation (EU) 2019/1975 of 31 October 2019. For the time estimated for record keeping refer to end note CCXIX – source Ramboll supporting study.

b) Development of crop-specific IPM rules	Direct costs	n/a	n/a	n/a	Professional pesticide users: potential costs related to IPM measures	n/a	Costs for revising and developing guidance (depends on baseline in each country)
	Indirect costs	n/a	n/a	n/a	Other stakeholders: Reduced sales of pesticides	n/a	n/a
c) Use mandatory crop-specific IPM rules as a basis for controls and enforcement	Direct costs	n/a	n/a	n/a	Professional pesticide users: potential costs related to IPM measures	n/a	1,3 million Euro per year (enforcement costs)
	Indirect costs	n/a	n/a	n/a	Other stakeholders: Reduced sales of pesticides	n/a	n/a
d) Strengthened role for independent advisory system	Direct costs	n/a	n/a	n/a	Professional pesticide users: obligatory strategic advice: large farms 540 Euro per year; small farms: 180 Euro per year	n/a	530,000 Euro annually for control and administration costs to establish independent advisory system
	Indirect costs	n/a	n/a	n/a	Other stakeholders: Reduced sales of chemical pesticides	n/a	n/a
e) Promotion harmonised standards for PAE testing	Direct costs	n/a	n/a	n/a	n/a	n/a	n/a
	Indirect costs	n/a	n/a	n/a	Professional pesticide users: Potential additional costs for mandatory repairs Other stakeholders: Potential costs to adapt to harmonised standards	n/a	n/a
f) More specificity on NAPs and links to CAP	Direct costs	n/a	n/a	n/a	n/a	Minor costs	n/a
	Indirect costs	n/a	n/a	n/a	n/a	n/a	n/a

Adapting new technology							
a) Allow more targeted pesticide application as part of precision agriculture, for example spraying with drones (also taking into account if such aerial spraying is permitted if in individual Member States) by trained operators	Direct costs	n/a	n/a	no additional costs	No additional costs	Cost to develop and implement electronic data collection	Cost to develop and implement electronic data collection
	Indirect costs	n/a	n/a	n/a	n/a	n/a	n/a
Improved monitoring							
a) Member States to establish a register of PAE	Direct costs	n/a	n/a	18.9 million Euro for intitial registration of PAE in the MS that currently do not have a PAE registration system[55]	Professional pesticide users: 2.9 milion Euro based on 15% turnover rate of the existing PAE units[56]	Almost no cost for those Member States already having such a register. In other Member States, depending on mechanism chosen for register, there could	Almost no cost for those Member States already having such a register. In other Member States, depending on mechanism chosen for register, there could be some costs

[55] At least 7 Member States have established national PAE registers. The number of existing PAE units requiringregistration is estimated at 1,173 mio. Time necessary for the registration is estimated at 1hr at an hourly tariff of16.10 Euro.

[56] It is estimated that 10% of the existing PAE units will be replaced annually by new equipment and another 5% will be sold between PAE owners resulting in an additional 175,000 new PAE registrations per year expected.

						be some costs)	
	Indirect costs	n/a	n/a	n/a	n/a	n/a	n/a
b) Electronic data collection of pesticide use data held by professional users	Direct costs	n/a	n/a	n/a	Professional pesticide users: costs included in the electronic IPM reporting above	Costs to develop and implement electronic data collection	Costs to develop and implement electronic data collection
	Indirect costs	n/a	n/a	n/a	n/a	n/a	n/a

ANNEX 4: ANALYTICAL METHODS

The baseline scenario is dynamic assuming that the SUD and related policies (except the pesticide-related targets in the Farm to Fork Strategy and Biodiversity Strategy) continue on the current trajectory through to 2030, and that other influences, such as climate change, continue to affect the environment, economics and wellbeing. Then, the assessment of social, economic and environmental impacts (positive and negative) of the Farm to Fork Strategy and Biodiversity Strategy pesticide targets relied on the mapping and identification of material impacts and associated indicators of impact from achieving those targets. The environmental, economic and social indicators selected were representative of the main categories of impacts (both intended and unintended, and short and long term) across the key stakeholders. An in-depth literature review was conducted with a view to:

- Identify indicators and metrics to qualitatively or quantitatively predict the relationship between reduced (hazardous) pesticide use and potential impacts; and
- Identify the most recent and comprehensive evidence base to inform the evolution of each indicator in the 2020 to 2030 baseline and in the scenario in which the pesticide-related targets announced in the Farm to Fork Strategy and Biodiversity Strategy are achieved.

Social, economic and environmental impacts are assessed for all policy options. Policy options are grouped into two strands:

1. Policy options that make reaching the two pesticide related Farm to Fork targets compulsory for Member States; and

2. Other policy options, aiming at improving current provisions and implementation of the SUD.

The first strand has potentially macroeconomic, environmental and social implications across Europe and, potentially, outside of Europe. However, the pathways are somewhat unclear since the mechanism to reach these targets would be defined by Member States, which does not allow for assessing direct costs, such as administrative or compliance cost.

The second strand aims at reducing the use and risk from pesticides; however, it is not possible to differentiate the contributions from individual provisions to the overall objective and the extent to which they together contribute to the objective. This is due to a few reasons which are listed below:

- Many of the provisions together (e.g. training and promotion of IPM) aim at accomplishing a behavioural change among pesticide users;
- Other provisions aim at supporting policy monitoring and enforcement which provide a framework for behavioural changes, but have no direct effect on pesticide use;
- The provisions reinforce each other and are to some extent interdependent (one will not function without the other).

Hence, for most of those policy options, it is very challenging to assess their social, macroeconomic and environmental impacts, other than in qualitative terms. However, the policy options having potentially direct economic costs (such as administrative costs) can be assessed.

Based on the reflections above, the following streams of assessment of impacts are presented:

- An assessment of social, macroeconomic and environmental impacts in Europe as well as outside of Europe of the situation in which the two pesticide related Farm to Fork Strategy and Biodiversity Strategy targets are made legally binding in the EU, and thus reached, by 2030.
- A qualitative assessment of the likely social, economic and environmental impacts and a quantitative assessment of direct economic costs of the policy options of group 2 mentioned above.

Harmonised risk indicators: description and calculation methodology

Harmonised Risk Indicators established under Directive 2009/128/EC aim to show the evolution in the risks to human health and the environment from pesticide use.

The European Commission shall calculate them for the EU, and Member States should calculate the Harmonised Risk Indicators at a national level. The data to be used for the calculations shall be statistical data collected in accordance with Union legislation concerning statistics on plant protection products, i.e. Regulation (EC) No 1185/2009 on pesticide statistics, and other relevant data.

The European Commission is obliged to calculate and publish the Harmonised Risk Indicators for the European Union, while each Member State is obliged to calculate and publish the Harmonised Risk Indicators for their territory. Member States must also identify trends in the use of certain active substances, and identify priority items or good practices.

All active substances are categorised into a Group and a Category (Table 8 below).

Table 8. Categorisation of active substances and weightings for the purpose of calculating Harmonised Risk Indicators 1 and 2

Row	Groups						
	1		2		3		4
(i)	Low-risk active substances which are approved or deemed to be approved under Article 22 of Regulation (EC) No 1107/2009, and which are listed in Part D of the Annex to Regulation (EU) No 540/2011		Active substances approved or deemed to be approved under Regulation (EC) No 1107/2009, and not falling in other categories, and which are listed in Parts A and B of the Annex to Regulation (EU) No 540/2011		Active substances approved or deemed to be approved under Article 24 of Regulation (EC) No 1107/2009, which are candidates for substitution, and which are listed in Part E of the Annex to Regulation (EU) No 540/2011		Active substances which are not approved under Regulation (EC) No 1107/2009, and therefore which are not listed in the Annex to Regulation (EU) No 540/2011
(ii)	Categories						
(iii)	A	B	C	D	E	F	G
(iv)	Micro-organisms	Chemical active substances	Micro-organisms	Chemical active substances	Which are not classified as: Carcinogenic Category 1A or 1B **and/or** Toxic for Reproduction Category 1A or 1B **and/or** Endocrine disruptors	Which are classified as: Carcinogenic Category 1A or 1B **and/or** Toxic for Reproduction Category 1A or 1B **and/or** Endocrine disruptors, where exposure of humans is negligible	
(v)	**Weightings applicable to quantities of active substances placed on the market in products authorised under Regulation (EC) No 1107/2009**						
(vi)	1		8		16		64

There are three Groups for approved active substances, Groups 1–3, and six Categories, Categories A–F. All non-approved active substances are placed in Group 4, Category G. Weightings are defined for the Groups, under Directive 2009/128/EC (Annex I).

The Harmonised Risk Indicator 1 is calculated by combining the statistics on the quantities of pesticide active substances placed on the market in accordance with Regulation (EC) No 1185/2009 and the information on active substances in accordance with Regulation (EC) No 1107/2009, including if they are low risk active substances, candidates for substitution, or other active substances. Candidates for substitution are active substances with more hazardous properties identified in accordance with the criteria in point 4 of of Annex II to Regulation (EC) No 1107/2009.

HRI 1 is based on the total quantities (kg) of active substances placed on the market in the EU or in a Member State during a reference period as reported under Regulation (EC) No 1185/2009. HRI 1 is presented as an index. The reference years concerned are from 2011 until the last available reference year. HRI 1 shall be calculated by multiplying the annual quantities of active substances placed on the

market for each Group in Table 8 by the relevant weighting set out in Row (vi), followed by the aggregation of the results of these calculations.

The second Indicator, Harmonised Risk Indicator 2 (HRI 2), is based on the number of authorisations granted for plant protection products under Article 8(4) of Council Directive 91/414/EEC and Article 53 of Regulation (EC) No 1107/2009 as communicated to the European Commission in accordance with Article 53(1) of that Regulation during a reference period. The HRI 2 is presented as an index. The reference years concerned are from 2011 until the last available reference year. Since June 2016, the Plant Protection Products Application Management System database is used to collect all notified emergency authorisations. The HRI 2 shall be calculated by multiplying the number of authorisations granted for plant protection products under Article 53 of Regulation (EC) No 1107/2009 for each Group in Table 8 by the relevant weighting set out in Row (vi), followed by the aggregation of the results of these calculations.

Calculation methods

1. Calculation of costs for procurement of a plant doctor advisory system

Table 9. Estimations of costs for procurement of a plant doctor advisory system[ccxxii] (this links to a possible prescription system for pesticides which was finally discarded as a possible policy element)

Name	Type	Assumptions	Costs	Distributional considerations
Procurement of plant doctor advisory services	Recurring annually	It is assumed that for 50% of the EU's utilised agricultural area (UAA) new advisory contracts are needed, while for the other 50% of UAA the price for existing services increases by 25%. Based on the Hungarian prescription system, the price per ha is assumed to be between 9 and 18 EUR.	Approximately between 880 million EUR and 1.7 billion EUR	In the assumed scenario, farmers with no existing advisor relations (which can be assumed to be smaller and part-time farmers) would face higher additional costs than ones with existing relations (presumably larger, highly professional ones).

2. Calculation of costs for a mandatory electronic IPM record-keeping and reporting system

The results from the survey with national authorities suggest that no country so far has a mandatory electronic IPM record-keeping in place. Only one country has a

system for voluntary record-keeping on IPM in place (Finland). Another country (Denmark) has a system in which they require farmers to answer questions regarding IPM; however, these data are not collected by the authorities.

Thus, given that such a system would be new in all countries, it would entail one-off costs for creating the system and then costs for maintaining it. Costs would accrue for professional users and national authorities.

Professional users

Professional users of pesticides under this policy option includes farmers but excludes other professional users. According to the latest available data,[57] in total there are around 10.3 million farms in the countries potentially covered by the SUD, which include the EU Member States as well as Iceland, Liechtenstein, and Norway[58]. The numbers per country are presented in Table 10 below.

Table 10 Number of farms per country[ccxxiii]

Country	Number of farms	Country	Number of farms	Country	Number of farms
Austria	132,500	France	456,520	Malta	9,310
Belgium	36,890	Germany	276,120	Netherlands	55,680
Bulgaria	202,720	Greece	684,950	Poland	1,410,700
Croatia	134,460	Hungary	430,000	Portugal	258,980
Cyprus	34,940	Ireland	137,560	Romania	3,422,030
Czechia	26,520	Italy	1,145,710	Slovakia	25,660
Denmark	35,050	Latvia	69,930	Slovenia	69,900
Estonia	16,700	Lithuania	150,320	Spain	945,020
Finland	49,710	Luxembourg	1,970	Sweden	62,940

Source: 2016 Farm Structure Survey

Large differences in the number of farms translate into different overall costs per country for policy options. This should be understood as context for the subsequent assessment of costs.

It can be expected that farmers face one-off costs for creating the necessary infrastructure as well as returning costs for the report keeping and reporting. Their expected costs are summarised in Table 11 below. Qualitatively, results from the targeted survey to users of pesticides and industry found division in the impact that electronic IPM record-keeping would have on reducing the use and risk of pesticides, in line with the Farm to Fork targets (17 out of 50 answering that it

[57] 2016 Farm Structure Survey. See: https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ef_m_farmang&lang=en

[58] The latter three countries are the countries of the European Free Trade Association (EFTA) (Iceland, Liechtenstein and Norway; excluding Switzerland); together with the EU countries they form the European Economic Area.

would have an impact and 20 out of 50 answering that its impact would only be minor).

Table 11. Overview of quantitative estimations of costs for professional users[ccxxiv]

Name	Type	Assumptions	Costs	Distributional considerations
Buying equipment	One-off	It is assumed that farmers need a computer for recording and submitting the data. No data is available on the number of farmers that already have a computer. Thus, it is assumed that the share of farmers owning a computer is equal to the share of the general population (households) having a computer which is in the EU 27 at around 91%.[59] It is thus assumed that 10% of all farmers would need to buy one. However statistical data collected under Commission Implementing Regulation (EU) 2019/1975 around 3 million farms are very small farms consuming >50 of their production are not consdered professional users. It is assumed that this type of farms do not own a computer, whle all other farms do. It is therefore, not necessary to include consider cost in IT equipment for stakehoders affected by this obligatiion.		
Time for recording IPM practices	Recurring annually	The eventual properties of the framework (e.g. level of detail) play a crucial role in assessing how much time is needed. As suggested in the policy option, it is assumed that the framework could take the form of a decision making tree[ccxxv]. It is assumed that on average a farmer would have to spend around 6h[60] per year on	Approx. 495.7 million EUR annually (per farmer on average 72 EUR)	Labour costs differ between countries Large differences in time spent between types of farms (mainly dependent on number of lots

[59] 2020 data available from the OECD. See: https://stats.oecd.org/Index.aspx?DataSetCode=ICT_HH2#

[60] The estimation on time spent is based on observations from the existing IPM recording system in Finland in which farmers can voluntarily record IPM measures. The time is purely for recording and not for field observations and planning, which is part of the normal IPM process and not the recording. It should also be mentioned that farmers in general already record all agronomic practices from land preparation to harvest and that the time assumed here is for transferring information from their existing system into the framework

Name	Type	Assumptions	Costs	Distributional considerations
		recording (and transmitting) decisions in such a framework. An average hourly labour cost[61] of 16.10 EUR is assumed[62]		and diversity of crops)

Source: Own elaboration

National authorities

Costs for national authorities depend heavily on how the data collection will eventually be organised. For the cost assessment is assumed that data collection will be done as part of the upcoming Farm Sustainability Data Network (FSDN), as specificized in the policy option, and which is the most likely way forward. At the time of this study, the initiative for converting the existing Farm Accountancy Data Network (FADN) into a FSDN is still ongoing and it is assumed that the Commission will adopt the initiative in the second quarter of 2022[63]. Quantitative estimations on costs for national authorities are presented in Table 12 below.

Table 12. Overview of quantitative estimations of costs for national authorities[ccxxvi]

Name	Type	Assumptions	Costs	Distributional considerations
Collection and assessment of annual submissions	Recurring annually	Across the EU, statistics from approx. 80,000 farms are collected annually through the current FADN and it is expected that this number will remain stable A recent study on the costs for FADN data collection[64] found that, on average[65],	Approx. 800k EUR annually	The sample sizes between different Member States vary The cost per collected farm data set varies widely between different Member States (the Commission study

provided by the national authorities. It can be assumed that the time needed would decrease over time if recording gets more standardised and streamlined.

[61] Labour costs include wage as well as indirect costs/overheads (e.g. social contributions).

[62] The estimation is based on findings from the study Baiocco, S. et al (2019): Labour costs in agriculture: comparative study. The estimation presented here is based on the assumption that the farm manager or another permanent staff member is in charge of the administrative tasks and to a large extent based on "imaginary worker" type 1 presented in the study. It should be noted that there are large differences in labour costs between different countries in the EU also between different types of workers (e.g. seasonal, permanent, specialised). Since the estimations are recent and inflation has been low, the costs have not been adjusted for inflation.

[63] More information can be found here: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12951-Conversion-to-a-Farm-Sustainability-Data-Network-FSDN- en

[64] European Commission (2015): Cost of and good practices for FADN data collection. See: https://op.europa.eu/en/publication-detail/-/publication/02ee48a9-d479-11e5-a4b5-01aa75ed71a1

[65] Data includes UK.

Name	Type	Assumptions	Costs	Distributional considerations
		the costs (incl. data collection, data processing and validation) per collected farm data set is around 680 EUR. No numbers are available on how much additional costs would occur by adding IPM data collection to the process, especially since it would be part of the wider expansion of FADN into a FSDN; however, it can be estimated that additional costs would not surpass 10 EUR[66] per collected farm data.		found that a completed FADN Farm Return cost an average of 107 EUR in Bulgaria but 2,905 EUR in Belgium)

Source: Ramboll, Study supporting the evaluation of Directive 2009/128/EC on the sustainable use of pesticides and impact assessment of its possible revision, Final report – impact assessment part, Luxembourg: Publications Office of the European Union, 2022, doi: 10.2875/074218

Additional costs will occur for the infrastructure. However, since data collection can build on existing processes and infrastructure, the only costs that occur are for adapting the current system. As found in a recent study on the costs for FADN data collection, although extending the collection of any type of data to the Member States that do not currently collect it would incur costs, there would be marginal to the basic data collection infrastructure already in place.

As said, under the current FADN, statistics from around 80,000 farms throughout the EU are collected annually and it is expected that this sample size remains somewhat stable. This represents only a fraction (0.8%) of the existing farms which report data annually. Between years, the turnover rate within the samples (i.e., the number of new sampled farms compared to the prior year) differs between Member States between 5% and 30%, with just over a third of Member States have a turnover of around 10%.

Those two metrics (sample size and sample turnover) of the FADN have an impact on the usability of the collected data for policy purposes. While not further specified in the policy option, the data could be used for policy reporting (e.g., for progress towards implementation of the SUD), within the policy cycle (e.g., for feeding into future revisions of the SUD or other IPM related policy frameworks) or for

[66] Based on expert judgement.

enforcement of the obligation of farmers to apply IPM. For the first two use cases, it can be assumed that the sample size and turnover are sufficient.

For the third use case, however, it can be assumed that the sample size and low turnover rate are not sufficient in addition to two supplementary factors: firstly, participation in the survey voluntary and secondly, the validation of data is mostly automated[67]. The first supplementary factor would be detrimental to the use of the data for enforcement. The second factor would imply that considerably higher costs could accrue for national authorities for applying additional plausibility checks to ensure proper enforcement. While the exact costs for this cannot be quantified because too many variables are unknown, it can be assumed that those costs would be considerably higher than the ones listed in Table 12 above.

3. Calulation of cost for developing crop specific IPM standards

Table 13 below shows the crop specific IPM guidelines that are already in place in the EU Member States.

Table 13. Development of IPM guidelines in the Member States

Member State	Number of IPM guidelines	Crops for which guidelines have been developed	% of utilised agricultural area for which IPM guidelines have been developed
Austria	2	Cereals, vineyards	no information
Belgium	3	No further detailed information	no information
Bulgaria	47	Guidelines approved in 2008, and have not been updated since; updating of the Guidelines was an action under Measure 6 of the NAP, but it was re-scheduled for the end of 2022	90%
Croatia	4	Field crops, vineyards	6.8%
Cyprus	1	Vineyards	no information
Czechia	31	Range of field crops, permanent crops and vegetables	95%
Denmark	60-70	Guidelines covering all major crops	no information
Estonia	26	No further details available	49.7%
Finland		No information, states that IPM Guidelines are available, and these were developed by private stakeholder, but no specific information on number and crops	no information
France	5	Guidelines for arable crops, viticulture, vegetable growing, fruit growing and tropical crops	no information
Germany	17	Fruit and vegetables; golf courses; sugar beet; home gardening; medicinal and aromatic plants/herbs; urban greening; gardening, landscaping and sportsground construction; maize; railway tracks; nurseries;	no information

[67] Around 90% of the resources are for collection of the data and only the remaining 10% for data processing and validation.

Member State	Number of IPM guidelines	Crops for which guidelines have been developed	% of utilised agricultural area for which IPM guidelines have been developed
		woods/forests; storage protection; potatoes; arable farming; vineyards; hops; ornamental plants	
Greece	7	Vineyards, tobacco, cherry, rice, kiwi, olives and cotton	24%
Hungary	40	No information	90%
Ireland	3	1 general Guidance document, and 2 crop-specific Guidance documents; however, both crop-specific ones are focused on crop management in general rather than specifically on IPM	no information
Italy	Developed at regional level	e.g. 78 crop-specific IPM protocols (55 for arable crops, 16 for fruit trees and 7 for medicinal plants) in Campania, and 98 in Tuscany	95%
Latvia	25	No further details available	Almost 100%
Lithuania	20	Winter wheat, spring wheat, spring barley, peas, winter oilseed rapes, winter triticale, oats, potatoes, carrots, apples, beans, winter rye, spring oilseed rape, corn, buckwheat, beet, cabbage, onions, black currants and strawberries	no information
Luxembourg	0	No information	no information
Malta		Reported that guidelines are available but no further details on the number and/or crops covered	
Netherlands	60	Mainly crop/pest control measures listed, without giving emphasis on non-chemical alternatives; in addition, crop-specific Guidelines were available, which are developed by other stakeholders	no information
Poland	68	Covering a wide range of crops, forestry, mushroom production and gardening for non-professional users	98%
Portugal	72	1 general and 71 crop-specific guidelines	no information
Romania	1	General IPM guidelines, crop specific guidelines under development	no information
Slovakia	0		no information
Slovenia	4	No further details on crops/groups of crops covered	no information
Spain	26	Guidelines including forestry and agricultural crops	80%
Sweden	10	No information	36%

Source: EU Commission data based on 2017 web survey among Member States, complemented with audits and fact-finding missions (status as per 2021)

As can be seen, there are large differences between the Member States but that in general most Member States have already specific guidelines in place, some of which already meeting the target of 90% of the utilised agricultural area. However,

it should be noted that there is no one definition of what an IPM guideline is and that there are major differences of how those can be and have been approached[68]. Thus, even if guidelines exist, in many Member States, there are large differences in what they define in detail.

The above should be seen as baseline to this policy option and defines the costs for the different stakeholders together with a crucial second factor which is the specific result this policy option aims to achieve. There are two main options in this regard.

National authorities and European institutions

A first possibility is that the policy option aims at improving IPM practice by providing specific guidance to farmers, accounting for the fact that the overall IPM principles are fairly general and hard to operationalise for farmers. To this end, crop-specific guidance could help farmers taking sensible decisions in their day-to-day work and improving the implementation of IPM. To this end and to improve effectiveness, it would likely be beneficial if the European Institutions could define minimum quality standards for crop-specific rules. Those would likely require at least parts of the existing guidelines to be revised. However, it can be expected that a large share of the existing catalogue of crop-specific guidelines could be maintained. In this case, the Member States which do not yet have guidelines in place would face costs for developing them.

The second possibility goes further than this by providing considerably more specificity of what a crop-specific rule is; i.e., by highly operationalising the guidelines to an extent at which they can be used a) as a concrete decision-making tool by farmers (e.g. in the form of a decision-tree) and b) as a basis for controls and enforcement.

This second possibility would likely cause higher costs for the Member State authorities since it is likely that they would have to revise the majority of already existing guidelines.

Professional users

The costs for the farmers cannot be defined since, even if they would have to adapt practices following specific guidelines, this will vary widely at rotation level per plot/field in addition to the crop level and with considerable differences across crops, regions, production types and even farmers within a region. In addition, since only very scarce data on the actual implementation of IPM at farm level exists, no baseline can be created.

[68] As per findings from the focus group on IPM measures.

In addition to potential costs, however, it can also be expected that this policy option would entail benefits for farmers due to the existence of guidance which to some extent can replace own research and potentially bad practices.

4. Calculation of costs for spot checks on IPM compliance

Direct economic impacts

Currently, as per results from the survey with national authorities, three countries already have a system in place to control implementation of IPM at farm level. This includes France which controls implementation of some IPM provisions; Belgium, which controls implementation of some IPM measures for a certification scheme on sustainable agriculture and other provisions as part of CAP cross-compliance checks; and Poland[69].

Professional users

This policy option only concerns farmers and no other professional users. The costs for farmers for this policy option will depend on how the final framework for controls will look like.

It is not possible to foresee the fees to be charged by national authorities for these controls given that they would likely vary widely per country. However, as per Article 80 of the OCR, the fees would need to be cost based.

It should be noted that the OCR also foresees actions to be taken by competent authorities as well as penalties in the case of non-compliance. Those would, in case of non-compliance, pose costs for farmers. However, those costs, which are punitive or deterrent in nature, are not counted into the assessment of costs and benefits of this policy option.

Another aspect of potential costs for farmers stemming from this policy option which are not counted as part of the analysis are costs for farmers which so far did not comply with IPM standards and would change their practices to avoid penalties.

Another potential pathway for building on an existing mechanism for this policy option is by including the controls in the performance-based penalty system of the CAP. In the current CAP (until 2023), this is the cross-compliance mechanism; in the new CAP, starting in 2023, this will be replaced by conditionality. Controls under this mechanism would not create direct costs for farmers since the costs for the controls are borne by the public authorities. However, farmers could receive penalties in the form of reduced CAP payments. Again, those penalties do not count into the cost benefit assessment of the impact assessment, as well as the costs for changing practices. It should be noted that not all sectors/farmers receive CAP payments.

[69] Albeit Poland authorities also mention that it is challenging to control IPM implementation.

However, in any case the process needed for this policy option (creation of crop- and region specific IPM standards, preparation for recording, start of recording and submission of first data) can be expected to take a considerable amount of time before being operational. Thus, while it can be expected that this policy option is effective towards reaching the objective of improving measurability and monitoring of implementation of IPM (and through this the uptake of IPM), this would be rather in the long-term and it is unlikely that it will be instrumental in contributing to the two-pesticide related Farm to Fork targets which are to be reached by 2030.

For both pathways, farmers would also face costs due to time spent during the controls. However, it can be expected that those would be fairly low – for example, a study on administrative burden from certain rural development measures[ccxxvii] found that on-the-spot checks only account for 2%[70] of all administrative costs that farmers face linked to CAP direct payments (while application for those payments account for almost 80% of all administrative costs). Thus, even if on-the-spot checks would become more time intensive due to additional cheeks of IPM implementation, those costs would overall be minor.

National authorities

For national authorities, the costs also depend on the final selected mechanism of this policy option. As mentioned, the costs for controls through the OCR are recovered from fees so eventually no costs would accrue.

For the inclusion of the IPM controls the national authorities would face some costs for additional time spent during on-the-spot checks. Quantitative estimations on costs for national authorities are presented in Table 14 below.

Table 14. Overview of quantitative estimations of costs for national authorities[ccxxviii]

Name	Type	Assumptions	Costs	Distributional considerations
Additional time spent by inspectors during on-the-spot checks as part of the CAP conditionality mechanism	Recurring annually	It is assumed that at least 1% of all farms are annually subject to on-the-spot checks[71] An additional time of 20min is assumed per on-the-spot checks for checking records on IPM implementation An average hourly labour cost of 37 EUR for public authority staff is assumed[72]	Approx. 1.3 million EUR annually	Costs are per farm so countries with more farms (e.g., Italy, Poland or Romania) face overall higher costs Labour costs differ between countries Large differences in time spent between types of farms (mainly dependent

[70] It should be noted that the study is from 2011; however, it has also been used in the impact assessment feeding into the revision of the current CAP and thus the findings of the study are still considered relevant.

[71] As per current draft of the of the "Horizontal Regulation", Art 84(3)(d).

[72] Data about labour costs in the Member States is obtained from Eurostat's Labour Cost Survey, the latest available being 2016 (see: https://ec.europa.eu/eurostat/databrowser/view/LC_NCOST_R2__custom_1281363/default/table?lang=en; cost category "'public administration and defence, compulsory social security"), and adjusted for inflation. A

Name	Type	Assumptions	Costs	Distributional considerations
		Potentially also new hires would be needed to absorb additional time requirements; however, those are reflected in the calculated costs		on number of lots and diversity of crops)

Also, for both pathways the competent authorities would face costs for training the controllers. Since it is unclear how complex the recording framework would be, it is not possible to calculate how much training would be required.

It should be noted that during stakeholder consultations it was brought up that incentives for good implementation of IPM might work better than penalties for lacking implementation of IPM since the latter might only get farmers to do the bare minimum in order to pass the checks.

5. Calculation of costs linked an independent advisory system

As mentioned earlier, advisors in the context of the SUD are defined in Article 3(3) as "any person who has acquired adequate knowledge and advises on pest management and the safe use of pesticides, in the context of a professional capacity or commercial service, including private self-employed and public advisory services, commercial agents, food producers and retailers where applicable". Those advisors need to receive specific training (including on IPM) and a certificate on that training.[73] Below, the costs of this policy option for the different stakeholder groups are discussed against this baseline.

National authorities

In terms of cost for national authorities, there are costs for developing the more detailed training, rolling it out, and conducting it.

For developing the more detailed training and given that in a number of Member States the advisors already receive thorough training, and also given the need for crop- and region specific advice, it is unlikely that at European level new topics and detail could be added with relevance and added value for all of Europe. One possibility to add more detail to the training with relevance for all of Europe would be linking the additional training more specifically to the guidelines. The costs for doing so are discussed in that section.

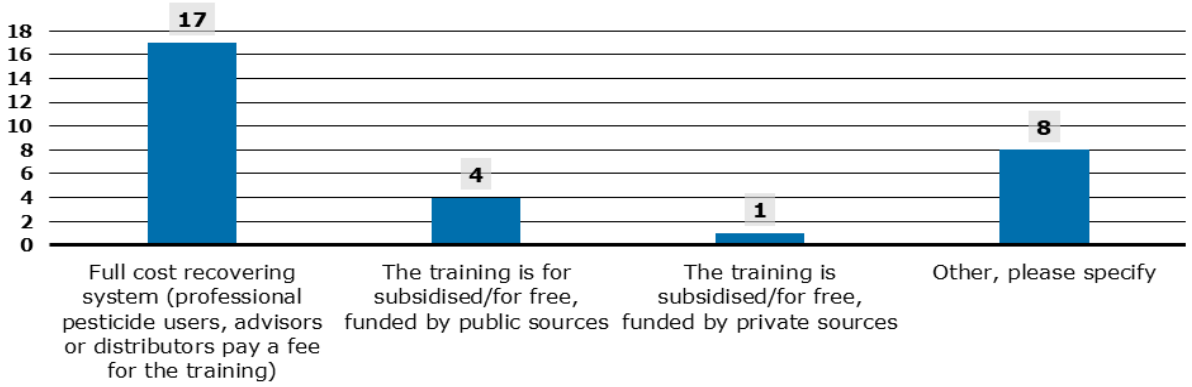
25% overhead cost is then added to obtain an average Member State daily labour cost for the public administrations. This leads to an average annual cost of approx. 63k EUR.

[73] It should be pointed out again that those advisors are not necessarily the same as the advisors of the Farm Advisory System (FAS) mechanism under the CAP. While the FAS as per current and future horizontal regulation also specifically covers the implementation of the SUD, the scope of advice between the two groups of advisors is different.

For rolling out the training, it is assumed that only little cost would occur since almost all countries can build on a well-established training system into which the new training subjects can be integrated[74].

In terms of costs for conducting the trainings, results from the member state survey have shown that in the majority of cases the costs are fully recovered through fees from the trained stakeholders[75] as can be seen from Figure 15 below.

Figure 15 Survey with national authorities: Please provide information on how the training and certification system is financed



Source: Ramboll study elaboration based on survey with national authorities

Given that in the majority of cases the costs are recovered through fees from the advisors, the costs for conducting the trainings are discussed below in more detail. In short, no numbers on the total numbers of advisors are available but it is estimated that an additional 7 EUR per advisor would accrue for this policy option for countries in which training is funded by public sources[76].

Advisors

Through the survey with national authorities, respondents provided estimates on average training costs for advisors[77]. Table 15 below summarises the detailed replies.

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[74] The evaluation of the SUD found that for establishing the training system of the SUD, despite it establishing a range of topics to be covered by covered (see Annex I of the SUD), only comparably little cost have occurred (in total five replies provided an estimation, all of them around 1 to 2 FTE for one year, for setting up the scheme for the central governments). Given that through this policy option only of topic (IPM) would be further elaborated on, it can be assumed that the costs will be negligible.

[75] In the "other" category, five replies pointed out that within one Member State there are different models that co-exist. Two of those replies also mentioned that the systems are decided on and differ between the regions in the respective Member States. One reply pointed out that there are differences between stakeholder groups, i.e., that distributors have to pay for training while it is free for professional users.

[76] Since fees in Table 15 are reported to fully cover the costs for training it is assumed that they are representative for the costs that national authorities would face.

[77] Through the survey, estimates were also collected on costs for trainings for professional users and distributors. The results showed that in most MS there are differences between the training costs for different stakeholder groups and typically, the costs for professional users are lower than for the other stakeholder

Table 15. Estimates of training and certification costs for advisors in cases where the courses are fully financed through fees

Advisor
40 EUR
40 EUR
40-50 EUR
75 EUR
165 EUR
235 EUR
250 EUR
300 EUR
Between 0 - 360 EUR (depending on training centre)
Basic course: 400 EUR; follow-up course: free
450 EUR
Basic course: 500 EUR; follow-up course: 200 EUR
Depends on the provider of the training

Source: Ramboll study elaboration based on survey with national authorities

As can be seen, there are large differences between countries and complexity is added by different prices for basic and follow-up courses. However, based on the numbers, it can be assumed that the average for one training at European level is at around 200 EUR.

Costs for advisor training vary between Member States between 40 and 500 EUR. An average of 200 EUR per training is assumed.

Based on the information above, estimated costs of the policy option are presented in Table 16 below.

Table 16. Overview of quantitative estimations of costs for advisors[ccxxix]

Name	Type	Assumptions	Costs	Distributional considerations
Additional costs for advisors for more detailed training	Recurring annually	Current average cost per training is 200 EUR (see above) The policy option does not specify what the more detailed training would entail and it thus cannot be calculated how much additional time would be needed. However, based on expert opinion, it is assumed that the training could be extended by 20% (leading to 20% higher costs per training, i.e. 240 EUR in total). However, depending on the requirements of the new training, e.g. if it is stronger focused on in-depth training for IPM this could also be higher. Thus, the cost should be understood as minimum The SUD does not prescribe specific or minimum intervals for renewals of trainings and no recent	At least 7 EUR annually per advisor	There are considerable differences between countries for costs for training

groups. Only in three cases the professional users face higher cost than one or both of the other stakeholder groups.

Name	Type	Assumptions	Costs	Distributional considerations
		data exists on renewal intervals. However, through a 2013 survey from the Commission to Member States78 it was found that the duration of validity ranges from a minimum of 2 years to a maximum of 10 years; it is assumed that this has not changed significantly and that on average the certificate has to be renewed every 6 years No concrete figures exist on total numbers of advisors in the countries and thus only the additional cost per advisor can be calculated and not the overall costs across all countries		

Source: Ramboll study

Professional users

It can be expected that direct cost of advisory services would increase for professional users, the estimation from France arrives at a total cost of 540 Euro per year for large farms and 180 Euro per year for smaller farms for the obligatory "strategic advice". For more specific advice on treatment, it estimates 1.500 Euro annually for large farms and 300 Euro annually for smaller farms.

It is also assumed that the change would lead to a decrease of pesticide use overall (due to increased quality of the service and decoupling from commercial interest) which may balance the increased costs. In the French impact assessment it was estimated that farms could save up to 25% of their pesticide input costs, which would offset the additional costs for buying mandatory advice (it was estimated that French farmers spend approximately 10.000 Euro per year on pesticide on average, thus generating a net benefit of 2.500 Euro per year once strategic advice and specific advice has been fully implemented)[79].

The costs from the change of the system could be partly balanced by higher subsidies or support to independent advisory structures.

6. Costs for PAE registration schemes

National authorities

Approaches vary widely in the existing registration systems in terms of governance and consequently the question of who bears the costs.

However, some costs would occur for national authorities for the creation of the national infrastructure (i.e. creation of a platform or integration of existing

[78] See: Sustainable Use Directive Survey on Training Certification Systems 1st semester 2013, European Commission

[79] It should however be noted that a key finding in the evaluation of SUD was that expected gains to farmers has thus far not materialised, e.g. there are no signs of reduced costs for pesticides benefiting professional users.

platforms and then maintenance) which would, however, be relatively low and thus it is not attempted to quantify them. Through case-based fact-finding, indicative costs for national authorities which have implemented a PAE register are presented below.

Table 17. Indicative costs for existing PAE registration schemes[80]

Member State	Description	Cost for implementation	Cost for monitoring
Belgium	Established in 1995 1st system established in paper format 2nd system updated 2007 to electronic submission (online app)	1st system in paper format: 5 days FTE 2nd system of electronic submission: 50 days FTE	Maintenance time minimal. Monitoring of the data approx. one FTE.
Cyprus	Developed as an e-government platform. System was developed to cover both PAE registration and applications for renewal/issuance of professional certification.	Approx. 41 days in total Five months of work divided between 4 staff working 1/3 of the time on implementation.	4 FTE per month for monitoring and maintenance
Slovenia	Established in 1998. Currently 16600 PAE are registered Records updated by PAE inspectors only	Not possible to estimate.	Approximately EUR 6000 per year

Additional costs for national authorities depend again on the governance model. If (like in Spain) only newly acquired PAE would have to be self-registered by the owners, it would not create any further costs for the authorities.

If, however, it is part of the policy option (through a cut-off date or an additional provision) that all PAE have to be registered, including the existing stock, this would likely create additional costs for the national authorities. Different pathways taken to achieve this would again entail different costs. For example, if a survey is used (like in Spain) this would likely create some costs which are, however, expected to be low if done through online forms.

Other options could e.g. entail a specific campaign in which inspectors visit all farms to take stock of PAE which would create considerable costs. However, since this is not required as part of the policy option and there are more efficient and less costly ways, it is unlikely that any Member State would take this route.

[80] Information gathered through case-based fact finding to Member State authorities

Farmers and other owners of PAE

The costs for owners of PAE would to some extent depend on the governance structure selected by the respective national authority. However, since registration would only take very limited time and would be a one-off cost (either when buying new equipment or through a survey) those costs can be considered negligible.

7. Costs linked to annual reporting on national action plans

National authorities

The current provisions on NAPs require Member States to review their plans every five years (Article 4 Paragraph 2) and report on the harmonised risk indicators, trends in active substances, as well as other priority items to the Commission and the public (Article 15 Paragraphs 2 and 3). The policy option to report annually on the national action plans would add additional yearly reporting requirements on other elements of the NAP, including monitoring information on the Farm to Fork Strategy pesticide targets and the HRIs.

Direct economic impacts would arise for Member States to collect the information and report on it to the Commission. There would also be a possibility of yearly reporting to the public in individual Member States.

Table 18. Overview of quantitative estimations of costs for national authorities

Name	Type	Assumptions	Costs	Distributional considerations
Data collection and reporting	Recurring annually	It is assumed that the 6 Member States with existing national annual reporting obligations have minor costs. With those Member States also more likely to respond to the survey question, the assumed number of Member States with noticeable costs is assumed at 20. It is assumed that other Member States require resources at the lower end of the spectrum of estimations for and evaluation and revision of the NAP, resulting in 0.5 FTE required.	Approximately 630 000 EUR	Countries with existing national obligations for annual reporting face lower costs than countries with no such obligation at the moment

Impacts on Member States depend on the current reporting system of the country. Based on the survey responses made by national authorities, Member States can be grouped into two categories[81]:

[81] It should be noted that not all Member States have responded to the survey and not all responses contained an assessment of potential costs. The number of Member States for which an assessment was reported is 16.

- Ones that already have national reporting obligations and therefore do not expect substantial additional costs, and
- Ones that do not presently report at such frequency and therefore expect relevant additional costs for relevant authorities.

The first group is smaller and comprises Belgium, Czechia, Denmark, Germany, France and the Netherlands. These Member States see only minor additional costs as long as the reporting covers high-level information on the elements of the NAPs and indicators based on sales data. Should, however, detailed requirements be made, or a translation to English be required, costs would also arise for these Member States.

In the remaining Member States, structures for annual reporting would have to be established. This would lead to additional human resources needed for the collecting the data and drafting the report. Nine Member States indicate the additional burden this would cause is substantial but not directly quantifiable. Yearly reporting is assumed to be less labour-intensive than revising the NAP, but due to data collection and reporting, considerable work is still needed. Therefore, the time assumption is made at the lower end of the spectrum of estimations for the evaluation and revision of a NAP. Thus, 0.5 FTE are assumed to be needed in 20 Member States (building on the fact that some Member States already have reporting mechanisms but those were more likely to reply to the survey).

Professional users

As the monitoring of certain measures of some NAPs is based on surveys with professional users, additional time requirements would arise for these as well, if yearly surveys would be needed. Only one Member State indicated this concern in the survey, but others may not have such a system yet, because systematic monitoring and reporting is not undertaken. The costs are therefore difficult to quantify. However, they would be driven by the measures of the NAP, the time needed to respond to such a survey and the number of farmers in that Member State.

In case of a survey to professional users, a combination of two elements is assumed based on the existing mechanism in place in Sweden:

- a short online questionnaire on elements such as PAE used or storage of pesticides that takes about 15 minutes to complete, and
- an extensive survey followed by an interview on pesticides used, crops, doses, etc., which in total requires 2.5 hours to complete.

Table 19. Overview of quantitative estimations of costs for professional users

Name	Type	Assumptions	Costs	Distributional considerations
Input to NAP monitoring	Recurring annually	It is assumed that 5% of all farmers in a Member State answer the two consultation	Approximately 165 000 EUR per 100 000	The costs would only apply to countries with elements in their NAP

Name	Type	Assumptions	Costs	Distributional considerations
through surveys or interviews		elements every year, based on estimations of the Swedish consultation. It is assumed that responding to the consultation requires in total 2.75 hours. An average hourly labour cost of 12 EUR is assumed[ccxxx]	farmers	that require monitoring through consultation with users Total costs depend on the number of farmers in the Member States using such a tool.

8. Costs linked to electronic record-keeping

Electronic record-keeping for the collection of data from professional pesticide users regarding pesticide use is currently in place in six Member States, according to the targeted survey to Member State authorities. A further six Member States noted that record-keeping systems are under implementation.

Evidence gathered during the evaluation of the study uncovered that under Article 67 on Regulation (EC) No 1107/2009, professional users are required to keep records, however the process is not automated, and data are not collected in electronic format in one system. Therefore, it can be the case that use data is currently being recorded at the farm level, however there is a disconnect from the farm to national level and national level to EU level.

Professional users

In understanding the direct economic costs to professional users, it is useful to examine the impact from two processes: [1] the recording of data and [2] the transfer of data onto an electronic system. Under the first process, given that users are already required under Article 67 of Reg. 1107/2009 to record such information, the direct economic cost from the implementation of this option would be comparable.

On the transfer of data, evidence from countries which already collect use data often have in place a strong advisory service network thus reducing the time for users to upload data, as well as ensuring that the data that is uploaded is accurate. Thus, for those countries which already report the data at the national level, the direct economic impact would remain the same. The cost per hour is based on the EU average of 12 EUR per hour for an agricultural worker. Overall, while some Member States (BG, DK, FI) noted an increased administrative burden, the current data outlines minimal extra costs for users to provide the data to the national authorities.

Furthermore, on the assumption that most of Member States have in place a form of advisory service that could assist with reporting, it could be assumed that the costs to report the data would be low. However, if such services are not available, this could require greater time for the user to report, thus increasing the direct economic impact.

Table 20. Cost estimates for reporting use data across selected countries by users through surveys

Member State/ Country	Costs to users	Estimated cost per farmer
Belgium	All the costs and burdens are for administrative purpose. For the respondents (farmers), there is no burden in addition to their commitment to the FADN.	
Bulgaria	High administrative burden	
Denmark	Increased digitalization caused additional burden	
Estonia	108 minutes per respondent	1.8 hours = EUR 21.60 per user
Finland	Specific cost not available. Submitting of pesticide data was an additional burden for the farmers.	
France	The burden on the respondent is approximately between 1 and 1.5 hour	Approx. EUR 12 – 18 per user
Germany	The respondents will receive representational allowances. The sum of these expenses was 134.500 € in 2018.	1310 farms sampled. Assuming 1 user per farm. Approx. EUR 102 per user compensation.
Greece	As far as the sellers are concerned, the burden was minimal since almost all the data collected are also required for issuing the relevant invoice.	
Ireland	Average respondent time is 25-30 mins	Approx. EUR 5 – 6 per user
Lithuania	In 2018, the average time spent by respondents on the filling-in of the statistical questionnaire – 2 hour 56 minutes.	Approx. EUR 36 per user
Netherlands	The survey is postal and mainly electronic and the range of detail of data collection has been further lowered in 2016 by sending the form every quarter of the year. Though not all farmers do have a computer use of paper is lowered to a minimum.	
Slovakia	Average time for filling in the reports on pesticide use by respondents vary and depends on acreage of their farms (in the interval from 50 to 5000 ha of agricultural land). Thus it can be from couple minutes to 8 hours.	Approx. EUR 12-96 per user
United Kingdom	For burden on respondents: arable, £1,221; orchards, £2,611; soft fruit, £2,944; edible protected crops, £2,609; outdoor vegetable crops, £5,764, grassland & fodder approximately £6,000.[82]	Arable: EUR 1428 Orchards: EUR 3054 Soft fruit: EUR 3444 Edible protected crops: EUR 3052 Outdoor vegetable crops: EUR 6743 Grassland & fodder: EUR 7020

Source: Eurostat. 2018. Pesticide use in agriculture (aei_pestuse) - National Quality Reports. [online] Available at: https://ec.europa.eu/eurostat/cache/metadata/en/aei_pestuse_esms.htm

National Authorities

Estimates on the development of an electronic system were provided in the region of 500,000 EUR by two Member States while monitoring ranged from two full time employees to a sum of 100,000 EUR. The divergence in these estimates and the lack

[82] It should be noted that it is assumed that these figures include the cost for the farmer to gather the data and report it and not the reporting cost alone.

of comparable estimates means that these figures should be treated with caution and only seen as indicative.

Using figures from quality reports of use data submissions by Eurostat, the total cost of conducting data collection (most commonly through surveys) is estimatedr period as being between 125,000 EUR – 209,800 EUR, thus averaging 25,000 EUR – 42,000 EUR per year.

EU Institutions

With regards to the impact on EU institutions, no quantitative assessment was possible, however on the basis of informed assumptions, the impact is foreseen to be minor. On the basis that the EU's statistical body, Eurostat, already collates data on the use of pesticides, it is assumed that an increase in the volume of data being transferred would only lead to a minor impact.

ANNEX 5: RELEVANT BACKGROUND ANALYSIS AND OTHER RELEVANT POLICY INITIATIVES OF THE COMMISSION

Modelling and Estimates of the effect of Green Deal and Farm to Fork Strategy targets in the EU

Several recent publications have tried to provide estimates of the impacts of achieving the Farm to Fork Strategy targets, including the pesticide reduction targets which are within the scope of this impact assessment. The publications include computable general equilibrium models (Beckman et al. 2021)[ccxxxi]; partial equilibrium models for the agricultural sector (Barreiro-Hurle et al. 2021[ccxxxii]; Bremmer et al. 2021[ccxxxiii]; Henning et al. 2021[ccxxxiv]), extrapolation of assumptions to actual market data (Noleppa and Carstburg, 2021[ccxxxv]; COCERAL, 2021[ccxxxvi]) or simulation of assumptions with farm level data (Guyomard et al. 2020[ccxxxvii]). None of these publications can be considered a fully-fledged impact assessment of the policy, but their results provide some insights into the economic impacts of policy decisions limiting the use of plant protection products.

These assessments, in general terms, introduce an assumption on the change in farming practices from reducing plant protection product use and its related impact on yields. For example, Barreiro-Hurle et al. (2021) consider a reduction in costs associated with the lower use of plant protection products, assume an increase in other costs to reflect increased mechanical weeding, and consider an increase in the use of cover crops as a pest management alternative. As expenditure for pesticides is included in the cost function of the economic model used for the analysis, but there is no associated yield response function, an exogenous yield loss of 10% is introduced to simulate the effect on production of a 50% target reduction in pesticide use[83]. Similar approaches are used by all the other analyses published. As the actual targets refer to reduction in use and risk of plant protection products, the translation of this to expenditure is, at best, a very crude measure.

The range of impacts reported is large, but in general (and with the exception of the USDA study, where an assessment cannot be made of the effect of pesticides alone) the impact of reducing plant protection product use is that of a reduction in production in the EU with associated reductions in net exports (i.e. higher imports and lower

[83] The justification for the 10% impact provided relates to available data on impact of selected pests on hosts obtained during the drafting of the Priority Pest list by the Commission (Sánchez et al. 2019). In this analysis, for the 20 pests for which the impact review was undertaken, on average 18.6% of EU's production was found to be potentially affected by these pests. A worst-case scenario of production losses of 50% of this impact was assumed, and this yield loss [rounded up to 10%] was applied to cereals, oilseeds, vegetables, other arable crops and permanent crops in Barreiro-Hurle et al. (2021).

exports). Some of these supply-side impacts could be readily mitigated by additional actions on the demand side such as food waste reduction, added value chains for sustainable food, etc. Moreover, the simultaneous achievement of different policy targets shows that some of these (e.g. increased land under high-diversity landscape features) can ease the achievement of the reduction in plant protection products use and risk.

Leaving aside the imperfect representation of the pesticide reduction target in the models, in order to fully capture the impact of this target, other changes that are likely to happen by 2030 in absence of policy and other induced changes due to the extensive support actions announced under the Farm to Fork strategy to support the implementation of these targets should be included. For this reason, the mentioned studies qualify their results as an upper-bound of the expected production impacts of meeting this target on the agricultural sector. As the analysis of Barreiro-Hurle et al (2021) also tries to capture the contribution of aligning the CAP support to the Farm to Fork Strategy targets and the impact of Next Generation EU[84] (NGEU) funding, it is further outlined how this can be used to revise the magnitude of the impact of plant protection products use reduction on the agricultural sector in more detail.

JRC study "Modelling environmental and climate ambition in the agricultural sector with the CAPRI model"

Published in 2021[ccxxxviii] the JRC study models the impact of the four Farm to Fork Strategy targets together on a range of indicators including production, price and land use, with data provided for a range of different crops and animal products. The impact of achieving these targets is analysed assuming different CAP implementations; a continuation of the CAP 2013-2020 implementation, an implementation of the 2018 Commission CAP legal proposal in which countries which aim for a higher environmental and climate ambition, and one adding to the latter the potential impact of the NGEU funds for the agricultural sector.

The study concludes that the four targets together can achieve a significant positive environmental impact. The environmental impacts reported are restricted to greenhouse gas, ammonia and nitrogen emissions. The analysis does not attempt to quantify any secondary health benefits derived from lower emissions (e.g. reduced mortality and morbidity)[85] or plant protection product use[ccxxxix]. The study makes some

[84] NextGenerationEU , EC a recovery plan, (europa.eu)

[85] However, the benefits of these reductions extend to the whole society. For example, a recent analysis by Himics et al. (2022) shows that the reduced ammonia emissions also lead to reduced particulate matter in the atmosphere that further translates into a reduction of premature deaths. Considering the magnitude of the ammonia reductions achieved in the JRC study scenarios, if these policy actions were to be applied by 2030 and remain in place until

statements of the potential for leakage of issues to third countries, specifically for greenhouse gas emissions, but acknowledges that the model considers only the EU acting in isolation and does not consider the actions taken in international agreements, support for third countries and the complementary actions of international organisations. The corollary from achieving these targets is the impact on domestic production due to the assumed reductions in yields.

The study transparently acknowledges that there are limitations in these conclusions as they are based on broad assumptions. First, and most importantly, as plant protection products are considered in monetary terms, the baseline projection does not fully capture the starting downward trend in the HRI 1 observed in recent times. Secondly, the long list of supporting actions (with the exception of the CAP) that will support this transition (such as bringing new substances on the market, the market for sustainable foodstuffs, reducing food waste, etc.) are not incorporated into the analysis. Lastly, the study report presents results for all four Farm to Fork Strategy targets taken together and, for this reason, does not capture the synergies between the four targets. These three issues are addressed in turn below.

Taking first the issue of the baseline, the JRC study simulates a cut in pesticide use and risk of 50% with respect to the baseline counterfactual, implying that in the absence of a policy measure, the level of pesticide use would be the same in 2030 as in the 2015-17 reference period. However, there has been a clear downward trend over the last decade.

Table 21 below presents the sales of pesticides per Member State for 2018 and 2019.

Table 21. Sales of pesticides per EU Member State[ccxl]

Country	2018 sales (t)	% EU sales 2018	2019 sales (t)	% EU sales 2019
France	83983.1	23.7	54303.7	16.3
Spain	61343.2	17.3	75190.4	22.6
Italy	54038.5	15.2	48405.3	14.5
Germany	44953.8	12.7	45176.0	13.5
Poland	23156.6	6.5	24253.2	7.3
Romania	11107.6	3.1	9046.7	2.7
Netherlands	9387.1	2.6	9261.4	2.8
Hungary	8535.1	2.4	7815.0	2.3
Portugal	8057.3	2.3	9865.8	3.0
Belgium	6635.2	1.9	6126.5	1.8
Czech Rep	5178.1	1.5	5052.8	1.5
Austria	5279.5	1.5	4954.5	1.5

2050, this could lead to approximately 16,000 fewer premature deaths compared to mortality without the policy actions.

Greece	4860.5	1.4	4867.5	1.5
Finland	4901.6	1.4	4034.2	1.2
Bulgaria	5044.1	1.4	6660.0	2.0
Denmark	2646.1	0.7	2660.9	0.8
Slovakia	2490.2	0.7	2352.2	0.7
Ireland	2651.4	0.7	2971.8	0.9
Lithuania	2048.6	0.6	2317.6	0.7
Sweden	1870.7	0.5	1800.9	0.5
Croatia	1697.7	0.5	1563.8	0.5
Latvia	1587.0	0.4	1650.6	0.5
Slovenia	1171.3	0.3	973.2	0.3
Cyprus	1183.6	0.3	1230.8	0.4
Estonia	636.1	0.2	745.2	0.2
Luxembourg	63.0	0.0	56.8	0.0
Malta	90.0	0.0	75.6	0.0
Total tonnes sales	354597.0	100.0	333412.2	100.0

Figure 16 below presents the trend in the approval of low hazard active substances in the EU. As part of the Farm to Fork Action Plan, the Commission has prepared four draft Regulations regarding the data requirements, the approval criteria and evaluation principles for active substances that are micro-organisms and the plant protection products containing them with the objective of facilitating access to the market for these biopesticides. These texts were endorsed by Member States on 8 February 2022 and are now subjected to scrutiny of the European Parliament and Council. They are expected to be adopted and become applicable in the autumn of 2022[ccxli].

Figure 16. Trend in the approval of low hazard active substances in the EU since 2009[ccxlii]

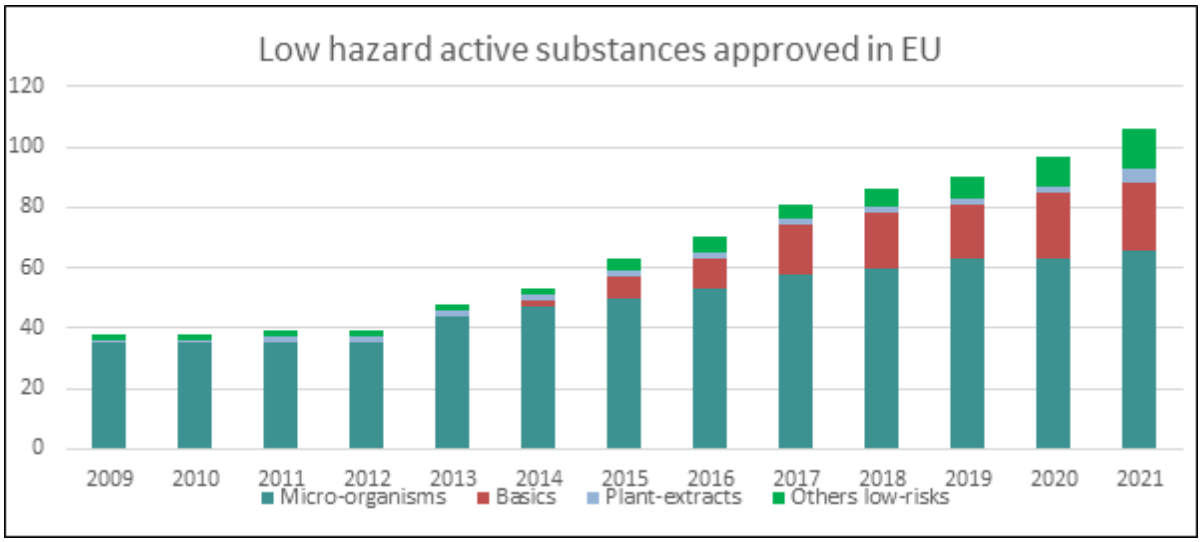


Figure 17 presents the trend in the application for new active substances and indicates that the share of new dossiers for biopesticides is increasing over time.

Figure 17. Trend in applications for approval of plant protection product new active substances in the EU since 1996[ccxliii]

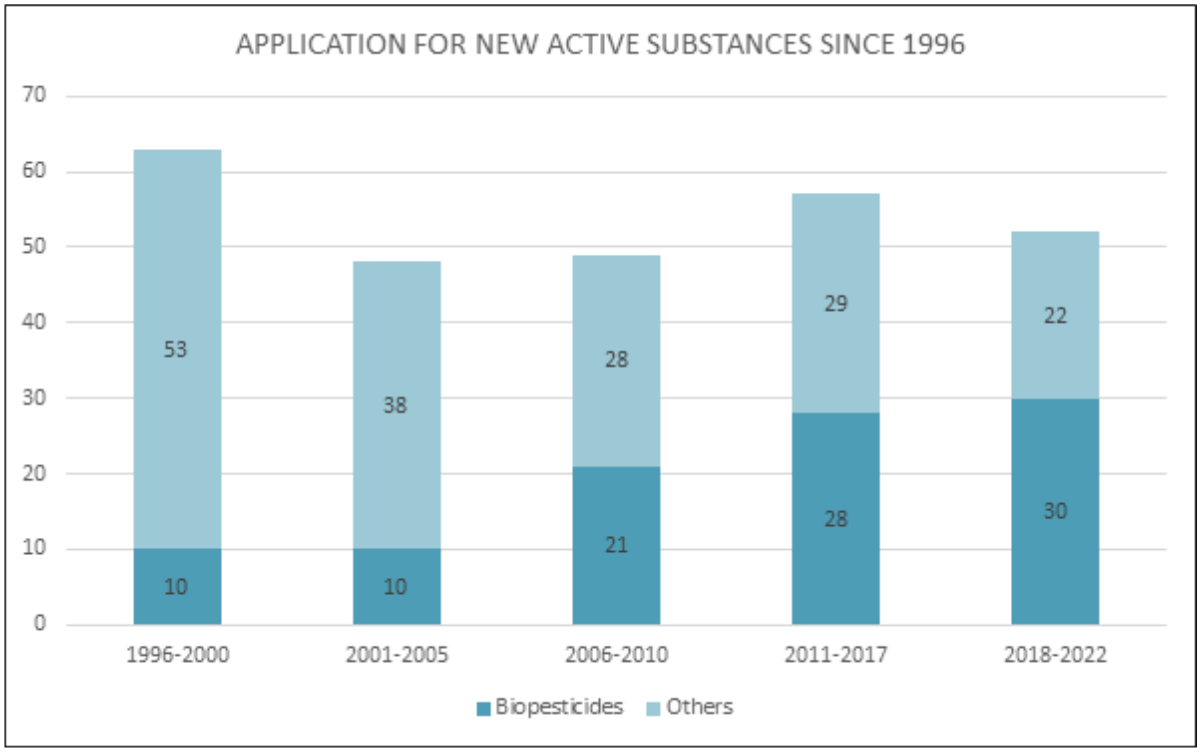
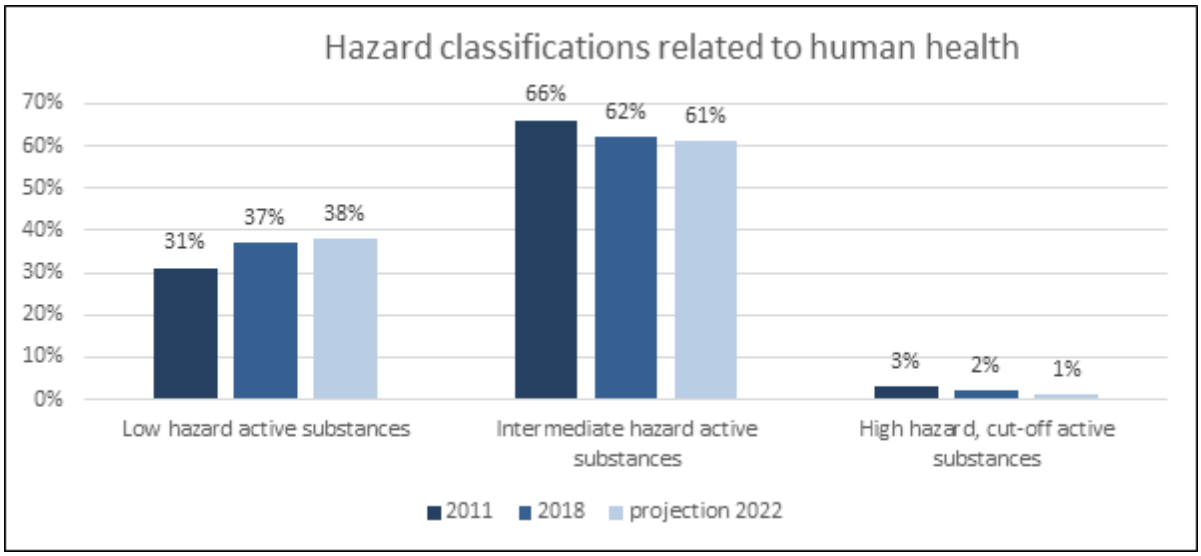


Figure 18 presents the evolution of the hazard profiles of the active substances approved in the EU showing a downward trend as regards the highly hazardous substances (fulfilling the cut-off criteria) and the intermediate hazardous substances, compared to the non-classified substances and micro-organisms grouped under 'low hazard substances.'

Figure 18. Trend in human health hazard classification of EU plant protection product active substances[ccxliv]



Moreover, there are a number of additional factors that will continue to push the use and risk downwards. Taking the baseline levels referred to in the JRC report, based on the EU Agricultural Outlook, one could assume an additional 4% of land under organic farming by 2030 (i.e. increasing from 8% to 12%) which contributes to the reduction of pesticide use. It may therefore be considered that the baseline level in the absence of any policy measure would be 30% lower than in the 2015-17 reference period.. Taking into account the behaviour of the model used which tends to be nearly linear as long as the modelling assumptions are also linear (i.e. in this case yield reductions and increases in other costs), the resulting impacts on final agricultural production could be assumed to be those set out in Table 22 below.

Table 22. Impacts on EU27 supply of a reduction in pesticide use

	Barreiro-Hurle et al. 2021 results for a 50% reduction in use of plant protection products	**Rescaling of Barreiro-Hurle et al. 2021 assuming a 30% reduction in use of plant protection products**
Total agricultural output	-2.7	-1.6
Cereals	-7.9	-4.7
Oilseeds	-11.0	-6.6
Vegetables and Permanent crops	-10.4	-6.2

Pasture	-0.4	-0.2
Dairy Cows	-0.3	-0.2
Beef meat activities	-0.9	-0.5
Pig fattening	-1.0	-0.6
Sheep and Goat fattening	-1.9	-1.1
Poultry fattening	-1.7	-1.0

In this case the crop group that saw the biggest reduction in production in the JRC report, oilseeds, the impact is reduced to 6.6% instead of 11.0% as a result of introducing the assumptions as described above.

The results for a scenario that assumes a 10% yield reduction, with the impacts set out in the first column, would then correspond to a considerably more ambitious target. As explained above the additional reduction would be less and therefore the impacts are rescaled.

Concerning the second point not captured by the analysis of the JRC study, namely mitigation measures, the impact of plant protection product use reduction targets could be further eased via the possible relaxation of rules concerning targeted aerial spraying by drones, and access to professional agricultural advisers. However, the exact impact of these new technologies cannot be foreseen as the cost of these technologies and the willingness to adopt by farmers are uncertain.

Other actions would also be expected to contribute positively, most notably better IPM implementation supported by IPM standards and farm advisors, and availability of alternatives such as biocontrols coming to the market, but these are harder to predict and quantify in any meaningful way.

Lastly, it is important to bear in mind the synergies between the four Farm to Fork targets, to avoid double-counting the impacts as one might if they are only considered individually. The results of the analysis in the JRC study are not reported separately for each individual target and do not attempt to quantify the contribution of each target to the others. For example, as organic farming uses less plant protection products, the increase in organic area already provides some of the pesticide reduction needed to achieve the target.

Supplementary material from the JRC study allows to examine the estimated impacts of each target individually. From this analysis, the first message that come across is that the four targets are synergetic, meaning that the aggregated impact is smaller than the sum of the individual impacts. This is what one would expect, as, for example, meeting

the organic target would already deliver a significant reduction in pesticide use and therefore go a considerable way towards meeting the pesticide target.

Table 23. EU27 supply changes in 2030 for the individual target and combined scenarios relative to baseline

	Pesticide reduction	Increased land under organic farming	Increased area under high-diversity landscape features	Reduction of gross nitrogen surplus	Combined
Total agricultural output	-2.7	-0.4	-2.1	-7.0	-11.2
Cereals	-7.9	-4.4	-6.0	-3.3	-14.9
Oilseeds	-11.0	-6.4	-2.3	-1.6	-15.5
Vegetables and Permanent crops	-10.4	-5.0	-0.3	-0.1	-12.1
Pasture	-0.4	1.0	0.5	-11.1	-10.0
Dairy Cows	-0.3	0.3	-0.7	-7.4	-10.1
Beef meat activities	-0.9	0.1	-1.2	-10.5	-14.3
Pig fattening	-1.0	-0.4	-0.7	-12.2	-15.5
Sheep and Goat fattening	-1.9	-1.4	-0.6	-6.4	-10.0
Poultry fattening	-1.7	-0.8	-0.9	-11.2	-15.9

For example, a move from the projected 12% of land under organic farming in 2030 according to the EU Agricultural Outlook, to 25% in line with the Farm to Fork Strategy target, would imply a reduction of around 10% in overall pesticide use and risk (assuming that organic farming entailed an 80% reduction in pesticide use and risk[86]). As regards the fertiliser use target, the JRC report projects a 35% adoption of precision farming techniques when meeting the four targets driven by both the nitrogen surplus reduction and the support made available by the CAP. As the model does not include the potential impact of precision farming on pesticide use efficiency this does not lead to a reduction of pesticide use. From the available literature on the impact of precision farming on pesticide use one gets multiple crop specific savings without impacts on yields[87]. Assuming that on average the savings could be around 20%, the adoption of

[86] In certain crops there are various technologies that could reduce pesticide use largely, by around 90% (for example mechanical weeding/ spot herbicide application machines and vertical vine variable spraying equipment), but more widely the use of surveillance, GPS and shielded variable rate application technology can reduce the overall pesticide rate by 10-25% (based on the Swiss EU H2020 funded project and the EP study mentioned below) without yield loss or additional cost.

precision farming techniques would deliver an additional 7% reduction of pesticide use without impacts on yields. Thus, these two additional targets together could be expected to deliver a 17% reduction in pesticide use and risk. This together with the reductions expected in the baseline would amount to achieving the full 50% pesticide reduction target.

Wageningen Economic Research Study

This study was commissioned by CropLife Europe and conducted by Wageningen Economic Research (WecR), and published in December 2021.

The main strength of this report is the fact that yield impacts of reduced plant protection product use and risk are based on a selection of 25 country/crop cases studied. The predicted impact on yields range from -30% for table olives in Italy to zero impact for maize in France. It also includes potential impacts on prices due to quality impacts from pest attacks that do not reduce yields. These impacts range from -15% for sugar beet in Poland to zero impact for grapes in France for example. These point-estimates for crop/country pairs are then extrapolated to the EU and the impacts in production and prices at EU level are estimated using an economic model.

The WecR Study does not consider the positive impact of the policy action on human health or the environment, but models the impact the changes will have on yield for the different crops in meeting the targets at farm level, and then transfers these to a macro (EU level) using a predictive economic model. It concludes that there is a variable yield loss, with greater effect on perennial crops, and a significant impact on trade with external trade partners. Yield losses are generally higher than in the JRC study, but also more variable. This is particularly the case regarding pesticides as a policy alone with a range of effect on yield per crop of -2% and -21%. The exogenous price shock due to quality loss has a range of between 0 (for olives and citrus) and -7% for sugar beet.

The assessed impact of meeting the pesticide target is made by discussing at farm level the best way of achieving the reduction, be it total volume reduction, switching to lower risk alternatives, applying IPM or using available precision application technology, and assessing the cost of such a change on yield. The analysis of the farm questionnaires indicates that this effect is driven by the limited availability of alternatives in some crops (e.g. sugar beet and perennials) requiring a reduction in pesticide application and corresponding yield loss, but that in some crops yield and cost impact is minimal as the result can be achieved by the switching from higher risk to lower risk products without significant cost or yield impact (e.g. maize). The effect of increasing organic area gives a rather negative opinion of the benefits of organic agriculture on pesticide reduction.

The report makes a more detailed analysis of the effect of the findings on policy and includes a number of recommendations for policy makers. It particularly identifies the negative effects of perennials on the figures for pesticides, recommends investments in new innovations such as breeding techniques, resistant varieties, rotation, mechanical methods and precision agriculture, and cautions at the role of organic farming in achieving the objectives (based on their findings).

USDA-ERS Study

Released in November 2020 the USDA Economic Research Service produced a report, based on some broad assumptions on the possible application of the EU Green Deal strategies to the EU, to those countries with explicit trade agreements with the EU and to the global effect. Although affected by the limitations of other economic models and not considering the mitigating steps that could be taken, it is the only model analysis that considers the impact not only on the EU but a global scale.

The report concludes on a 12% reduction in agricultural yield and 17% increase in prices due to application of the whole range of targets (pesticides, antimicrobial resistance, fertiliser reduction and 10% set aside land) at EU level, and a 7% yield reduction in the EU and 53% price change for the EU if applied globally. It concludes that the stronger the targets the more marked the impact and the greater the potential consequence for global food security[88]. It does not consider the target of organic production and possible mitigating measures such as precision agriculture, new plant protection products coming on the market, implementation of IPM etc., nor the support framework of the CAP.

As far as it is possible to assess the impact of pesticides, the model uses a 50% reduction in pesticide use, not linked to risk or hazard categories, again using cost as a proxy for the target. There is no conclusion or detail as to how pesticides contribute compared to the other actions which are concluded and no dis-aggregated data is provided to allow this assessment.

University of Kiel

The study, published in September 2021, uses the same data sets and methodology as the JRC study, and is thus an attempt to extract some specific assessment of the effect specifically of the targets in isolation, and linked to a separate model of international trade flows it offers more predictions of the effect of ''leakage''. It thus suffers the same

[88] Other papers show that price transmission does not immediately take place from highly developed economies to very poor ones, most-importantly because the latter do not play an important role in trade and import substitution is also quite high. See for example: Thompson, Wyatt, and Ignacio Pérez Domínguez. "Straining the links between biofuel policies and food insecurity in developing countries." Presented at the International Consortium on Applied Biotechnology, Ravello, Italy, June 19, 2013

limitations in analysis as the JRC study as it uses the same source data and predominantly the same methodology. It does go further in attempting to quantify the effects of the targets on a biodiversity index and greenhouse gas emissions, and in applying another model on global impacts to assess the ''leakage effect'' to non-EU countries, although the latter says little specifically about the effect of pesticides.

The report predicts decrease in production and increase in costs to the consumer, and thus a decrease in exports, resulting in the balance of products imported into Europe increasing. Unlike the other reports examined though, it predicts a significant increase in farm income[89], due to the increased value of the decreased production. The only prediction on increase linked to pesticides is for oilseeds and fruit and vegetables, a figure of 10%.

The assessment of the effect on greenhouse gas emissions and on biodiversity is individual to this study, predicting a positive contribution of the pesticide targets on biodiversity indices and on reduced greenhouse gas emissions, and an additional increase in land under forestry. The effect of nitrogen/ fertiliser targets is seen as being of most impact and there is little additional analysis giving insight into pesticide reduction.

COCERAL- UNISTOCK

This analysis (described as an impact analysis) is undertaken by industry market specialists to specifically assess the effect of Farm to Fork Strategy targets on the grain and cereal sector. It makes an assessment of the economic impact of the Farm to Fork Strategy targets together (pesticides, fertilisers, organic and 10% set aside) based on four scenarios for what proportion of the actions are for the grain and cereal sector.

The method used to assess the impacts is not clear but is said to be based on review of literature and discussions with farmers and consultants by the nominated industry market specialists. The impact of the pesticide reduction target is seen as having a moderate effect on grain yield and price, but a more significant one for oilseed crops.

The report does not consider mitigating measures or any change to the markets in the coming years, nor the support mechanism of the CAP affecting the outcome as this was still uncertain at the time of the report in May 2021.

European Parliament INRAE Study

Although not an independent impact assessment or study, this November 2020 detailed European Parliament study, commissioned by the European Parliament

[89] The JRC CAPRI analysis also predicts that higher prices and lower production typically lead to higher income (expressed as value added) due to low demand elasticities.

Agriculture and Rural Development Committee and conducted by INRAE and AgroParisTech, provides a detailed assessment of the effect of the Green Deal actions on agriculture and in particular a detailed analysis of the possible steps of the new CAP in achieving these.

The study is based on a detailed literature review and assessment by a panel of experts, and provides a much more positive representation of the targets and the potential to reach these, including assessment of alternative agricultural methods rather than mitigating steps within the current agricultural system. For pesticides it describes the significant cost of chemical pesticides and looks at the increase in IPM, precision agriculture and organic farming as steps to achieve the pesticide reduction targets. It specifically indicates that meeting the 25% organic agriculture target would result in a 14.5% reduction in pesticide use, and that existing precision agriculture can contribute a 10-20% reduction without affecting yields or incurring additional cost.

Common features of all the studies

Impacts on yields from plant protection product use reductions are taken mostly from expert knowledge. There is no attempt to assess the positive feedback loop from improved eco-system services, like improved biodiversity, due to reduction in plant protection product use (e.g. pollination services).

With the exception of the USDA study, all of the studies make an assessment of potential impact on imports and exports of agricultural commodities, but only consider that actions in support of the Farm to Fork Strategy targets are made by the EU alone.

None of the reports attempt to quantify or assess the positive health and environmental impacts of the policies and targets being implemented, even when some indication of economic impacts might be expected.

A recent paper on modelling transitions to sustainable food systems[ccxlv] recognises that agricultural stakeholders have significant concerns regarding the potential impact of the Farm to Fork and Biodiversity strategies on the agricultural sector. While the afore-mentioned studies have tried to assess and model how these strategies would affect the agricultural sector in particular, it is argued that the narrow focus of the analyses undertaken is the main driver of the reported reduction in agricultural production in the EU, its deteriorating trade balance and increased prices. The strategies include a much broader set of interventions that are not accounted for in the analyses and the assessment tools used have limitations preventing them from capturing the full scope of potential impacts and benefits, due in part to the limited evidence available on the co- benefits of improved environmental quality that the strategies aim to attain. Based on available data and modelling and assessment tools, it is therefore difficult to comprehensively and holistically assess the impacts that a transition to more

sustainable food systems[ccxlvi];[ccxlvii] (including reduced use and risk of pesticides) will have on the agricultural sector in particular and overall society more generally.

The JRC is also currently working on improving the representation of biodiversity and plant protection products in their integrated agro-economic modelling platform (iMAP)[90]. The developments aim at allowing a more comprehensive analysis in model-based assessments of agricultural and related policies, with a broader incorporation and reflection of the merits of the transition to more sustainable food systems, including reduced use and risk of pesticides.

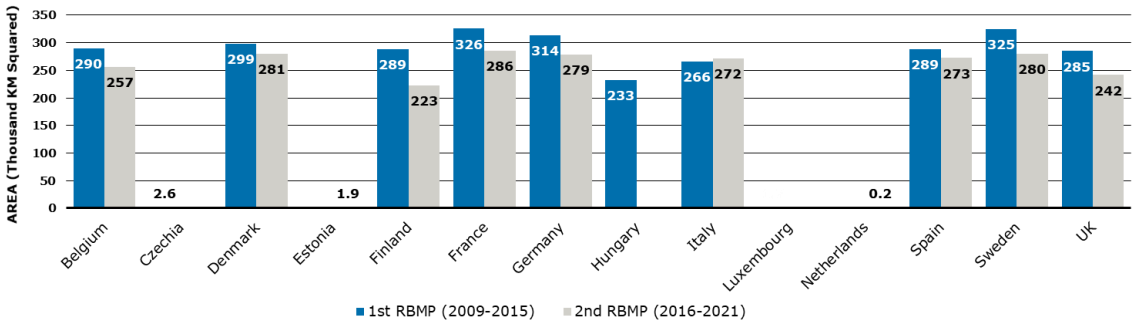
Examples of environmental and health impacts linked to the use of pesticides

Environment impacts

Water

With respect to pollution of pesticides in ground water, data from the first (2009-2015) and second (2016-2021) River Basin Management Plans under the Water Framework Directive[ccxlviii] displayed a 21% drop in the levels of pesticides reported to be found in ground water. It should be noted that this data only represents 14 Member States which reported the presence of active substances in pesticides, including their relevant metabolites, degradation and reaction products. The development per Member State is shown in the Figure below.

Figure 19. Area of groundwater polluted by pesticides per reporting Member State, (Data from 1st and 2nd River Basin Management Plan assessments – EU 14)



In addition, data from the 2020 EEA report on pesticides in European surface and ground water[ccxlix] highlighted that for surface waters, insecticides presented the highest rate of exceedances in the time period 2007 to 2012 (between 22% in 2007 and 48% in

[90] DataM - Agriculture & economics - European Commission (europa.eu)

2012), while post 2012, the rate of exceedance of insecticides decreased significantly (to less than 10%). For ground water, the highest rates of exceedances were found from herbicides, however this trend is decreasing by 7-8% from 2015-2017. Other studies found varying results, specifically in fresh water eco-systems as shown in the example case study box below.

Case study example of pesticide mixtures in Swedish freshwater streams

Gustavsson, M., Kreuger, J., Bundschuh, M. and Backhaus, T., 2017. Pesticide mixtures in the Swedish streams: environmental risks, contributions of individual compounds and consequences of single-substance oriented risk mitigation. Science of the Total Environment, 598, pp.973-983.

Gustavsson et.al (2017) conducted an ecotoxicological assessment and environmental risk evaluation of complex pesticide mixtures that were found to be present in freshwater ecosystems in southern Sweden. The study conducted an evaluation fo the pesticide exposure data collected by the Swedish pesticide monitoring program over the period 2002 to 2013. The data comprises more than 128,000 analytical measurements from 308 weekly samples for between 76 and 131 pesticides and pesticide degradation products. The geographical area that the study covered four streams draining 8–16 km^2 and two rivers draining 102–488 km^2. The analysis of the data adopted to use the Kaplan-Meier method which is a non-parametric statistic used to estimate the survival function from lifetime data. The results from the research found that the environmental risk of 73% of the samples exceeded acceptable levels, with organisms such as algae being most sensitive to risk from pesticides. The presented risk analysis therefore concluded that pesticide residues frequently put aquatic ecosystems in Southern Sweden at risk.

Table 24. Examples of costs to water utility providers

Member State	Example of costs
Belgium	According to data from Belgaqua, since 1995 monitoring and treatment of pesticides has amounted to 20 million Euros per year to water utilities
Czech Republic	In Prague the water operator had to improve the technology of water treatment plant (WTP) with a capacity 1 - 1,8 m^3/s to remove Chloridazon metabolites. This generated a cost for the WTP costs for the new step of technology of 800 million Czech Crowns, that is 28,5 million Euros. Due to the necessity to add sorption step of technology to remove pesticides in the second WTP of Prague prepared for capacity ca 3,5 m^3/s. The investment costs are calculated about 50 million Euros.
Denmark	The costs of protecting groundwater against pesticides are in general less than for nitrate but it depends on the crop system. Grasslands are not depending on pesticides whereas e.g. potatoes growing demands many pesticides so the costs vary from maybe 2,000 Euro to 10,000 Euro (lump sum). However there are groundwater protection measures mainly used against pesticides that are more expensive because they aim to take areas completely out of production.

Source: EurEau (2016). Water utilities costs associated with agricultural pollution; Examples from EurEau members

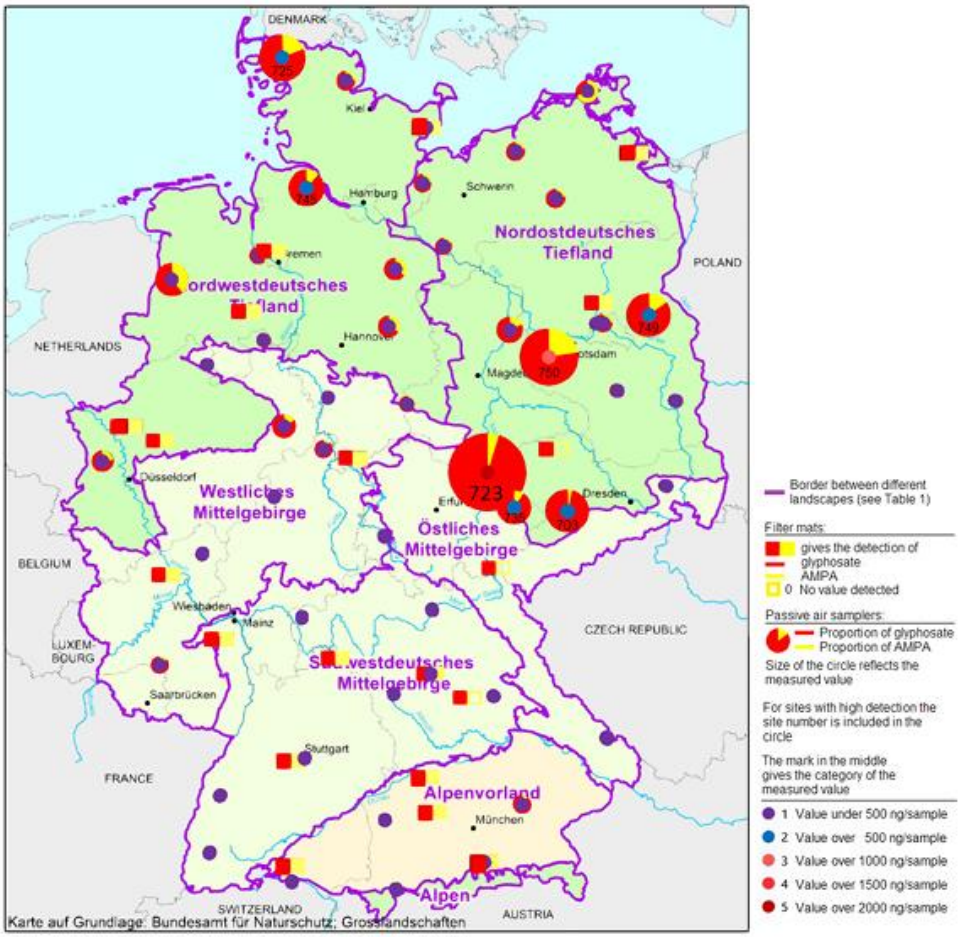
Air quality

With regards to the risks and impact of pesticides on air quality, while there are scarce regulatory values for this area at the national level, across scientific literature and in some countries they are well documented. In France for example, the PhytAtmo database[91] indicate that from 2002 to 2017, around 40 to 90 active substances were detected annually in rural and urban areas.

Similarly, a recent study conducted in Germany[ccl] explored pesticides and related substances in ambient air across 69 sites. Analysis of the samples collected found 109 substances of which 28 were found to not be approved for use in Germany. Crucially, statistical analysis highlighted that landscape classification and agricultural intensity were the primary factors influencing the number of substances detected in ambient air. Interestingly, the variable of location, such as protected areas or regions of organic farming, had only a small effect on the number of substances recorded. Medium- and long-range transport likely accounts for these findings. Extending the current sampling method will probably detect more pesticides than the data currently suggest. The study concluded that airborne pesticide mixtures are ubiquitous in Germany and that this is particularly concerning for glyphosate, pendimethalin, and prosulfocarb. Deposition of these pesticides on organic products was considered to risk potentially disqualifying them from the market, resulting in economic losses to farmers. Air concentrations of pesticides was assessed as being a relevant issue and considered necessary to be reduced.

[91] The Phytatmo database is run by the French National authorities and compiles the measurements of pesticides in the ambient air of AASQA from 2002; 321 active substances sought, and 6837 samples taken at 176 sites throughout mainland France and overseas.

Figure 20. Presence of glyphosate in air samples (Kruse-Plaß et.a.l, 2021)



Biodiversity

The documented impacts of pesticides on air, soil and water quality also present and exacerbate the impacts that pesticide use can have on biodiversity. Similar to other data sources, while there is no clear aggregated EU level data or indicators on the levels of biodiversity and the impact that pesticides may have, specific scientific articles and research provides a collective view of the observed impacts on biodiversity, with there being widespread agreement of pesticide application having an adverse impact upon biodiversity. As noted in the 2018 report by the Commission[92], results at the national level highlight a deterioration of biodiversity in rural landscapes.

For example, in Germany a decline of more than 70% of insect biomass in protected areas was documented, along with the halving of farmland bird populations in Europe and effects on pollinators[ccli]. It should be caveated from this research however, that

[92] European Commission (2018). Science for Environment Policy: Flying Insects in West German Nature Reserves Suffer Decline of More Than 76% (1973–2000). European Commission DG Environment News Alert Service.

protected areas in this context may be affected by pesticide use and indirect exposure of non-target species.

While there are other factors which can be attributed to this decline (i.e. habitat loss, intensive agriculture and urbanisation, introduction of pathogens and species as well as climate change), further research has identified pesticide application as a likely driver with high importance for the worldwide decline in insect populations[cclii].

As aforementioned, the lack of specificity in the HRI's does not allow the assessment of a reduction in risk to specific areas of the environment. For example, the pesticides sales data used in the HRI's does not currently include specific information on actual application and toxicity of the substances involved, along with monitoring data on their occurrence in environmental media and human exposure[ccliii].

Organic farming

Alternative approaches or techniques to pesticide control includes (but is not limited to) methods such as biological control, natural chemical control as well as management techniques such as IPM and organic farming. As documented in the 2018 EPRS study on SUD implementation, evaluating the use of alternative approaches or techniques is very complex and difficult to calculate. One main alternative approach is the transition to organic farming and practices.

Data and studies consistently point to overall declines in the levels of biodiversity across Europe and indeed the world. Thus, the importance of protecting biodiversity is of great importance and further underlines the significance of alternative farming practices and an overall transition to a more sustainable use of pesticides. For example, studies and experiments have long pointed to the role of organic farming and rewilding in providing important empirical evidence to support biodiversity conservation strategies[ccliv].

Case study example of the effects of converting to organic farming on Pest and disease Control

Merot, A., Fermaud, M., Gosme, M. and Smits, N., 2020. Effect of conversion to organic farming on pest and disease control in French vineyards. Agronomy, 10(7), p.1047.

Merot et.al (2020) conducted a study into a network of 48 vineyards in southern France over the period from 2013-2016 which were under conventional management as well as some which were transitioning towards organic farming. The areas of assessment mainly focused on the grapevine phytosanitary management of four major pests and diseases and variations in control efficiency. Key pests and diseases were investigated in particular, including downy and powdery mildew, grape berry moths, and Botrytis bunch rot. The findings from the study highlighted that over the three-year period, pests and diseases were able to be controlled with the same degree of efficiency between both the organic and convention farming practices. It was noted however that there was a drop in efficiency in the first two years of farms transitioning to organic farming, however this outlined a need for greater support and advice to farmers in the transitioning towards

more organic farming practices.

Potential health impacts

In assessing the risks on human health, it is important to state that concerns on the use of pesticides and their impact on human health and possible effects have long been identified. Furthermore, it is important to separate the risks to human health for both the [1] users of pesticides (professional and non-professional) and [2] citizens living close to areas where pesticides are applied as well as consumers of food products.

Risks and impact to human health for users of pesticides

While there are no clear aggregated data at the EU level on the level of risk specifically for users of pesticides, several meta-analyses of academic and scientific literature point to similar and recurring conclusions on the risks and possible impacts[cclv]. In particular, from the available data gathered through the meta-analysis conducted by Inserm (2021), it was found that there is a strong presumption of there being a link between exposure to pesticides and six main pathologies. These include non-Hodgkin's lymphoma (NHL), multiple myeloma, prostate cancer, Parkinson's disease, cognitive disorders, chronic obstructive pulmonary disease and chronic bronchitis. These findings are further supported from toxicological studies which point towards mechanisms of action of active substances and families of pesticides that are likely to lead to the health effects demonstrated by epidemiological studies.

Case study example: Link between pesticide application and Parkinson's disease

Kab, S., Spinosi, J., Chaperon, L., Dugravot, A., Singh-Manoux, A., Moisan, F. and Elbaz, A., 2017. Agricultural activities and the incidence of Parkinson's disease in the general French population. European journal of epidemiology, 32(3), pp.203-216.

This study conducted by Kab et.al (2017) set out examine the hypothesis that persons living in regions with agricultural activities involving more intensive pesticide use would be at higher risk. Using data from the French National Health Insurance databases (2010–2012), the study identifieid 69,010 parkinson disease (PD) cases. This data was then categorised, and proportion of land dedicated to 18 types of agricultural activities were identified, allowing the study to investigate the association between agricultural characteristics and PD incidence in a French nationwide ecologic study.

Results from the statistical analysis uncovered that living in rural areas was associated with higher PD incidence with regions with higher density of vineyards displaying the strongest association. This association was similar in men, women, and non-farmers, stronger in older than younger persons, and present in all French regions. Persons living in the cluster with greatest vineyards density had 8.5% higher PD incidence. In France, vineyards rank among the crops that require most intense pesticide use. Regions with greater presence of vineyards are characterized by higher PD risk; non-professional pesticides exposure is a possible explanation.

Across many of these identified diseases, evidence from academic studies[cclvi] and EFSA annual reports arrive at similar conclusions that it is difficult to categorically link specific pesticides with increased or decreased risk to human health. Despite this, currently available data from meta-analysis by Inserm (2021) points to greater links between risk of diseases and the use of herbicides and insecticides compared to other categories.

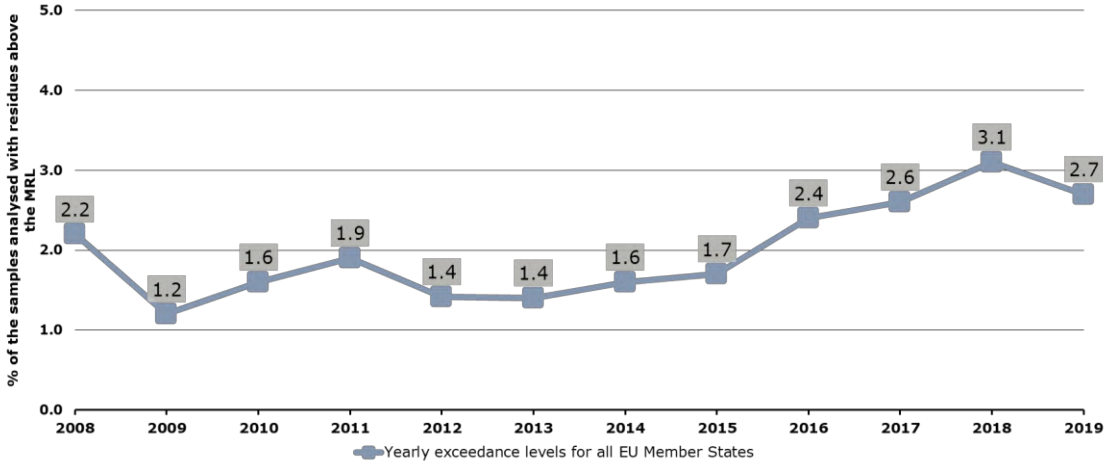
Risks and impact to human health for non-users of pesticides

The second part under the area of human health relates to the risks and impacts for non-users of pesticides, including citizens, consumers as well as those who live or are close to areas where pesticides are applied. With regard to different population groups, foetuses, infants, and children are particularly sensitive to neurotoxic pollutants, even at very low levels of exposure, because of the vulnerability of early-stage development of the human brain. Toxic exposure during so-called windows of vulnerability in early life can cause lasting damage to brain function. Examples of pollution-related diseases in children that have been identified through prospective studies are among others microcephaly at birth, anatomical and functional delays in brain development, and autistic behaviours in children exposed prenatally to the organophosphate pesticide chlorpyrifos[cclvii]. The organophosphate insecticides are a large and widely used class of pesticides. Members of this class of chemicals are powerful developmental neurotoxicants, and prenatal exposures are associated with persistent deleterious effects on children's cognitive and behavioural function and with long-term, potentially irreversible, changes to brain structure that are evident on MRI[cclviii]. Toxicological studies of rodents exposed perinatally to organophosphates produce parallel findings[cclix]. Organophosphate exposures were associated with 13.0 million (sensitivity analysis, 4.24 million to 17.1 million) lost IQ points and 59 300 (sensitivity analysis, 16 500 to 84 400) cases of intellectual disability, at costs of €146 billion (sensitivity analysis, €46.8 billion to €194 billion)[cclx].

Regarding consumers in particular, one of the main sources of data originates from reporting conducted by EFSA on the Maximum Residue Levels (MRL), specifically on the levels of exceedance rates. In assessing the average MRL exceedance levels[93] from 2008-2019 provided by EFSA, data presents an overall fluctuating trend as shown in the graph below. It should be noted that the targeted nature of samples as a basis for MRL checks limits the possibility to draw direct links to broader pesticide use.

[93] MRLs for pesticides are based on good agricultural practices and dangerous exposure thresholds for vulnerable consumers. In this respect, their exceedance represents a health concern for vulnerable groups rather than for the entirety of consumers.

Figure 21. Average Maximum Residue Level Exceedance rates for samples with origin in EU countries



Source: EFSA (2020). European Union report on pesticide residues in food (2008-2019). N.B. This graph displays the average across all EU 27 Member States + UK of the MRL exceedance rates for samples grown in reporting countries. These numbers should be interpreted with caution due to different priorities in the design of each MS's national monitoring plans.

It should be caveated however that these averages should be interpreted with caution when comparing rates across Member States due to the differences in national monitoring activities (i.e., in the levels of risk-based sampling, different food trade interests and patterns of pesticide use). It should also be noted that these averages only present the reported exceedances for samples with an origin in the EU-28, while the rate for non-EFSA reporting countries is noticeably higher[cclxi]. Similarly, the increase in MRL exceedances from 2014 onwards could be linked to improvements in the targeted nature of residue sampling, however it is not clear from EFSA reporting to what degree this has accounted for increases in MRLs exceedances[cclxii]. Despite this, MRL testing is undertaken as a compliance check and does not aim for representativeness or comprehensiveness. The number of samples that were tested also did change year on year, thus this may also have an impact on the average exceedance rates.

Despite this however, on acute exposures to pesticides, it was concluded across the annual assessments conducted by EFSA that the probability of being exposed to pesticide residues which could lead to adverse health effects are low.

With regards to the possible contamination of living areas and exposure to those living in the proximity of "use" areas, similar to studies conducted on chronic exposure, the evidence is inconclusive. For example, some studies have found that residents living close to spraying areas are exposed to higher pesticide levels compared to reference groups (i.e., residents who do not live near areas that are sprayed with pesticides)[cclxiii]. The degree to which these local spraying events have an effect on human health of local populations is however inconclusive, with comparable studies finding no conclusive

effects to human health that can be linked to specific timeframes of pesticide application[cclxiv].

Existing evidence on precision agriculture and pesticide reduction

Precision Agriculture is a farming management concept based upon observing, measuring and responding to inter- and intra-field variability and needs in crops and to variability and needs of individual animals with the use of digital techniques. This summary analyses Precision Agricultural Technologies dividing them into the following three categories, typology that is widely used:

GPS (Global Positioning System) guidance systems includes all forms of automatic steering/guidance for tractors and self-propelled agricultural machinery. For example, Global Navigation Satellite Systems (GNSS) help farmers to reduce overlaps and optimise their field traffic. This is a relevant saving in time as well as savings in inputs like pesticides[cclxv]. Economically, this a win-win technology. GPS guidance systems are regarded as the most adopted precision agriculture technologies worldwide. For example, recent adoption trends have been recorded by the precision agriculture dealership survey conducted by Purdue University, USA in 2013[cclxvi]. This survey pointed out the increasing trend of using auto-steer and the declining trend of lightbar systems. In respect to GPS correction systems, 70% of respondents used the wide area augmentation system correction (a free service for the USA only), while 22% used a personal real time kinematics base station, and only 17% had purchased a satellite correction system. In Europe the situation is rather different. A survey in the Netherlands in 2013 showed a 65% uptake of GNSS guidance systems in arable farms, with a high uptake of real time kinematics at 50% average of the GNSS systems implemented, with an increasing tendency linear to farm size[cclxvii]. In Germany, 36% of farmers use auto guidance on their farms while only 9% and 1% of the Danish and Finnish farmers, respectively, used auto-guidance[cclxviii].

Recording technologies includes field surveying, soil mapping, yield mapping, etc. The environment is not directly affected by the use of yield, protein and oil content mapping, but as this information is used to optimise agricultural inputs, it has an impact on use and risk of pesticides. There is limited scientific evidence on the adoption and impacts (yields and economic) of these technologies.

Reacting technologies. Variable rate pesticide application technologies enable changes in the application rate to match actual or potential pest stress in the field and avoid application to undesired areas of the field or plant canopies. They can also significantly reduce spray overlap. However, variable rate technologies for pesticides has the lowest ratio of hectare-level adoption to farm-level adoption[cclxix]. For instance, variable rate pesticide applications is both the newest and least common form of variable rate technologies at less than 10% of corn farms and acres in the US in

2016[cclxx]. Current commercial applications focus on herbicide spraying, while variable rate insecticide and fungicide applications have not yet reached the stage of commercial breakthrough. Benefits of variable rate pesticide spraying are mainly associated with savings on pesticide use. Since most research has been done in the area of herbicide application (vide supra), the focus of this note lies on the economic impact of variable rate herbicide application. Several studies have found reductions in the use of herbicides by site-specific, weed management in Europe.

Swinton (2003)[cclxxi] states that research results on the profitability of site-specific weed management are very variable, because certain studies focus only on potential reduced cost from less herbicide spraying while ignoring the increased capital cost of variable rate application equipment and the increased variable cost of information processing. Other studies do take these last two factors into account, which might results in more realistic numbers on profitability. Timmermann et al. (2003)[cclxxii] found that the monetary savings resulting from the reduction in herbicide use varied between crops, depending on the amount of herbicides saved and the price of herbicide. In maize, winter wheat, winter barley and sugar beet, savings of respectively 42 €/ha, 32 €/ha, 27 €/ha, and 20 €/ha were realised. In this regard, savings also depend on the different economic thresholds for pest control (i.e. the pest population density at which it becomes worthwhile to apply a form of pest control) and the different competitive power of the crops. Batte and Ehsani (2006)[cclxxiii] estimated pesticide savings of about 4 €/ha for a map-based spraying system compared to a self-propelled sprayer without any form of GPS for guidance assistance or sprayer control on hypothetical fields. The magnitude of input savings further increased as waterways were added to the field. Those authors also calculated the costs of the spraying system. Most of the costs are related to the fixed investment which diminishes per hectare as farm size increases. They also conclude that the benefits increase proportionally to the cost of the pesticide being applied and the number of annual applications, and to the driver error-rate of the non-precision spraying system. Gerhards and Sökefeld (2003)[cclxxiv] evaluated the economic benefits of a real-time, automatic, site-specific weed control system compared to conventional field spraying. They found that although the costs (i.e. investment and maintenance costs) for the variable rate application technology were larger (9.56 €/ha vs. 5.20 €/ha), the average costs for weed control were lower due to herbicide savings (32 €/ha vs. 68 €/ha in winter wheat and winter barley, 69 €/ha vs. 148 €/ha in sugar beet, and 96 €/ha vs. 103 €/ha in maize). Based on these economic calculations, Dammer and Wartenberg (2007)[cclxxv] comment that if sensors were available on the market, it would be profitable for farmers to invest in variable rate technologies. Takács-György (2008)[cclxxvi] stated that in Hungary, the extra investment in variable rate pesticide application is economically viable for farms with an acreage above 150-160 ha. However, this minimum acreage boundary may have moved over

the course of the last few years. Oriade et al. (1996)[cclxxvii] suggest that weed patchiness is the most important factor justifying the use of site-specific weed control. Using simulation, they show that economic and environmental benefits are almost zero at low weed pressures, particularly if weeds are evenly spread. The benefits were larger as weed populations and level of patchiness increased. At high weed patchiness, return values of 17 €/ha to 33 €/ha were found in corn and soybean. The authors concluded that returns from site-specific management less than 14 €/ha are not sufficient to warrant the practice. The costs of information collection, time effects, and human capital were not considered in this model by Oriade et al. (1996).

Besides pesticide saving, more savings are possible from shorter times per hectare for filling the tank and carrying the spray mixture to the field by reducing the volume that is needed per hectare (Timmermann et al., 2003). Costs of map-based variable rate application technologies are attributed to mapping, data processing, decision making and site-specific application technology. Commercial mapping services typically charge 4.5 – 9.0 €/ha to map field boundaries including waterways and other physical features (Batte and Ehsani, 2006). Gerhards and Sökefeld (2003) estimated the costs (fixed + variable) of a direct injection system at 3.9 €/ha (in addition to the costs of the sprayer) for weed control in sugar beet, maize, winter wheat and winter barley in a German study. Batte and Ehsani (2006) state that the extra cost of a precision sprayer equipped with individually controlled nozzles based on GNSS information would be about €8,000. However, Timmermann et al. (2003) comment that several components of variable rate technology, including GNSS, board computer and GIS, can also be used for other precision farming activities such as planting, fertilisation and harvest, and can therefore not be considered as a cost that is solely related to variable rate pesticide application. In contrast to map-based variable rate application technologies, in sensor-based variable rate application technologies an additional step of generating an application map with the help of geographic information systems (GIS) is not necessary. Therefore, there are no additional costs for computers, GIS software or differential GPS. However, the sensor technology can be very expensive, although cheap sensors are available as well. Gerhards and Sökefeld (2003) estimated the cost of a camera system for weed detection at 40,000 euro, whereas Dammer and Wartenberg (2007) used an optoelectronic weed sensor of about 2,000 euro. The latter could however not distinguish between crops and weeds and was therefore limited in its operations. In a study of Vasileiadis et al. (2011)[cclxxviii] on maize-based cropping systems, experts within Europe evaluated that precision spraying using GPS spray maps can result in a net profit within a time frame of 3-4 years.

The ecological benefits of variable rate pesticide application result mainly from a reduction in pesticide use. The potential for herbicide reduction varies between crops depending on the different economic thresholds for weed control and the different

competitive power of the crops (Timmermann et al., 2003). As a result of pesticide reduction, the risk of ground and surface water contamination could be decreased by site-specific pest management. In addition, the biodiversity could possibly increase (Timmermann et al., 2003). Several studies have found reductions in the use of herbicides by site-specific, weed management in Europe. Gerhards et al. (1999) were able to reduce herbicide use by nearly 70% with a system for selective control of each 3 m-section of the spray boom. Heisel et al. (1999)[cclxxix] achieved a 54% herbicide reduction. An average herbicide saving of 54% was also reported by Timmermann et al. (2003). For grass weed herbicides, those authors found savings of 90% in winter cereals, 78% in maize, and 36% in sugar beet. For herbicides against broadleaved weeds, 60% were saved in winter cereals, 11% in maize, and 41% in sugar beet. Solanelles et al. (2006) recorded 70%, 28%, and 39% of product savings in comparison to a conventional application in olive, pear and apple orchards respectively, with lower spray deposits on the canopy but a higher ratio between the total spray deposit and the liquid sprayer output (i.e. better application efficiency). These results were obtained using a prototype of an electronic control system mounted on an air-assisted sprayer. The control system was based on ultrasonic sensors and solenoid valves to apply rates proportional to the canopy width of the trees. Comparable, Gil et al. (2007) used ultrasonic sensors and electro-valves to modify the flow rate from the nozzles in real-time in relation to the variability of thecrop width in vineyards. In their study, on average 58% less spray volume was applied compared to the constant rate application, while maintaining similar coverage and penetration rates. The same sprayer control system was tested by Llorens et al. (2010)[cclxxx] in three vine varieties at different crop stages with a similar average saving of approximately 58%. Chen et al. (2013) compared a variable-rate air-assisted sprayer implementing laser scanning technology to apply appropriate amounts of pesticides based on various tree-canopy characteristics with a conventional air-blast sprayer in an apple orchard. The variable-rate sprayer only consumed 27% to 53% of the spray mixture while still achieving adequate spray coverage inside the canopies. Using a conventional field sprayer with a multiple nozzle body (Lechler VarioSelect) with four different nozzle types to vary the flow rate and a reflectance based weed sensor, average herbicide savings of 22.8% and 27.9% were achieved in cereals and peas respectively, in a study by Dammer and Wartenberg (2007). Takács-György et al. (2013) calculated that herbicide savings due to variable rate technology can amount up to 30,000 tonnes in the EU.

Variable rate pesticide application can also cause reductions in insecticide use. Dammer and Adamek (2012)[cclxxxi] found a 13.4% reduction in insecticide use when conventional spraying and variable rate spraying with the same machine were compared. Studies have shown that limiting insecticide use and providing floral resources and shelter habitats can increase the abundance, diversity and fitness of

natural enemies, decrease pest damage, increase crop yield and the farmer's profit (Vasileiadis et al., 2013)[cclxxxii].

Finally, variable rate spraying technologies with separate chemical tanks instead of tank mixes reduce the risk of operator exposure to the chemical (Humburg, 2003)[cclxxxiii]. Furthermore, variable rate technologies could reduce the time needed for filling the tank by decreasing the volume needed per hectare (Timmermann et al., 2003), although with map-based technologies extra time and labour may be needed to construct the application maps. Precision spraying technologies which reduce the pesticide use are also socially important given the public concern about pesticides (Dammer and Wartenberg, 2007). European experts evaluated that precision spraying technologies using GPS spray maps can be accepted by society in terms of their environmental and health impact, and safety of end products (Vasileiadis et al., 2011). Society may also benefit through reduced cost of food and fibre due to reduced agrichemical use (Batte and Ehsani, 2006). Considering the public concern about pesticides with regard to the environment and public health, precision spraying technologies which reduce pesticide use are also socially important (Dammer and Wartenberg, 2007).

Precision physical weeding

Precision physical weeding technologies enable changes in the configuration of mechanical weeders (e.g. in the position of or the resistance exerted by the tines of a harrow) during weeding, to match weed presence and/or density in the field. The challenge of physical weeding is to obtain a high degree of selective weed control without producing considerable crop damage as a result of weeding (burning, mechanical weed control with knives, discs, hoes or harrows) Non-chemical weed control methods need to be directed towards a site-specific weeding approach, in order to compete with conventional herbicide applications. Different approaches and prototype systems have been proposed, adjusting the hoeing/harrowing/burning intensity based on the (earlier or real-time) observed soil density or weed density. Precise guidance and detection systems are prerequisites for successful site-specific weed management. An effective detection and identification is a primary obstacle toward commercial development and industry acceptance of robotic weed control machines. Various sensors may be used to detect the weeds, although the most promising approach for weed detection is a continuous ground-based system adopting image analysis (Martelloni, 2015)[cclxxxiv].

Two recently developed examples of physical weeding machine prototypes are given in the next paragraphs.

Peteinatos et al. (2015)[cclxxxv] developed an experimental harrow that changed the angle of sets of flexible tines in real-time through an electric actuator, based on ultrasonic

sensors detecting the plant density in a specific location. In this way, areas with higher plant densities, and thus higher weed/total plants ratios, received more aggressive harrowing treatments.

As part of the RHEA project (Robot fleets for Highly Effective Agriculture and forestry management[cclxxxvi]), a prototype of a precision hoeing-flaming implement was designed for use in maize fields (Martelloni, 2013). The correct position of the tools (mechanical and thermal) is guaranteed by an automatic precision guidance system connected to an image based row detection system.

As this technology is still in its infancy, no specific environmental impact figures are readily available. Some general observations can however be made.

- Precision physical weeding can replace pesticides, reducing environmental pressure and avoiding the development of pesticide resistance in various weed species;

- By changing the angle of harrow tines, the power (and thus fuel) consumption during harrowing can be reduced (Peteinatos et al., 2015);

- Variable rate application technology applied in weed burning may lead to a reduction of the amount of fuel used for burning compared with conventional weed burning methods.

Autonomous robotic weed control systems hold promise toward the automation of one of agriculture's few remaining unmechanised and drudging tasks, hand weed control (Slaughter et al. 2007). On the other hand, this automation may lead to job loss in agriculture.

Links with other relevant policy initiatives

The SUD is part of a broad set of EU policy instruments regulating the value chain of pesticides and it has connections with several other policy areas and legislation, for example those other elements of the so-called "pesticides package" Regulation (EC) No 1185/2009 (statistics on pesticides), Regulation (EC) No 1107/2009 (placing on the market of plant protection products), Regulation (EC) No 396/2005 (maximum residue levels), as well as the CAP, broader policies and legislation on protecting the environment, health and safety of workers, plant health, disposal of hazardous waste, machinery, performance of official controls by Member State competent authories etc. The evaluation accompanying this impact assessment concluded that the coherence of the SUD with other EU policies and legislation is high. As regards complementarity, the evaluation also found that the SUD is complementary to other pieces of EU legislation in the regulatory framework for pesticides such as Regulation (EC) 1107/2009, by regulating the use phase of pesticides. There is also a dependency of the SUD on

Regulation (EC) No 1185/2009 to provide relevant statistics for the assessment of progress towards the objectives of the SUD.

Table 25 below outlines relevant links with other current or upcoming Commission initiatives, including relevant research projects.

Table 25. Policy Initiatives complementary to the European Green Deal and Farm to Fork objectives

General topic	Lead Commission DG	Specific initiative planned	Expected contribution to better achieving SUD objectives	Current situation/expected timeline of this parallel initiative
Agricultural statistics, specifically on plant protection products (PPPs)	ESTAT	Proposal for Regulation of the European Parliament and of the Council on statistics on agricultural input and output (SAIO) and repealing Regulations (EC) No 1165/2008, (EC) No 543/2009, (EC) No 1185/2009 and Council Directive 96/16/EC, COM(2021) 37 final.	More and better quality statistics on sales and use of PPPs will be available to assist with monitoring, evaluation and possible development of future indicators.	Agreement reached between the Commission, European Parliament and the Council in June 2022.
Agricultural policies, Common Agricultural Policy (CAP)	AGRI	In the Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system (COM(2020) 381 final), the Commission will propose legislation to convert its Farm Accountancy Data Network (FADN) into the Farm Sustainability Data Network (FSDN).	Will collect data/variables at the regional, national, the EU as well as sector levels to help assess economic, but also environmental and social targets and indicators stemming from the Farm to Fork and Biodiversity Strategies such as pesticides reduction related farming practices.	Adoption of EC Basic Act proposal 2022
Agricultural policies, Common Agricultural Policy (CAP)	AGRI	Move to 25% organic surface area by 2030, a specific target under Farm to Fork Strategy.	Organic farming relies on non-chemical crop protection methods (crop rotation, mechanical physical methods) and if this does not work only then low risk, low toxicity and natural products are allowed.	Member States have submitted their national strategic plans (NSPs) linked to achieving this objective.

General topic	Lead Commission DG	Specific initiative planned	Expected contribution to better achieving SUD objectives	Current situation/expected timeline of this parallel initiative
Beating Cancer Plan	SANTE	Communication from the Commission to the European Parliament and the Council published on 3 February 2021, Europe's Beating Cancer Plan {SWD(2021) 13 final}	The plan represents a renewed commitment to cancer prevention, treatment and care that recognises the growing challenges, and opportunities to overcome them.	Ongoing.
Biodiversity Strategy/ policies	ENV	Several related initiatives, for example nature restoration targets and urban greening initiative, see also Zero Pollution Action Plan below.	Restoring EU's ecosystems will help to increase biodiversity (complementary to SUD), mitigate and adapt to climate change, and prevent and reduce the impacts of natural disasters.	Commission proposal for legally-binding EU nature restoration targets.
Carbon farming	CLIMA	Proposal for a Regulation of the European Parliament and of the Council amending Regulations (EU) 2018/841 as regards the scope, simplifying the compliance rules, setting out the targets of the Member States for 2030 and committing to the collective achievement of climate neutrality by 2035 in the land use, forestry and agriculture sector, and (EU) 2018/1999 as regards improvement in monitoring, reporting, tracking of progress and review COM(2021)554.	The main policy objective is to achieve climate neutrality in the land sector by 2035 i.e. balance of emissions and removals from land use, land-use change, forestry (LULUCF) and agriculture).	Carbon farming initiative launched.

General topic	Lead Commission DG	Specific initiative planned	Expected contribution to better achieving SUD objectives	Current situation/expected timeline of this parallel initiative
EU Code of Conduct on responsible food business and marketing practices	SANTE-GROW-ENV	Voluntary industry-led initiative to facilitate the uptake of healthy and sustainable consumption patterns, increase sustainability in internal processes and increase sustainable sourcing.	Company commitments (food manufacturers, retailers and food service providers) to source products sustainably will contribute to using less PPPs. Commitments can also relate to reducing biodiversity loss.	The Code entered into force on 5 July 2021 and is signed by (EU) associations and individual companies.
Drone Strategy 2.0	MOVE	In its Sustainable and Smart Mobility Strategy, the Commission announced its intention to adopt a Drone Strategy 2.0 in 2022 in order to further develop drones into a vector of the sustainable and smart mobility of the future. The Drone Strategy 2.0 should therefore further set out the path allowing drones to contribute, through digitalisation and automation, to a new offer of sustainable services and transport, taking due account of possible civil/military synergies at the technology level.	The Drone Strategy will assess benefits and barriers of the use of drones in different service sectors, including agriculture. The Drone Strategy may propose actions which would address issues identified in the SUD IA as barriers for safe use of drones for aerial spreaying.	Commission Communication planned for Q4 2022.
EU Soil Strategy	ENV	Development of a new EU Soil Strategy as part of different ecosystems delivering on the specific commitments in the EU Biodiversity Strategy 2030.	Healthy soils are essential for achieving the objectives of the European Green Deal, including biodiversity restoration, zero pollution, healthy and sustainable food systems and a	Work is ongoing.

General topic	Lead Commission DG	Specific initiative planned	Expected contribution to better achieving SUD objectives	Current situation/expected timeline of this parallel initiative
			resilient environment.	
Framework for a Sustainable Food System	SANTE (also AGRI, ENV, MARE)	Proposal for a new and horizontal framework legislation on the sustainability of the Union food system.	As a *lex generalis* proposal, the framework legislation will set horizontal sustainability principles, objectives, and definitions and apply to food/feed and food system operators. Furthermore it will consist of general minimum requirements, elements for sustainability analysis, a monitoring framework and governance mechanisms. It will also provide push and pull provisions in order to accelerate the transition. As such it will help drive reducing pesticide use and risk through direct and indirect means.	Adoption of legislative proposal planned for Q4 2023.
Harmonisation of record-keeping by professional users of plant protection products (PPPs)	SANTE	Commission Implementing Regulation harmonising the elements of the records on use of PPP that professional users must keep under Article 67(1) of Regulation (EC) No 1107/2009	Harmonisation of records of PPP use and requiring that they have to be kept in electronic format will facilitate their collection by competent authorities and greatly improve availability of statistic on pesticides use.	Discussions in the Standing Committee on Plants, Animals, Food and Feed – Section Phytopharmaceuticals – Legislation are ongoing.
Increasing the efficiency of comparative assessments under Regulation	SANTE	As announced in the REFIT report on the pesticides legislation, an amendment of Annex IV to Regulation (EC) No	The REFIT evaluation of the pesticides legislation has shown that comparative assessments for PPP containing more	Discussions with Member States in the context of the Standing Committee on Plants, Animals, Food and Feed – in

General topic	Lead Commission DG	Specific initiative planned	Expected contribution to better achieving SUD objectives	Current situation/expected timeline of this parallel initiative
(EC) No 1107/2009		1107/2009 and of relevant guidance is envisaged to increase the efficiency of comparative assessments required for PPP that contain more hazardous active substances (i.e. substance that are candidates for substitution).	hazardous active substances rarely (if ever) lead to the refusal of authorisations for such PPP because the requirements in Annex IV to Regulation (EC) No 1107/2009 are too complex and demanding. Reviewing the principles for comparative assessments (and related guidance) intends to increase efficiency and facilitate the refusal of authorisations for PPP containing more hazardous substances. This will contribute directly to achieving the 2nd pesticides related target in the Farm to Fork Strategy.	particular its Working Group on Post-Approval Issues – started in 2020 and a dedicated meeting took place in May 2021. Finalisation of the work is expected for Q4 2022.
International trade aspects linked to sustainable food systems	SANTE	Bilateral international angle: the inclusion of a Chapter on Sustainable Food Systems (SFS) in the Agreements, starting with those that are currently in negotiation. Will also propose a chapter on SFS for future Agreements.	The SFS Chapter includes provisions for cooperation on specific aspects of sustainable food systems, such as the fight against food fraud and food loss and waste, to improve animal welfare standards, to reduce the use of chemical pesticides and fertilisers, and to reduce the use of antimicrobials.	The text of the SFS Chapter was presented to Chile during the last negotiation round on 29 April 2021 and will be presented to New Zealand, Australia and Indonesia for discussion at the respective rounds.
Invertebrate Biological Control Agents	SANTE	Study concerning the Union's situation and options regarding the	The replacement of use of chemical pesticides by	The study is currently under preparation and will be submitted

General topic	Lead Commission DG	Specific initiative planned	Expected contribution to better achieving SUD objectives	Current situation/expected timeline of this parallel initiative
		introduction, evaluation, production, marketing and use of invertebrate biological control agents within the territory of the Union, requested by the Council under Art. 241 TFEU.	biological control agents is one of the possible measures mentioned under the general principles for IPM in Annex to the SUD. The study will help to identify shortcomings in the current system and may serve as a basis for fostering the use of biological control agents in future, therewith contributing to the reduction of the use of chemical pesticides.	to the Council by the end of 2022.
Micro-plastics used in agriculture	GROW/ENV	Draft regulation on restricting the voluntary use of micro-plastics.	This could have a link to SUD, as micro-plastics are used in seed treatment technologies and also in micro-encapsulation, which could have an impact on quantities of PPP used and safer exposure/risk.	Ongoing.
Organic Farming action plan	AGRI	Organic action plan is launched aimed at stimulating the demand and consumer trust, stimulating conversion and reinforcing the value chain and improving the sustainability of the methods applied.	The action plan will deliver on economies of scale in sustainable use of pesticides and also on improving the sustainability of the plant health and plant protection methods.	CAP subsidies and national strategic plans (NSPs) will be instrumental for the effects of the organic farming action plan on the SUD.
Promoting microbiological (non-chemical) alternatives to chemical pesticides in the context of	SANTE	Four Commission implementing acts in the context of Regulation (EC) No 1107/2009 revising data requirements for active substances	Fostering the placing on the market of PPPs containing micro-organisms as alternatives to chemical active substances, through	Four draft Regulations agreed by Member States in February 2022 in the Standing Committee on Plants, Animals, Food and Feed -

General topic	Lead Commission DG	Specific initiative planned	Expected contribution to better achieving SUD objectives	Current situation/expected timeline of this parallel initiative
active substance approvals and authorisation of plant protection products under Regulation (EC) No 1107/2009		that are micro-organisms, for PPPs containing micro-organisms, approval criteria of active substances that are micro-organisms and the uniform principles to assess and authorise PPPs containing micro-organisms.	the adoption of legal requirements which are updated to the latest scientific developments and which focus on the biological properties of the micro-organisms will increase the availability of biological pesticides that can replace chemical pesticides.	Section Pharmaceuticals – Legislation (then submitted to a three-month scrutiny period for the co-legislators).
Standardisation Strategy	GROW	The Standardisation Strategy was announced in the 2021 update of the Industrial Strategy.	The Standardisation Strategy will define the EU vision on the European Standardisation System (ESS) and how it can best be used to serve the EU's flagship policies (with a particular attention to the European Green Deal. The Strategy will also indicate several follow-up actions.	Adoption planned.
Sustainable growth of the algae sector	MARE	Blue bio-economy-towards a strong and sustainable EU algae sector.	Possible non-food production from algae: a major emerging application of microalgae is for use as biofertiliser or biostimulants to enhance the productivity of agriculture and horticulture crops and reduce the use of chemical synthetic fertilisers and chemical PPPS.	Impact assessment is ongoing.
Taxation of plant	TAXUD	Commission proposal for a COUNCIL	Taxation can be a useful instrument to	Council Directive (EU) 2022/542 of 5

General topic	Lead Commission DG	Specific initiative planned	Expected contribution to better achieving SUD objectives	Current situation/expected timeline of this parallel initiative
protection products (PPPs)		DIRECTIVE amending Directive 2006/112/EC as regards rates of value added tax COM/2018/020 final.	nudge behaviour concerning the purchase and use of certain products. Concerning PPPs, VAT rates currently applied by Member States range from a super-reduced rate of 4% to a highest rate of 27%	April 2022 phasing out access to reduced rates of VAT for PPPs.
Water policies	ENV	As announced in the Zero Pollution Action Plan, the revision of the priority lists under the Water Framework Directive by amending the Environmental Quality Standards Directive and the Groundwater Directive. Also ongoing, an evaluation and impact assessment of Urban Waste Water Treatment Directive, evaluation of Bathing Water Directive.	The current priority lists include certain pesticides (active substances) and ensures through monitoring that the SUD actions are reducing pesticides pollution below values set by the water Directives. The revised lists may include additional active substances.	Planned adoption in 2022.
Zero pollution action plan	ENV	The Action Plan re-states the Farm to Fork targets for pesticides and expects the revised SUD to deliver most to the reductions. In addition, the Action Plan announces: Revision of the Industrial Emissions Directive (and the European Pollutant Register) The revision of	Action 1 is regulating those industrial production sites of pesticides which are covered by the scope and collects emission data. This action is fully complementary to the SUD. Action 2 is described in above row regarding water policies. Action 3 will	Action 1 is scheduled for 2022. Action 2, see above row regarding water policies. Action 3 aims at establishing a list by 2024. Actions under the Biodiversity Strategy for 2030 are also relevant, for example

General topic	Lead Commission DG	Specific initiative planned	Expected contribution to better achieving SUD objectives	Current situation/expected timeline of this parallel initiative
		the list of priority substances under the Water Framework Directive Establishing an EU priority watch list for soil contaminants and introducing a zero soil pollution module in the future LUCAS survey	strengthen the monitoring of pesticides already undertaken in the context of LUCAS and help demonstrate effectiveness of the SUD by following the concentrations and risks from pesticides in the soil environment.	urban greening initiative.
Some examples of relevant EU-funded research projects				
Human bio-monitoring for EU (HBM4EU)	JRC	Project ending in 06/2022 provides some biomonitoring information (target and non-target analysis) on pesticides measured in human matrices, mainly blood and urine.	Results can inform future human health risk indicators	Project in its final year. Integration of HBM4EU data into Information Platform for Chemical Monitoring (IPCHEM) is ongoing.
Partnership for the Assessment of Risk from Chemicals (PARC)	JRC	Large (200 mil €) EU-public partnership project covering multiple areas of exposure assessment, toxicology and ecotoxicology, supporting chemical risk assessment and management. With respect to human biomonitoring data it continues work started under HBM4EU.	Some data streams (e.g. HBM data) may feed into future development of harmonised risk indicators (HRIs).	Project started 2022.
Land Use/Cover Area frame statistical	JRC/SANTE	JRC/SANTE Screening and quantification of level of active ingredients and	Better quantification of pesticide load to soil. Characterisation of changes in	Laboratory analysis ongoing on LUCAS 2018 samples. Results due mid-

General topic	Lead Commission DG	Specific initiative planned	Expected contribution to better achieving SUD objectives	Current situation/expected timeline of this parallel initiative
Survey Soil (LUCAS Soil) residues of active ingredients in soil		metabolites in samples collected from agricultural land through the LUCAS survey.	application. Contribute to evaluation of risk assessment procedures.	2022. Discussion on content and funding on laboratory analysis on LUCAS 2022.
PESTI risk JRC project	JRC	*Spatially explicit PESTIcide health RISK indicators based on satellite mapping of crops and human settlements*	The main goal of the project is to develop new spatially explicit PESTIcide health RISK indicators based on satellite mapping of crops and human settlements. Spatially explicit crop type maps can be used to model exposure scenarios of people.	Project commencing in 2022.

ANNEX 6: MARKETING AUTHORISATION OF ACTIVE SUBSTANCES

EU rules distinguish between active substances, such as glyphosate, and plant protection products.

Active substances are the components of plant protection products that actually control harmful organisms (the so-called pests, such as insects, fungi and weeds) or plant diseases.

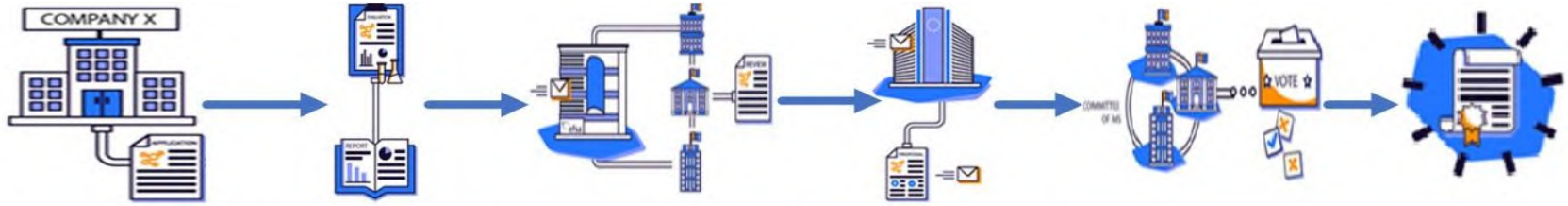
Plant protection products - which are often referred to as pesticides (e.g. insecticides, fungicides, herbicides) - are mixtures containing one or several active substance(s) and other ingredients (so-called co-formulants).

The legal framework for the placing of plant protection products on the EU Single Market is set by the Plant Protection Products Regulation .

Given that plant protection products are designed to have effects on (harmful or unwanted) living organisms, their placing on the market in the EU is strictly regulated so that all measures are taken to avoid potential adverse effects on human or animal health or the environment.

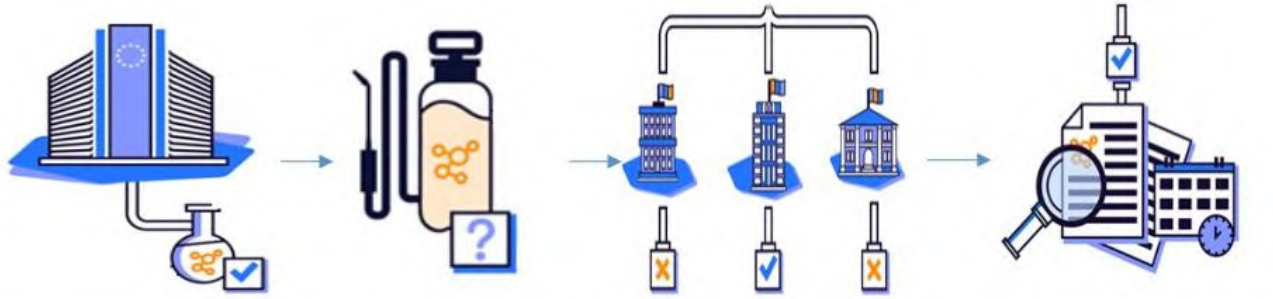
While active substances are approved at EU level, plant protection products are authorised by national authorities in each EU Member State taking into account their agricultural and environmental conditions.

The approval process of **active substances** is as follows:



1	2	3	4	5	6
Company "X" submits an application for the approval of an active substance "Y" to any EU Member State (in case of renewals/reviews, the Member State is assigned by the Commission and cannot be chosen freely). That EU Member State – subsequently called "Rapporteur Member State" (RMS) – is then tasked with the initial scientific and technical evaluation of the active substance.	The RMS drafts an assessment report for the active substance "Y" and sends it to the European Food Safety Authority (EFSA), in charge of risk assessment.	In consultation with other EU Member States, EFSA carries out a peer review of the assessment report and sends its conclusions to the European Commission.	Based on EFSA's review, the European Commission, in charge of risk management, makes a proposal on whether or not to approve substance "Y".	A regulatory committee composed of representatives of all EU countries votes on the Commission proposal for active substance "Y" (more information on Comitology procedure http://ec.europa.eu/transparency/regcomitology/index.cfm?do=FAQ.FAQ).	After the Committee has delivered an opinion, the Commission adopts and publishes a Regulation approving or refusing the approval of the active substance "Y".

The authorisation process of **plant protection products** is as follows:



1	2	3	4
After approval of an active substance at EU level…	…plant protection products containing it may be authorised by national authorities in each EU Member State.	EU rules allow Member States to refuse or restrict the use of plant protection products, based on the agricultural and environmental circumstances in their territory. For example, some Member States have not allowed the use of such products close to the harvest of cereals or by private consumers.	For authorised plant protection products Member States have to enforce their correct use according to their label.

ANNEX 7: DETAILED OVERVIEW OF POLICY MEASURES SUBJECT TO IMPACT ASSESSMENT

Annex 7.1. Policy options for strengthening current provisions

The policy options listed in Tables 26-29 below have been assessed according to the following criteria:

- **Effectiveness** – An assessment of the extent to which the different options are expected to achieve the respective specific objectives.
- **Coherence** – The extent to which the different options are coherent with other EU policy objectives.
- **Efficiency** –In the detailed assessment, the assessment of costs has been broken down per stakeholder group and assesses direct compliance costs and enforcements costs, where possible in quantitative terms and else qualitatively. Benefits in almost all cases entail improved welfare through health, safety and environment benefits which concern society as a whole. The assessment of efficiency thus is done in terms of cost-effectiveness, i.e. an assessment of the ratio between the costs (combined across all stakeholder groups) and the expected effectiveness of reaching the specific objectives.
- **Proportionality** – Assessing the proportionality of different options. This entails if the efforts required to implement the different measures are proportionate to the benefits that can be expected from achieving the specific objective.
- **Subsidiarity** – Assessing the compliance with the subsidiarity principle of the different options

The policy elements shown in bold in Tables 30-33 below form part of the finally preferred policy option.

Table 26. Evaluation of the policy options per specific objective against the effectiveness criterion

Effectiveness	Policy Option 1 Least ambitious	Policy Option 2 Medium ambitious	Policy Option 3 Most ambitious
Alignment of SUD with pesticide targets			

Effectiveness	Policy Option 1 Least ambitious	Policy Option 2 Medium ambitious	Policy Option 3 Most ambitious
Achievement of pesticide targets	-[94]	+	+++
Limit the use and risks from pesticides, particularly more hazardous ones	+ to ++	++	+++
Strengthening SUD provisions			
Improved operationalisation of IPM principles	+ to ++	+ to +++	++ to +++
Improve controls and apply harmonised standards	++	+++	
Strengthen effectiveness of NAPs	+	++	
Improve expertise of pesticide users	+		
Monitor the use as well as the risk of use from pesticides			
Monitor the use as well as the risk of use from pesticides	+	++	
New technologies			
Promote precision farming and develop alternatives	n.a.		
Clarifying on use of drone for pesticide application	/	n.a. n.a.	
Emerging technologies for sustainable use of pesticides	+	+	

[94] Ranking used throughout the tables

- n.a. –assessment not possible
- /: no impact
- Costs, burdens, or negative performance on indicators: signalised with between 1 and 3 minus signs, between low costs or burdens (-) and high (---)
- Benefits, savings and positive performance on indicators: signalised with between 1 and 3 plus signs in the same way (+; ++; or +++)
- (): brackets if costs, benefits etc. are only potential
- If there is uncertainty as to the range of costs, benefits etc. a range is indicated: e.g. ++ to +++ or – to +

Table 27. Evaluation of the policy options per specific objective against the coherence criterion

Coherence	Policy Option 1 Least ambitious	Policy Option 2 Medium ambitious	Policy Option 3 Most ambitious
Alignment of SUD with pesticide targets			
Achievement of pesticide targets	-	+ to ++	+++
Limit the use and risks from pesticides, particularly more hazardous ones	+++	+++	+++
Strengthening SUD provisions			
Improved operationalisation of IPM principles	+++	+++	+++
Improve controls and apply harmonised standards	+++	+++	
Strengthen effectiveness of NAPs	+++	+++	
Improve expertise of pesticide users	+++		
Monitor the use as well as the risk of use from pesticides			
Monitor the use as well as the risk of use from pesticides	+++	+++	
New technologies			
Promote precision farming and develop alternatives	+++		
Clarifying on use of drone for pesticide application	/	+++ (*assuming that a potential future legislative Annex or specifically established use parameters to be defined and agreed would be designed to not lead to any negative health and environment impacts*)	
Emerging technologies for sustainable use of pesticides	+++	+++	

Table 28. Evaluation of the policy options per specific objective against the efficiency criterion

Efficiency	Policy Option 1 Least ambitious	Policy Option 2 Medium ambitious	Policy Option 3 Most ambitious
Alignment of SUD with pesticide targets			
Achievement of pesticide targets	-	+	/
Limit the use and risks from pesticides, particularly more hazardous ones	/ to +	+	++
Strengthening SUD provisions			
Improved operationalisation of IPM principles	+ to ++	/ to ++	+ to ++
Improve controls and apply harmonised standards	++	++	
Strengthen effectiveness of NAPs	+	+	
Improve expertise of pesticide users	/		
Monitor the use as well as the risk of use from pesticides			
Monitor the use as well as the risk of use from pesticides	++	++	
New technologies			
Promote precision farming and develop alternatives	n.a.		
Clarifying on use of drone for pesticide application	/	n.a.	
Emerging technologies for sustainable use for pesticides	+	+	

Table 29. Evaluation of the policy options per specific objective against the proportionality criterion

Proportionality	Policy Option 1 Least ambitious	Policy Option 2 Medium ambitious	Policy Option 3 Most ambitious
Alignment of SUD with pesticide targets			
Achievement of pesticide targets	/	+++	-
Limit the use and risks from pesticides, particularly more hazardous ones	+++	+++	+++
Strengthening SUD provisions			
Improved operationalisation of IPM principles	++	++	++
Improve controls and apply harmonised standards	+++	+++	
Strengthen effectiveness of NAPs	+++	+++	
Improve expertise of pesticide users	+++		
Monitor the use as well as the risk of use from pesticides			
Monitor the use as well as the risk of use from pesticides	+ to +++ (*Proportionality for monitoring acute poisoning is considered high. For chronic poisoning the proportionality can be considered to be lower since the assessments would be complex and resource intensive.*)	+++	
New technologies			
Promote precision farming and develop alternatives	+++		
Clarifying on use of drone for pesticide application	/	+++	
Emerging technologies for sustainable use of pesticides	+++	+++	

Table 30.

Limited operationalisation of IPM principles	Improve practical implementation and operationalisation of IPM principles to reduce the use and risk of pesticides and promote alternatives to pesticides	Use of IPM is compulsory for all professional users in the EU under the current SUD Level of implementation is unknown Most of Member States have not converted the IPM general principles into prescriptive and assessable criteria to be applied by users Controls and control mechanisms are lacking	Difficult to "measure" and monitor IPM implementation (especially for purposes of auditing and positive incentives)	Improve measurability and monitoring of implementation of IPM	[…]	Establish mandatory common framework for electronic IPM record-keeping by professional users. The record-keeping could take the form of a decision tree based on IPM pyramid including pest/economic injury thresholds as applicable. 'is a certain tool feasible: yes, no, if not why not?' Justification and evidence for this and then move to the next decision step in the pyramid Require that those records be transmitted on an annual basis to both MS CAs and the Commission (potential links could be established with e.g.: FSDN[95])	Medium ambitious option + the below Use mandatory crop-specific IPM rules as a basis for controls and enforcement, using penalties and other remedial measures under the OCR[cclxxxvii].

[95] FSDN scheduled to be adopted in Q2 2022. See: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12951-Conversion-to-a-Farm-Sustainability-Data-Network-FSDN-_en

	The operationalisation of the IPM principles is complex and context- and crop specific	Operationalise IPM principles or different contexts and crops	Current IPM principles in annex to SUD clarified and reworded (including potential new technologies which can promote the application of IPM principles) Requirement for MS to establish tailored IPM guidance (region/crop specific) representing crops covering at least 90% of UAA	[...]	
	Current SUD obligation for MS to introduce incentives for farmers to adopt IPM principles is apparently poorly implemented Resistance to change in the sector	Improve implementation of obligation to create incentives / compensation for farmers for using IPM	Further emphasise the current SUD compulsory requirement for MS to introduce incentives for the use of non-chemical pest control alternatives and methods as well as for any IPM measure that may lead to economic losses for farmers (e.g. crop rotation)	[...]	[...]
	Lack of technical services to train and advice farmers on IPM practices Lack of expertise of advisory services on IPM Potential or perceived conflicts of interest if advisers recommending the use of particular pesticides and PAE to pesticide users also have an economic	Ensure that advisory services can provide robust advice on IPM	Introduce a legal requirement for more detailed training and holding of a relevant certificate for all advisors	Least ambitious option + the below Strengthened role and rules for independent advisory service to professional pesticide users (decoupled from economic interest of selling pesticides and PAE), including link to possible prescription system/obligatory advice (see below) (prescription	[...]

			interest in selling such products			system not a preferred policy element)	
Poor implementation of the SUD concerning testing of pesticides application equipment	Improve controls and application of harmonised standards	No change. To note that enforcement and reporting tools under the Official Controls Regulation (EU) No 2017/625 do not apply to PAE	Testing of pesticides application equipment is not harmonised	Harmonise testing of pesticides application equipment across the EU	Further promote guidelines, harmonised methodology where CEN standards exist and stimulate knowledge sharing among Member States	Least ambitious option + the below Commission supports drift technology reduction tests, aiming to promote a more harmonised approach at EU level, the application of best available technologies (BATs) and the development of standards for PAE	Medium ambitious option + the below Amend OCR to include PAE in its scope (not a preferred policy element)
			Risk of defective new PAE not being tested before being put into use so that it would be potentially 5 years before the equipment would be tested and such defects identified and resolved	Improve provisions on inspection intervals	[...]	Require all new PAE to be tested and certified before being put into use to avoid that defects and problems might otherwise only be detected years subsequently (not a preferred policy element)	[...]
Limited effectiveness of NAPs, delays in production and review	Strengthen effectiveness of the NAPs	5 year requirement for review remains	Level of ambition shown in NAPs differs strongly between MS[96]	Ensure high level of ambition in all NAPs	Legislation provides for more specificity as to what is included in NAP	Least ambitious option + the below Template provided on NAP	[...]

[96] See e.g. findings from including:

- More than two thirds of Member States failed to complete the review of their initial NAP within the five-year legal deadline
- Only a small minority of MS identified specific examples of useful targets and indicators based on the review of their initial NAP

					Commission takes stronger line in enforcement of existing requirement and in links to target	structure and improved Commission guidance on NAP reporting, including reduction of use and risk for health and environment	
			Reporting intervals are too long to allow for effective monitoring of the situation in MS	Ensure more frequent reporting from MS	[…]	Reporting on NAPs has to take place annually, including monitoring progress related to F2F targets and outcome of HRI trends[97]	[…]
Pesticide users may have insufficient expertise because they are not subject to training obligations	Improve expertise of pesticide users	Training for pesticide users as required under Article 5 cannot be assessed in term of effectiveness towards the objective of reducing risk and impact of pesticides	Training/certification requirements for professional users in the current SUD do not lead to reducing risk and impact of pesticides	Make training for pesticide users mandatory	All operators of PAE (i.e. pesticide users) to hold a certificate of training instead of the current requirement that only the purchaser of the PPP be trained (i.e. delete current requirement for a training certificate to purchase a PPP, instead introduce requirement for a training certificate to use PPP since this is the riskier element rather than merely purchasing a PPP)	[…]	[…]

- Most Member States have not addressed the weaknesses identified by the Commission in their initial NAPs in their revised NAPs, so that the majority of revised NAPs lack ambition and fail to define high-level, outcome-based targets, so as to reduce the risks associated with, and dependency on, PPPs

[97] See also links with options on Farm to Fork Strategy targets below

Annex 7.2. Policy options for strengthening data availability and monitoring

Table 31.

Problem	General objective	Baseline	Driver	Specific objective	Least ambitious option	Medium ambitious option	Most ambitions option
Knowledge on pesticide use and risk is lacking, and available information not used to the full	Monitor the use and as well as the risk of use from PPP and use the information for policy development at Member State and EU level	No change to SUD Problems at EU level with disaggregation of current data and confidentiality limitations. The statistics on agricultural use of pesticides R1185/2009 annex II, is to be designed by the MS to meet the needs of the MS but MS may not be actively using it for risk management. Discussions on current agricultural statistics SAIO proposal proceed in parallel (ESTAT)	Available use data on MS and EU levels is not sufficient to monitor risks from pesticide use Pesticide users already collect use data which however is not collected	MS make better use of available use data to allow for better monitoring	[…]	**Oblige MS to collect in electronic manner and analyse the existing PPP use data currently held by pesticide users under Article 67 of Reg. 1107/2009** **Report on this and progress towards reaching the F2F pesticide use and risk targets to the Commission on a yearly basis as well as report at the farm level for a specific (e.g. FSDN) farms sample**	[…]
			Data on pesticide-related poisoning incidents is insufficient for effective monitoring of risk of use of pesticides	Improve data collection on pesticide-related poisoning incidents	**Mandatory collection by MS of information on acute and chronic poisoning – delete "where available" from current SUD.**	[…]	[…]

Problem	General objective	Baseline	Driver	Specific objective	Least ambitious option	Medium ambitious option	Most ambitions option
			Available information about pesticide-related health and environment risks is insufficient EU harmonised risk indicators do not allow for effective monitoring of risk	Improve available information about pesticide-related health and environment risks Improve EU harmonised risk indicators	**MS to submit to the Commission and share information on current national health and environment monitoring indicators concerning the risk of pesticides as a basis for the possible future development of additional harmonised risk indicators at EU level as requested by European Court of Auditors etc.**	***Least ambitious option + the below*** **Based on data collected and progress with relevant research projects such as HBM4EU, IPCHEM, LUCAS, Commission to propose in the longer term specific harmonised indicators**[98]	[…]

Annex 7.3. Policy options for aligning with Farm to Fork Strategy objectives

Table 32.

Problem	General objective	Baseline	Driver	Specific objective	Least ambitious option	Medium ambitious option	Most ambitions option

[98] Obligation in the legal text for the Commission to submit a specific future report and proposal on this issue of new indicators. Impacts of this work introducing potential new HRIs will be assessed in the future.

Problem	General objective	Baseline	Driver	Specific objective	Least ambitious option	Medium ambitious option	Most ambitions option
SUD not in line with F2F objectives	Align SUD with F2F objectives, Implementation of use and risk pesticide reduction targets according to the European Green Deal and Farm to Fork and Biodiversity strategies	The two pesticide reduction targets announced in the Farm to Fork Strategy and Biodiversity Strategy remain as aspirational goals (also taking account of related organic farming target and consequences of complying with that, recently published Organic Farming Action Plan) (consider parallel trade issue also, PPP might be purchased in one MS but used in another)	Roadmap (incl. monitoring, responsibilities, and governance) towards reaching the F2F targets is unclear	Define roadmap (incl. monitoring, responsibilities, and governance) towards reaching the F2F targets	Targets remain aspirational **Commission continues to monitor progress at EU and MS level annually** **In case of undershooting the expected trajectory of achieving the targets by 2030, linked to NAPs (if NAPs are maintained), each MS shall submit annually a specific action plan to the Commission on measures that will be taken to get back on track towards achieving the targets by 2030**	**The two pesticide reduction targets are included in EU legislation as mandatory targets to be achieved at overall EU level.** **As part of a tailored "effort-sharing approach" among MS, each MS would set their own tailored reduction targets at national level in order to contribute to achievement of the overall EU target and taking account of their existing national situation and level of progress in reducing the use and risk of pesticides.** **In case of insufficient progress towards reaching the EU level targets by 2030, the Commission would identify additional elements and steps to be taken to get this progress back on track**	The two pesticide reduction targets are included in EU legislation as mandatory targets addressed to MSs to be achieved at overall EU and individual MS levels. Each MS would be expected to achieve the two targets based on their starting position during the reference baseline period (fixed 50% binding targets for all Member States not a preferred policy element)

Problem	General objective	Baseline	Driver	Specific objective	Least ambitious option	Medium ambitious option	Most ambitions option
	Limit use and risks from PPP, particularly more hazardous ones[99]	No change to SUD. Likely that some more hazardous active ingredients would be removed from the market over time. Advances in precision farming would also be expected to be increasingly applied over time and contribute to reducing the use and risk of pesticides	The outcomes of the current SUD (in terms of **use reduction of more hazardous pesticides;** might not be sufficient to meet the F2F targets	Increase ambition towards reaching F2F target on reducing use of more hazardous pesticides (see footnote 100)	**Prohibit purchase and use of more hazardous pesticides (see footnote 100) by non-professional users (e.g. for them to be used the person would need to be trained)**	*Least ambitious option + the below* A prescription system for the purchase by professional users of more hazardous pesticides (not a preferred policy element) Prohibit use of more hazardous pesticides in sensitive areas such as urban green areas	*Medium ambitious option + the below* **Legal provisions to prohibit the use of all chemical pesticides in sensitive areas such as urban green areas[100] as per ambition of Biodiversity Strategy**
			The outcomes of the current SUD (in terms of **use and risk reduction**) might not be sufficient to meet the F2F targets	Increase ambition towards reaching F2F target on reducing use and risk of pesticides	[*This is covered by the overall package of policy options*]	[*This is covered by the overall package of policy options*]	[*This is covered by the overall package of policy options*]

[99] As defined in footnote 13 of Farm to Fork Strategy: "These are plant protection products containing active substances that meet the cut-off criteria as set out in points 3.6.2. to 3.6.5 and 3.8.2 of Annex II to Regulation (EC) No 1107/2009 or are identified as candidates for substitution in accordance with the criteria in point 4 of that Annex".

Annex 7.4. Policy options accounting for new technologies

Table 33.

Problem	General objective	Baseline	Driver	Specific objective	Least ambitious option	Medium ambitious option	Most ambitions option
Precision farming and development of alternatives not promoted through the SUD	Promote precision farming and the development of alternatives to chemical pesticides through the SUD	No reference to precision farming is made in the current SUD	Precision farming not promoted Development of alternatives is not sufficiently promoted	Promote the application of precision farming Promote the development of alternative methods/products to reduce the use and risk of pesticides.	**Commission and MS to promote targeted training and advice measures for precision farming to have an efficient uptake from professional pesticide users,** **Commission and MS to promote the use of forecasting tools and prediction models and the development of alternative methods that can help to reduce the use and risk of pesticides**	[…]	[…]

Problem	General objective	Baseline	Driver	Specific objective	Least ambitious option	Medium ambitious option	Most ambitions option
Drones not accounted for in SUD	Account for drones in the SUD	No reference to drones is made in the current SUD	Legal situation on the question if drones fall under aerial spraying is unclear	Clarify rules for potential aerial spraying by drones	**Clarify that definition of aerial spraying includes spraying by drones**	***Least ambitious option + the below*** **Within certain parameters, to be defined in a future legislative Annex, no derogation will be required for aerial spraying by drones**[101]	Any type of **spraying** (including aerial spraying) is allowed without prohibition and without derogation if the spraying instrument is less than 2 metres from the crop being sprayed (not a preferred policy element). Other parameters concerning use and risk would need to be studied and established (retain current prohibition on aerial spraying to allow for spraying by planes and helicopters subject to derogation). The Commission could adopt a delegating act to account for future technological progress

[101] This would include more detailed Commission implementing rules on derogations for aerial spraying using drones to be defined in the future. CEN standards for unmanned aerial vehicles are in development

Problem	General objective	Baseline	Driver	Specific objective	Least ambitious option	Medium ambitious option	Most ambitions option
SUD provisions do not account for emerging spraying (?) technologies and techniques	Revise SUD provisions to account for emerging technologies and techniques	Current SUD does not account for emerging technologies and techniques	There are no provisions for testing PAE for emerging technologies and techniques	Create conditions for harmonised testing standards of new PAE technologies	[…]	**Promote (through CEN/ISO) harmonised standards for approval of additional PAE, including for precision farming technologies and smart machinery including drones**[102]	[…]
			Potential of precision farming and new technology such as drones, smart machinery and robotics not included in IPM principles	Include reference to precision farming and new technology such as drones, smart machinery and robotics in IPM principles	**Current IPM principles in annex to SUD clarified and reworded for example to fully reflect the potential of precision farming and new technology such as drones, smart machinery and robotics to reduce the use and risk of pesticides**	[…]	[…]

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[cclxxxvii] Regulation (EU) 2017/625 of the European Parliament and of the Council of 15 March 2017 on official controls and other official activities performed to ensure the application of food and feed law, rules on animal health and welfare, plant health and plant protection products.