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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

{COM(2022) 305 final} - {SEC(2022) 257 final} - {SWD(2022) 169 final} - {SWD(2022) 171 final}

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Glossary

Term or acronym	*Meaning or definition*
6EAP	6th Environment Action Programme
6FP	6th Framework Programme
7EAP	7th Environment Action Programme
7FP	7th Framework Programme
BTSF	Better Training for Safer Food
CA	Competent authority
CAP	Common Agricultural Policy
COM	European Commission
DG	Directorate-General
DG ENV	Directorate-General for Environment
DG SANTE	Directorate-General for Health and Food Safety
ECA	European Court of Auditors
EFSA	European Food Safety Authority
EIP-AGRI	European innovation partnership for agricultural productivity and sustainability
EP	European Parliament
EPRS	European Parliamentary Research Service
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FTE	Full-time equivalent
H2020	Horizon 2020
HRI	Harmonised risk indicator
HRI 1	Harmonised risk indicator 1
HRI 2	Harmonised risk indicator 2
IPM	Integrated pest management

ISO	International Organization for Standardization
MS	Member State
NAP	National action plan
NGO	Non-governmental organisation
NSP	National strategic plan
PAE	Pesticide application equipment
PPAMS	Plant Protection Products Application Management System
PPP	Plant protection product
R&D	Research and development
REACH	Registration, evaluation, authorisation and restriction of chemicals
SDG	Sustainable Development Goal
SPISE	Standardised procedure for the inspection of sprayers in Europe
SUD	Sustainable Use of pesticides Directive
UAA	Utilised agricultural area
UN	United Nations

1. ANNEX 8: EVALUATION OF SUSTAINABLE USE OF PESTICIDES DIRECTIVE 2009/128/EC: INTRODUCTION

Pesticides[1], used synonymously with the term plant protection products (PPPs) for the purpose of this evaluation, are mixtures of one or more formulated active substances and other co-formulants that are widely used to protect plants by repelling, mitigating or destroying harmful organisms.

Regulation (EC) No 1107/2009 of the European Parliament and of the Council concerning the placing on the market of plant protection products defines PPPs as: "*products, in the form in which they are supplied to the user, consisting of or containing active substances, safeners or synergists, and intended for one of the following uses:*

(a) protecting plants or plant products against all harmful organisms or preventing the action of such organisms, unless the main purpose of these products is considered to be for reasons of hygiene rather than for the protection of plants or plant products;

(b) influencing the life processes of plants, such as substances influencing their growth, other than as a nutrient or a plant biostimulant;

(c) preserving plant products, in so far as such substances or products are not subject to special Community provisions on preservatives;

(d) destroying undesired plants or parts of plants, except algae unless the products are applied on soil or water to protect plants;

(e) checking or preventing undesired growth of plants, except algae unless the products are applied on soil or water to protect plants"[2].

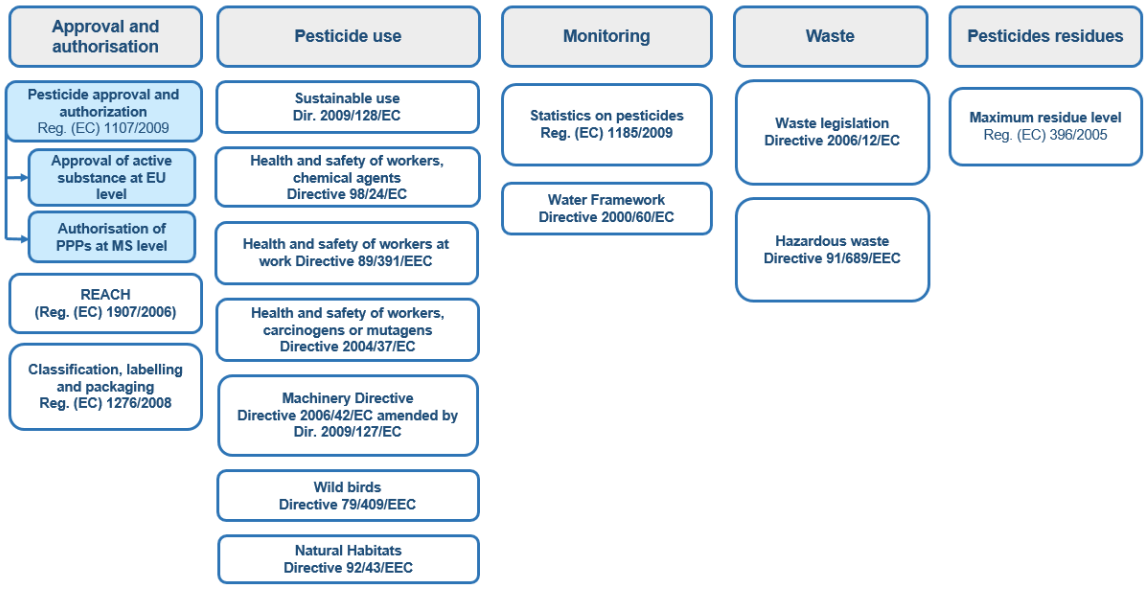
PPPs are used against plant pests, plant diseases and for weed control mainly in agriculture but also for other uses such as in forestry, along roads, on and along railway tracks, airport runways, in sports grounds, golf courses and in green urban areas Since PPPs may have harmful effects on health and the environment they are strictly regulated at EU level and their use is of societal concern. Depending on their composition – and in particular the active substance contained therein - PPPs can be classified into categorised of being more or less hazardous to health and the environment. Active substances can be chemicals or micro-organisms.

[1] The legal definition of pesticides includes plant protection products (PPPs) and biocides, but since the scope of the SUD was never extended to biocides, the SUD evaluation is restricted to PPPs only.

[2] Article 2 of 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 repealing Council Directives 79/117/EEC and 91/414/EEC, OJ L 309 24.11.2009, p. 1.

Directive 2009/128/EC of the European Parliament and of the Council, the Sustainable Use of Pesticides Directive[3] (SUD), establishes a framework for EU action to achieve the sustainable use of pesticides[4]. It should be noted that the term "sustainable" is not defined in the Directive. The SUD has the general objective of protecting human health and the environment from possible risks and impacts associated with the use of PPPs. The SUD interacts with a variety of other EU legislation relevant to PPPs, see Figure 1.

Figure 1: Interaction of the SUD with other EU legislation relevant to PPPs (under the responsibility of various Commission DGs)



The SUD was adopted in 2009 as one of the follow-up actions of the Commission thematic strategy on the sustainable use of pesticides[5]. Member States were required to bring into force the national provisions of transposing the SUD by 26 November 2011.

Purpose and scope of the evaluation

The Commission committed in the European Green Deal[6], Biodiversity Strategy[7] and the Farm to Fork Strategy[8] to a fair, healthy and environmentally-friendly food system and to

[3] Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides, OJ L 309, 24.11.2009, p. 71–86.

[4] The Food and Agriculture Organization of the United Nations states that to be sustainable, agriculture must meet the needs of present and future generations, while ensuring profitability, environmental health and social and economic equity Sustainable Food and Agriculture | Food and Agriculture Organization of the United Nations (fao.org).

[5] Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions - A thematic strategy on the sustainable use of pesticides, COM(2006) 373 final, Document 52006DC0372, www.eur-lex.europa.eu

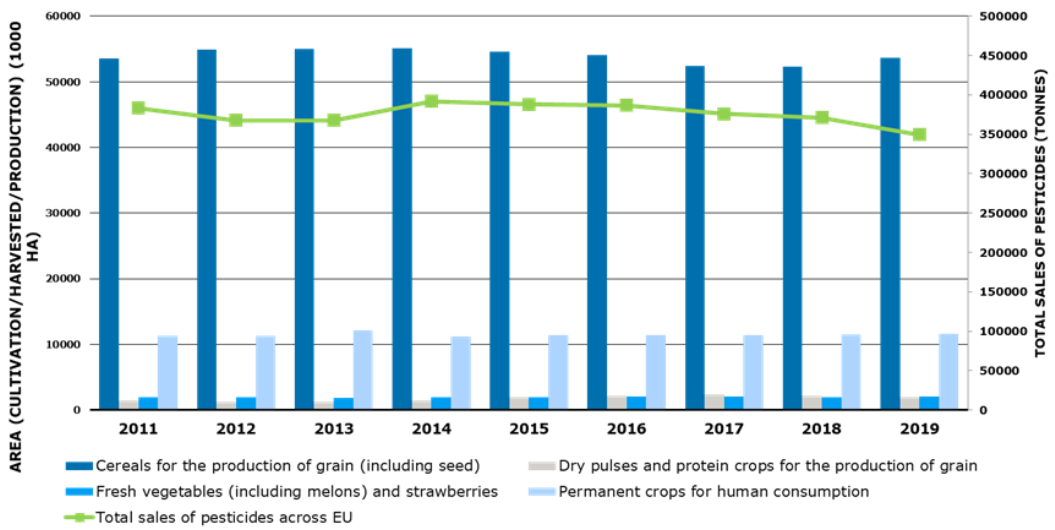
[6] Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions The European Green Deal, COM/2019/640 final, Document 52019DC0640, www.eur-lex.europa.eu

[7] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions EU Biodiversity Strategy for 2030 Bringing nature back into our lives, COM/2020/380 final, Document 52020DC0380, www.eur-lex.europa.eu

significantly reduce the use and risk of chemical pesticides in the EU. The use of certain chemical pesticides contributes to soil, water and air pollution, as well as biodiversity loss and affecting natural flora and fauna including vertebrates and invertebrates. The Farm to Fork Strategy states that the Commission will revise the SUD in order to enhance provisions on integrated pest management (IPM) and promote greater use of safer alternative ways of protecting plants from pests and diseases. In this context, the Commission decided to launch a back-to-back evaluation of the SUD and an impact assessment[9] of possible options to revise the SUD in order to reduce the use and risk of chemical pesticides.

Audits and fact-finding work carried out by the Commission Directorate-General for Health and Food Safety (DG SANTE) indicate weaknesses in the implementation of the SUD and a failure to satisfactorily achieve its overall objectives. These findings are supported by subsequent implementation reports, the European Parliament's resolution on the implementation of the SUD[10], and a report[11] of the European Court of Auditors (ECA) on plant protection products. Available data[12] show that total sales of pesticides in the EU have declined by approximately 10 % since 2011 while agricultural production has remained stable.

Figure 2: Total amount of sales of pesticides compared to overall volume of agricultural production, 2011–2018, EU 27



[8] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of The Regions A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system, COM/2020/381 final, Document 52020DC0381, www.eur-lex.europa.eu

[9] Combined evaluation roadmap/inception impact assessment Revision of the sustainable use of pesticides Directive, Ref. Ares(2020)2804518 - 29/05/2020, https://www.ec.europa.eu/info/law/better-regulation/have-your-say_en

[10] European Parliament resolution of 12 February 2019 on the implementation of Directive 2009/128/EC on the sustainable use of pesticides, text adopted P8_TA(2019)0082, https://www.europarl.europa.eu/doceo/document/TA-8-2019-0082_EN.html

[11] 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, Luxemburg, 2020, https://www.eca.europa.eu/Lists/ECADocuments/SR20_05/SR_Pesticides_EN.pdf

[12] European Commission, Food Safety, https://ec.europa.eu/food/plants/pesticides/sustainable-use-pesticides_en

Source: Eurostat (2021). Pesticide sales. Pesticide sales, Dataset: [aei_fm_salpest09] and Crop production in EU standard humidity dataset [apro_cpsh1]

This evaluation will assess the effectiveness, efficiency, relevance, coherence/ complementarity and EU added value of the SUD in line with the Better Regulation guidelines of the European Commission. The outcome of the evaluation is used to shape the parallel impact assessment work in this back-to-back assessment (in particular the problem definition and the refinement of the options) as to whether a revision of the SUD is needed.

The evaluation covers the period 2011-2020 (i.e. starting from the deadline for national transposition of the SUD by Member States). The years before 2011 serve as baseline for the analysis. The evaluation covers the 27 EU Member States plus the UK, which was a Member State of the EU until 31 January 2020. In addition, the possibility to include best practices and comparisons with some non-EU and non-European countries was considered.

2. BACKGROUND TO THE INTERVENTION

There are economic and social benefits associated with the use of PPPs, which can improve or safeguard yields by eliminating or reducing competition from weeds and attacks by pests, also reducing potential food waste after harvest. The sustainable use of PPPs contributes to ensuring the availability of low-priced fruits and vegetables of good quality, which makes them affordable for all consumers. The use of PPPs also reduces demand for land for food production and enables the regional production of a wide variety of food, which in turn can reduce transport costs and make more land available for other uses, e.g. amenity, natural parks and protection of biodiversity. The European plant protection industry is a significant economic player on the world market and an important employer in Europe[13].

Certain PPPs could harm humans and the environment. Risks to human health[14] [15] could occur through direct exposure during production and use (industrial workers producing PPPs and operators – in particular farmers - using them, as well as residents and bystanders close to areas where use occurs), and indirect exposure after use (consumers – from residues in food, residents and bystanders, environmental exposure), in particular during or after use in agriculture, landscaping, on golf courses, to control weeds on roads and railways, for lawn caring and other plant health related activities. A detailed regulatory framework concerning PPPs exists in the EU, including in particular Regulation (EC) No 1107/2009 concerning the placing of PPPs on the market, which ensures that Member States can only authorise PPPs after a comprehensive scientific

[13] Crop Protection industry economic footprint- Oxford Economics.pdf (croplifeeurope.eu)

[14] Pesticides : Effets sur la santé · Inserm, La science pour la santé.

[15] Correlation between exposure to PPP and certain diseases: These include non-Hodgkin's lymphoma (NHL), multiple myeloma, prostate cancer, Parkinson's disease, cognitive disorders, chronic obstructive pulmonary disease and chronic bronchitis. 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, p.28.

assessment shows that the risks of PPP use for human health and the environment are absent or acceptable, respectively, and Regulation (EC) No 396/2005[16] on pesticides residues which ensures that residue levels of active substances in food are safe for consumers and establishes a comprehensive annual monitoring programme[17].

Ecosystems influenced by agriculture have experienced a dramatic loss of terrestrial and aquatic biodiversity, for example as demonstrated by a 57% decline of European farmland birds between 1980 and 2017[18]. Several driving factors contribute to this biodiversity decline, including habitat loss. Nevertheless, there are certain correlations between the presence of PPPs in water and soils and decline of flora and fauna,[19] and that the use of certain chemical PPPs as it currently stands is a key driver contributing to an increasing trend of biodiversity loss and to water and soil pollution across the EU[20]. While there is no clear aggregated EU level data or indicators on the levels of biodiversity and the impact that PPPs 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[21]. Biodiversity losses can result from direct poisoning on the treated fields or off-site, as well as through a reduction of food resources, for instance through herbicides lowering biomass of weeds. It is important to address the issue of PPP residues or metabolites from PPP use along the food and nutritional chain as well as their possible impact on water quality which can lead to increasing costs for water supply.

Description of the intervention and its objectives

In order to complement the provisions of the pesticide regulatory system (Directive 91/414/EEC preceding Regulation (EC) No 1107/2009) and to ensure a more sustainable use of PPPs in line with the regulated (authorised) uses, the Commission adopted the Thematic Strategy on the sustainable use of pesticides as a priority area under the Sixth Environmental Action Programme of the European Community 2002-2012. The intervention had operational objectives such as to increase awareness of consumers and society at large about the possible risks from the use of PPPs, support forms of agriculture and pest management methods that restrict or better target the use of plant protection products, encourage a rational and precise PPP use and appropriate crop and

[16] 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 and amending Council Directive 91/414/EEC, OJ L 70, 16.3.2005, p. 1.

[17] These two Regulations have recently been the subject of a Better Regulation evaluation refit (europa.eu)

[18] European Indicators, Pan-European Common Bird Monitoring Scheme, https://pecbms.info/trends-and-indicators/indicators/indicators/E_C_Fa/

[19] 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.

[20] Pesticide sales, The European Environment Agency (EEA), https://www.eea.europa.eu/airs/2018/environment-and-health/pesticides-sales

[21] See for example: Flying insects in west German nature reserves suffer decline of more than 76% between 1973 and 2000, "Science for Environment Policy", Issue 511, July 2018, European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol.

soil management practices, improve the behaviour of PPP users (in particular professional users) by ensuring better training and education and improve the quality and efficacy of pesticide application equipment (PAE) to enable PPP users to optimise the effectiveness of the treatments whilst minimising any adverse impact on human health or the environment.

The Commission's SUD proposal COM(2006)373[22] aimed to implement those provisions of the Thematic Strategy that could not be included in existing instruments or policies. It proposed rules concerning the:

– Establishment of Member State national action plans (NAPs) to set objectives to reduce hazards, risks and dependence on chemical control for plant protection, while allowing for the necessary flexibility to adapt the measures to the specific situations in the Member States. Member States were required to set individual objectives to reduce hazards, risks and dependence on chemical control for plant protection. Stakeholders were also to be involved in the setting up, implementation and adaptation of the NAPs. The detailed arrangements for public participation, and the level at which this will be organised, would be determined by the Member States so as to give the public early and effective opportunities to participate in the process.

– Developing Community-wide standards on Integrated Pest Management (IPM), and establishment of necessary conditions for implementation of IPM. It was considered that application of IPM by farmers and other professional pesticide users would result in a better targeted use of all available pest control measures, including pesticides, and would contribute to a further reduction of the risks to human health and the environment and the dependency on the use of pesticides. Member States were expected to promote low pesticide-input pest management, in particular IPM, and establish the necessary conditions and measures for its implementation. IPM was defined in the proposal for a Directive as the 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 PPPs 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.

– Specific measures to protect the aquatic environment from pollution by pesticides and defining areas of significantly reduced or zero pesticide use in line with measures taken under other legislation (such as the Water Framework Directive, the Birds Directive, the Habitats Directive, etc.) or to protect sensitive groups.

– Measuring progress in risk reduction through appropriate harmonised indicators.

[22] Proposal for a Directive of the European Parliament and of the Council establishing a framework for Community action to achieve a sustainable use of pesticides [COM(2006) 372 final].

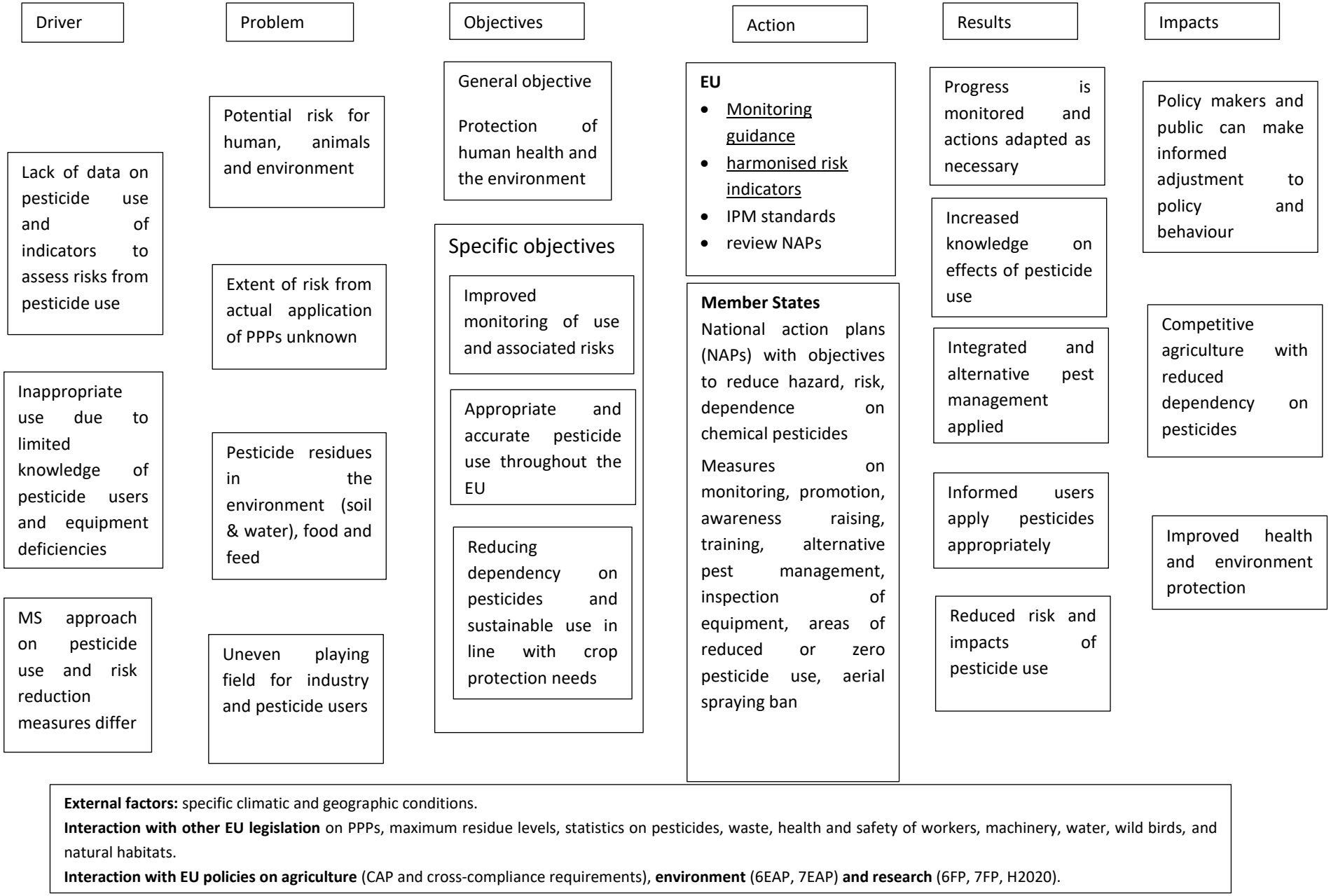
– Creating a system of training and awareness-raising for distributors and professional users of pesticides in order to ensure that they are fully aware of the risks involved. It was considered essential that Member States set up systems of both initial and additional training for distributors, advisors and professional users of pesticides and certification systems to record such training so that those who use or will use pesticides are fully aware of the potential risks to human health and the environment and of the appropriate measures to reduce those risks as much as possible.

– Appropriate handling and storage of pesticides and their packaging and remnants.

– Regular inspection of PAE in order to reduce adverse impacts of pesticides on human health (in particular as regards operator exposure) and the environment during application. It was considered necessary to improve the quality and efficacy of PAE to enable pesticide users to optimise the effectiveness of the treatments whilst minimising any adverse impact on human health and the environment. PAE was defined in the proposal for a Directive as any apparatus specifically intended for the application of pesticides, including accessories that are essential for the effective operation of such equipment, such as nozzles, manometers, filters, strainers and cleaning devices for tanks.

– Prohibition of aerial spraying with derogations being possible, aiming to limit the risks of significant adverse impacts on human health and the environment, in particular from spray drift. It was considered that aerial spraying should generally be prohibited with derogations possible where it represents clear advantages in terms of reduced impacts on human health (e.g. for the operators) and the environment in comparison with other spraying methods, or where there are no viable alternatives, provided that the best available technology to reduce drift is used.

Figure 3: Intervention Logic of Directive 2009/128/EC on the sustainable use of pesticides (SUD) supplemented with additional targets from the European Green Deal



Baseline and points of comparison

A regulatory framework for pesticide use (use phase) was established with the SUD. This evaluation assumes as likely that in the absence of the SUD the situation would have continued to evolve with Member States taking action nationally to regulate the use of pesticides in line with the *original impact assessment*[23] baseline scenario.

At the time of its SUD proposal, the Commission considered that the situation regarding pesticide use in the Member States was marked by large variations. These could be partly explained by the diverging structures of the agricultural sector and different climatic conditions (leading to different needs in terms of plant protection), but also by differing efforts undertaken in several Member States to reduce the need for pesticides and the correlated risks to human health and the environment through NAPs. This created a situation where there was no level playing field for pesticide users and the pesticide industry, which could lead to unfair competition for economic actors in different Member States. Furthermore, there was considered to be no equal level of protection of human health or the environment throughout the Community and pesticide use showed diverging trends between Member States. Without any Community intervention, this trend towards divergence in the Member States was considered very likely to continue, leading to different levels of protection of health and environment and diverging conditions for the main users of pesticides (e.g. farmers) in the Member States. Societal concerns around possible negative health and environmental effects linked to the use of pesticides might also have increased.

One of the shortcomings of the EU legal framework existing prior to the SUD is that the actual use phase, which is key to the determination of the overall risks that pesticides pose, was not sufficiently addressed. Prior to the SUD, for example, it was considered that there was no common understanding of IPM as applied by pesticide users in different Member States.

3. IMPLEMENTATION / STATE OF PLAY

Description of the current situation

The Commission has issued, in 2017 and 2020, two reports to the European Parliament and the Council on the implementation of the SUD. The 2017 report[24] focused on overall

[23] Commission staff working paper - Accompanying the Proposal for a Directive of the European Parliament and of the Council establishing a framework for Community action to achieve a sustainable use of pesticides {COM(2006) 373 final} - The impact assessment of the thematic strategy on the sustainable use of pesticides, Document 52006SC0894, www.eur-lex.europa.eu

[24] Report from the Commission to the European Parliament and the Council on Member State National Action Plans and on progress in the implementation of Directive 2009/128/EC on the sustainable use of pesticides COM(2017)587 final.

implementation of the SUD. The 2020 report[25] focused more specifically on the implementation by Member States of national targets in their NAPs. Both reports identify significant shortcomings in the objectives and targets defined in Member State NAPs, the enforcement of IPM at farm level, delays in testing PAE and practical limitations of established harmonised risk indicators (HRIs) used for monitoring trends in PPP risk both at EU and Member State levels. The 2020 report included a compliance-monitoring index to quantify progress in the implementation by and between Member States, which revealed a particularly poor implementation of the SUD provisions with regard to IPM enforcement (34 % implementation by 2019), PAE (41 %) and NAPs (53 %).

The implementation and achievements of the SUD have been assessed by the European Parliamentary Research Service (EPRS[26]) and the European Court of Auditors (ECA[27]). The EPRS highlighted several constraints in the adoption of SUD provisions and suggested a range of measures like establishing a European target for pesticide use reduction, developing guidelines on national criteria for measuring IPM implementation and promoting agricultural approaches founded on preventive and indirect plant protection as well as a transparent system for statistical data collection related to pesticide use and impacts and strengthening incentives to professional PPP users, for instance by enhancing coherence of the SUD with related policy areas such as the Common Agricultural Policy (CAP). The ECA recommended inter alia checking the conversion of the general principles of IPM into measurable national criteria, improving statistics on PPP sales and use and adjusting or complementing current HRIs to better quantify progress towards stated policy objectives concerning the use of PPPs.

Transposition and implementation

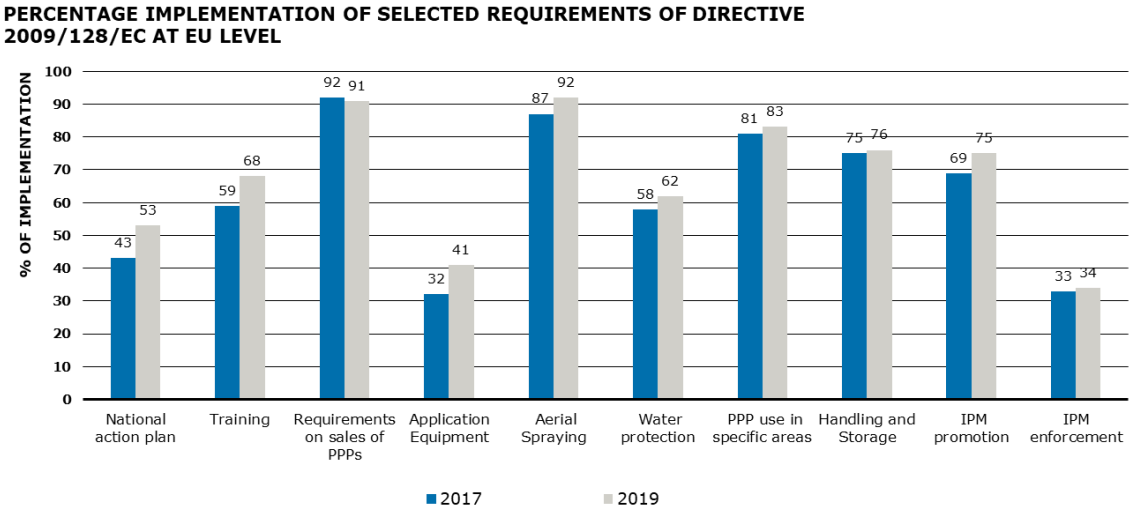
Since the provisions of the SUD had to be transposed into national law and thus require both implementation and enforcement at national level, the major responsibility for the success of the SUD lies with the Member States. The transposition of the SUD was delayed in a high number of Member States. In 2012, after the deadline for transposing the Directive had passed, the Commission initiated infringement procedures on the SUD against 17 Member States (still including the UK at the time) for non-transposition of the Directive into national law. The development and communication of NAPs was delayed in several Member States. In 2013, the Commission started a dialogue with eight Member States which failed to submit the NAPs to ensure legal compliance. Figure 4 below summarises the implementation status as presented in 2020 Commission report to the European Parliament and the Council.

[25] Report from the Commission to the European Parliament and the Council on the experience gained by Member States on the implementation of national targets established in their National Action Plans and on progress in the implementation of Directive 2009/128/EC on the sustainable use of pesticides COM(2020) 204 final.

[26] 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.

[27] 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, Luxemburg, 2020, https://www.eca.europa.eu/Lists/ECADocuments/SR20_05/SR_Pesticides_EN.pdf

Figure 4: 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

Since the enactment of Directive 2009/128/EC, both the overall configuration and the implementation of specific provisions have been critically reviewed by relevant stakeholders. Evidence[28] from recent years has revealed a possible need to adapt legislation to current developments, such as to reduce pesticide risks and impacts on pollinators as specified by the EU Pollinators Initiative, as well as the requirement to overcome deficiencies in the implementation of relevant provisions.

National action plans and targets

The Commission's 2017 report to the European Parliament and the Council concluded that Member States needed to further review and improve the quality of their NAPs, for example by establishing specific and measurable targets and indicators as part of a long-term strategy to reduce the risks and impacts from pesticide use. 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 second report[29] to the European Parliament and the Council, published in 2020, concluded that less than one third of Member States had completed the review of their NAPs within the five-year legal deadline and, of those that had reviewed their NAPs, most had failed to address the

[28] Roadmap for the EU Pollinators Initiative, Ares(2017)5895634, European Commission DG Environment, Ref. Ares(2017)5895634-01/12/201, https://ec.europa.eu/environment/nature/pdf/roadmap-for-the-eu-pollinators-initiative.pdf

Communication from The Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee Of The Regions: EU Pollinators Initiative, COM/2018/395 final, Document 52018DC0395, www.eur-lex.europa.eu

[29] Report from the Commission to the European Parliament and the Council on the experience gained by Member States on the implementation of national targets established in their National Action Plans and on progress in the implementation of Directive 2009/128/EC on the sustainable use of pesticides COM(2020) 204 final.

weaknesses identified by the Commission in their initial NAPs. When assessing the impact of NAPs at the EU level, it is very difficult to ascertain the effectiveness of the actions set out by each Member State, primarily due to the lack of consistent and quantifiable data. Based on the review of NAPs conducted by the Commission services in 2020, only a small proportion of Member States had set clear quantitative targets.

Training

The Commission's 2017 report[30] on SUD implementation stated that a majority of Member States had established training and certification systems, resulting in a high level of compliance with provisions on training and certification of professional users, distributors and advisors. The report stated that there were delays in the training and certification of operators in six Member States and that no data were provided by three Member States.

Testing of pesticide application equipment

The Commission's 2017 report on the implementation of the SUD[31] stated that systems for the testing of PAE were available in most Member States, often being in operation prior to the Directive. However an accurate assessment of progress is not possible due to uncertainty about the total number of PAE in use. Technical assistance was provided through the development of harmonised standards for the testing of PAE released in the form of ISO 16122 defining the general requirements and test methods, supplemented by different addenda for specific types of application equipment. The voluntary working group on Standardised Procedure for the Inspection of Sprayers in Europe (SPISE) was formed in 2004 to support the implementation of this provision with particular focus on harmonising inspection procedures and facilitating information exchange between PAE inspection services.

Aerial spraying and drones

The Commission's 2017 report on the implementation of the SUD indicated that aerial spraying was prohibited under national legislation in all Member States, with 21 Member States allowing for derogations to allow aerial spraying. The report stated that a major part of the derogations (95 %) in 2015 was granted by two Member States, Spain and Hungary, with aerial treatments on 0.7 % and 0.9 % of their agricultural surface area. Stakeholders such as farmers highlight the need for airborne spraying techniques under certain constraints. Specific crops and agricultural conditions depending on aerial application of pesticides are within the scope of derogations granted by the Member States. For instance, aerial spraying is allowed in some Member States by way of derogation in the absence of viable alternatives for steep slope vineyards or forestry.

[30] Report from the Commission to the European Parliament and the Council on Member State National Action Plans and on progress in the implementation of Directive 2009/128/EC on the sustainable use of pesticides COM(2017)587 final.

Drone technology is considered by pesticide users to have potential for alternative pesticide application from the air. However since drones are not mentioned in the SUD some stakeholders may assume that spraying by drones is prohibited as well and even not eligible for a Member States derogation to permit aerial spraying. If drones are classified as PAE harmonised standards should also be in place for their inspection as PAE and PPPs would need to be specifically authorised for application by drones.

Protecting the aquatic environment and reducing plant protection product use in specific areas

The 2017 Commission report on the implementation of the SUD informs about a range of measures for water protection taken by many Member States, such as using drift reduction technology and establishing buffer zones. A focus on risk reduction rather than on use reduction only is perceived as crucial since reduced application rates do not necessarily result in reduced risk to non-target species in the aquatic environment or water supply. The recent evaluation[32] of the Water Framework Directive found that its objectives have not been reached fully yet, largely due to insufficient funding, slow implementation and insufficient integration of environmental objectives in sectoral policies. The insufficient level of implementation by Member States and by those sectors of the economy with an impact on water has come to the forefront across the different criteria of evaluation for that Water Framework Directive. Precision farming techniques are considered to offer the potential for more precise application of PPPs and possibly reduce risks to the aquatic and wider environment, although it should also be recognised that an optimisation of pesticide application through precision farming does not guarantee environmental benefits.

The Commission's 2017 report stated that a majority of Member States had taken measures to fulfil the requirements for pesticide use in specific areas. With regard to an envisaged reduction of pesticides in public areas, the Commission mentioned the absence of measurable use reduction targets as being insufficient for measuring progress.

Handling and storage of plant protection products

The 2017 Commission report on SUD implementation indicated high compliance with regard to control systems for handling and storage of pesticides. The pesticide risk for human health and the environment depends on the appropriate behaviour of the pesticide user, including handling and storage of the PPP and safe disposal of empty PPP containers and residual PPP. The training of professional users may help in this regard as it increases the knowledge about pesticides in general and about hazard control and safety behaviour in particular.

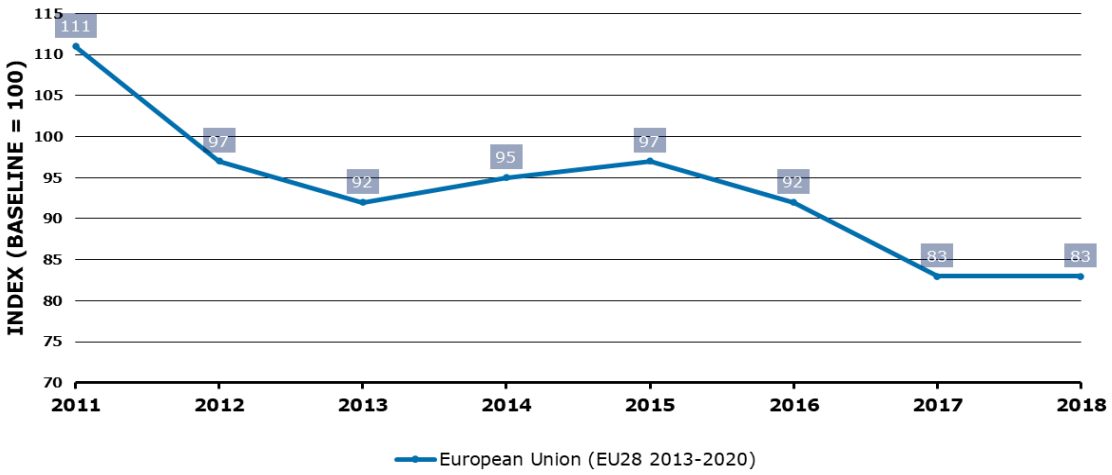
Harmonised risk indicators

[32] Fitness Check of the Water Framework Directive and the Floods Directive SWD(2019)439, European Commission, DG Environment.

Since 2019 HRIs are in place to quantify the overall progress in reducing the risks linked to pesticides under the SUD.[33] The first HRI (HRI 1) is based on the quantities of pesticides sold in each Member State, while the second (HRI 2) is based on the number of emergency authorisations granted under Article 53 of Regulation (EC) No 1107/2009 by each Member State. The Commission published HRIs 1 and 2 for the first time in 2019, for the period 2011-2017. HRI 1 is based on data on pesticide sales reported to the Commission by Member States under Regulation (EC) No 1185/2009 of the European Parliament and of the Council concerning statistics on pesticides[34]. HRI 2 is based on the number of emergency authorisations reported to the Commission by Member States using the Plant Protection Products Application Management System (PPPAMS). The indicators are calculated using the methodology laid down in Annex IV of Directive 2009/128/EC. Both indicators include a weighting to reflect the intrinsic properties of the active substances therein. A three-year baseline was used in calculating these indicators as the quantity and nature of the pesticides used fluctuates between years due to variations in the extent and severity of pest outbreaks between years.

HRI 1 shows a reduction in risk of 20% in the period from 2011 to 2017 even though the quantity of pesticides sold remained relatively constant over that period (see Figure 5). This is considered to be due to the continued, and accelerating, growth in the sales of pesticides containing non-chemical active substances and a possible decrease in the quantity of the more hazardous pesticides placed on the market[35].

Figure 5: Trends in Harmonised Risk Indicator 1, established under Commission Directive (EU) 2019/782



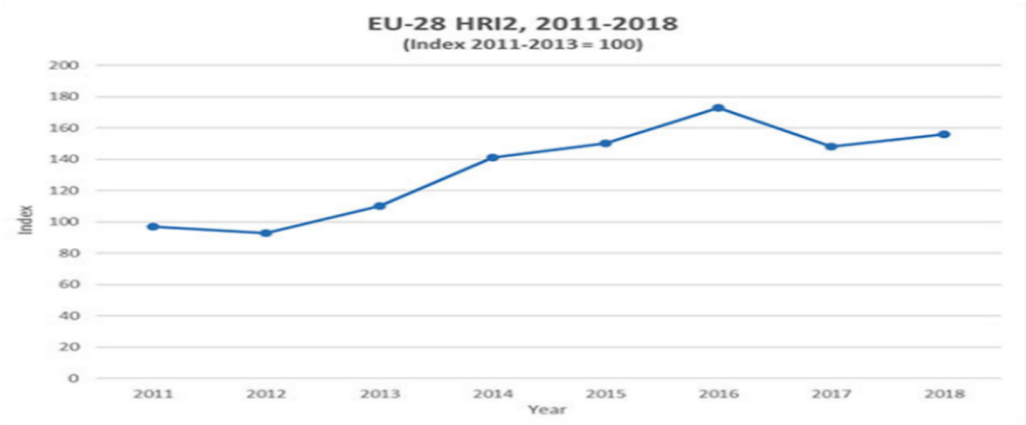
HRI 2 shows a 50% increase in the period from 2011 to 2017 (see Figure 6).

[33] Commission Directive 2019/782 amending Directive 2009/128/EC of the European Parliament and of the Council as regards the establishment of harmonised risk indicators, OJ L 127, 16.5.2019, p. 4. Directive 2019/782 established harmonised risk indicators as required by Article 15 of the SUD, and in line with the commitment given in response to the European Citizens Initiative "Ban glyphosate and protect people and the environment from toxic pesticides".

[34] Regulation (EC) No 1185/2009 of the European Parliament and of the Council of 25 November 2009 concerning statistics on pesticides OJ L 324 10.12.2009, p.1-22.

[35] Trends in Harmonised Risk Indicators for the European Union , European Commission, 2019.

Figure 6: Trends in Harmonised Risk Indicator 2, established under Commission Directive (EU) 2019/782



The indicator HRI 2 is based on the number of emergency authorisations weighted by the characteristics of the active substances in the pesticides. However, the scale of individual emergency authorisations, and hence the quantities of pesticides used, varies widely, from for example, a few hectares in the case of very minor crops, to widespread use on large-scale field crops, in some cases. These aspects concerning extent and type of the associated PPP use are not captured in a HRI 2 based only on the number of emergency authorisations issued. The Commission has developed and agreed with Member States additional guidance[36] aiming to improve the usefulness of HRI 2 in the future.

Integrated pest management

The Commission's 2017 report to the European Parliament and the Council concluded that Member States needed to do more to implement the SUD to achieve the intended environmental and health improvements. The assessment of IPM implementation was identified as a specific area requiring improvement. Measures taken to promote IPM vary strongly between Member States in existence and design, but include crop-specific IPM guidelines, training and certification of professional users and advisory systems. Nevertheless, the Commission's 2020 report to the European Parliament and Council on implementation of the SUD concluded that enforcement of IPM is low across most Member States, and there is limited evidence that IPM principles are systematically applied.

4. METHOD

Short description of methodology

This evaluation forms part of a back-to-back evaluation and impact assessment. The combined evaluation roadmap / inception impact assessment was published on 29 May 2020 with 360 public feedback comments received. These comments were extensively reviewed and taken into account throughout the evaluation and impact assessment where relevant. A single external study is supporting both the evaluation and impact

[36] Harmonised risk indicators for pesticides, European Commission, Eurostat (europa.eu).

assessment[37]. The study report describes in detail the methodology applied. As regards stakeholder consultation activities, these included a public online consultation, three public remote stakeholder events organised by the Commission, a specific Better Training for Safer Food (BTSF) workshop and other regular meetings with Member State competent authorities responsible for implementing the SUD as well as interviews, surveys, focus groups and workshops organised by the external study contractor. These activities and the stakeholders targeted are more extensively described in the stakeholder consultation synopsis report annexed to the accompanying impact assessment.

The evaluation was supported by an inter-service steering group (see annex to accompanying impact assessment).

Limitations and robustness of findings

A number of limitations of the evaluation and its methodology can be discerned. It has been difficult to comprehensively quantify economic costs due to a lack of robust data, including on health and environmental aspects. Data on costs was collected through a supporting external study literature review, interviews, and a survey to different stakeholder groups. It was not possible through these means to collect representative data on all categories of costs associated with implementing all elements of the SUD throughout the EU. Benefits have been difficult to quantify, as significant knowledge and data gaps exist. There is limited but growing evidence and knowledge about the actual use of pesticides and the risks posed to human health[38] and the environment[39].

Conflicting views across stakeholders also presents a challenge in agreeing fair and evidence-based results, specifically on what the SUD has and/or should have achieved. The objectives of the SUD are closely linked to other pieces of EU legislation, notably the Plant Protection Product Regulation (Regulation (EC) No 1107/2009) which leads to stakeholders commenting on wider pesticide policies and influencing factors, provisions and effects which may not be caused by the SUD itself. Evaluating the effects of the SUD is subject to an attribution challenge which means that when relevant changes can be observed (e.g. changes in quantity of sold pesticides) it is not a given that those changes can be attributed to the implementation of the SUD but could be due to changing climate conditions, other EU or national policies etc.

There are also temporal challenges linked to the evaluation of the SUD, such as the somewhat recent implementation of some of the provisions of the SUD and that some pesticides, once used, may persist in the environment and have potential effects on health and the environment for long periods.

[37] 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, Appendix 3: Methodology, Publications Office of the European Union, 2022, DOI: 10.2875/924365, p.143.

[38] Pesticides : Effets sur la santé · Inserm, La science pour la santé, 2017, https://www.inserm.fr

[39] See for example Flying insects in West German nature reserves suffer decline of more than 76% between 1973 and 2000 (europa.eu).

To some extent, the SUD builds on the assumption that too much or excessively hazardous pesticides are being applied by professional users without being necessary (and/ or are being incorrectly applied) and that there is room for reducing the dependency on pesticides and associated use and risk to better protect human health and the environment. It also builds on the assumption that effective alternative methods exist to prevent and control pests, with a similar performance and comparable cost as pesticides (the impact assessment of the Thematic Strategy assumed that the main economic benefit for farmers would be a reduction in costs for pesticides).

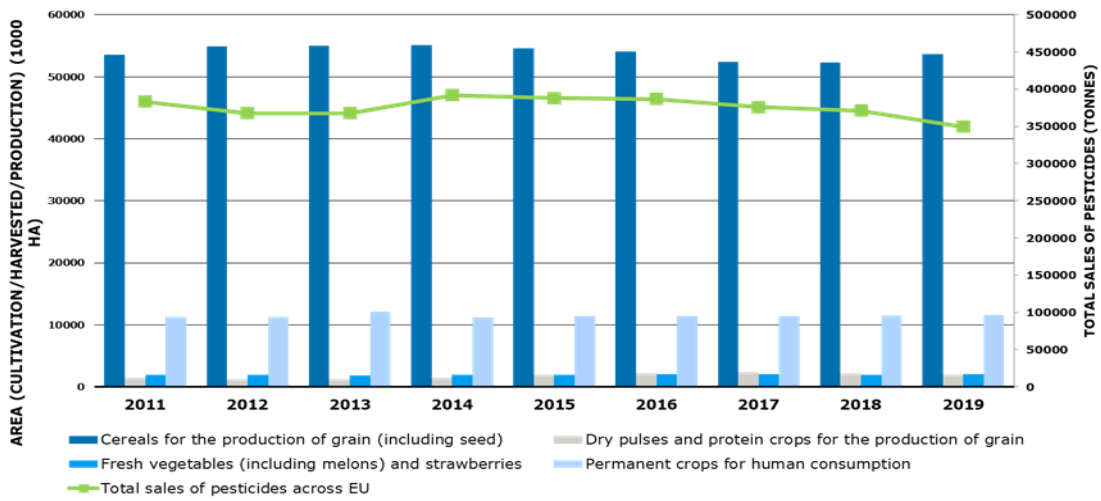
5. ANALYSIS AND ANSWERS TO THE EVALUATION QUESTIONS

5.1 Effectiveness

The analysis assesses the contribution of the SUD, in relation to the key actions such as the establishment of NAPs, promotion of IPM and others, towards the SUD's overall objectives of reducing dependency on pesticides and reducing risks to human health and the environment.

Available sales data show that there has been a 10% reduction between 2011 and 2019 levels (sales data are used here as a proxy for use data which are not available at EU level, see Figure 7) while agricultural production has remained stable.

Figure 7: Total amount of sales of pesticides compared to overall volume of agricultural production, 2011–2018, EU 27



Source: Eurostat (2021). Pesticide sales. Pesticide sales, Dataset: [aei_fm_salpest09] and Crop production in EU standard humidity dataset [apro_cpsh1]

Reducing the risks of pesticide use was primarily envisaged to be implemented through the collective action of all SUD activities. Pesticides are still perceived as widespread pollutants. Available monitoring data links industrial agriculture and pesticides with harmful substances as environmental threats especially in aquatic ecosystems[40]. Although

[40] See for example https://ec.europa.eu/info/sites/info/files/com_report_wfd_fd_2019_en_1.pdf and European Environment Agency (2018): European waters. Assessment of status and pressures 2018. EEA Report No 7/2018.

the SUD aimed to reduce the risk of pesticide use to human health, the external study supporting this evaluation found that the SUD had a more indirect contribution through measures such as raising awareness and training. However, the lack of sufficient data and methodologies to calculate this with statistical certainty hinders the ability to state the true effectiveness of the SUD in this regard. It could be assumed that training activities under the SUD would lead to increased knowledge and awareness of the potential risks to human health. In surveys conducted as part of the supporting external study, users of PPPs were of the view that the SUD had contributed to a reduction of risks and impacts of pesticide use on human health, which was also broadly supported by Member State authorities. Non-governmental organisations (NGOs), consumer organisations and civil society representatives, however, largely disagreed.

It is important to separate the risks to human health for both the users of pesticides (professional and non-professional) and citizens living close to areas where pesticides are applied, as well as consumers of food products. Concerning exposures to pesticides, the European Food Safety Authority (EFSA), in several annual assessments[41], concluded that the probability of being exposed to pesticide residues in food which could lead to adverse health effects is low. Concerning the dossier prepared for each pesticide active substance, EFSA and the Member States also assess risks to PAE operators, bystanders, residents (including children) and workers before an active substance is approved or a PPP authorised, and PPP-uses are only authorised if no effects are expected Chronic effects are also considered in the risk assessment for each active substance and PPP. Monitoring data are limited concerning possible contamination of living areas and exposure of those living in the proximity of pesticide use areas.

Comprehensive European indicators related to the health and environmental impacts pesticide do not exist or are not available. There are a few indications of improvements, such as less pesticides and metabolites found in water bodies[42], but the data available are not complete and makes it difficult to draw conclusions on an EU level. The 2020 ECA special report on PPPs also found that data currently collected and made available are not sufficient to allow effective monitoring of the risk and environmental impacts of PPP use.

While many of the SUD provisions have been implemented in most Member States, and likely contributed to a reduced risk of pesticide use as suggested by the decrease of HRI 1 by 20% over the last five year period, it is not possible to quantify the Directive's exact direct contribution to reducing the risk of pesticide use.

National action plans and targets

Lack of measurable targets in NAPs in most Member States hinders quantification of achievements as regards effectiveness of the SUD. The Commission's 2020 report on

[41] Annual reports from EFSA. Available at: https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2021.6491

[42] Pesticides in European rivers, lakes and ground waters – Data assessment, Technical Report 1/2020, ISBN 978-3-944280-66-0, European Topic Centre on Inland, Coastal and Marine waters (ETC/ICM).

SUD implementation highlighted widespread delays in the review of NAPs by Member States. Achievements of the SUD with regard to the sustainable use of pesticides largely depend on the commitment of the Member States. When assessing the impact of NAPs at the EU level, it is very difficult to ascertain the effectiveness of the actions set out by each Member State, primarily due to the lack of consistent and quantifiable data. A substantial point of criticism relates to inconsistencies in the establishment of quantitative goals, targets, indicators and timetables, as requested in Article 4(1) of the SUD. Many NAPs lack appropriate indicators that are suitable for measuring progress and identifying necessary interventions.

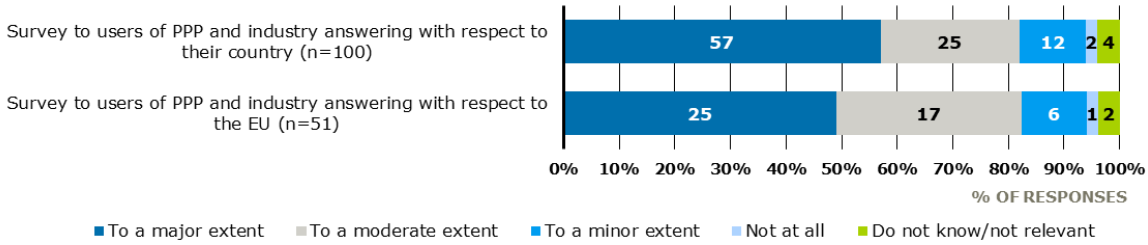
Training

Training activities and peer-to-peer learning was seen as an important driver in the implementation of IPM and achieving the general objectives of the SUD. However its application across all Member States is not consistent, thus limiting the effectiveness of IPM and the SUD more generally, particularly in reducing the dependency of pesticide use[43].

Testing of pesticide application equipment

The external study supporting the evaluation found that the SUD had played a role in improving the accuracy of PAE equipment but it was difficult to quantify this due to many variables, such as the proficiency of the user. A targeted study survey of users of PPPs and PPP and PAE industry representatives concluded that the SUD requirement for PAE in professional use to be inspected regularly was implemented to a major or moderate extent as shown below.

Figure 8: External study targeted survey to users of PPP and industry: In your opinion, to what extent are the following elements of the current SUD actually being implemented in your country/ the EU? - - *Pesticide application equipment in professional use must be inspected regularly*



Nevertheless it is difficult to quantify what proportion of PAE has actually been inspected as required. A 2018 SPISE survey[44] concluded that the lack of national PAE registers limits the ability to effectively carry out inspections. In the external study survey of Member State competent authorities, only 8 respondents were able to indicate

[43] 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, Improving the behaviour and practices of pesticide users, Publications Office of the European Union, 2022, DOI: 10.2875/924365, p.20-26, p.41-43.

[44] 7th European Workshop on Standardized Procedure for the Inspection of Sprayers in Europe Athens, Greece September 26-28, 2018 Julius Kühn-Institut, http://www.julius-kuehn.de Bereich Veröffentlichungen – Berichte.

the number of PAE existing or used in their Member State. This presents an overall mixed picture on the effectiveness of the SUD as regards the inspection of PAE.

Aerial spraying and drones

The 2020 Commission report on SUD implementation found declining areas treated by aerial spraying and improved requirements for aerial applications concerning training of operators and inspection of equipment. In a supporting survey of Member States, roughly two thirds of respondents (15 out of 23) indicated that derogations to allow aerial spraying are possible. However, only two Member States reported substantial areas of agricultural or forestry production that are treated aerially. Most respondents were not able to provide data, or their Member States did not receive any requests for derogation since the entry into force of the SUD. Stakeholders surveyed emphasised that technological development and innovation could also be strengthened and better supported, specifically the use of drones in precision farming. Currently the use of drones for aerial spraying of PPPs (as opposed to use of drones for crop surveying for example) is considered to fall under the ban on aerial spraying, which some stakeholders, in particular pesticide users, consider as the SUD presenting a barrier to the application of new technology in this area. According to them, the targeted application of PPPs can reduce the risk, in particular the exposure of pesticide users, and also the volume of product used, although other external study interviewees expressed a sceptical view on spraying with drones as their contribution to reducing the risk of pesticide use has not been proven. Some stakeholders also saw a need for promotion of the uptake of other technological developments in the area of digitalisation and precision agriculture.

Protecting the aquatic environment and reducing plant protection product use in specific areas

There is some indication of an overall decline of pesticide prevalence in water bodies. With respect to pollution of pesticides in ground water, data from the first (2009-2015)[45] and second (2016-2021)[46] River Basin Management Plans under the Water Framework Directive displayed a 21% drop in the levels of pesticides reported to be found in ground water. It is difficult to ascribe such a decline specifically to the effectiveness of the SUD as it is also related to the fact that the approval of several active substances polluting the aquatic environment has not been renewed under Regulation (EC) No 1107/2009. The lack of specificity in the HRIs and non-availability of pesticide use data at EU level do not allow an assessment of a reduction in PPP use or risk in specific areas of the environment.

[45]Report from the Commission to the European Parliament and The Council on the implementation of the Water Framework Directive (2000/60/EC) and the Floods Directive (2007/60/EC) Second River Basin Management Plans First Flood Risk Management Plans COM/2019/95 final, Document 52019DC0095, www.eur-lex.europa.eu

[46] European Overview - River Basin Management Plans SWD(2021) 253 final, www.europa.eu

Handling and storage of plant protection products

The results of the online public consultation / "have your say" conducted by the Commission show that the SUD might have improved the behaviour and practices of pesticide users concerning the handling and storage of PPPs. The majority of PPP users answered that they dispose of empty pesticide containers through triple-rinsing and sending them to a collection centre for empty pesticide packaging (223 out of 369 – 60%). Similarly, 72% of PPP users answered that when using pesticides, they wear gloves, while 41% wear facemasks. While there is not a comparable baseline on the data related to the handling, use and disposal of pesticides, the results from the online public consultation provide evidence of where the SUD may have contributed. In targeted surveys, PPP users largely agreed that measures to ensure the appropriate storage, handling, dilution, and disposal of pesticides had been implemented both at the national and EU level. This view was not supported by NGOs, consumer organisations and civil society however, who perceived limited to no implementation.

Harmonised risk indicators

As reported in the supporting external study, some stakeholders do not consider the current HRIs as effective, stating that they do not reflect clearly the actual impacts of pesticides on human health and the environment. For example, the use of data on sales of pesticides (as a proxy for pesticide use data which are not available at EU level) does not determine the rate of application nor the method of application or area of land to which the pesticides have been applied. Stakeholders suggested developing alternative indicators to take a more holistic view, enabling the use of pesticides to be monitored in the context of other parameters. Additional data, especially concerning pesticide use, might need to be collected to facilitate the development of such new indicators.

Integrated pest management

A key objective of the SUD is the promotion of IPM, enshrined in the SUD as a mandatory practice to be followed, as a means to reduce dependency on pesticide use. The level of implementation of IPM has not been possible to establish, due to inconsistent monitoring by Member States. While awareness and knowledge about IPM may have improved linked to associated training and awareness-raising activities, it is uncertain whether this has translated into a change in practices at farm level. The Commission's 2020 report to the European Parliament and the Council on SUD[47] implementation in 2020 concluded that the assessment of IPM uptake at farm level by Member States was the weakest point of implementation across the EU. These findings are consistent with the results from the ECA report[48] that, since the proportion of pesticide users complying with the IPM principles was not recorded during inspections, it was not possible to assess the true implementation of IPM at the Member State level. Additionally, the 2018 EPRS implementation assessment report stated that survey

[47] see note 25.

[48] see note 11.

respondents highlighted the lack of available tools for measuring progress of the implementation of IPM. Authorities, health/environment NGOs and farmers themselves considered that IPM was not sufficiently understood by farmers and that this could be a factor hindering the proper implementation of IPM and hence its effectiveness.

A limited implementation of IPM by professional pesticide users can also be linked to economic aspects. The SUD has been criticised for applying objectives and indicators aimed at environmental protection and food safety rather than productivity and livelihoods. With regard to IPM, potential impacts on the economic sustainability are considered by some to be major obstacles to the adoption of alternative methods or the establishment of an IPM system, although there is generally a lack of quantitative evidence on economic performance and cost-effectiveness of IPM as compared to conventional practices.

An absence of prescriptive and assessable national criteria concerning the implementation of IPM may have limited effective monitoring and enforcement of IPM at farm level. Crop- or sector-specific guidelines developed in most Member States and covering some, but not all, crops may also support the practical implementation of IPM. Practical tools for pest monitoring and decision-making would also be expected to assist in this regard.

Another barrier to the implementation of IPM could be the limited benefit that can be achieved by marketing agricultural products grown in specific and alternative pest management systems. As a majority of respective certification schemes have been developed for business-to-business relations in certain market segments, few IPM labels are displayed on products in the grocery store, also considering that, according to the SUD, IPM is a mandatory requirement to be followed in all cases. From a business perspective, professional users could be expected to maintain their current pest management strategies unless superior innovative practices are at their disposal. As a consequence, the adoption of good agricultural practices such as IPM, which is considered economically undesirable by some due to perceived potentially higher input costs and higher levels of crop damage risk, is assumed to require compensation for related investments and potential disadvantages. The potential for even better integration of the SUD and IPM into the CAP could be a significant opportunity to better achieve progress in the sustainable use of pesticides and IPM, in line with the overall orientation of the European Green Deal, Farm to Fork Strategy and Biodiversity Strategy.

The impact assessment accompanying the SUD proposal considered that the expected benefits would mainly be reductions in adverse impacts on the environment or health, or other societal benefits (i.e. reduced external costs due to PPP use) linked to a more sustainable use of pesticides. However several key results have actually failed to materialise in the intervening period, such as a stronger evidence and data foundation for policy making on pesticide use and an improved knowledge about environmental and health effects of pesticide use and a broad introduction of alternative techniques to control pests as part of IPM. Limitations in currently available data on pesticide use, limited evidence of actual application of IPM and lack of relevant IPM record-keeping

requirements are considered to hinder the effectiveness of the Directive and the monitoring and evaluation of its effectiveness. Member State NAPs also have been not fully effective in achieving the ambitions the Directive placed on their role in achieving and promoting the sustainable use of pesticides nationally. It is therefore concluded that the SUD has overall only been moderately effective in achieving its stated objectives.

5.2 Efficiency

Costs for Member States

Data on the cost for Member States of implementing provisions of the SUD has been collected through interviews, a dedicated survey, and literature review. In general, a majority of the Member State authorities do not consider the SUD overly burdensome[49], which is consistent with the EPRS[50]. Costs for the preparation of NAPs were not estimated as part of the impact assessment accompanying the SUD proposal. Estimates on the cost of developing the first NAP vary greatly, and range from no costs, since some form of NAP had already been prepared before, to inestimable costs due to the complexity of the process underlying the NAP, and to the preparation of the NAP itself not being that costly, but that several measures introduced by the NAPs (e.g. IPM research projects) were cost intensive.

Concerning training, most Member States already had training and certification schemes in place before the SUD, so most Member States experienced low costs in adapting existing systems. Associated costs are recouped from the trained pesticide users via fees.

The costs for Member State authorities for the inspection of PAE in use includes costs for setting up the system and costs for operating the system. The costs for Member State authorities (including controlling institutions) vary widely depending on whether a comparable system was already in place before the SUD that Member States could build on. Before the SUD only ten countries had established a compulsory control system and seven had introduced inspection schemes on a voluntary basis in place. The impact assessment accompanying the SUD proposal estimated that controlling institutions would face costs of around 45 EUR per inspected sprayer but that those costs would be recovered from fees from farmers. This was confirmed in a survey of the external study supporting this evaluation where most replies stated that PAE inspection systems are financed through fees from professional pesticide users.

Very few Member States provided evidence or assumptions of costs for promoting and supporting low pesticide input crop production, including via the application of IPM. The impact assessment accompanying the SUD proposal estimated that no specific costs would apply to Member State authorities for the implementation of this activity except a shift of research and development (R&D) budget towards IPM support of approx. 75

[49] 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, 4.2.1The main costs to implement the SUD for the different actors concerned,p.59-71.

[50] see note 26.

million EUR – 500 million EUR. No baseline on IPM elements of R&D budgets in Member States before the SUD is available, however the survey of the supporting external study with Member State authorities confirmed that research on IPM is being financed. Concrete numbers given range from 400 thousand EUR annually to 5 million EUR annually. Other replies point out that grants and funding are provided in the Member States without providing quantitative estimations.

Costs for pesticide users (in particular farmers)

Farmers are the largest group affected by the SUD and also directly responsible for applying many of the provisions of the SUD, e.g. by attending trainings. As described in the supporting external study, surveys show that the implementation of the provisions of the SUD is considered on average much more burdensome by farmers than by Member State authorities. Within the provisions, the training obligation is considered to create the highest burden. In most Member States the costs of training and certification are fully or partly recovered through fees. Most Member States already had training in place before the SUD so such fees might have already applied before to farmers and other pesticide users. However, no baseline on the extent and the magnitude of those fees is available. The impact assessment accompanying the SUD proposal assumed that farmers would have to pay fees of around 400 EUR on average per farmer per training. Average costs are likely lower than this, but within a large range of 0 to 1,000 EUR provided by survey respondents.

The impact assessment accompanying the SUD proposal assumed that the average cost of an inspection of PAE would range from approx. 10 to 350 EUR. The findings of the external study survey supporting this evaluation are in line with this assumption. The impact assessment accompanying the SUD proposal estimated an average of 50 EUR of annual repair costs necessary after controls, half of which is attributed to the controls. Due to limitations in available data, these estimates could not be verified in this evaluation. The impact assessment also assumed that the provision on the inspection of PAE would overall lead to savings for pesticide users since the improved maintenance would lead to a reduction in the quantities of pesticides used/wasted or unduly sprayed. However, since pesticide sales have not substantially decreased since the SUD was implemented, while the volume of agricultural production also remained relatively stable, it is assumed that those savings have not been realised.

When surveyed, farmers/pesticide users also cited the general prohibition of aerial spraying and necessity to apply for derogations to practice aerial spraying as presenting relevant costs or an administrative burden. Costs per individual derogation request were not provided in the survey responses received.

Costs for pesticide producers and distributors

Pesticide producers and distributors were predicted to face the highest cost from the SUD in form of foregone sales and based on the expectation that pesticide sales would be reduced across the EU. However, since no clear downwards trend of pesticide sales can be observed it is assumed that the predicted losses/costs (loss in turnover of between 770

million EUR and 1,100 million EUR) foreseen in the impact assessment accompanying the SUD proposal did not occur to that extent. It is possible that to a limited extent the use of microbiological plant protection products may in some cases have substituted the use of more hazardous chemical pesticides. A switch to less hazardous substances may also have influenced the volume of products sold, given that less hazardous substances often need to be used in higher volumes compared to more hazardous substances.

Costs for the European Commission

As regards actions by the European Commission, several activities were undertaken including follow-up actions to the provisions concerning the development of HRIs, enforcement actions, training of government officials, as well as information and outreach actions. There is no evidence that those activities have entailed costs for the European Commission above those originally estimated as part of the original European Commission proposal of the SUD. The EU has also financed relevant research in support of the implementation of the SUD, including through Horizon2020 and by financing the "European Innovation Partnership for Agricultural productivity and Sustainability" (EIP-AGRI). Under Horizon2020[51] at least 30 research projects related to plant health have been financed with an overall value of approx. 160 million EUR.

Administrative burden

As many of the mechanisms required in the SUD had been in place in some Member States before the adoption of the Directive, experiences on the measures could be collected and particularly burdensome measures have been generally avoided. The 2018 EPRS study did not find evidence for an overly high administrative burden created by the SUD. In surveys conducted as part of the external study and with Member State authorities, stakeholders generally confirmed the measures of the SUD as having acceptable burdens, and that the current rules are accepted and not seen as unnecessary.

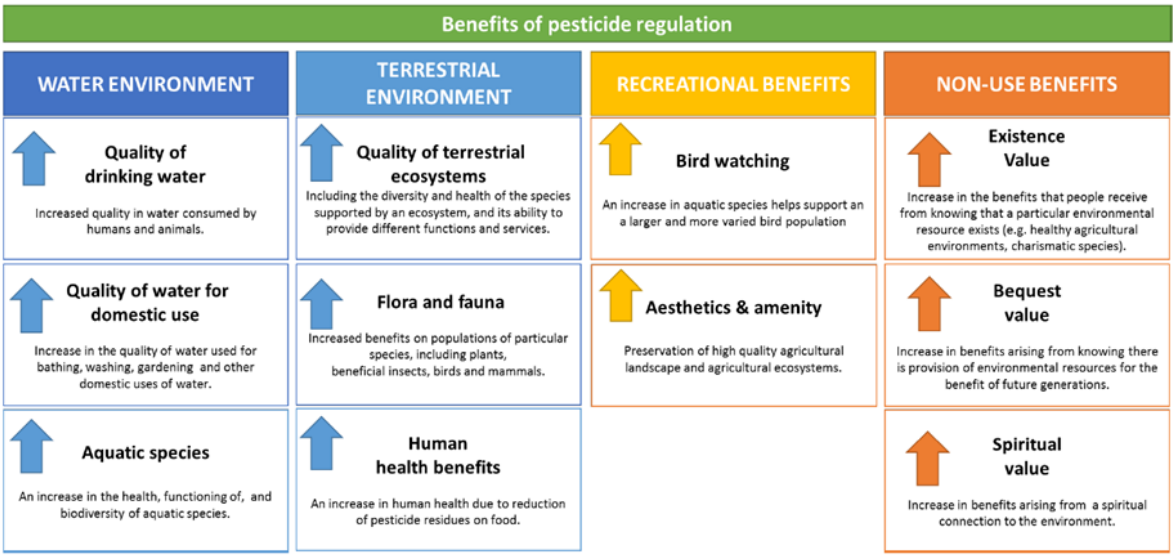
However, one exception from this general acceptance concerns requesting and processing derogations from the ban of aerial spraying. This is considered to create a high bureaucratic burden for both the party requesting the exemption (pesticide users) and the authority taking the decision, even if some Member States prohibit all aerial spraying and do not issue derogations to allow it. The external study found that the burden is increasing with the technological advances concerning potential application of pesticides by drones and the legal uncertainty among some stakeholders whether this constitutes aerial spraying and are prohibited by the SUD or not (also considering that the term "drone" is not mentioned in the SUD). Requesting and processing derogations from the ban of aerial spraying creates high bureaucratic burden for both the party requesting the exemption and the authority taking the decision.

Benefits

[51] Integrated health approaches and alternatives to pesticide use, Cordis, European Commission, ec.europa.eu

A wide range of social, environmental and economic benefits can be expected from a well-functioning SUD. As is often the case, however, only a limited few of those can actually be quantified, and even fewer can be monetised. Attribution and temporal challenges are highly relevant in this regard. A recent study of the European Commission[52] "Study on the cumulative health and environmental benefits of chemical legislation" estimated that the current annual human health and environmental benefits of EU pesticide regulation overall (not restricted to the SUD alone) may be between 15 – 54 billion EUR, equating to between 70 EUR and 250 EUR per EU household.

Figure 9: Overview of benefits of European pesticides regulation



However, this estimation should be seen as highly uncertain and simply to gauge possible orders of magnitude (i.e. that the benefits are likely to be in the order of several billions per year rather than focusing too much on the derived estimate).

As to whether the SUD's costs have been proportionate to its benefits (i.e. positive outcomes), even though large methodological challenges exist, especially for the benefits side, it is estimated that benefits surpass costs when taking into account environmental and health externalities in the benefits.

Looking at costs, the main costs from the SUD accrue for farmers and entail predominantly costs for training and certification (ranging from 0 – 1,000 EUR every three years per farm manager) and inspection of spraying equipment (between 50 and 500 EUR per inspection).

It seems to be the case that while farmers bear many of the economic costs of the implementation of the Directive, economic benefits to farmers (e.g. reductions of pesticide use and associated costs) might not have manifested to the expected extent. At the same time, a large part of those costs also consists of payments towards services such

[52] Amec Foster Wheeler Environment & Infrastructure UK, Study on the cumulative health and environmental benefits of chemical legislation, final report, Publication Office of the European Union, 2017.

as training, inspection etc., meaning that the stakeholders with a positive economic outcome are mostly paid by farmers. Provisions concerning training and the testing of PAE for example may have reduced the risks posed by occupational exposure to pesticides among pesticide users and PAE operators.

Overall, the evaluation concludes that the main costs from implementing the SUD are expected to have been proportionate to the likely benefits generated in terms of risk reduction. While it has not been possible to quantify the environmental, economic and social/health benefits of the achieved risk reduction, a qualitative assessment indicates that the likely benefits outweigh the costs of the SUD. The benefits mainly accrue to the environment and society at large, in particular health and environmental benefits, which in turn generates economic benefits and/or reduces costs.

The direct costs of SUD implementation (training, inspections, IPM) mainly fall on the professional users of pesticides, in particular farmers, who on the other hand have little direct economic benefit from implementing SUD provisions. This is likely one element hindering or challenging the full implementation of the Directive at farm level. It is possible that measures under the recently agreed reformed CAP could incentivise farmers to a greater extent to achieve the more sustainable use of pesticides. Costs for other stakeholders have been limited, in several Member States SUD measures were already implemented and the SUD did not bring significant additional costs.

5.3 Relevance

Consulted stakeholders are generally of the opinion that the SUD's objectives and required actions are still relevant to address current and future needs and problems. The issues mentioned are more related to effectiveness in implementation and enforcement, than to any fundamental flaws in the objectives and the actions in the Directive.

From some PPP industry representatives there are calls for clearer objectives and actions for alternatives to pesticides, to support the realisation of use reduction and risk reduction targets. While it is acknowledged that IPM is part of the solution, it was emphasised that technological development and innovation could also be strengthened and better supported, specifically the use of drones in precision farming. Currently the use of drones for spraying PPPs is considered to fall under the ban on aerial spraying, which in the view of certain stakeholders hinders innovation towards precision farming as a means to achieve a (more) sustainable use of pesticides. Drones are also used under the umbrella term of precision agriculture to monitor crop development, weeds and other pests. Some stakeholders see a need for promotion of the uptake of other technological developments in the area of digitalisation and precision agriculture, as this market is expected to grow and provide new ways of sensing and pest control and better implement the principles of IPM accordingly.

Given that the SUD pre-dated the obligation for Member States to prepare National Strategic Plans (NSPs) under the CAP, there is no explicit link in the SUD to these NSPs which could create overlaps or potentially unexploited synergies with the NAPs that Member States are required to prepare under the SUD. It should also be considered that

NAPs focus on pesticide use generally while NSPs would be expected to be limited to those agricultural uses relevant to the CAP.

An effective SUD has high relevance also on an international level, for example linked to achieving the UN Sustainable Development Goals[53] (SDGs). With its objectives and actions, the SUD can be linked to a range of relevant SDGs, such as zero hunger (SDG 2), good health and well-being (SDG 3), decent work and economic growth (SDG 8), climate action (SDG 13), responsible consumption and production (SDG 12), life below water (SDG 14) and life on land (SDG 15). The range of the relevant goals shows the importance of the SUD for sustainable development, even though achieving some of the SDGs will potentially require trade-offs with other goals. Still, this list makes clear that an effective SUD has high relevance also on an international level, in addition to the supporting external study finding that EU legislation on pesticides (including the SUD) can act as a guide and inspiration for related policies applied in non-EU and developing countries.

An important consideration for the relevance of the SUD arises from the Farm to Fork and Biodiversity Strategies, which both establish targets for the reduction of use of pesticides in general and of the more harmful ones in addition to the risk reduction. The current objectives of the SUD only target risk and impact reduction of pesticide use. The supporting external study found that some stakeholders such as consumer and worker organisations considered that the developments in the political context warrant an inclusion of quantitative use targets in the objectives of the SUD. The Farm to Fork Strategy states that "there is an urgent need to reduce dependency on pesticides …. and reverse biodiversity loss". Reports show that biodiversity loss is – amongst other factors – connected to the use of pesticides. Insect species and in particular pollinators are found to be in decline in Europe and worldwide while EU policy instruments have not yet been able to stop this trend. In their responses to the public consultation, 64% of all respondents strongly agree or agree with the need for pesticide use and risk reduction targets set by the EU. This underlines the significance of the targets set in the Farm to Fork Strategy to continued efforts to reduce risk and use of pesticides. A number of stakeholders interviewed as part of the supporting external study emphasised an evolving public opinion and that consumer attitudes have developed since the SUD was adopted, with more awareness and concerns about sustainable food production and the impact of pesticides on human health and the environment, which can be seen as an additional driver for action.

With regard to the alignment of policies across the EU, the SUD is considered to have acted as a framework for the better harmonisation of policies applied in different Member States. However, the limited specificity of the SUD on provisions such as IPM mean that variations between Member States remain. The Commission's audit reports from several Member States and external study survey responses from pesticide users and Member

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

State authorities confirm this argument. Therefore, the need to harmonise the national approaches to the sustainable use of pesticides continues to exist.

The evaluation concludes that the objectives of the SUD were, and still are, considered highly relevant to address the risks posed by pesticide use to the human health and the environment. The European Green Deal, Farm to Fork Strategy and Biodiversity Strategy have added new expectations and ambitions concerning reducing the use and risk of pesticides, including specific reduction targets. Given that the SUD has preceded all of these new strategies by several years, it can be considered that some updates or amendments to the SUD would be needed to ensure appropriate and continued relevance with these new strategies, ambitions and expectations and to ensure that the SUD is a suitable instrument to meet the ambition of achieving these targets. Some stakeholders also consider that the existing SUD provisions have not kept pace with ongoing technological developments concerning the use and risk of pesticides.

Taking these aspects into account, the current Directive is likely only moderately relevant in addressing future issues and needs.

5.4 Coherence and complementarity

Overall, the Directive is considered to be internally coherent for the majority of its provisions. However, the inability to adequately monitor pesticide use and risk proves to be a weakness to measuring the achievement of the objectives of the SUD. Limitations in available monitoring data hamper an assessment of the uptake of IPM practices and an associated impact on risk reduction. Moreover, the creation of HRIs based on the sales of pesticides instead of their use patterns (unavailable at EU level) undermines the ability to evaluate the effects of the SUD and its measures.

The coherence with most EU legislation was assessed positively with the wide range of other policies it interacts with (water protection, health and safety of workers etc.), with some exceptions for biocides legislation and the current CAP concerning coherence and/ or complementarity. As regards biocides, it should be noted that recital 2 of the SUD states that the scope of the SUD would be extended to cover biocidal products. However this anticipated extension has not taken place and a possible extension to cover biocides has not been included in the scope of the accompanying impact assessment of the possible revision of the SUD. It should be noted that an evaluation of the biocidal products Regulation is scheduled to take place in 2024-25. Concerning the current CAP, the conceived link between the SUD and the CAP is strong, but in practice weak, and the CAP has so far not been key in implementing the Directive (for example through promoting/rewarding more sustainable practices). There are few incentives in place to support a change in agricultural practices specifically regarding the use of pesticides at a broader scale, and so far the CAP has not been specifically used to support a transition towards IPM. Although some Member States have invested in demonstration farms showing promising results, this has not translated into a systemic change in pest control practices. The recently agreed reformed CAP may offer increased potential and more effective instruments to better support achieving the objectives of the SUD in the future.

The SUD has a strong and direct link to environmental and agricultural policy. There is general alignment between policies, however there are few signs of active support in the implementation of the SUD from the related policy areas. There is a similar situation at Member State level in terms of governance, e.g., there is generally a lead ministry (often Ministry of agriculture and food) coordinating the implementation, but the level of coordination and collaboration differs across Member States, including at regional levels. The broad and transversal scope of the Directive makes it challenging to coordinate. Information flows are generally not optimised either, making it difficult to gauge the actual progress on implementation.

As regards complementarity, 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. It should be noted that pesticide statistics currently available at EU-level have several limitations:

- 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 individual 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.

It is concluded overall that the internal and external coherence of the Directive is strong and there are no major inconsistencies or overlaps. The coherence with most EU legislation was assessed positively, with some exceptions for legislation on biocides[54] and the CAP.

EU added value

Before the SUD was introduced some Member States had already adopted measures to reduce the risks for health and the environment linked to pesticide use, while others had not yet taken action, leading to an uneven playing field for pesticide users and the pesticide industry, which could amount to unfair competition for economic actors in the EU. Without EU action it was considered likely that diverging trends would continue, and lead to different levels of protection of health and environment in the EU, with diverging conditions for the main users of pesticides (farmers) as well as other actors involved in the area. It should be noted that, in order to be used, PPPs should be

[54] Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products, OJ L 167, 27.6.2012, p. 1–123.

authorised and the authorisation system is mainly national, despite zonal evaluation and mutual recognition rules.

The supporting external study found that there is broad consensus that the SUD has been considered key in ensuring that the use of pesticides and methods for risk reduction are discussed among stakeholders.

Furthermore, the SUD contributes to achieving a level playing field to further reduce risks from pesticide use, as well as diminishing the discrepancies of the approaches followed across Member States. The added value of the SUD needs to be compared to the instruments that Member States had already in place before the adoption of the SUD. Many Member States had measures in place that formulated requirements to pesticide use that are similar to those contained in the SUD. The previously existing measures however varied between the Member States and were not harmonised or uniform across the EU. While some Member States applied many instruments already and, in a few cases, had established national plans for pesticide management, other Member States had none or only one measure comparable to the SUD's requirements in place. No Member State had all measures contained in the SUD in place at the time of its adoption. The available evidence collected via the supporting external study shows an additional value of the SUD as an EU directive in comparison to national or regional initiatives.

It is concluded that the objectives and concept of the SUD have provided a clear EU added value by creating a common and more harmonised framework for the sustainable use of pesticides.

6. CONCLUSIONS

This evaluation concerns the Sustainable Use of pesticides Directive (SUD), adopted in 2009, with support from an external study. With a view to contributing to the ongoing review of the SUD following the adoption of the Farm to Fork Strategy in May 2020, it assesses the Directive's effectiveness, efficiency, relevance, coherence, and EU added value since its implementation in 2011 to understand how lessons learned can further improve the regulation of pesticide use in the EU.

In addition to the regulatory framework which regulates the placing on the market of PPPs in the EU, and which is based on an a-priori risk assessment for active substances and PPP uses which consider potential effects on human health, animal health, and the environment, the SUD aims to achieve a sustainable use of pesticides by further reducing the risks and impacts of pesticide use on human health and the environment, and promoting the use of IPM or alternative techniques such as non-chemical pesticide alternatives. Specifically, it seeks to improve the monitoring of pesticide use and associated risks, reduce dependence on pesticide use, improve the behaviour and practices of pesticide users during use and post-use, improve the accuracy of PAE, and raise general awareness on pesticide use risks.

In order to reduce the pesticide risks to health and environment, the European Commission adopted the Thematic Strategy on the sustainable use of pesticides as a

priority area under the Sixth Environmental Action Programme of the European Community 2002-2012. The intervention had overall objectives such as to increase awareness of consumers and society at large about the possible risks from the use of pesticides, support forms of agriculture and pest management methods that restrict or better target the use of PPPs, encourage a rational and precise pesticide use and appropriate crop and soil management practices, improve the behaviour of pesticide users (in particular professional users) by ensuring better training and education and improve the quality and efficacy of PAE to enable pesticide users to optimise the effectiveness of the treatments whilst minimising any adverse impact on human health and the environment.

Some limitations of the evaluation and its methodology can be discerned. It has been difficult to comprehensively quantify economic costs due to a lack of robust data. Benefits have been difficult to quantify, as significant knowledge and data gaps exist. There is limited but growing evidence and knowledge about the actual use of pesticides and the risks posed to human health and the environment. A limiting factor is the inability of linking monitoring data to actual pesticide application data, which is not systematically gathered (though required to be recorded by pesticide users) to identify potential associations.

Conflicting views across stakeholders present a challenge in establishing agreed fair and evidence-based results, specifically on what the SUD has and/or should have achieved. Evaluating the effects of the SUD are subject to an attribution challenge which means that when relevant changes can be observed (e.g. changes in quantity of sold pesticides) it is not a given that those changes can be attributed to the implementation of the SUD but could be due to changing climate conditions, other EU or national policies etc. There are also temporal challenges linked to the evaluation of the SUD, such as the somewhat recent implementation of some of the provisions of the SUD and that some pesticides, used in the past but prohibited now, may persist in the environment and have potential effects on health and the environment for long periods.

The Commission's 2006 SUD proposal aimed to implement those provisions of the Thematic Strategy that could not be included in existing instruments or policies. It proposed rules concerning the:

– Establishment of Member State NAPs to set objectives to reduce hazards, risks and dependence on chemical control for plant protection, while allowing for the necessary flexibility to adapt the measures to the specific situations in the Member States.

– Developing Community-wide standards on IPM, and establishment of necessary conditions for implementation of IPM. It was considered that application of IPM by all farmers would result in a better targeted use of all available pest control measures, including pesticides and would contribute to a further reduction of the risks to human health and the environment and the dependency on the use of pesticides.

– Establishment of specific measures to protect the aquatic environment from pollution by pesticides and defining areas of significantly reduced or zero pesticide use in line with measures taken under other legislation (such as the Water Framework Directive, the Birds Directive, the Habitats Directive, etc.) or 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 in order to ensure that they are fully aware of the risks involved.

– Appropriate handling and storage of pesticides and their packaging and remnants.

– Regular inspection of 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 with derogations being possible, aiming to limit the risks of significant adverse impacts on human health and the environment, in particular from spray drift.

The SUD has only been moderately effective as a policy instrument. Weaknesses have been identified concerning the implementation and enforcement of IPM and the limited effectiveness of Member State NAPs. Many Member States do not set quantitative targets or indicators in their NAPs to promote the sustainable use of pesticides or better protect human health and the environment. The evaluation concludes that training has likely helped in improving awareness and reducing potential risks to pesticide users and the environment. Nevertheless, the evaluation concluded that better training and specific record-keeping requirements on IPM could be helpful in ensuring that the overall potential of the SUD and IPM in particular is better achieved. The effectiveness of PAE inspection requirements cannot be fully assessed, given a lack of data of the number of PAE actually in use in all Member States and what proportion of these have been inspected. Stakeholders comment that the SUD has impeded, or at least not encouraged, the application of new technologies and innovation such as precision farming which could potentially reduce the use and risk of pesticides. The SUD prohibition on aerial spraying is considered to have contributed to a reduction of aerial spraying, but uncertainties persist among some stakeholders about whether aerial spraying by drones is permitted or needs a derogation, given that drones are not mentioned in the SUD.

The Commission has issued, in 2017 and 2020, two reports to the European Parliament and the Council on the implementation of the SUD. The 2020 report included a compliance-monitoring index to quantify progress in the implementation by and between Member States, which revealed a particularly poor implementation of the SUD provisions with regard to IPM enforcement (34 % implementation by 2019), PAE (41 %) and NAPs (53 %).

The general provisions of the SUD may have had some beneficial effect on reducing pesticide contamination of the aquatic environment. Given data limitations, it is difficult

to conclude on the extent to which the SUD has better protected human health from adverse effects of pesticides. The SUD has facilitated an improvement in the handling and storage of pesticides, which might be linked to the SUD's requirements for training to be provided and completed. There has been a limited and varying reduction in the sales (as a proxy for use) of pesticides since 2011. It is not clear to what extent the SUD contributed to this reduction as opposed to other polices or sectoral trends. Nevertheless, the SUD has likely contributed to reducing the risk of using pesticides to human health and the environment as suggested by the evolution of HRI 1. The control and enforcement of IPM by Member State competent authorities is considered to be hampered by the principle-based nature of IPM and absence of clear definitions and criteria which makes it difficult to gauge the actual level of implementation.

Concerning efficiency, the main costs from implementing the SUD are considered proportionate to the likely benefits generated in terms of risk reduction. A qualitative assessment indicates that the likely environmental, economic and social/health benefits of the achieved risk reduction outweigh the costs of the SUD. The benefits mainly accrue to the environment and society at large, in particular health and environmental benefits, which in turn generates economic benefits and/or reduces costs.

The direct costs of SUD implementation (training, inspections, IPM) mainly fall on the professional users of pesticides, in particular farmers, who on the other hand have little direct economic benefit from implementing SUD provisions. This is likely one element hindering or challenging the full implementation of the Directive at farm level. Costs for other stakeholders have been limited.

Concerning coherence, the internal and external coherence of the SUD is considered to be generally strong with no major inconsistencies or overlaps. The conceived link between the SUD and the CAP is strong, but in practice it is weak. Potential measures under the CAP could incentivise farmers to a greater extent to achieve the more sustainable use of pesticides.

The implementation and achievements of the SUD have been assessed by the EPRS and ECA which both identified certain shortcomings concerning implementation of the SUD. Audits and fact-finding missions performed by the Commission have also confirmed such shortcomings. The Commission's 2017 and 2020 reports on SUD implementation to the European Parliament and the Council highlighted some progress and also some shortcomings in implementation, progress towards the SUD objective of reducing the risks and impacts of pesticide use on human health and the environment but shortcomings in achieving the aim of promoting the use of IPM and alternative approaches or techniques such as non-chemical alternatives to pesticides. Commission fact-finding missions and audits have identified delays and deficiencies in the practical testing and inspection of PAE, aggravated by the fact that the total number of PAE application equipment is generally not known at national level and even less at EU level. The SUD is criticised by industry stakeholders and pesticide users as limiting technological innovation, (e.g. drones and other precision farming techniques), which

might have the potential to reduce overall dependency on pesticides and associated risks to human health and the environment.

The Commission and other stakeholders have concluded that considerable deficiencies remain in the implementation of the SUD's requirements to apply IPM – particularly with translating the general principles into assessable criteria for supporting, monitoring and enforcing the realisation of IPM at farm level. Another obstacle is the limited availability of practical guidelines considering crop- and sector-specific requirements as well as of integrated approaches to cropping systems combining different techniques to control pests. There is a lack of practical alternatives in form of biological, physical and non-chemical methods for pest control.

Improving the availability of data on pesticide use is particularly important for monitoring chronic poisoning developments that is necessary to evaluate long-term pesticide impacts on human health. A generally high compliance with the provisions on handling and storage of pesticides has been identified. Different measures could be considered for improving the safety behaviour, including better training of professional users, practical guidelines on the safe use of pesticides at farm level and adequate labelling of pesticides for an effective risk communication. Weaknesses in the identification of trends in the use of substances, priority items and good practices are apparent. The current lack of reliable indicators or data on pesticide use or how IPM is implemented in practice for example do not allow to correctly assess progress made. To better achieve the objectives of the SUD, it is considered that crop protection practices would need to change, meaning that pesticides users change how and when they apply pesticides to control pests.

While implementation differs between Member States, the SUD has clearly had an EU added value through establishing a more level playing field and ensuring that all Member States have a policy framework in place for pesticide risk reduction.

The evaluation finds 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, although relevance is hampered by the uneven implementation and limited effectiveness. The European Green Deal, Farm to Fork Strategy and Biodiversity Strategy have acted to highlight and even increase the relevance of the SUD.

Annex 1

Table 1: Overview of costs and benefits identified in the evaluation

		Citizens		Professional pesticide users (predominantly farmers)		Member state authorities[55] [56]		EU institutions		Other stakeholders	
		Quantitative	Comment	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment
Environmental and social benefits to the general population from reduced use and risk of use of pesticides.											
Indirect benefits	Recurrent		There are very few robust estimations on benefits from reduced use and risk of use of pesticides available and only very few of those attempt quantification, and even fewer monetisation. A recent DG ENV study estimated that the current annual human health and	/	/	/	/	/	/	/	/

[55] For most provisions, costs faced by the Member State authorities were hard to assess and report on for the surveyed competent authorities due to the complexity of the policy file.

[56] For most provisions, there are large differences between Member States in terms of costs depending on the extent to which certain provisions had already been in place beforehand in the Member State.

		Citizens		Professional pesticide users (predominantly farmers)		Member state authorities[55] [56]		EU institutions		Other stakeholders	
		Quantitative	Comment	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment
			environmental benefits of EU pesticide regulation may be between 15 – 54 billion EUR, equating to between 70 EUR and 250 EUR per EU household (see footnote 52).								
The EU has financed relevant research in support of the implementation of the SUD, including through Horizon2020 and by financing the "European Innovation Partnership for Agricultural productivity and Sustainability" (EIP-AGRI)											
Indirect costs	One-off	/	/	/	/	/	/	Around 170 million EUR 2014 - 2020	/	/	/
MS authorities faced costs for the preparation of the National Action Plans											
Direct compliance costs	One-off	/	/	/	/	Estimations on costs range from zero since similar plans had already been in place beforehand; to 5 FTE for a year. Also, additi	/	/	/	/	/

		Citizens		Professional pesticide users (predominantly farmers)		Member state authorities[55] [56]		EU institutions		Other stakeholders	
		Quantitative	Comment	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment
						onal costs from follow-up projects to the plans have occurred.					
Member State authorities face costs for the review of the National Action Plans											
Direct compliance costs	Recurrent	/	/	/	/	/	Member States face costs for the revision of the National Action Plans at least every five years.	/	/	/	/
Member State authorities face costs for setting up a training and certification system.											
Direct compliance costs	One-off	/	/	/	/	In total five replies provided an estimation in the survey wit MS authorities, all of them around 1 to 2 FTE for one year.		/	/	/	/
Member State authorities face costs for maintaining the training and certification scheme.											
Enforcement cost	Recurrent	/	/	/	/	Member States report costs	/	/	/	/	/

		Citizens		Professional pesticide users (predominantly farmers)		Member state authorities[55] [56]		EU institutions		Other stakeholders	
		Quantitative	Comment	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment
						for maintaining the training and certification scheme, estimates average 1 FTE, stretching from 0.1 to 3 FTE.					
Professional users have to attend trainings (initial and additional training) on the sustainable use of pesticides and get certified.											
Direct compliance costs	Recurrent	/	/	Large differences between Member States and even sometimes within Member States. Costs for participants to the trainings reach from zero (publicly financed) to 1,000 EUR per training.	/	/	In cases where trainings are publicly organised or financed, the public authorities bear the costs of the trainings. However, in most Member States the costs for the training and certification system are fully	/	/	Distributors and advisors are also subject to training obligations through the SUD. For both, distributors and advisors, estimations on costs per training reach from zero to 500 EUR.	(Training institutions receive the fees paid by participants)

		Citizens		Professional pesticide users (predominantly farmers)		Member state authorities[55] [56]		EU institutions		Other stakeholders	
		Quantitative	Comment	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment
							recovered through fees.				
Member State authorities face costs for setting up a pesticide spraying equipment inspection scheme.											
Direct compliance costs	One-off	/	/	/	/	/	Only few estimates on direct costs were received but it was mentioned that Member States faced material costs for setting up the system which include costs for purchasing mobile test stations, software, reference sprayers and nozzles, and laboratory equipment	/	/	/	/
Member State authorities face costs for maintaining the pesticide spraying equipment inspection scheme.											

		Citizens		Professional pesticide users (predominantly farmers)		Member state authorities[55] [56]		EU institutions		Other stakeholders	
		Quantitative	Comment	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment
Enforcement cost	Recurrent	/	/	/	/	/	Five estimates were provided by Member State authorities, which range from 0.5 FTE to 800 thousand EUR annually	/	/	/	/
Pesticide spraying equipment needs to be inspected at least every three years											
Direct compliance costs	Recurrent	/	/	Costs per inspections vary widely between Member States. Estimates reach from 25 to 150 EUR (based on survey results); another source[57] provides estimates	/	/	/	/	/	/	(Inspection institutions receive the fees paid for the inspections)

[57] 7th SPISE ("The Standardised Procedure for the Inspection of Sprayers in Europe" Working Group) workshop, held in 2018 in Athens, p.12.

		Citizens		Professional pesticide users (predominantly farmers)		Member state authorities[55] [56]		EU institutions		Other stakeholders	
		Quantitative	Comment	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment
				between 50 and 500 EUR.							

Annex 2

Harmonised risk indicators: description and calculation methodology[58]

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 2 below).

Table 2: 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

eurostat

[58] Methodology for calculating harmonised risk indicators for pesticides under Directive 2009/128/EC, 2021 edition, manuals and guidelines, Eurostat, European Commission.

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.

Harmonised Risk Indicator 1 (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. The 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 2 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 (PPPAMS) 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 2 by the relevant weighting set out in Row (vi), followed by the aggregation of the results of these calculations.

Annex 3

Table 3 Main deadlines for implementation of SUD provisions as listed in the initial legal act[59]

Article	Title	Enforcement date	Obligation
23	Transposition	14 Dec 2011 (*Corrected to 26 Nov 2011*)	Deadline for transposition of the SUD obligations into national laws, regulations, and administrative provisions
4	NAPs	14 Dec 2012 (*Corrected to 26 Nov 2012*)	MS shall communicate their NAPs to the EC and other MSs
		14 Dec 2014 (*Corrected to 26 Nov 2014*)	COM shall submit to the EP & the Council a report on information communicated by the MSs in relation to NAPs
		14 Dec 2018 (*Corrected to 26 Nov 2018*)	COM shall submit to the EP & Council a report on experience gained by MSs on the implementation of national targets
5	Training	14 Dec 2013 (*Corrected to 26 Nov 2013*)	MSs shall establish certification systems and designate CAs responsible for their implementation
6	Requirements for sales of pesticides	14 Dec 2015 (*Corrected to 26 Nov 2015*)	(1) MSs shall ensure that distributors have sufficient staff in their employment holding a certificate on training (Article 5(2))
		14 Dec 2015 (*Corrected to 26 Nov 2015*)	(2) MSs shall take necessary measures to restrict sales of pesticides authorised for professional use to persons holding a certificate referred to in Article 5(2)
7	Information and awareness-raising	14 Dec 2012 (*Corrected to 26 Nov 2012*)	COM, in cooperation with MSs, shall develop a strategic document on monitoring and surveying of impacts of pesticides use on human health and the environment
8	Inspection of equipment in use	14 Dec 2016 (*Corrected to 26 Nov 2016*)	MSs shall ensure that pesticide application equipment has been inspected at least once.
9	Aerial spraying	As from 2013	Aircraft shall be equipped with accessories that constitute the best available technology to reduce spray drift
14	IPM	30 June 2013	MSs shall report to the COM on the implementation of measures to promote IPM (Articles 14(1) and 14(2))
		01 Jan 2014	MSs shall describe in their NAPs how IPM principles are implemented by professional users
17	Penalties	14 Dec 2012	MSs shall notify provisions to the COM on penalties applicable to infringements of the national provisions

[59] 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.9.

Article	Title	Enforcement date	Obligation
			adopted pursuant to the SUD

Annex 4

Table 4: Development of IPM guidelines in the Member States[60]

Member State	Number of IPM guidelines	Crops for which guidelines have been developed	% of utilised agricultural area (UAA) for which IPM guidelines have been developed (if available)
Austria	2	Cereals, vineyards	
Belgium	3	No further detailed 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	
Czechia	31	Range of field crops, permanent crops and vegetables	95%
Denmark	60-70	Guidelines covering all major crops	
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	
France	5	Guidelines for arable crops, viticulture, vegetable growing, fruit growing and tropical crops	
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; woods/forests; storage protection; potatoes; arable farming; vineyards; hops; ornamental plants	
Greece	7	Vineyards, tobacco, cherry, rice, kiwi, olives and cotton	24%
Hungary	40		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	
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	
Luxembourg	0		
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	

[60]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.24.

Member State	Number of IPM guidelines	Crops for which guidelines have been developed	% of utilised agricultural area (UAA) for which IPM guidelines have been developed (if available)
		addition, crop-specific Guidelines were available, which are developed by other stakeholders	
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	
Romania	1	General IPM guidelines, crop specific guidelines under development	
Slovakia	0		
Slovenia	4	No further details on crops/groups of crops covered	
Spain	26	Guidelines including forestry and agricultural crops	80%
Sweden	10		36%