

impact assessment

on the removal of pesticides by the new EU regulations
on the sustainable use of plant protection products

comissioned by UEFA and the European Golf Association (EGA)

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- KNVB - Koninklijke Nederlandse Voetbalbond – Royal Dutch Football Association
- DBU - Dansk Boldspil-Union – Danish Football Association
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- FFF - Fédération Française de Football – French Football Federation
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Golf National Associations

- German Golf Association
- Royal Spanish Golf Federation
- Swedish Golf Federation
- Netherlands Golf Federation
- Danish Golf Union
- Golf Ireland
- French Golf Federation
- Italian Golf Federation
- Finnish Golf Union
- Royal Belgian Golf Federation
- Swiss Golf
- Czech Golf Federation
- Portuguese Golf Federation
- Austria Golf Association

Golf Organisations

- European Golf Association
- The R&A
- International Golf Federation
- Federation of European Golf Greenkeepers Associations
- European Tour Group
- Ladies European Tour

Data

- GEO Foundation
- Chemservice



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Appendices

1. Executive summary

The European Union is currently considering a proposal tabled by the European Commission on 22 June 2022 for a new Regulation on the sustainable use of plant protection products (PPPs) and amending Regulation (EU 2021/2115. The existing Sustainable Use Directive (Directive 2009/128/EC, in force since 2009) includes all sports grounds (including golf courses and football pitches, from community level to professional and elite venues) under a list of “specific areas” where conventional PPPs’ use needs to be minimised. The Commission’s proposal for a Regulation to replace that Directive seeks to go further by including sports grounds in a list of “sensitive areas” where the use of all conventional PPPs would be banned. Following the publication of the Commission’s proposal, a non-paper followed to put forward some potential adjustments to the proposed regulation. Among a number of suggestions for non-sporting areas, it confirmed that sport was still considered as relevant to be included in sensitive areas, but that low risk chemicals and biologicals could be used on sports turf surfaces.

The Commission’s proposal is now being discussed by national governments of the EU and members of the European Parliament who will jointly decide on any final measures. One of the prominent themes arising in the interinstitutional discussions relates to the need for greater evidence regarding the impact of the proposed rules. Following the European Commission’s official feedback period on the proposal from June to September 2022, it was decided that sport would carry out an impact assessment on the proposed inclusion of sports grounds in the list of sensitive areas. A key purpose being to provide analysis and data to aid with further discussions with policymakers’ on the impacts of the Commission’s proposal.

In this context, and with the explicit objective of constructively assisting EU policy discussions, STRI has been commissioned by the European Golf Association (EGA) and Union of European Football Associations (UEFA) to undertake an impact assessment across multiple different EU and EEA countries for sports that use natural turf as a playing surface. Whilst the focus of the impact assessment is sport in general, the framework has been based on football and golf, which are two of the leading participation sports across the EU played on natural turf and span community level through to facilities for elite professional sport.

The key objectives of this impact assessment have been to:

- summarise how natural grass sports surfaces are managed in relation to PPPs and the Integrated Pest Management (IPM) methods employed by turf managers,
- evaluate how and how much PPPs are being used on sports surfaces,
- assess the technical, operational and socio-economic impacts a withdrawal of PPPs from natural grass sports surfaces,
- review the challenges and opportunities associated with withdrawing PPPs from natural grass sports surface managers.

The intention of the impact assessment has been to put forward evidence for how sport uses PPP, is actively engaging in reduction and to allow informed discussion on policy options on PPP use on natural grass sports surfaces.

The impact assessment was carried out using publicly available data, as well as engaging with individual national associations, stakeholder organisations and sports facilities across 14 different EU and EEA countries. A review of existing literature and data sources was carried out to provide a baseline on PPP usage in natural grass sports. Targeted data was obtained from both questionnaires to individual football clubs and through interviews with both golf and football national associations/ stakeholders. From these data and published information, the extent of PPP use was assessed along with the potential impacts of a complete withdrawal of PPPs from sports use. Finally, a review of existing technologies and IPM methods was carried out and fed into an analysis of the challenges and opportunities presented by withdrawal of PPPs from sport.

The Commission’s non-paper introduced the concept that low-risk and biological products would be available for sensitive areas. The impact of having these types of solutions available to sports turf managers has been considered throughout the impact assessment. However, whilst the use of low-risk and biologicals may be part of a future integrated approach, currently the ability of these types of products to fill the gap left by a withdrawal of PPPs is limited.

There are no low-risk products used on turf primarily because the substances do not have efficacy for the pest, weed or disease issues encountered or they are not suitable for application to turf. Biological products are coming into the market for turf use and whilst their use is increasing and used to supplement PPPs and other IPM based approaches, their viability as practical turf management solutions are constrained by a range of factors including:

- their efficacy and usage window
- high cost and requirement for frequent application

- restrictions concerning time of year they can be applied
- level of pest, weed and disease problem they be used to treat
- limitations on storage and application

All these considerations has meant that the impact of low-risk and biologicals is limited on being able to mitigate the effects of potential PPP withdrawal, as technology and innovation currently stands. These technologies are a candidate for future innovation and development but are not a direct replacement for chemical PPPs.

To be of use to EU policymakers’ ongoing discussions, the impact assessment has needed to be conducted within time and geographic scope limitations. The selection of countries analysed has to an extent been made based on the relevant football and golf national associations and stakeholders’ capacity to efficiently feedback and effectively access relevant data and information. Findings could therefore be subject to change from additional research in other countries and further data collection and analysis could be deemed necessary (i.e. to look deeper into specific segments of the football and / or golf ecosystems and / or at specific countries / geographies).

The risk of exposure of bystanders and vulnerable groups has been put forward as one of the drivers behind the European Commission’s proposal. It is therefore sensible to review the current situation with PPP route to market and data needed to support applications. The current regulatory framework for bringing PPPs to the market means that active substances have to be approved for use. The formulated PPP then has to be authorised in each Member State to allow it to be used in that country. At each stage of this process, the impacts of the active substance and formulated

product on human and bystander health (including vulnerable groups) has to be assessed as being safe and acceptable, in addition to the compound or product being assessed for its impact on wildlife and the environment. Further protections for human health are enshrined in the hazard-based approach used, rather than the old risk-based approach. Now, only the harm done is assessed and no mitigations can be considered. This is already a rigorous process, as it should be as it concerns safety, that can take a long time to be completed and requires a significant quantity of evidence and data.

Even before IPM was a concept, sport and turf management was already enacting its central tenets, such as preventing problems before they occur, managing the plant and the growing environment to promote a healthy plant and focusing on cultural methods of pest, weed and disease management. When IPM was introduced as a concept it has been adopted as best practice by sport. There is a considerable amount of scientific and industry articles and literature giving the latest developments, ideas and concepts in IPM. (over 1900 articles). It also forms a large part of the conversation at seminars, workshops and conferences and is a critical part of modern sports turf agronomy. Sport aims to be a responsible user of PPPs and embraces the need for IPM and working towards meaningful reductions in PPP usage.

When assessing the use of PPPs and the impact of their potential withdrawal for sports use under the European Commission's proposal, it is essential to understand some of the fundamentals of natural grass sports turf maintenance. Turf management is different to growing food crops, whether they are for human or animal consumption. Sports turf is a delicate balance between

delivering a surface that is suited to playing sport on (ball roll characteristics, turf strength and resistance to wear) whilst still being a viable biological entity. This can often push biology to the extreme edges of what plants can withstand making them more vulnerable to pest, weed and disease pressure. To achieve year round and all weather safe and playable permanent turf surfaces requires integrating many agronomic and environmental factors and working with natural cycles and rhythms.

The impact assessment has demonstrated that PPPs are still being used in sport, because there are some pest, disease and weed challenges that cannot currently be managed with cultural or non-chemical controls alone. The evidence from the impact assessment shows that significant strides have been made in both developing IPM based technologies for sports surfaces and that many facilities/ countries can demonstrate reductions in the amount of PPP being used. Some countries such as Denmark, Netherlands, France and Belgium have made great strides towards extensive PPP reduction. Other countries can also demonstrate reductions but not to the same extent. The impact assessment has shown that sports turf managers understand the need to reduce the use of PPPs to a minimum, not only on environment grounds, but also financially as they are expensive solutions. Grassroots sports tend to use PPPs very rarely with greater use coming from higher end sport. This is because high end and elite turf sports need to produce safe, consistent and high performance surfaces, and in the case of stadia pitches, this has to be done in a highly challenging growing environment, whereas the focus at grassroots is often for safe and acceptable turf for that level of play and within the available resources at that facility. World class players can only perform to their true potential and safely on high quality playing surfaces.

The impact assessment demonstrated that all countries

included in the study are on the pathway to PPP reduction. Where countries have made greater strides, this has come through gradual reductions over an extended period of time (5 years or more). This is critical to understand, as the success has been forged with time. Turf is a mini-ecosystem and it needs time to be conditioned to operating in a world with reduced PPPs. The impact assessment has highlighted that rapid and sudden changes are likely to result in much greater impacts, as can be seen in countries or regions where PPPs have been suddenly banned (for example the Wallonia region of Belgium).

When considering the impact of a withdrawal of PPPs from sport, a wide range of moderate to high severity impacts have been identified by this study, especially in the short-term (measured in years). These impacts range from difficulties in managing turf in more extreme climates such as the cold north in Scandinavia and Mediterranean countries where surfaces and grass have to withstand hot summers and cool winters, through to managing severe pest, weed and disease problems with existing nonchemical solutions and the socio-economic impacts in tourist regions where sport plays an important role in the local economy. The most severe impacts for golf and football have been highlighted in the table below.

However, even with these impacts, sport continues to reduce PPP usage and working with IPM to promote best practice turf management. The impact assessment found that

Impact	Comment
Effective disease control under high disease pressure or a rapid infection.	There was concern that rapid spread of a disease under conducive conditions may exceed the capacity of non-chemical controls or biologicals to halt the spread of disease.
Control of disease in challenging enclosed stadia environments.	Stadia environments are both a poor and stressful growing environment for grass (poor light and airflow, coupled with player damage) and conducive to fungal pathogen growth. Often in this environment disease attacks can be severe and happen rapidly resulting in severe turf damage which can threaten the safe playing of sport.
Controlling diseases and weeds under extremes of climate (cold winters and hot summers).	Under extreme weather conditions, effective control of disease can be more challenging and there are greater risks of turf damage due to secondary turf stress factors such as heat, cold, dehydration etc.
Control of disease with non-chemical or biological options in winter when grass is much less active.	Biocontrols are subject to the same environmental stresses as grass and pathogen and if not adapted for winter use, the biocontrol may not survive long enough to be effective. Likewise, if the biocontrol needs the plant to be active (if it stimulates part of the plant's biochemistry) then its efficacy will be reduced when the plant is not active.
Managing disease during non-sporting events.	Often PPPs are a vital part of managing disease activity during non-sporting events on turf. Turf is covered to provide access to staging and pedestrians and this brings severe disease risk. PPPs are essential in the build up to an event of this type and in preventing disease and managing any outbreaks afterwards.
Impact on the smooth and true roll of a golf ball on the golf green putting surface.	Without PPPs for managing outbreaks of disease or weed invasion, certainly in countries looking to lower PPP usage but where surfaces are still being conditioned, there was concern that increased scarring or weeds would negatively affect how a golf ball rolled over the surface.
Prevention of loss of grass cover resulting in safety issues with surfaces.	Player traction and therefore the risk of slipping and having an injury was a concern, especially in professional football where the value of players is very high and the fitness of these elite athletes is a primary concern. If grass cover was lost due to difficult to control disease activity in stadia there were concerns over the playability and safety of pitch surfaces as the loss of grass cover would likely lead to a loss in surface stability and ultimately traction.

sports stakeholders recognized the need to further reduce PPP usage and that this should be done at a phased and gradual pace, which has worked for countries such as Denmark, Netherlands, France and Belgium (Flanders). Results of the impact assessment demonstrated that sports want to reduce PPP use, but this needs to be done over an extended period. The evidence shows that a gradual process is needed as turf and its ecosystem needs to acclimatise and be conditioned. Working with biology and a permanent playing surface requires time and the conditions for success to be created before continuing to the next phase of PPP reduction.

Aesthetic impacts on sports turf surfaces are not a primary reason to use PPPs, but are a consideration for surfaces at certain levels of sport (typically at higher levels, where tourist players are a major component of the player base and for televised events). At grass roots and lower level facilities, such as community football pitches, visual concerns are not a priority over functional and playing characteristics of the turf, i.e. maintaining a safe and playable surface. At this level of football, there are multiple limiting factors on using PPPs, in addition to minimising their use as part of IPM, such as costs and resource constraints, as well as player expectation. Aesthetic concerns have not been a major priority for PPP usage, but at some levels and for some events, the importance of visual effect has a greater impact.

The impacts of a complete ban are likely to be disproportionately high and will potentially have wide ranging and unintended ramifications.

These impacts included:

- excessive financial pressures on individual sports facilities at a time of increasing operational and staff costs resulting in risk of facility closure,

- severe financial impacts on countries where golf tourism is a major component of national or regional income,
- increased turf pressures associated with climate change resulting in less ability to effectively control existing or new turf issues,
- multilayered pressures such as extended turf disease and growing season, overlaid with increased water use due to the extended growing season coupled with water use restrictions due to climate change,
- impact of health and wellbeing of players who may not be able to afford to play sport to the same extent as before or who may be disinclined to play if surface functional quality is severely reduced.

All national sports associations were willing and ready to explore further reductions. The level and pace of reduction was open to discussion and the starting point for reduction has to be considered. Those countries that have already achieved high levels of PPP reduction are unlikely to be able to achieve the percentage reductions of other countries as their usage of PPPs is already at a minimum. The impact assessment has highlighted that some countries have achieved significant reductions in PPP usage in sport. Denmark has achieved reductions of 90%. Since 2009 France has reduced fungicide usage by 56%, herbicide usage by 65%, and insecticide usage by 100%. Ireland has achieved up to 90% reduction in fungicide use and 36% reduction in herbicide use over 7 years. Netherlands have achieved an 80% reduction in PPP usage from 2015 – 2020. Sweden has reduced PPP usage by circa 50%. In general, based on responses by national associations to the questionnaires and interviews carried out as part of this impact assessment, it was felt that in countries where further reductions were achievable, a reduction of

50-60% PPP usage would be possible over a 6-10 year timeframe.

To achieve further PPP reduction, let alone a complete withdrawal, needs much greater support for IPM solution innovation and development, especially in a small market (relative to agriculture) like sports turf. Supporting innovation and technological development needs to encompass creating commercial stimuli, such as accessible grant funding support, to help reduce or remove financial or market driven constraints. The legislation and pathway to bring new and innovative technologies to the market needs to be streamlined. The solutions also need to be effective and when used in combination can provide the required pest, weed and disease control. There are innovations and new technologies being developed, but they need support to get them to market quicker and at an affordable price to allow turf managers access to them.

The impact assessment has shown that sport plays a significant role in the health and wellbeing of citizens of the EU. Engagement of citizens with sport and physical activity has been acknowledged as being a cornerstone of maintaining and improving the health of people in the EU. Playing sport and taking part in physical activity has been scientifically linked to a wide range of health benefits from reducing the risk of some cancers and developing type 2 diabetes, to helping prevent and manage mental health issues. Socio-economic studies have shown that sport actively contributes to the economy of the EU. It is estimated that each golf course contributes around €1 million in revenue per year to the local economy. The revenue value of golf increases dramatically in areas where golf tourism is a major component of the economy and in these countries a net benefit has been estimated to be between €13 billion to €18 billion. Football as well has been shown to have a net benefit of around €44 billion when you combine economic, social and health impacts.

The results of the impact assessment showed that sport plays an important role with regards to biodiversity

and environmental stewardship. Golf courses for example are open areas, often in or near urban areas/settlements, offer great potential for encouraging wildlife and pollinators, and providing sympathetically managed habitats. Golf courses have been embracing habitat creation and biodiversity gain for decades. This is seen by both turf managers and many players as a significant benefit of their facility. This has been nurtured and grown by National Federations and experts alike. One example has been the success of the GEO Foundation certification which provides a formal pathway for golf clubs to get their environmental, sustainability and biodiversity efforts acknowledged and accredited. Sports facilities are also beneficial for creating other ecosystem services and societal benefits. For example, in urban environments flooding can be a major problem, but large open areas of permeable material, which if managed sympathetically, can provide huge water attenuation and flood risk mitigation value.

In summary, the impact assessment has shown that sport is utilising IPM methods and is achieving reductions in PPP usage. Sport has embraced IPM and there are new technologies being developed, but there are not the range of tools currently available with the required efficacy at cost effective price points to replace PPPs. This development will need to be supported by the EU to help reduce barriers for entry and encourage innovative technologies to come to market more quickly. There are significant impacts on sport at all levels of a PPP withdrawal that will certainly impact on playing surfaces, the operation of natural grass sports facilities and on their financial resilience. The potential withdrawal of PPP cannot be isolated from other global and regional challenges such as climate change, inflationary pressures and resource availability. These are all key drivers for change and interact with how natural sport surfaces are produced, maintained and the associated businesses are operated.

2. Introduction

This chapter covers the following topics:

- The organisations behind the impact assessment
- The aims and objectives of the impact assessment
- Contextualisation of the legislation around PPPs and the Sustainable Use Regulation
- The approach taken when carrying out this impact assessment.

Natural turf sports surfaces, such as golf courses, football and rugby pitches, equestrian surfaces, cricket pitches, tennis courts etc, use a plant, grass, to provide different technical requirements:

- Surface stability to physically hold the surface together
- Grip to the player/horse
- Cushioning to absorb impact forces
- A smooth surface over which a ball can roll or a player/horse can run.

These attributes of natural grass are relevant for all levels of sport, from community level through to elite professional sport. For each attribute, the health and strength of individual grass plants contributes to the overall functioning of the playing surface. To produce a safe and consistent natural grass sports surface, there has to be sufficient grass cover (the grass cover threshold depends on the sport and level that it is being played), with the grass plants being healthy to ensure they are resilient to abiotic and biotic stresses and robust to withstand usage.

As a result, plant protection products (PPPs) have been a vital tool to help ensure healthy turf, which provides a safe and consistent playing surface. As natural grass sports surfaces have evolved to meet modern demands for all weather, year round usage, the challenges of managing both abiotic and biotic stresses have become more difficult.

Over recent decades, the use of plant protection products has also gone hand in hand with integrated pest management (IPM). Often for sports turf, this has been referred to as integrated turf management (ITM) due to the depth and range of factors that need to be considered when managing a sports surface. IPM/ITM has been a key strategy when managing modern sports surfaces, with its links back to some of the more traditional methods for turf management.

The proposal for a Regulation on the sustainable use of plant protection products and

amending Regulation (EU) 2011/2115, looks to limit the use of PPPs across the EU and, in sport, this could result in a withdrawal of these products. This impact assessment looks to evaluate the likely effects of a withdrawal of PPPs (excluding low-risk or biological products). It aims to give a balanced and realistic view on these impacts, whilst acknowledging that sport has a history of adopting and working with IPM/ITM approaches to help prevent problems that would require application of a PPP and to help reduce the amount of PPP being used.

A good example is to consider modern elite level stadia that have evolved into amphitheatres for sport. However, in achieving this architecture with a focus on spectator comfort and experience, the growing environment created puts greater stress on the grass plant and therefore greater susceptibility to turf problems, such as fungal disease. Technology has helped to mitigate some of the risk, but there are times when the use of plant protection products has been essential to ensure a safe and consistent playing surface.



2.1 Who are the organisations behind the impact assessment?

This impact assessment is being carried out on behalf of sports that use natural turf as a playing surface. It covers the general impacts on natural turf based sports, as well as specific impacts on certain sports. Whilst the focus of the impact assessment is sport, the framework has been based on football and golf, which are two of the leading participation sports across the EU and span community level through to facilities for elite professional sport.

Details of the three organisations involved with the impact assessment are outlined in the following sections. The European Golf Association and UEFA have commissioned the impact assessment, whilst STRI has carried out the assessment work on their behalf.

2.1.1 European Golf Association (EGA)

The European Golf Association is the representative body for European national amateur golf associations, federations or unions. The EGA has 49 member countries as part of the Association.

The EGA's main activities include:

- Arranging and co-ordinating both amateur and professional tournaments and international matches (Championship and Professional Technical Committees)
- Reviewing European aspects of Rules, Amateur Status and Handicapping in R&A and EGA Committees

- Information and communication:
 - amongst member federations
 - between the EGA, R&A and the International Golf Federation
 - between the Executive Committee, the Championship Committee and EGA Committees
 - amongst press and media
 - through regular circulation of information of general interest such as circular letters, précis, regulations and calendars
- Education often in the form of golf conferences, seminars, meetings between member countries
- Golf Course Management in collaboration with the R&A
- Course Rating and Handicapping: Set-up and management of the EGA Handicap System
- Building and maintaining good relationships with the professional golfing bodies.
- Integration of European emerging golf countries in the EGA
- Information centre for our member federations to answer questions in various fields of the game of golf (statistical, technical etc).

The mission of the EGA is to “further promote golf at the highest level of amateur competition, strengthen EGA member unity, coordinate best practice for the development

of golf throughout Europe and foster sustainable, viable and efficient operating methods”.

The EGA is very active in promoting and assisting members on all aspects of sustainability in golf. A particular focus has been further enhancing sustainability on the golf course and in turf management.

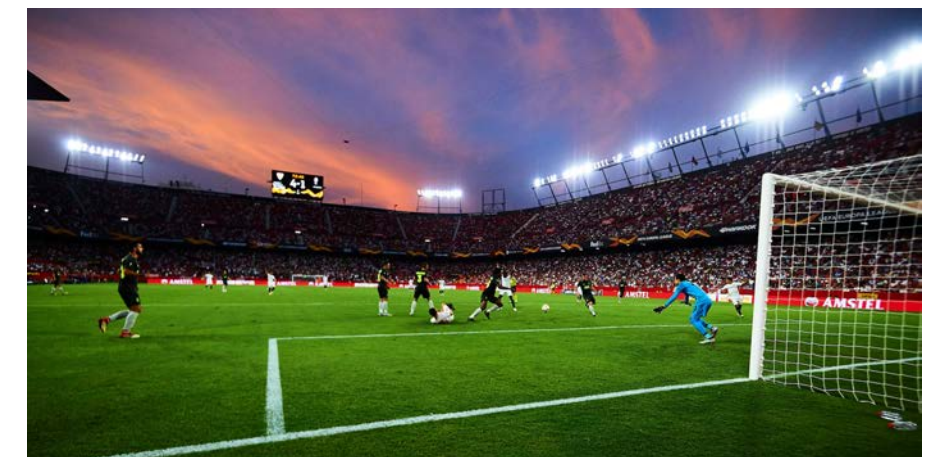
2.1.2 UEFA

UEFA – the Union of European Football Associations – is the governing body of European football and the umbrella organisation for 55 national associations across Europe.

UEFA’s objectives are, “among other things, to deal with all questions relating to European football, to promote football in a spirit of unity, solidarity, peace, understanding and fair play, without any discrimination on the part of politics, race, religion, gender or any other reason, to safeguard the values

of European football, promote and protect ethical standards and good governance in European football, maintain relations with all stakeholders involved in European football, and support and safeguard its member associations for the overall well-being of the European game”.

UEFA recognises the need to champion and enhance sustainability across all aspects of football and has recently published its Football Sustainability Strategy 2030 – ‘Strength through Unity’. UEFA’s football and sustainability mission states that it has a “longstanding commitment to manage all its activities and events based on the core value of respect and the principles of sustainability, leading by example and ensuring a positive legacy for the future. Our mission is to inspire, activate and accelerate collective action to respect human rights and the environment within the context of European football”.



2.1.3 STRI

STRI, formerly the Sports Turf Research Institute, is a global research and consultancy business that works across all types of sports surfaces and associated green infrastructure. STRI are global leaders in planning, designing, building, and maintaining sports surfaces. Research and science underpins all of the work STRI undertakes. STRI has been active in sports surface research and consultancy since its inception in 1929 and is in a unique position to understand the scientific, technical and practical considerations with designing and managing sports surfaces, as well as intimately

knowing the turf product/ solution development and supply industry.

STRI has always focused on best practice management of turf, integrating the latest developments and knowledge in the advice given to end-users. Over recent decades, sustainable management and how to meet current and future challenges has become an even greater focus of the work STRI undertakes. Latterly, this has involved linking the value and benefit of sports facilities and green infrastructure to provide enhanced ecosystem services and sustainable solutions at sporting venues.



2.2 Aims and objectives of the impact assessment

The aim of the impact assessment is to give a balanced and realistic view of the effects of PPP withdrawal on natural grass sports from a technical, operational, and socio-economic standpoint.

The objectives of the impact assessment are to:

- Establish the principles of natural turf sports surface management and how they relate to PPP usage
- Outline across the EU how PPPs are being used, taking into account the different climate zones found in the EU, as well as the national legislative landscape that governs PPPs
- Review available evidence on how much PPPs are being used and trends on reduction in usage
- Evaluate how IPM/ITM strategies are implemented by sport and how they affect PPP usage
- Outline the alternative technologies available to help replace or reduce the need for PPPs
- Assess the likely impacts of PPP withdrawal on technical and operational management of turf, accepting that low-risk and biological approaches will still be available
- Assess the likely socio-economic impacts of PPP withdrawal in relation to natural grass sport
- Review the challenges and opportunities associated with PPP withdrawal in sport, including potential mitigation strategies and policy requirements.



2.3 Summary of the changes being introduced by the Sustainable Use Regulation



The proposal for a Regulation on the sustainable use of plant protection products and amending Regulation (EU) 2021/2115, hereafter known as the European Commission's proposal or Sustainable Use Regulation, was put forward on 22 June 2022. Its intention will be to replace the Directive 2009/128/EC, the Sustainable Use Directive (SUD).

The European Commission's proposal has four objectives (as reproduced directly from the explanatory memorandum of the proposal):

- “The first objective is to:
 - i. reduce the use and risk of chemical pesticides, in particular those containing more hazardous active substances;
 - ii. increase the application and enforcement of integrated pest management (IPM); and
 - iii. increase the use of less hazardous and non-chemical alternatives to chemical pesticides for pest control.
- The second objective is to improve the availability of monitoring data, including on:
 - i. the application, use of, and risk from pesticides; and
 - ii. health and environmental monitoring. This will ensure a better framework to measure progress.

- The third objective is to improve the implementation, application and enforcement of legal provisions across all Member States to improve policy effectiveness and efficiency.
- The fourth objective is to promote the adoption of new technologies, such as precision farming that makes use of space data and services (including geospatial localisation techniques), with the aim of reducing the overall use and risk of pesticides”.

The aims of the European Commission's proposal are (as reproduced directly from the explanatory memorandum of the proposal):

- i. “replace the SUD in regulating the use of pesticides; and
- ii. better align with the objectives of the European Green Deal and Farm to Fork Strategy.

This proposal aims to reduce the risks from – and impacts of – pesticide use on human health and the environment by:

- iii. achieving pesticide-reduction targets contained in the Farm to Fork Strategy; and
- iv. promoting the use of IPM and alternatives to chemical pesticides”.

‘SENSITIVE AREA’

Defined as an area used by the general public, such as a public park or garden, recreation or sports grounds, or a public path.

The intention of the European Commission's proposal is to drive change in the use of plant protection products to help meet EU strategic aims outlined in The European Green Deal, Biodiversity 2030 and Farm to Fork strategies. This results in a tougher set of measures that will need to be implemented by Member States, as compared to the SUD, where there was greater ability for Member States to interpret the intentions of the SUD, and therefore its implementation has not been as consistent as the European Commission would like.

For sport, there are some major changes that have been put forward in the European Commission's proposal and the non-paper arising following Council Working Party meetings. These mainly relate to the ‘sensitive area’ clause within the legislation that would see either a complete ban on PPPs or restricting use to low-risk and biological options. The proposed legislation and what it means for sport are outlined in section 2.3.2.

2.3.1. What are we doing now?

Before discussing the legislation on plant protection products, it makes sense to ensure that there are clear definitions in place. There are a number of terms used when talking about controlling and managing pest, weed and disease problems in any crop or sports turf surface. It makes sense to be clear about what these terms mean.

The European Commission Food Safety website defines three of the most commonly used terms (pesticide, plant protection product and active substance):

“A **‘pesticide’** is something that prevents, destroys, or controls a harmful organism (‘pest’) or disease, or protects plants or plant products during production, storage and transport.

The term includes, amongst others: herbicides, fungicides, insecticides, acaricides, nematocides, molluscicides, growth regulators, repellents, rodenticides and biocides.”

“**Plant protection products** are ‘pesticides’ that protect crops or desirable or useful plants.

They are primarily used in the agricultural sector but also in forestry, horticulture, amenity areas and in domestic gardens.

They contain at least one active substance and have one of the following functions:

- Protect plants or plant products against pests / diseases, before or after harvest
- Influence the life processes of plants (such as substances influencing their growth, excluding nutrients)
- Preserve plant products
- Destroy or prevent growth of undesired plants or parts of plants.



They may also contain other components including safeners and synergists.

EU countries authorise plant protection products on their territory and ensure compliance with EU rules.”

“An **active substance** is any chemical, plant extract, pheromone or micro-organism (including viruses), that has action against ‘pests’ or on plants, parts of plants or plant products.

Before an active substance can be used within a plant protection product in the EU, it must be approved by the European Commission.

Substances undergo an intensive evaluation and peer-review by Member States and the European Food Safety Authority before a decision can be made on approval.”

This website also highlights a key difference between the terms pesticide and plant protection product:

“The term ‘pesticide’ is often used interchangeably with ‘plant protection product’, however pesticide is a broader term that also covers non plant / crop uses, for example biocides.”

Now the terminology is clear, it is important to understand the multiple layers of regulation and

protections in place to protect human health, wildlife and the environment. To put it into context, the regulation around pesticides governing what can be used, where and why, is very stringent. It is not dissimilar in level to that in place for bringing medicines and pharmaceutical products to market.

The European Food Safety Authority (EFSA) and European Commission Food Safety websites give clear guidance concerning how plant protection products and active substances are regulated. The EFSA website states:

“A large body of EU legislation regulates the marketing and use of plant protection products and their residues in food. Plant protection products cannot be placed on the market or used without prior authorisation. A dual system is in place, under which EFSA evaluates active substances used in plant protection products and Member States evaluate and authorise the products at national level. Plant protection products are principally regulated by framework Regulation (EC) No 1107/2009.”

On the Pesticide Evaluation section of EFSA’s website notes:

“EFSA is responsible for the peer review of the risk assessment of active substances used in plant protection products in



the EU. Each active substance (the active component against pests/plant diseases contained in the plant protection product) has to be proven safe in terms of human health, animal health and impact on the environment. EFSA is also in charge of the risk assessment of the maximum residue levels (MRLs) of pesticides permitted in products of plant or animal origin marketed in the EU.”

To summarise the regulatory protections in place, the pathway to get an active substance approved and therefore eligible to be used in a formulated plant protection product has been summed up succinctly by EFSA’s website:

“Since 2003, EFSA has been responsible for the EU peer review of active substances used in plant protection products. This task is carried out by EFSA’s Pesticides Peer Review Unit following procedures set out in the legislation and the latest scientific standards and methods. EFSA conducts its work in close collaboration with scientific experts from the Member States.

In general, active substances are evaluated through a phased approach:

An application for approval of an active substance is submitted by the producer of the active substance to a

designated rapporteur Member State (RMS), together with a dossier.

- For each substance an initial assessment report is produced by the RMS carrying out the first risk assessment
- The RMS’s risk assessment is peer reviewed by EFSA in cooperation with all Member States
- EFSA drafts a conclusion on the active substance
- The European Commission takes a legislative decision whether or not to include the substance in the Union’s list of approved active substances.

EFSA is also responsible for the EU peer review of applications for renewal of the approval of active substances. Active substances are generally approved for a period of 10 years, after which it is possible for an applicant to apply for renewal. The application is submitted to an RMS, which provides its initial evaluation in a renewal assessment report (RAR). EFSA then carries out a peer review of the RAR in collaboration with Member States.”

During this process, data on human and animal health, as well as environmental impacts are considered. For an active substance to be approved, EFSA and the European Commission have to consider the compound or organism not to have unacceptable effects. This is

highlighted on the European Commission’s Food Safety website:

“At least one use of the substances in plant protection products must be proven safe for people’s health, including their residues in food, for animal health and must not have any unacceptable effects on the environment before a substance can be approved, where relevant subject to conditions or restrictions.”

The plant protection product in the bottle available for use by the end user also has to undergo rigorous scientific testing to ensure it is both efficacious and safe. This is the second layer of protection for humans, animals and the

environment. The EC’s Food Safety website states that:

“PPPs contain at least one approved active substance; these may include micro-organisms, pheromones and botanical extracts.

Before any PPP can be placed on the market or used, it must be authorised in the EU country concerned. Regulation (EC) No 1107/2009 lays down the rules and procedures for authorisation of PPPs.”

EFSA’s website states that:

“As part of the application dossier for the authorisation of a plant protection product, an assessment of the exposure of operators, workers, residents, and bystanders

from representative uses of the product needs to be provided.”

In summary, Figure 1 outlines the multi-layered legislative protections put in place to protect humans, animals and the environment. During both approval of active substances and the authorisation of a formulated plant protection product, a significant part of the assessment and scientific evidence required in the submitted dossiers focuses on protecting humans, animals and the environment, including bystanders and those that enter those areas. EU legislation on active substances and PPPs are a minimum standard and each member state can implement stricter regulations through their national legislation.

Tiers of protection	Level of protection	Type of protection
1	EU level	Active substance approval • Safety and environmental fate of a compound • Protection of human, animal and environmental health
2	EU / Member State level	Plant protection product authorisation • Safety to humans, animals and environment of a product • Directly relates to what end users can apply • Establishes efficacy, dose rate and crop safety
3	Member State level	National legislation • All aspects of product safety and environmental protection

Figure 1. Layers of legislative protection.

These protections are already enshrined in current legislation and require positive scientific evidence for an active substance and a plant protection product to reach an end user. It also needs to be borne in mind that this process is not static. All active substances and plant protection products are subject to review, either as part of keeping their approvals/authorisations active or at any time as a result of new scientific evidence or to meet enhanced safety standards.

Over the past decade there has been significant change in the type and safety profile of the products being used, as a result of EU legislation. This means that the products available to the end user put less active substance into the environment, which also reduces any exposure risk and the types of compounds used have an even safer profile for human, animal and environmental health.

The legislative/regulatory strategies employed to minimise the impact of PPP usage include the following:

- Review of active substances as candidates for substitution
- Approving active substances with the safest possible profile to humans, animals and the environment and with those decisions based on detailed scientific evidence submitted as a dossier

- Authorising PPPs that have multiple active substances to minimise resistance risk and reduce total active substance loading in the environment
- Authorising PPPs that use active substances with the safest possible profile to humans, animals and the environment based on scientific data
- Restricting application rates and conditions for use (where, when and how they can be used)
- For crops for human or animal consumption, designating maximum residue levels for an active substance that can be present in a crop prior to ingestion
- Requiring exclusion periods where nothing or no-one can access the area treated for a specific period of time
- Ensuring that those using PPPs in a professional context have appropriate training to ensure that they understand how to use PPPs safely and that they understand the implications of using them
- Publishing information on the active substances approved for use and for member states to hold lists/database on PPPs that are authorised in their territory.

This means that the EU has one of the strictest regimes for the scientific and peer review of the activity, safety and persistence of active substances and PPPs. These measures mean that only



the safest and least impacting products on the environment and wildlife are able to reach the market.

The Sustainable Use Directive (SUD) was introduced in 2009 with the intention of helping to ensure that the use of PPPs can be done sustainably and safely. The European Commission Food Safety website page on sustainable use of pesticides summarises the objectives of the SUD as:

“Directive 2009/128/EC aims to achieve a sustainable use of pesticides in the EU by reducing the risks and impacts of pesticide use on human health and the environment

and promoting the use of Integrated Pest Management (IPM) and of alternative approaches or techniques, such as non-chemical alternatives to pesticides. EU countries have drawn up National Action Plans to implement the range of actions set out in the Directive.

The main actions relate to training of users, advisors and distributors of pesticides, inspection of pesticide application equipment, the prohibition of aerial spraying, limitation of pesticide use in sensitive areas, and information and awareness raising about pesticide risks.

EU countries must also promote Integrated Pest Management, for which, general principles are laid down in Annex III to the Directive.”

This website notes that the main actions for Member States should include:

“EU countries were required to adopt National Action Plans (NAPs) to implement the Directive for the first time by November 2012. These plans should contain quantitative objectives, targets, measures and timetables to reduce the risks and impacts of pesticide use. These plans should be reviewed at least every five years.

The Directive identifies specific measures that EU countries are required to include in their plans for proper implementation. The main actions relate to

- training of users, advisors and distributors
- inspection of pesticide application equipment
- the prohibition of aerial spraying
- the protection of the aquatic environment and drinking water
- limitation of pesticide use in sensitive areas
- information and awareness raising about pesticide risks
- systems for gathering information on pesticide acute poisoning incidents, as well as chronic poisoning developments, where available.”

The SUD was a way to strengthen the need for the safe and effective use of PPPs by ensuring that professional users of PPPs are properly trained and application equipment is suitable, that IPM based approaches should be followed as the norm and that information on the risks of PPPs are available and awareness of these risks is improved.

2.3.2. How will the European Commission’s proposal change this?

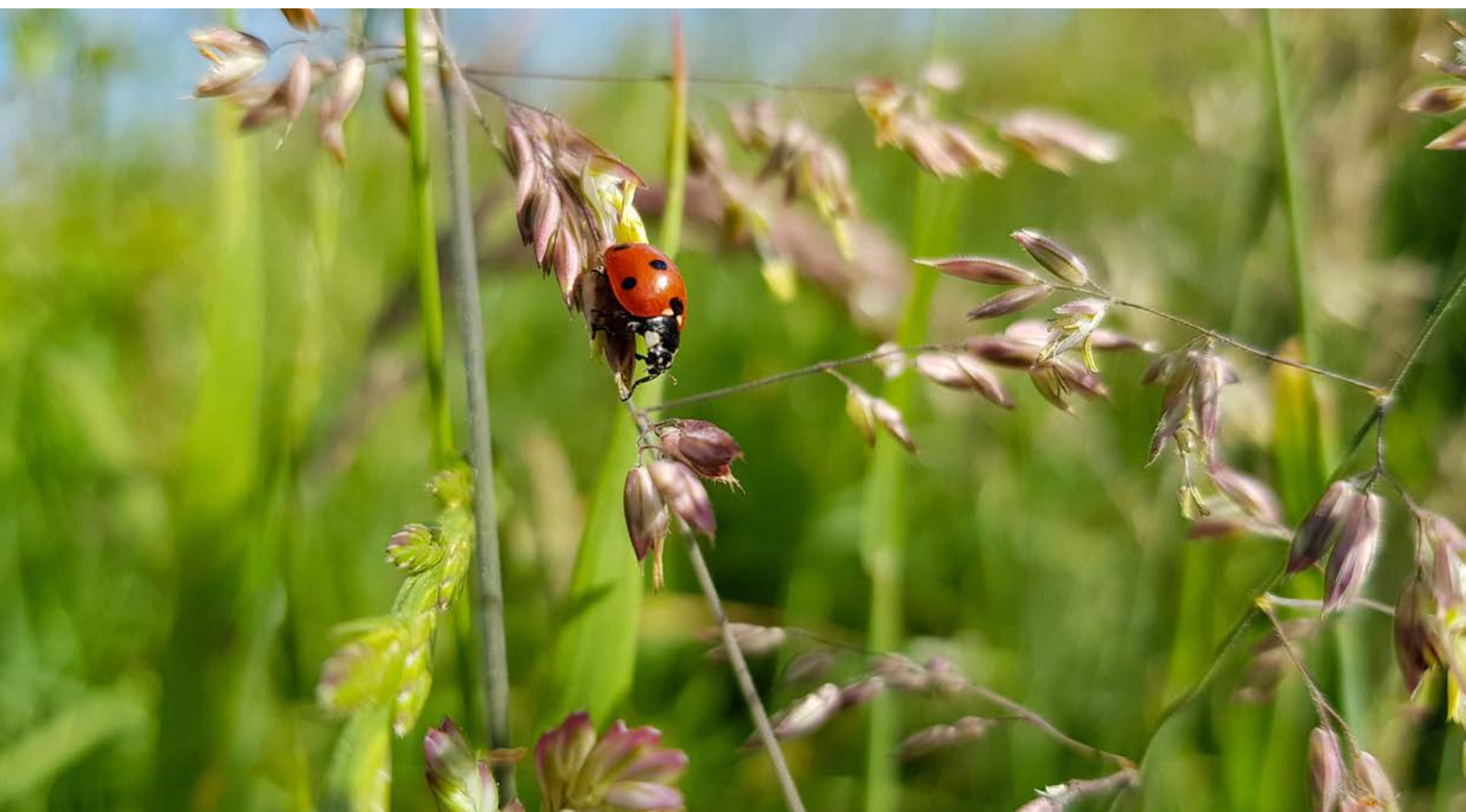
The proposed Sustainable Use Regulation has a direct implication for all users of plant protection products. The main aims have been stated as (taken directly from the EC Food Safety website, sustainable use of pesticides section):

- “Legally binding targets at EU level to reduce by 50% the use and the risk of chemical pesticides as well as the use of the more hazardous pesticides by 2030. Member States will set their own national reduction targets within defined parameters to ensure that the EU wide targets are achieved.
- Environmentally friendly pest control: New measures will ensure that all farmers and other professional pesticide users practice Integrated Pest Management (IPM). This is an environmentally friendly system of pest control which focuses on pest prevention and prioritises alternative pest control methods, with chemical pesticides only used as a last resort.

- A ban on all pesticides in sensitive areas: The use of all pesticides is prohibited in places such as urban green areas, including public parks or gardens, playgrounds, recreation or sports grounds, public paths as well as protected areas in accordance with Natura 2000 and any ecologically sensitive area to be preserved for threatened pollinators.

Other key measures include requiring **Member States** to set positive targets to increase the use of non-chemical pest control methods and requiring **farmers and other professional users of pesticides** to obtain independent advice on alternative methods to ensure greater uptake of non-chemical pest control methods.”

From these objectives, it can clearly be seen that sport and the management of pests, weeds and disease on sports surfaces will be heavily impacted. The intention being to ban the use of chemical pesticides in these areas. In the proposed regulation, this is covered in the parts that deal with sensitive areas:



“‘sensitive area’ means any of the following:

- (a) an area used by the general public, such as a public park or garden, recreation or sports grounds, or a public path;”

With plant protection products defined as products intending to:

- (a) “protect 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) influence the life processes of plants, such as substances influencing their growth, other than as a nutrient or a plant biostimulant;
- (c) preserve plant products, in so far as such substances or products are not subject to special Union provisions on preservatives;
- (d) destroy undesired plants or parts of plants, except algae unless the products are applied on soil or water to protect plants;
- (e) check or prevent undesired growth of plants, except algae unless the products are applied on soil or water to protect plants.”

In essence this means that all fungicides, herbicides, insecticides, nematocides and plant growth regulators will be affected. Based on the strictest interpretation of the proposed regulation, none of these products could be used in the management of pests, weeds and diseases.

In the proposed regulation, terms for derogations for use of PPPs are defined as:

“...a competent authority designated by a Member State may permit a professional user to use a plant protection product in a sensitive area for a limited period with a precisely defined start and end date that is the shortest possible

but does not exceed 60 days, provided that all of the following conditions are met:

- (a) a proven serious and exceptional risk of the spread of quarantine pests or invasive alien species exists;
- (b) there is no technically feasible lower risk alternative control technique to contain the spread of quarantine pests or invasive alien species.”

Following Council Working Party meetings in October and November 22, a number of suggestions for modification of the proposed European Commission’s proposal were put forward. The main topic covered by the non-paper is possible adjustments to the sensitive areas sections of the regulation. The main changes put forward in the non-paper that would affect sport are:

“Allowing the use of biocontrol and low-risk products in such areas would also help incentivise bringing such products to the market. It may therefore be considered by Member States to allow the use of biocontrol and low-risk products in all sensitive areas. This would be consistent with the need to promote biological and low-risk pesticides as safer alternatives to chemical pesticides.”

“Member States have commented that the proposed derogations to allow pesticide

use for the control of quarantine pests and invasive alien species are too limited and too short (60 days duration), adding to administrative burden. While the potential options outlined for consideration above would also address some of the concerns in this context, Member States could consider extending the period of each derogation to one full growing season or for 120 days, whichever is the longest.”

Additionally, the non-paper also considered the exact areas that were covered in “sensitive areas” and whether private sports clubs were included. The wording of the response in the non-paper is given below, but the message was that the priority was to protect public health therefore private sports clubs where users have to pay are included in sensitive areas:

“Some Member States have also asked whether private sports clubs (and other similar areas) are covered by ‘areas used by the general public’ and responses to public consultation also raised this issue. The Commission considers that the protection of public health is of utmost importance regardless of whether an area is open to the public in general or only to paying members of the public. The use restriction, referred to under section 1 of this non-paper, should apply to areas used by the general public, including those accessible after paying for entry.”



2.4. Approach

The approach taken in this impact assessment has been to interrogate existing data sources on sport's PPP use and implementation of IPM/ITM, to be able to provide a baseline for what is the current state of play in a range of countries across the EU. Additionally, it has been necessary to engage with key stakeholders across the EU to obtain an understanding of the current legal framework for PPP use in a range of countries, whilst also allowing data to be gathered on the impacts of the proposed European Commission's proposal on the management and maintenance of sport surfaces.

In most countries across the EU, there is no consolidated data for sports usage of PPPs and product availability. Whilst there is often data for key usage sectors, like agriculture, often sport is not separated out from other usages. This lack of granularity in data sources has meant that it has been necessary to reach out to sport stakeholders, whilst evaluating multiple threads of data and information to be able to base a view on the impact that withdrawal of PPPs would have on sports, local communities and the wider socio-economic effects.

The approach taken has had to account for the fact that

there are inherent differences across EU Member States in terms of climate, turf challenges faced, factors influencing turf maintenance, PPP legislation and the extent of transition to reduced or even no PPP usage. This is why common challenges and impacts have been tackled across sport as a whole, whilst country, region or sport specific issues have been outlined and discussed separately.

2.4.1. The sporting context

There are many common areas of turf management, PPP usage and legislation across sports. It does not matter if you are dealing with a football pitch or golf green, how a PPP is used and applied will be the same. This also extends to IPM/ITM approaches. For example, to help keep turf weed free, focusing management on optimising grass cover and not allowing gaps that weeds can exploit, or preventing fungal diseases by ensuring the leaf surface is dry, are all strategies employed across all sports. These are common approaches and so, where possible, challenges and opportunities with PPP reduction and withdrawal that are common across all sports have been discussed together.

Sport also covers a range of levels of participation, ranging

from more specialist sports like horse racing where only relatively few users participate, through to sports like golf and football which have high participation by players ranging from community, to high level amateur, semi-professional through to professional and elite players. Where there is commonality of impact from potential changes introduced by the proposed European Commission's proposal, these have been dealt with together.

2.4.2. Appreciating the nuance associated with different sports

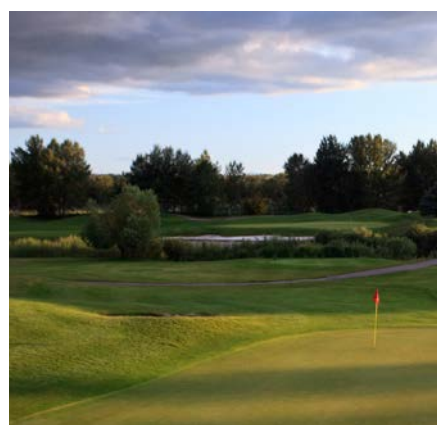
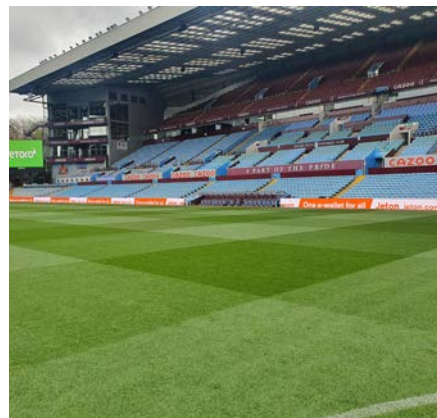
Whilst natural turf sports share a lot of common ground in terms of management, grass issues where PPPs are currently being used and how these issues are being tackled using IPM based techniques, there are a number of differences between sports with some of the most important factors including:

- The nature of the sport being played and its specific requirements (golf is more focused on the roll of a 46 g golf ball, whereas football still requires good ball roll, but also needs a strong, stable and hard-wearing surface to withstand the physical nature of how the game is played and provide a safe surface for the payers)
- The grass species used to form the playing surface (golf focuses on fine leaved grasses that have a carpet like finish, whilst football and rugby use grasses that have larger and more robust leaves)
- Area of turf to be managed. A football pitch and its surround is around 8000 m², whereas a golf course may be 80 ha plus of turf, albeit with around 3 ha of more intensively managed turf
- Location of the surface is important. Golf courses are areas of managed land in a more natural landscape than a football pitch or stadium. Golf courses tend to reflect the local landscape as part of their functionality, whilst they are designed and managed to be part of the surrounding ecosystem. A football pitch, being a drained and levelled area of turf, tends to be constructed and, in a stadium context, has a more artificial and often more challenging growing environment
- Golf courses tend to be maintained at a variety of heights of cut depending on the area being managed and the surface being prepared, with each height of cut being maintained to meet functional requirements, but each having an effect on the health and growth of the grass plant. Typical ranges of cut height

on golf courses would be 3-5 mm on greens, 8-12 mm on tees, 8-16 mm on fairways and 16 mm and above (to very long grass at times) in the rough and ecological rough. A football pitch tends to have a more defined height of cut, typically between 18 mm on warm season (hot climate grasses) and 25 mm for cool season grasses

- Given the different management, grasses and environments they are grown in, the types of problems encountered on sports surfaces can vary as well. Additionally, different levels of a sport may have different challenges. For example, community level football may have more issues with weed invasion than professional football surfaces, but the latter is likely to have more issues with disease due to the level of management needed to keep the turf playable and safe.

It is therefore important not to make generalisations when they could hide the true impacts, challenges and opportunities that the proposed European Commission's proposal may bring. As a result, it has been important in this impact assessment to appreciate and understand the nuance of each sport's requirements and challenges.



2.4.3. How has the data and evidence been gathered, and what information has been used?

It has been necessary to have a multithreaded approach to gathering data and information for the impact assessment. This is because the data available has been spread around many different locations, some of which are public domain sources and many others are

private sources held by key industry stakeholders. Data and information have been gathered through the following pathways and are summarised in Figure 2:

- Desktop literature review looking at existing published sources of information on PPPs available in different countries, PPP usage, IPM/ITM research and strategies for sports turf management, alternative technologies

- for pest, weed and disease management
- Review of current legislative framework for active substance approvals and PPP authorisation
 - Interrogation of non-public and public databases for PPP availability and usage data
 - GAP analysis to establish where there is little data coverage, which has helped focus efforts for direct data collection

- Direct data collection through questionnaire survey and stakeholder interviews. A cross section of countries for football and golf were selected as being representative of a range of climate zones and market sizes. The countries engaged are shown in Table 1
- Direct data collection for football, involved direct surveying of football facilities asking about PPP usage, how they are engaging with IPM/ITM and the impacts of managing their playing surfaces without PPPs. This work was facilitated by the national representative bodies who sent questionnaires to clubs in their own country. For golf, the approach was slightly different and focused on obtaining existing data from the national representative bodies and from data held by GEO (Golf Environment Organisation - www.sustainable.golf)

- Case studies to highlight key challenges and opportunities that rapid reductions or complete withdrawal of PPPs would bring. These are to support the impact assessment and the statements made within it
- Review of new developments in turf management that help advance IPM
- Review on a report by Chemservice on the socio-economic impacts of PPP withdrawal on sport turf facilities.

Table 1. Countries engaged in the direct data acquisition for both football and golf

Football	Golf
Germany	Germany
Spain	Spain
Sweden	Sweden
Netherlands	Netherlands
Denmark	Denmark
Ireland	Ireland
France	France
Italy	Italy
Finland	Finland
Belgium	Belgium (Wallonia & Flanders)
Portugal	Portugal
LaLiga (Spain)	Austria
LND (Italy)	Switzerland
	Czech Republic

2.4.4. Limitations

As with all such studies, the main limitation is on the availability of quantitative data. One of the biggest challenges for sport is that, whilst it is a very visible industry with many watching or participating in it, it is very small in comparison to other industries that use PPPs, such as agriculture. This means that often data collection by government or local authorities is sporadic and often does not offer the granularity or resolution to separate out sport, let alone individual sports.

However, data has been sought from a number of public and private sources to attempt to build as comprehensive a picture of PPP usage as possible.

The engagement of national representative bodies, as well as other regional and local organisations has been vital. Acknowledgement of those who have taken part and played a key role with assisting in this impact assessment is at the start of this report.

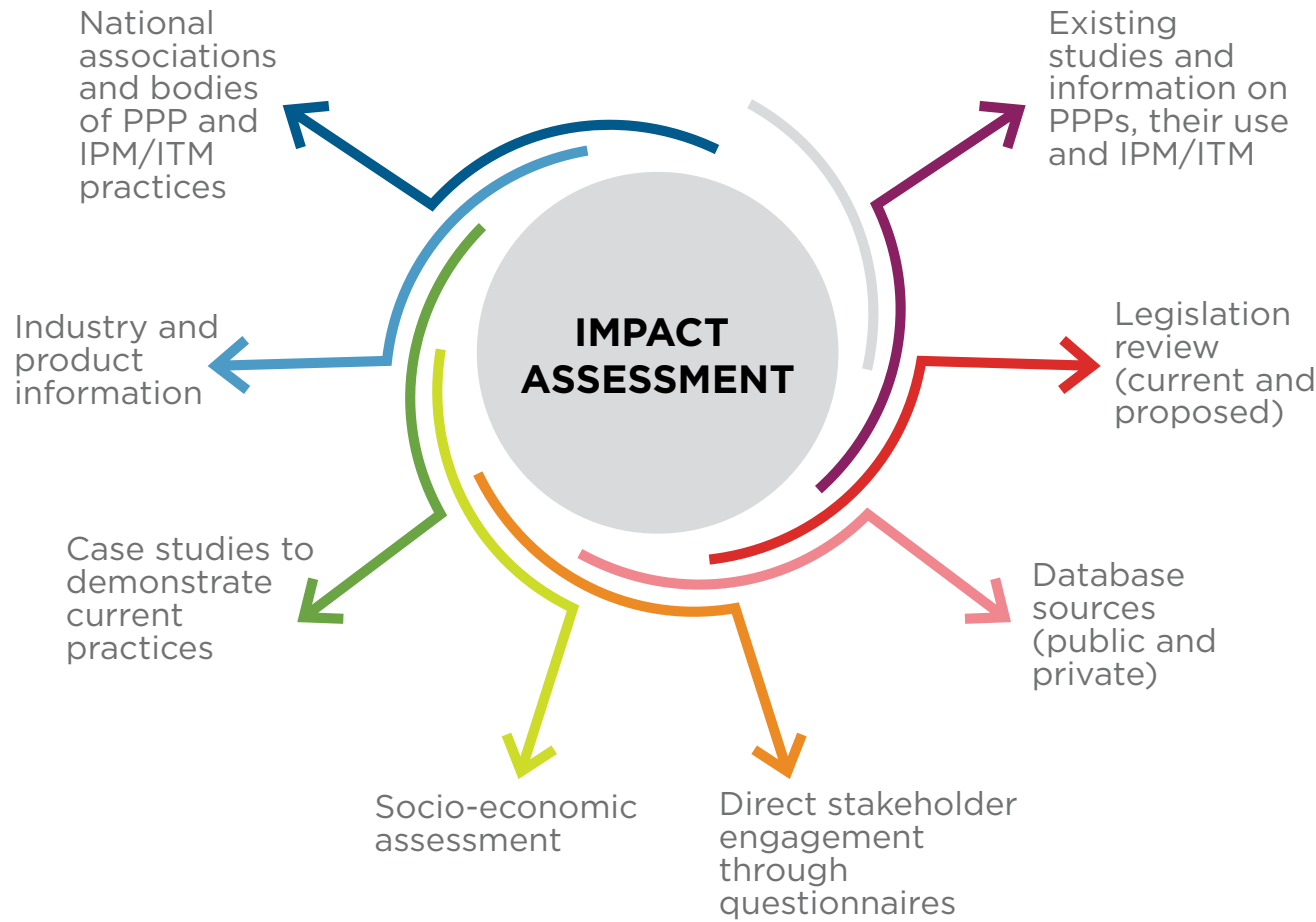


Figure 2. Summary of the different threads of evidence used in the impact assessment.

3. Market overview

The objectives of this section are:

- To outline the essential principles of turf management that relate to pest, weed and disease issues
- To highlight the commonalities and differences in turf management between football and golf
- Why and how are plant protection products used in sport?
- The key factors that affect turf pests, weeds and diseases
- The implementation of IPM/ITM in natural turf sports surface management.

The world has not stayed still, climate change, resource availability and legislative change have all led to challenges that sports turf facilities and managers have had to adapt to.

It is impossible to understand how pest, weed and diseases affect turf and how they can be controlled without appreciating some of the core concepts of turf management. This section aims to outline and explain the essential components of turf maintenance that affect turf, turf issues and IPM/ITM.

The fact that natural turf sports are played on a living surface means that there is a strong and inextricable link between achieving acceptable surface performance, whilst working with biological, physical and chemical systems. Achieving the tolerances required for safe and high-quality playing surfaces means that turf managers, greenkeepers and groundspeople, have to fully understand how to manage biology and adjust their maintenance in response to both biotic and abiotic conditions. This balancing of biology and the physicochemical environment with the functionality of playing surfaces has always, consciously or subconsciously, formed part of traditional best practice management in sports turf.

where efforts need to focus on prevention, rather than curing the symptom but not resolving the underlying causes. In many ways, this has been the core philosophy of traditional turf management. Integrated management has been practiced in sports turf management for many decades before the SUD. However, this legislation helped to focus attention on IPM and encouraged turf managers and advisers to embrace it and make it best practice.

The world has not stayed still, climate change, resource availability and legislative change have all led to challenges that sports turf facilities and managers have had to adapt to. Indeed, these challenges are still here and dynamically changing, which means sports approach to best practice management also has to adapt.

The following sections deal with turf management principles, covering those which are common across sports, and those specific to golf and football.

3.1.1. General

There are a number of turf maintenance practices that are common across all natural grass sports surface types (Table 2). Some of these practices are carried out extremely frequently, whilst others are more targeted procedures that

3.1. Essentials of sports turf management

Current best practice guidance for turf management has IPM/ITM at its heart. IPM reflects the need to embrace a holistic management approach,

Table 2. Typical turf maintenance operations carried out on all sports surfaces

Maintenance operation	Frequency	Description
Mowing	- Depends on the type of surface, rate of grass growth and the level of the sport being played. - Most frequently mown turf will be golf greens, tees and high level football pitches, which may be mown daily or every two days. - Elite level football pitches may even be mown twice in a day in preparation for a match.	- Cutting of the grass leaf to even out and remove excessive growth. - Type of mower depends on the size of the area and type of turf being mown. - Mowing is essential to produce a playable surface and to encourage the grass to thicken producing a strong and dense coverage.
Fertiliser application	- As needed based on the demand of grass and the storage capability of the growing medium. - Frequency also affected by time of year, type of turf, usage (damage recovery) and type of fertiliser used.	- Fertilisers are an essential part of sports turf management to help supplement natural inputs of essential nutrients. - Most important for turf where clippings are removed, as nutrients in the plant tissue cannot be recycled.
Irrigation	- As needed through hot and dry weather. In hot climates, this can be daily or even twice a day. - On sand-based pitches, water is also applied in preparation for a game to help provide cohesion between sand grains, thereby adding to pitch stability. - Frequency also depends on turf and soil type and water management strategies	- Typically applied using automatic pop-up systems. - Manual systems can be used such as self-travelling irrigators and are sometimes still used on lower level turf or large regular sized areas. - Hand watering for hot spot targeting - Typically aiming not to replace all the water lost but typically 60-80% ET loss.
Dew removal either by brushing or switching	Should be daily but more often in periods where there is heavy dew formation.	- Aim is to keep the leaf surface dry as most turf diseases are fungal pathogens that need water on the surface of the leaf to survive and grow. - Achieved by physically knocking water off the leaf surface.
Aeration (also called aerification in North America)	- Typically, a targeted operation to tackle or prevent problems from occurring. - In some circumstances a little but often approach is taken, whilst at other times a less frequent but more extensive programme is carried out. - Lower level sports surfaces may only get aeration once per year.	- Different types of aeration to tackle different issues. - Issues commonly treated or prevented with aeration include: - Soil compaction - Drainage improvement - Organic matter removal/reduction - Promoting air exchange within soil
Detritus removal (typically involving scarification or brushing)	- Carried out as needed depending on the rate of organic detritus accumulation. - Some sports and situations it is done frequently (once a week) whereas other times it may only be done once or twice per year.	- A balance of organic matter and soil mineral material is important. - Excess accumulation of organic matter is a major agronomic problem and results in increased disease and weed problems. - Organic matter concentrated on the surface or in the upper layer of the soil is problematic and needs to be prevented and controlled.

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Top dressing	- Dependent on sport and situation. - Some take a little but often approach whereas others are constrained to carry out at targeted times of the year, such as during renovations.	- The process of adding a sand dominant material (often just sand) helps to: - Dilute organic matter - Improve water and air entry into the soil - Level low spots or repair of divots or turf damage.
Overseeding	- Routine overseeding is done during a period of surface renovation. In this case the whole or designated sector of the surface is treated. - Local repair such as divot repair will be done as needed.	- Can be done to repair the surface from damage, such as through heavy usage in goal mouths on football pitches or speed up divot repair on golf tees. - Can be carried out on golf surfaces (mainly greens to achieve or maintain the desired grass species). - In the challenging growing environment of a professional stadium the pitch can be often oversown to help maintain grass density.
Application of biostimulants	If used, often applied frequently ranging from weekly to monthly depending on the biostimulant.	- Defined in EU law* as materials improving the nutrition processes of crops, in particular by improving how efficiently they use nutrients and their resistance to environmental conditions - Used to help improve plant health and defences against both biotic and abiotic stresses such as diseases, wear, heat, drought, shade.
Application of PPPs	Should be used only as needed as part of an IPM/ITM strategy	An important tool for managing pest, weed and disease issues, but over recent decades the use of preventative measures and IPM approaches have seen reductions in their use.

* Biostimulants are governed by Regulation (EU) 2019/1009 laying down rules on the making available on the market of EU fertilising products.

are carried out much less often and usually to either prevent a particular issue from occurring, or to tackle an existing problem.	- Type of sport being played (football, Rugby, golf, horseracing etc) - Level of sport being played (grassroots, high-level amateur, professional, elite level) - Frequency of use - Quality of the turf surface and the performance required - Presence of any surface issues	- Weather or environmental conditions - Resourcing of the sports facility (staff, machinery, budget) - Expectation of the users of the surface - Experience and knowledge of the turf managers - State of current understanding and best practice advice.
These turf maintenance operations are carried out on all sport surfaces, but when, where and how often depends on a range of factors, including:		

It is also important to understand that turf maintenance practices evolve as our scientific understanding advances, as practical experience grows and as technology develops. It has never been static or prescriptive, but it has evolved over the years and sometimes reconnects with older ideas which are modernised to meet current and future challenges.

3.1.2. Golf

Golf has some of the most complex management programmes among all sports due to the diversity of playing surfaces and out of play areas.

The surface types around the course, their typical area and characteristics are outlined in Table 3.

Each of these surfaces has its own unique characteristics and traits. This means to be able to achieve the desired quality, specific maintenance is required for each. Greens tend to be the most intensively managed areas of the golf course due to all foot traffic being concentrated on this area of turf. The surface needs to fulfil two roles, firstly accepting a well struck approach shot but not being overly receptive (soft) or firm, whilst secondly having good ball roll. To do this takes a

great deal of effort and refining of the turf to achieve these requirements. The presence of excessive disease and weeds can have a negative effect on the functional performance (playability) of the surface, as it can be very difficult to maintain acceptable ball roll under these circumstances. This is why control measures to manage diseases and weeds on greens has been a major focus of turf management.

Tee management focuses on repair of damaged turf and promoting plant health to make the grass as strong as possible to withstand high levels of foot traffic (play for that hole has to start on the tee so there is a lot of footfall on the turf). Fairway management looks to maintain turf that is playable in all weathers, but the tolerance for weeds and diseases is generally higher than on greens and tees, where these can pose more playability (functional) issues. Key focuses for fairway management are mowing, divot repair, water management (managing excess and drought), as well as targeted management of excessive weeds or pest activity.

Rough and ecology/biodiversity rough are typically low maintenance areas. The main management operation is usually periodic mowing, with rough being mown more frequently than ecology rough. Occasional scarifying is carried

out to ensure a thin and open grass sward that promotes diversity of plant species and allows players in rough to find their ball.

Many golf courses have areas of surface water (ponds, lakes, streams etc.) and woodland. These also need to be managed to maintain their health and environmental value. Vegetation in water may need to be physically managed to prevent overgrowth of the water which will ultimately reduce biodiversity and start the process of succession towards a wetland rather than an aquatic area. Woodlands need active management to ensure healthy tree growth and to manage dead wood. This offers opportunities to encourage woodland flora and fauna. This can take the form of targeted tree clearance to promote a floristically rich understorey through to managing fallen and dead wood to encourage a range of invertebrates such as insects and vertebrates such as reptiles and small mammals.



Table 3. Different turf types on a typical 18 hole golf course with total course areas typically varying between 40-80 ha

Turf area	Typical total area coverage of golf course*	Characteristics
Greens	1-1.5 ha	Close mown turf whose function is to receive an approach shot and not be too receptive or firm, whilst also allowing smooth, true and consistent ball roll. The ball should “roll out” and not decelerate too quickly and is measured as “green speed” or more technically, ball roll length. Typically mown between 3 – 5 mm depending on grass species and time of year.
Tees	0.6-0.9 ha	Not as closely mown as greens but still kept between 8-15 mm depending on grass species. Wear tolerance and recovery from damage are important due to divotting from tee shots. Usually rectangular and flat raised areas used to start the play on a hole. The intensity of management is between greens and fairway turf.
Green surrounds and fairway	12-18 ha	Less intensively managed turf compared to greens and tees given the large areas involved. Usually made up of native or originally sown grasses that have become adapted to that growing environment. Main improvements focus on drainage for all weather performance and localised treatment of problem areas (weeds, disease, dry spots).
Rough	Highly variable but typically 10-15 ha	Low intensity managed area where the grass height can be highly variable depending on the course and its character. Meant to be a penalty for players whose ball enters the taller grasses to encourage players to stay on the fairway.

* Area of each surface varies considerably among golf courses as is based on landscape, design and available space.

There are also maintenance practices that are most commonly carried out on golf turf, rather than on football pitches:

- Rolling (turf ironing) – this practice sees the turf rolled with a bespoke lightweight roller that lays the grass blade flat. This can reduce the need for mowing and can be done in conjunction with cutting to increase green speed (ball roll length). It is an IPM/ITM practice that scientific trial work has proven can help reduce disease incidence (Giordano *et al.* 2021).
- Wetting agents (soil surfactants) – these help manage the water balance in the soil by affecting how easily water can penetrate the soil and, depending on the product, help water to be distributed more evenly in the growing medium. They are often used on golf courses where it can be a) difficult and impractical to irrigate all areas and b) often turf is being maintained in a drier condition so wetting agents help to manage drought stress and its effects.

It is also important to note that golf courses are permanently grassed surfaces, so balancing the needs of the turf, player and dealing with environmental stresses can be challenging. This permanency offers potential environmental benefits such as grassland habitat creation, long-term micro-ecosystems to form,

sustainable water attenuation for urban golf courses, and the possible but not well studied effects on short-term carbon storage and dynamics.

3.1.3. Football

The basic requirements for football are consistent across all levels of the game, namely a robust, densely covered grass surface that is strong enough to give players good traction (weak grass or thin turf cover significantly reduces traction to unsafe levels), that is relatively smooth and flat, whilst safely absorbing the impact energy from players as they use the pitch. However, as the level of football increases to professional and elite facilities, other considerations for management are important, such as the stadium microclimate. □

Given the nature of football and other pitch based sports, resistance and recovery from wear damage is vital. Management practices often focus on promoting grass growth, whilst using resilient grass species and cultivars.

A common practice on higher level pitches is to renovate the surface. For facilities with more restricted budgets, the scope, frequency and extent of renovation is more restricted and is often limited to scarification and overseeding. For those with a higher budget or with hybrid pitches, the □

STADIUM MICROCLIMATE

The creation of amphitheatre like stadia as focal points for football has resulted in more shade and reduced natural air movement for grass. These are conditions that are stressful for the turf and are potentially good for fungal disease. This means turf management needs to account for this and over the years technologies like supplementary lighting and fans for air movement have been developed to mitigate some of the consequences of arena style stadia.

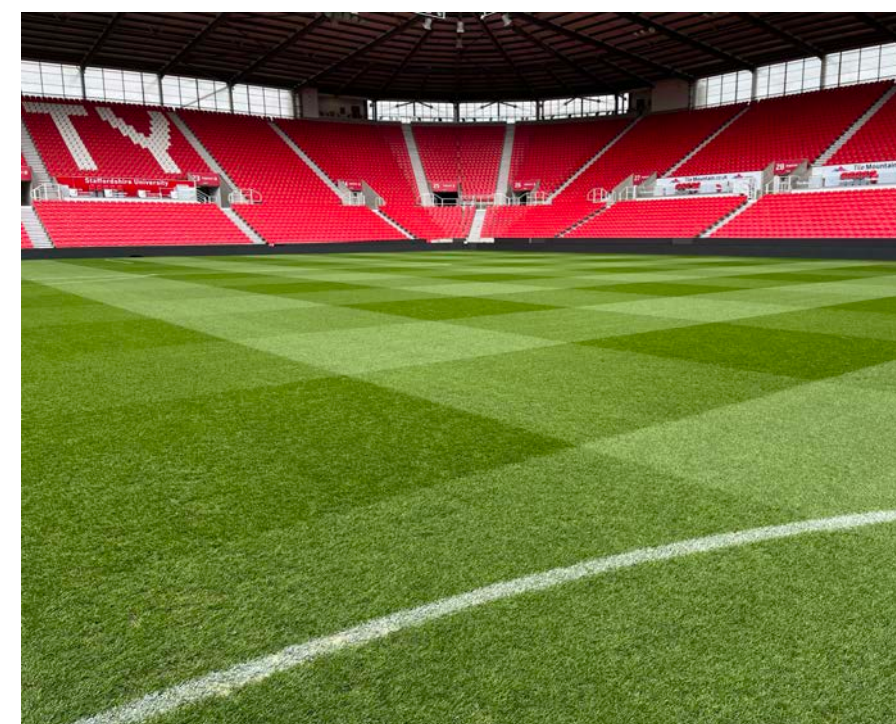
HYBRID PLAYING SURFACES

These are football surfaces that have been reinforced with plastic fibres either stitched into the pitch or installed as a carpet with the turf grown in it. This high performance surface maximises drainage whilst helping to maintain grass cover, and if grass density is reduced, traction for players can still be maintained. However, it can be less supportive for grass health, so careful and higher maintenance inputs are needed.



surface layer (10-20 mm) is removed, more growing medium added and a new pitch sown. This is very effective at removing and controlling weed invasion, but at high financial cost and with potential environmental implications for the disposal of sand and other debris.

At community/grass root level, the challenges are different, as are the problems faced. Often budget restricts the maintenance operations that can be carried out and one of the main challenges is managing a year round playable surface, whilst being able to tackle weed invasion problems. Disease is often less of an issue, but promoting grass cover and healthy turf with minimal inputs is vitally important.



3.2. Plant protection product usage in sport

The definition of what constitutes a plant protection product has been outlined in section 2.3.1. In summary, these are products that carry out the following functions:

- “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;
- influencing the life processes of plants, such as substances influencing their growth, other than as a nutrient or a plant biostimulant;
- preserving plant products, in so far as such substances or products are not subject to special Union provisions on preservatives;
- destroying undesired plants or parts of plants, except algae unless the products are applied on soil or water to protect plants;
- checking or preventing undesired growth of plants, except algae unless the products are applied on soil or water to protect plants”.

This is the definition as given in Regulation (EU) 1107/2009 concerning the placing of plant protection products on the market with the addendum of biostimulant exclusion, as

introduced by Regulation (EU) 2019/1009 laying down rules on the making available on the market of EU fertilising products.

The following sub-sections detail why and how PPPs are being used in natural grass sports turf management.

3.2.1. What PPPs are used in sport?

There are four groups of products that are used on natural turf sports surfaces:

Fungicides – products that are used to control fungal turf diseases.

Herbicides – there are two main types of herbicide. Both aim to kill non-desirable weeds:

- The first group are selective herbicides and these are able to control certain weeds within a natural grass surface. This is because these PPPs are more active against biochemical pathways in dicotyledonous plants, which are the typical broad-leaved weeds found growing and competing with grass in turf surfaces. Grasses being monocotyledonous, have distinct differences in some of the biochemical processes/biological structures that allow targeted and selective control of dicots. A sub-group of selective herbicides are graminicides that will kill all monocotyledonous plants,

but substances that have greater effect on some grass species and at certain doses can be used to control weed grasses in a turf surface.

- The second group are total herbicides. These are products that will kill all plant tissue and so cannot be used for area application to turf surfaces. If they are used, they need to be used as targeted spot treatments (such as pelargonic acid for spot treatment of weeds and moss) or applied as post emergence control on areas being prepared and where the seed bank has been allowed to germinate to reduce the amount of weed seed prior to final preparation and grass sowing.

Insecticides/nematicides – used to control insect or other related pests such as grubs/larvae and plant parasitic nematodes.

Plant growth regulators – used to suppress the growth of grass plants to reduce mowing inputs, CO₂ emission reduction due to less fossil fuel burning, improved stress tolerance and often they result in changes in growth habit, such as greater tillering (multiple stems) to create denser and greener turf. Studies have shown that use of plant growth regulators can reduce the amount of CO₂ emissions due to needing to mow turf less.



A project by Cranfield University in 2009 estimated based on modelling that CO₂ emissions could be reduced by up to 48% across the whole golf course when using the plant growth regulatory PrimoMaxx (Syngenta 2011).

3.2.2. How and why are PPPs being used in sport?

Why are PPPs being used by sport? Fundamentally, they are being used to treat turf problems, whether they are pests, weeds or diseases, that conventional maintenance methods are not able to adequately control. PPPs have been developed and been assessed as part of regulatory authorisation to achieve a minimum level of efficacy, as well as being acceptably safe to be used for the intended purpose. This focus during the development on safety (human, wildlife and environment) and efficacy means that what is available in the market is effective at the job it is intended to do. This makes PPPs powerful tools for tackling hard or persistent turf problems.

Why are turf issues such as pests, weeds and diseases a problem for sports turf? There are a number of reasons why pests, weeds and diseases are a problem for sports turf:

- **Functional playability of the surface** – this is where a pest, weed or disease problem causes a loss in playability. In other words, the capability of that surface to perform its intended function is reduced. An example would be weeds or disease scars that altered the roll of a golf ball on a putting surface, such that it is deviated from its intended

line. In this case the quality of the surface is negatively affecting its functionality. There are of course levels to this and where the problems are on the playing surface is a factor in considering whether to treat or not with a PPP (if the problem is not affecting play then the need to treat with a PPP over a non-chemical or cultural method is reduced).

- **Safety of the playing surface** – this is where a pest, weed or disease issue influences how that surface is used and the safety of the player to use it. The most common example would be in pitch based sports like football. The ability of the player to have adequate traction is primarily determined by grass cover and the softness of the surface. If grass cover is lost

due to a disease outbreak, this may mean players cannot get adequate traction and increases the risk of injury from slipping or falling over when turning or stopping.

- **Visual quality** – this is often a secondary consideration when using PPPs as it does not influence how a playing surface can be used. However, in certain circumstances it can be an issue for elite broadcast sport. With the promotion of IPM and damage thresholds this has become much less of a reason to use a PPP. Indeed, surveys by the Danish and Netherlands golf federations have shown that many players are willing to accept surface blemishes such as localised small weed and disease patches, thereby reducing pressure on turf managers to carry out treatments.



In the past, there was a culture of blemish or problem free turf, but this has changed in the sport sector over recent decades.

What is the tolerance for pests, weeds and diseases in sports turf? There are of course different levels of tolerance for these problems in turf, both between sports facilities and over time. In the past, there has been a culture of blemish or problem free turf. However, that culture has changed in the sport sector over recent decades. Much greater emphasis has been placed on accepting a certain level of pest, weed and disease activity. This was a strong message to come out of the interviews and stakeholder engagement as part of the impact assessment. For example, in the Netherlands setting damage thresholds, which is a core principle of IPM, is a requirement for using PPP on sports surfaces (Dutch Advisory Committee 2022).

How are PPPs being used on sports surfaces? Firstly, there are strict conditions on the product label concerning how and when to use PPPs. It is a requirement that all users of PPP are appropriately trained and following the instructions on the product label. This then minimises any risk to either the user, bystanders, wildlife or the environment.

Secondly, PPP usage should be part of an IPM/ITM approach to avoid the need to treat turf with PPPs and to ensure that cultural, non-chemical and biological methods are used first. In some countries and regions (for example, Denmark, Netherlands, Flanders, Germany), the application of PPPs are highly regulated and restricted to help ensure the bare minimum of PPP is put into the environment. Prophylatic spraying (spraying without a good reason and on a fixed schedule) is highly discouraged as part of IPM/ITM and not legal in many countries.

Thirdly, PPPs are only used when absolutely necessary. Often when a pest, weed or disease problem is not responding to cultural, non-PPP or biological approaches. This, coupled with damage thresholds and managing end user expectations, means that PPP usage can be reduced and applied only when necessary to prevent significant loss of playability of the surface.

3.2.2.1. What are we trying to treat or protect against?

There are a range of diseases, weeds and pests that affect sports turf. Some are specific to particular turf types (golf greens, fairways, football pitches), whereas many are ubiquitous across all sports turf contexts. The following diagrams highlight the common turf problems, indicating what these issues look like and what type of sport surfaces they tend to affect:

Turf diseases

Most turfgrass diseases in Europe are caused by fungal pathogens, which use the plant as both a food source and as a reproductive structure. There are occurrences of bacterial diseases, but they are rare and they tend to cause damage by the bacteria building up in the water carrying vessels in the plant causing it to wilt and not get enough water.

Diseases that are common to all sports surface types



Microdochium patch (high risk disease as causes extensive damage and is very common)



Leaf spots (moderate risk disease that can be higher risk in shady areas such as stadia)



Gray leaf spot (high risk to perennial ryegrass in hot and humid conditions where it can cause extensive and rapid damage)



Rust (low risk on most species but moderate risk on smooth-stalked meadow-grass / Kentucky bluegrass)



Seedling blights (moderate risk disease at time of seeding in high humidity)



Pythium blight (high risk disease, warm climates or seedling blights in cool season)



Brown patch (warm climates only)



Red thread (low risk disease as usually can be treated with increased nitrogen input)

Diseases that most commonly affect only golf turf



Dollar spot (high risk disease on certain grass species such as creeping bent and red fescue and many warm season grasses. Tends to develop in situations with low nitrogen inputs)



Anthracnose (moderate risk disease but if left undiagnosed can cause extensive damage as only individual grasses are affected)



Take-all patch (high risk disease on bentgrass species)



Fairy ring type 1 (moderate risk as this type of fairy ring is mostly associated with turf dieback and therefore affecting playability)



Fairy ring type 2 (low risk as only causes green up of turf)



Fairy ring type 3 (low risk as just mushrooms present in turf which are easily mown off)

Turf weeds

Weeds can be defined as plants growing in a place where they are not wanted or where they cause a quality, playability or safety issue. There are many different types of weeds that are commonly found in turf, but all tend to be competitive and will exploit any gaps in the grass canopy if there is weed seed present.

Common turf weeds that can occur in many sports surfaces



Daisy (tends to like compacted bare areas and can tolerate relatively high traffic)



Dandelion (perennial weed that spreads by wind and can be difficult to control due to its below ground tap root)



Clover (common on area of turf that are nutrient poor. It is a problem because it can dominate large areas of turf)



Plantain (survives in compacted soils and can be difficult to treat)



Pearlwort (often seen in close mown sports turf like golf greens. It can be difficult to spot as it looks from a distance like a dense patch of grass. Problem as it can cause a golf ball to bobble and deviate from its line when putting)



Moss (found in areas with low disturbance and is highly competitive during cold periods of the year when grass plants are less active. Can become dominant in areas of turf and has poor playability and surface stability characteristics)

Turf pests

Most turf pests cause damage as they feed on roots, leaves or both causing physical damage and stress that weakens plants. Some large insect larvae are also attractive food sources for birds and mammals which can cause severe damage as they hunt for these grubs. Earthworms are recognised as having a beneficial effect on the soil ecosystem, but a few species tend to come to the surface regularly and they create mounds of soil on the surface (casts) which interfere with ball roll, bring weed seeds to the surface and if the soil is heavy in texture, the casts smear and effectively seal the surface preventing water movement.

Common turf pests



Leatherjacket (larvae of crane fly which are a major problem for turf as they can eat both roots and leaves causing direct damage and stress to the turf and are hunted by birds and mammals that can “rip up” turf to find them)



Chafer grub (larvae of chafer beetle species which directly feed on grass roots creating stressed plants that are more susceptible to disease damage and drought. They can be large grubs which are an attractive food source for birds and mammals who will destroy turf to find them)



Nematodes (plant parasitic nematodes feed on grass roots causing turf stress, which can kill the plant at high levels of infection or if there are other stresses like drought. Can be particularly problematic on football pitches as root feeding damages the roots which reduces the strength of the turf, therefore increasing the risk of players slipping due to reduced surface traction)



Earthworms (have beneficial effect on soil and do not feed on live plant tissues, but surface casting species cause problems, particularly for golf turf. Casts are the perfect seed bed for weed seed brought to the surface in the worm’s gut. The casts reduce the playability of the turf and can result in winter drainage issues when they are smeared by mowing, leading to poor infiltration into the playing surface)



Worm casts (can be problematic for golf turf, especially when there are a lot of worms present in an area)

From interviews with golf associations and practitioners in the target countries, the priority turf pest, weed and disease problems on golf courses are given below:

- **Diseases** – microdochium patch and dollar spot are the main diseases that cause most damage.
- **Weeds** – various plants (broad-leaved and grasses) are a problem but clover, daisy, dandelion, pearlwort and moss were mentioned as priority for control.
- **Pests** – insect larvae such as leatherjackets and chafer grubs. Earthworms also a perennial concern due to casting creating surface damage.

To establish the typical pest, weed and disease problems experienced by a range of football facilities, specific countries were contacted by questionnaire survey. The survey elicited 427 responses. The countries where the respondents were from are given in Figure 3, whilst the breakdown in type of football facility is shown in Figure 4. A disproportionate number of respondents were from Germany, where 85% of responses were from amateur football clubs. The breakdown in the level of football played on the respondent’s pitches is shown in Figure 5.

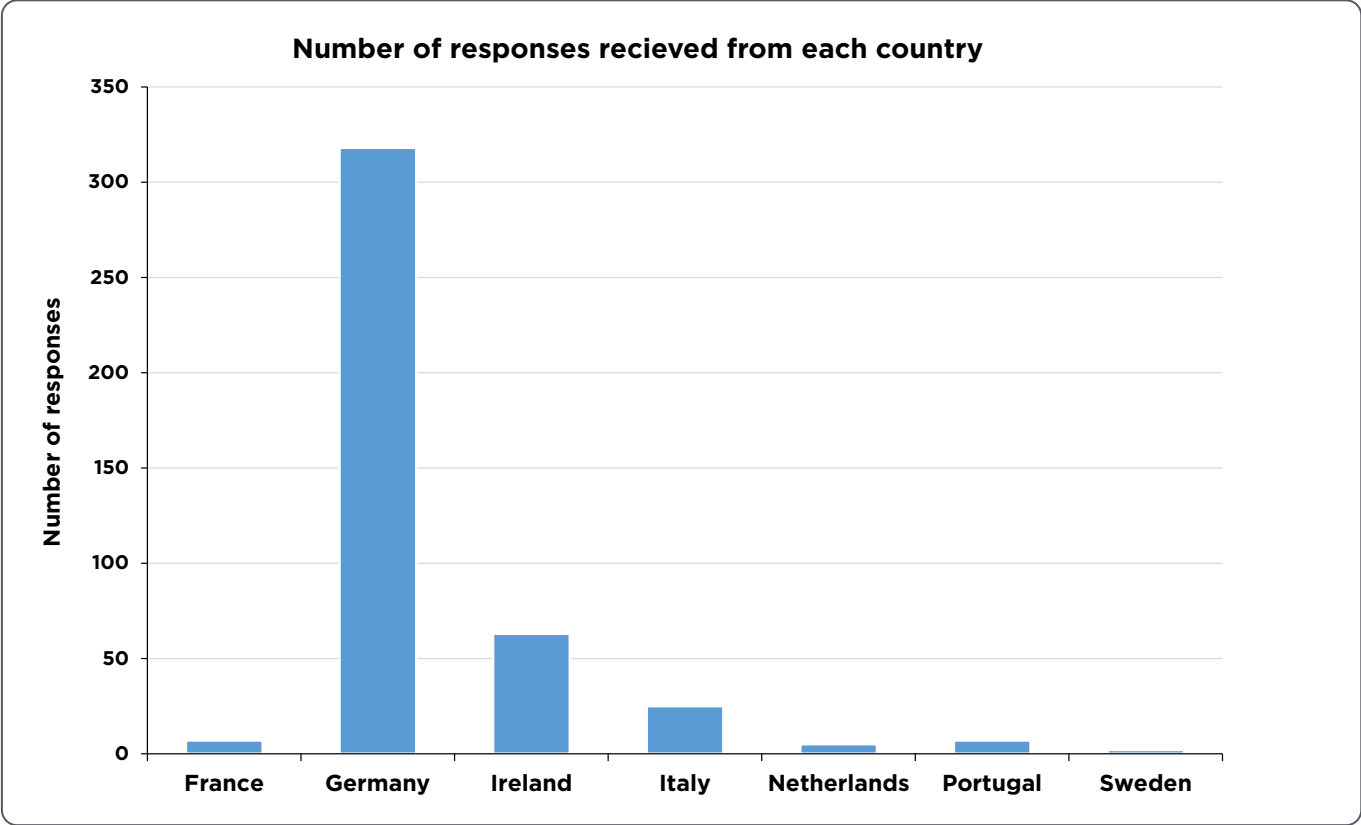


Figure 3. Country breakdown of respondents to the survey.

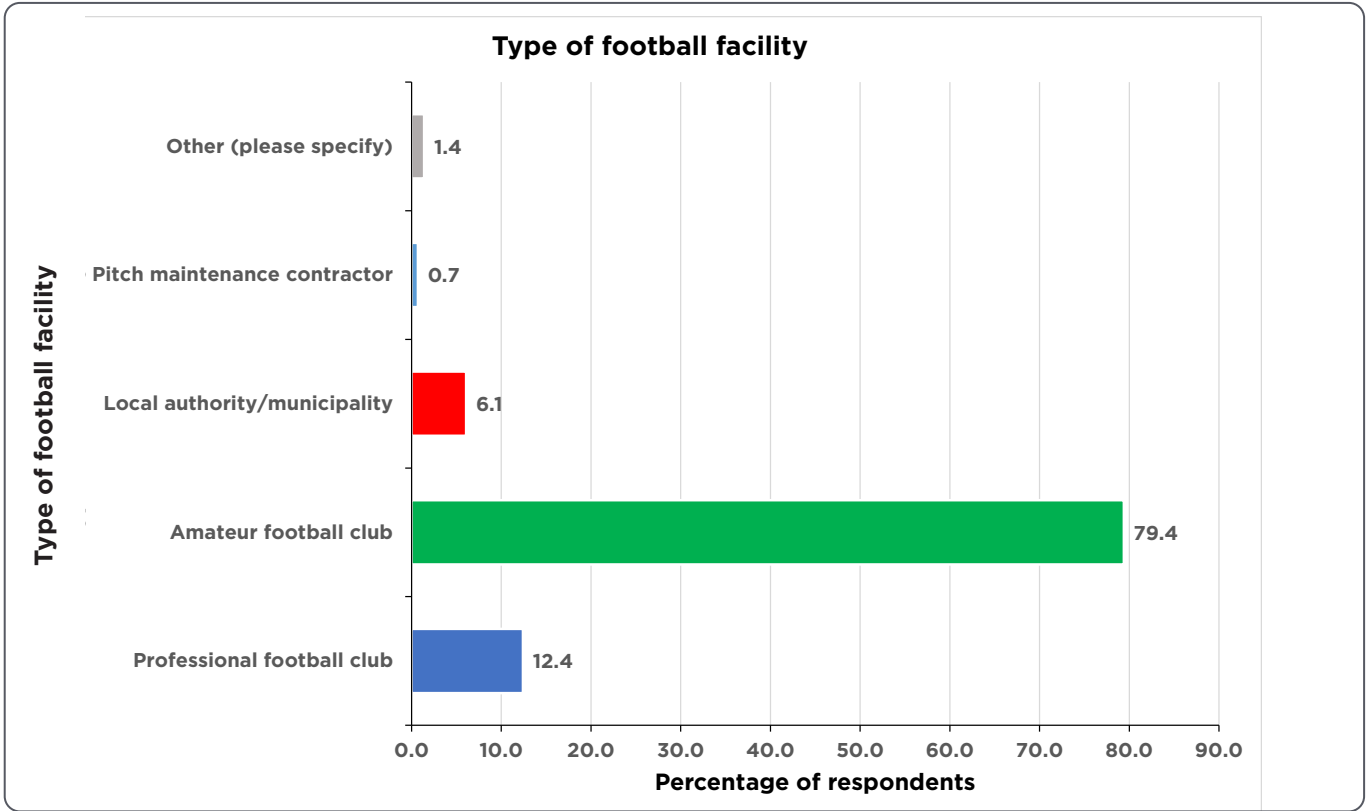


Figure 4. The breakdown in type of football facility where the respondents are from.

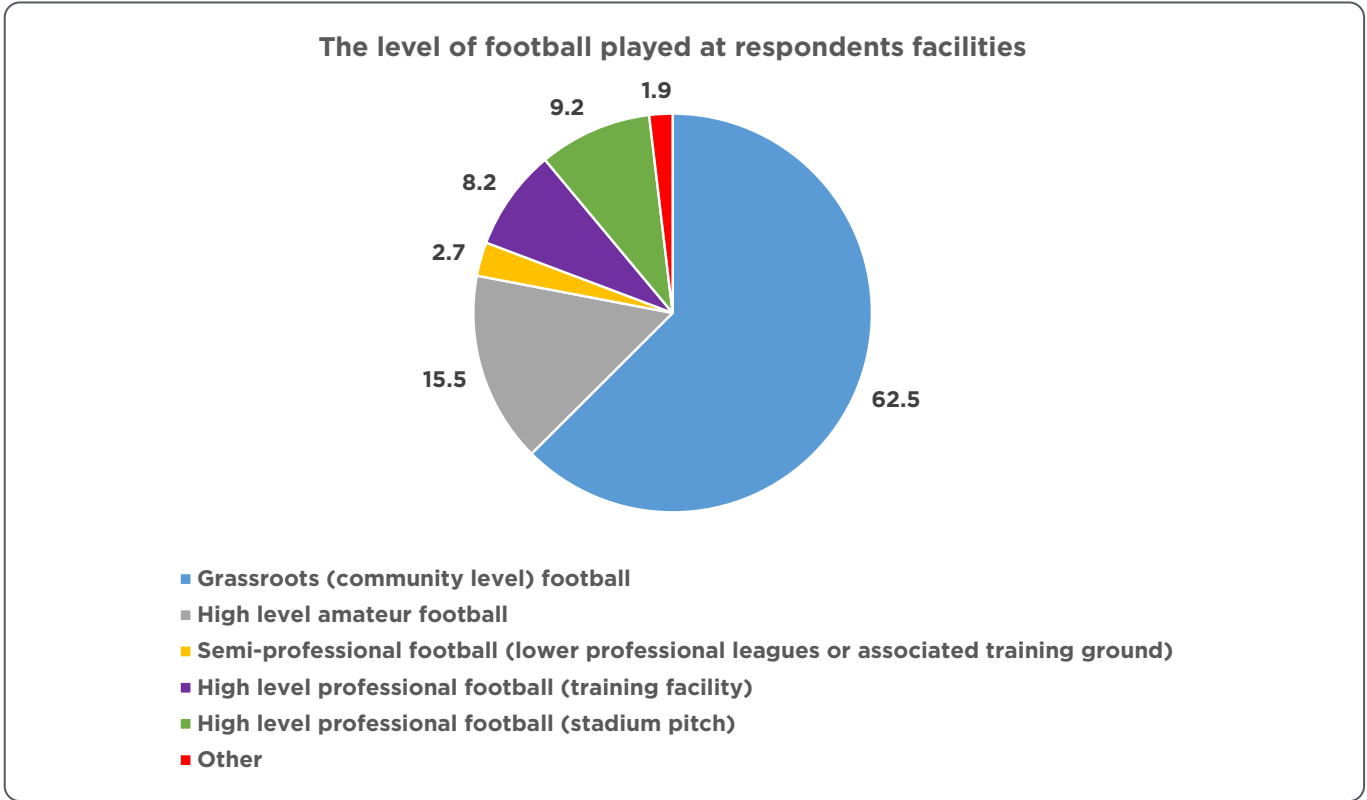


Figure 5. Breakdown in the level of football played on pitches managed by the respondents.

The typical problems experienced by survey respondents are given in Figure 6. It shows that weed invasion was the most common issue on football pitches, which is not surprising given that the majority of respondents were from amateur football clubs playing grassroots/community football. This is a common trend seen with football pitches at that level due to budget restrictions meaning repair of grass cover is often limited, resulting in bare ground where weeds can grow. The second most common turf problem was disease.

3.2.2.2. How have PPPs been integrated into turf management?

Traditional sports turf management has focused on preventing problems before they occur. This ethos has continued in IPM practices which have spread into all areas of sports turf management. Figure 7 shows the hierarchy for managing all turf issues. This requires understanding the root causes of turf issues and actively managing turf to prevent the problem from occurring in the first place. If a pest, weed or disease issue

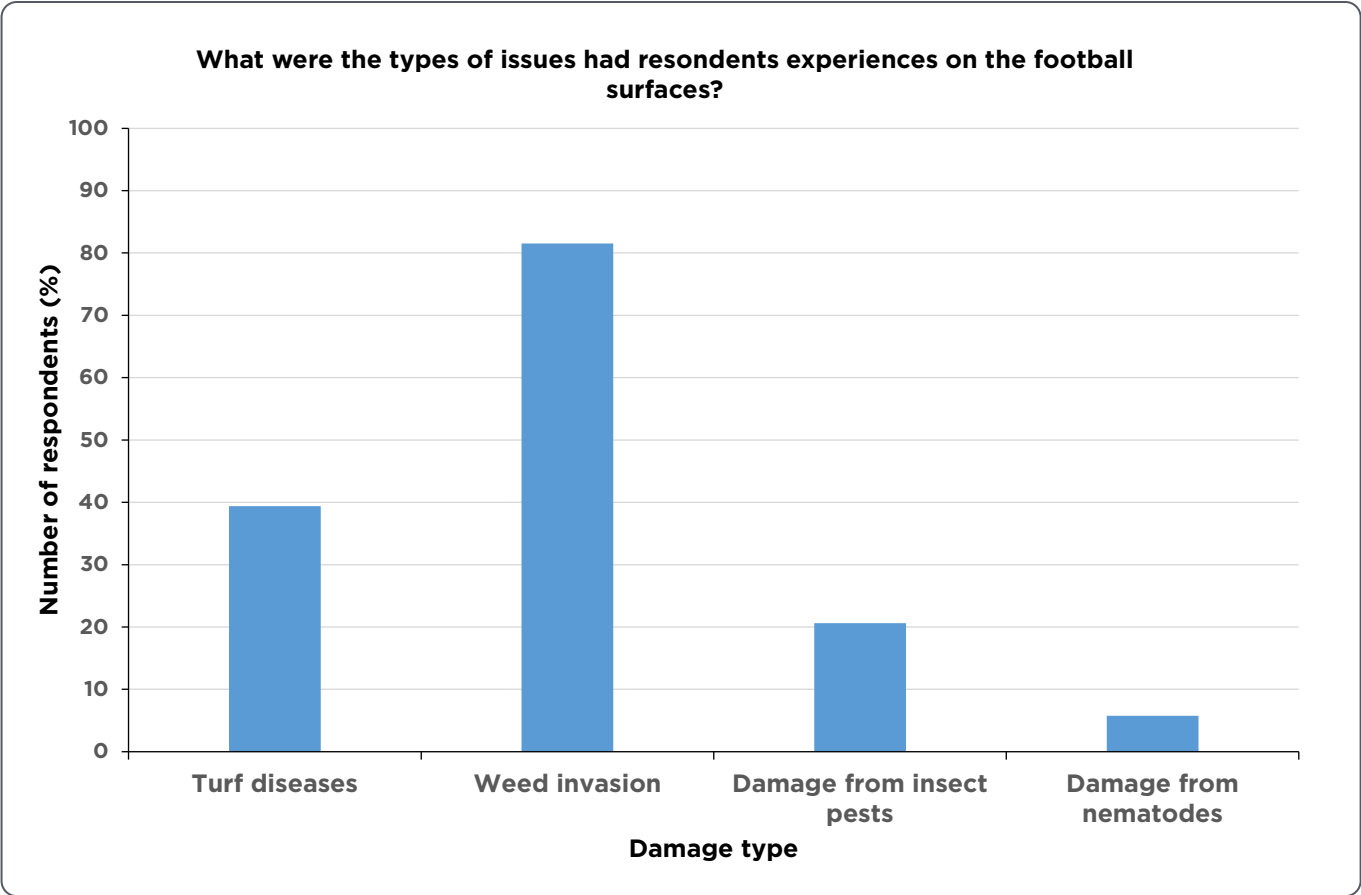


Figure 6. Types of turf issues experienced by the survey respondents.

does appear, then the next stage is to look at how we can culturally manage that problem. For example, this could be the strategic application of nutrient to boost plant health, to fight off the infection and grow out the damage. This goes hand in hand with physical control. This is where the problem is managed physically, such as hand removing a weed or using aeration tines to kill soil borne insect pests. The next stage of treatment is to look for appropriate biological controls, such as the use of parasitic nematodes to control young problematic insect larvae, such

as crane fly or chafer beetle larvae. The final line of defence is chemical control. This should only be used to treat a problem that is not responding to all other actions. This should be carried out in conjunction with damage thresholds, which identify levels of effect on turf above which chemical control is advisable or permitted. This is important, as if a problem becomes well established and extensive, it can be more difficult to control and actually require more PPP use, so it is a fine balance between when to act whilst not leaving action too late.

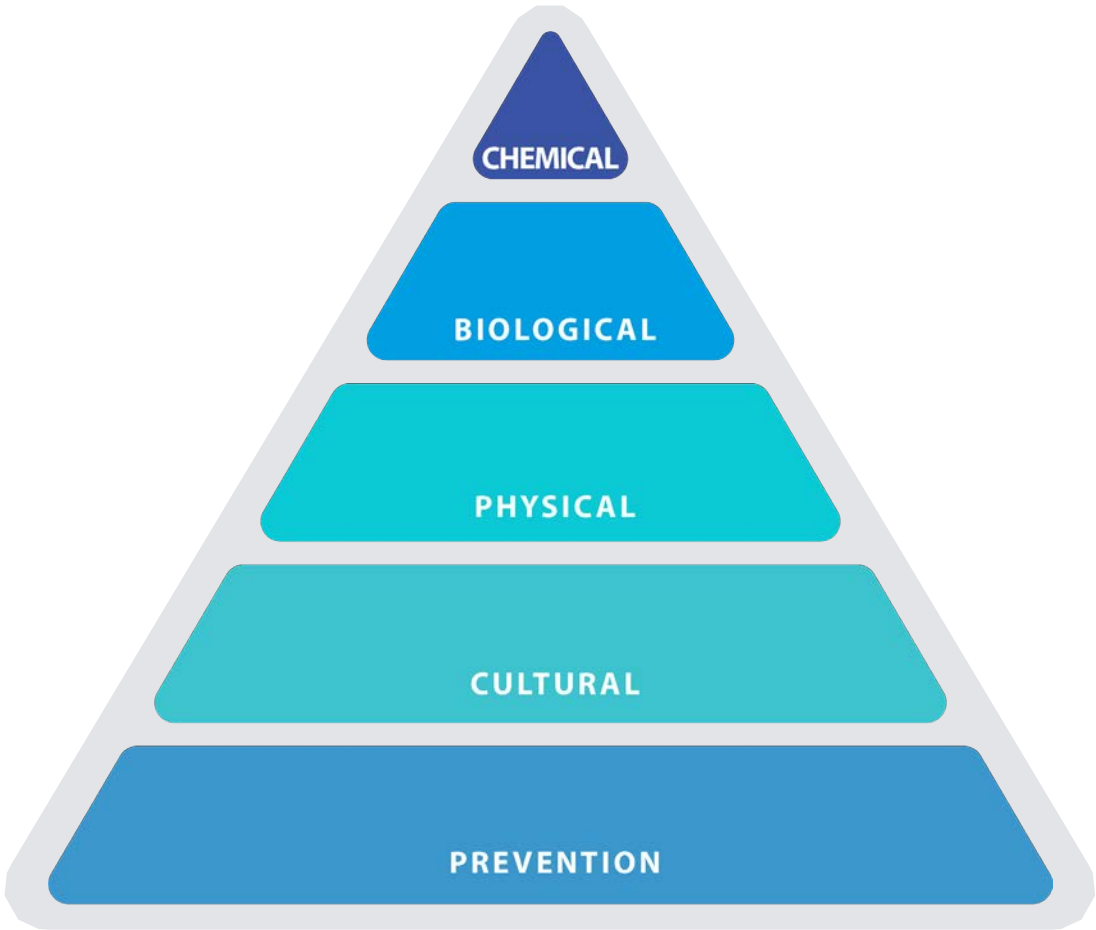


Figure 7. Decision hierarchy for IPM control of pests, weeds and diseases.

Legislation at EU and Member State level (especially in a number of countries like Netherlands, Belgium, Denmark, France, Sweden, Germany) all push users towards the legal need to follow IPM and minimise PPP usage. This links to best practice guidance from sport governing/national bodies, independent scientific experts, agronomists and consultants, that train and encourages users to only consider PPP use on sports surfaces when it is absolutely necessary so that their use can be minimised, i.e. used in situations when other measures are not successful in checking and controlling a problem. IPM/best practice advice is also discussed and promoted by the product

and solution supply chain for sports turf. Many producers, suppliers and distributors of products provide free guidance on how to tackle turf problems following the principles of IPM. Section 3.2.3 highlights the ways that sport has embraced IPM and how its principles have become part of best practice advice and routine maintenance.

3.2.2.3. What factors influence pest, weed and disease pressure?

Key to preventing turf issues is knowing what conditions favour the development of pest, weed and disease issues. Guidance and training in the sports turf industry focuses on assessing why a problem has either occurred or could occur, i.e. the need for root cause analysis. This means that it is vital for turf managers to understand their growing environment, its history and the factors that can affect a specific pest, weed or disease developing on their turf. To help visualise the relationship and interaction between the factors to be considered, the pest/weed/disease triangle is commonly used in training (Figure 8).

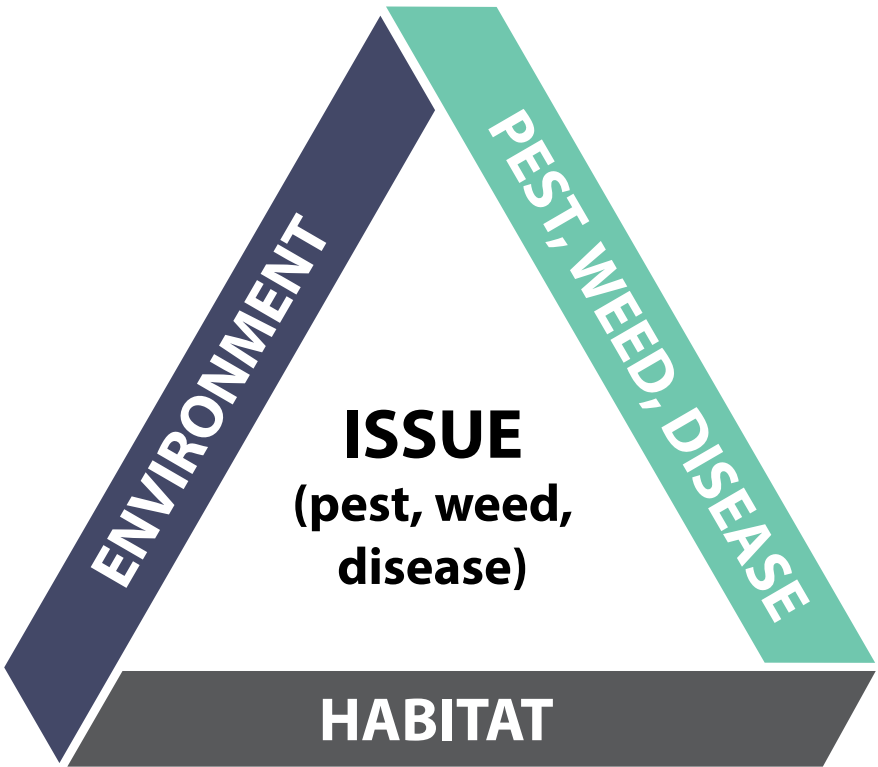


Figure 8. Pest/weed/disease triangle to help visualise the relationship between the factors that can result in turf problems from occurring.



In essence, Figure 8 shows that for a turf issue to be present three factors need to be satisfied:

- There needs to be a habitat or host for the problem. The pest, weed or disease needs somewhere to grow and survive
- There needs to be a sufficient population of the problem to result in pests, weeds or diseases establishing. For example, a single fungal pathogen will not cause disease symptoms and damage to the turf from occurring. However, when that population becomes sufficiently large so it can sustain itself and enough individual organisms are present to infect plant tissues causing symptoms and damage
- Finally, the environment must be suitable for that pest, weed or disease population to be able to thrive and persist.

For practical turf management this means:

- Keep turf healthy and strong so the grass is competitive against weeds and tolerant to disease attack
- Don't allow the conditions in the turf and soil to favour the pest, weed or disease, this helps to keep these populations to a minimum and below the threshold level to cause the problem in the first place

- Actively manage the pest population, for example this could be maintaining turf drier than normal to inhibit the growth and survival of fungal pathogens that need moist conditions to survive.

This means sports turf managers have to understand the biology and ecology of pests, weeds and diseases. They also need to understand the biology, physics and chemistry of the environment they work in, especially as they are managing permanent grassed surfaces. Being a turf manager is a highly skilled profession, which to be successful, a greenkeeper or groundsperson needs to understand how small changes in the growing environment or abiotic/biotic stresses will impact the health of their turf and acting in a timely and definitive way.

Alongside understanding the pathogen and the environment they are growing turf in, greenkeepers and groundspeople need to understand the impact and effects they can have with the maintenance tools they have available and how to get the best out of them. It is vital they appreciate how to optimally manage turf, in conditions when the environment they are in is continually changing, day to day, season to season, year to year.

TGIF is a database of turf literature spanning scientific papers, reports, conference proceedings, industry articles which is a cooperative project of the United States Golf Association and the Michigan State University Libraries' Turfgrass Information Center.

3.2.3. How is sport following the principles of Integrated Pest Management (IPM)?

In the scientific, educational and reference literature, the first mention of Integrated Pest Management is in 1979. Gibault *et al.* (1979) discussed IPM as being the new modern concept for managing pest, weed and disease issues in turf grass management. Further articles discussing the topic came out in 1980 and it has been discussed and promoted in the sports turf management industry ever since. Even the first authors noted that IPM is a repackaging of traditional approaches to managing turf issues, namely identify the root cause and put in place management processes to remedy the situation. Indeed, it became so commonly used within sports turf management, that it has been included in the Beard's *Encyclopaedia for Golf Courses, Grounds, Lawns, Sports Fields* (Beard and Beard 2005).

IPM is not a new concept and certainly not a new one to the sports turf industry. IPM/ITM stands for best practice in turf management and is widely promoted within the industry. When searching for the exact phrase "Integrated pest management" in the Turfgrass Information Files (TGIF), there are 1908 unique articles and publications. When the search "Integrated turf management" is

entered, 183 entries are found. This shows the level of activity in sports turf when it comes to discussing, spreading and researching IPM/ITM.

A search of recent research conferences from around Europe demonstrates that IPM is at the heart of scientific research and learning. At the 2022 International Turfgrass Conference (ITRC 2022) held in Copenhagen, the theme of which was "Development and Sustainability", there were 81 papers and poster presentations that dealt with IPM and topics related to IPM and best practice management. In June 2023, The Norwegian Institute of Bioeconomy Research (NIBIO) held a two day International Turfgrass Field Day event, which drew an audience from countries such as Norway, Sweden, Finland, Denmark, Netherlands, Germany and UK. Presenters discussed practical research results whose core theme was ITM and best practice management. At this event, 14 out of 19 presentations directly informed the audience on the latest findings in applied IPM research for sports turf.

STERF (Scandinavian Turfgrass and Environment Research Foundation), plays a key role in northern Europe leading practical research and communication of best practice turf management. STERF has

STERF is an independent research foundation that supports existing and future R&D efforts and delivers 'ready-to-use' research results that benefit the golf and turfgrass sector. STERF was set up in 2006 by the golf federations in Sweden, Denmark, Norway, Finland, Iceland and the Nordic Greenkeepers' Associations. Research funded by STERF is carried out at universities or research institutes (or equivalent) where most relevant research capacity is concentrated. STERF helps to strengthen research capacity by encouraging and supporting networks and collaborating actively with international key organisations in the field of turfgrass management. STERF also arranges innovation workshops to help identify the golf and turfgrass industry's future research needs, where researchers and industry representatives contribute to the planning process. STERF receives funding from participating golf associations, complemented by funding from other sources. (Source: www.sterf.org/sv/about-sterf).

a very wide range of research and technical information, as well as practical guidance available for turf managers, a large proportion of it promoting and sharing IPM/ITM advice.

Golf's governing body, The R&A launched Golf 2030 in 2018 to promote sustainable golf course management and give guidance and resources on disease and pest management, resources, biodiversity and climate.

National Associations, such as ffgolf in France (ffgolf 2017), have produced guidelines on the environmental and sustainable design and management of golf courses. A number of national associations have also produced strategies or action plans on managing PPPs, such as SwissGolf's 2030 action plan to zero phyto (SwissGolf 2023).

When discussing how National sports associations engage with turf managers on IPM/ITM, all said that they run events such as conferences, seminars and workshops. The common theme was that these events are an opportunity to provide training on best practice, as well as allowing turf managers to share their experiences and to network with others who may have or had similar turf issues.

Some countries have transitioned further down the pathway to minimal PPP usage and its implementation (as best practice and legal requirements). The Netherlands

Golf Course GC2030 was established by The R&A in 2018 as a long-term research initiative to share knowledge of sustainability best practice in the golf industry. Since its introduction in 2018, in excess of £650K has been awarded to research projects that help those working in golf course management address complex challenges around the themes of sustainable agronomy, resources, biodiversity and climate. Its aim is to produce a roadmap that will steer the sport to mitigate for the challenges and take advantage of the opportunities that these issues present. The programme has an important focus on sustainability and seeks to deliver best practices and practical solutions. Publications and resources provide practical advice and guidance on a wide range of sustainable agronomy and resource management issues in golf bringing together the latest academic research and thinking by industry experts.

is a good example where IPM practices, such as setting damage thresholds and limiting where PPPs can be used, are core to the requirements for all sports turf managers.

In the golf industry, the GEO Foundation for Sustainable Golf is "an international not-for-profit, founded sixteen years ago to help inspire, support, and reward credible sustainability action and to strengthen and promote golf's social and environmental value" (www.sustainable.golf). It is a unique organisation who works "collaboratively with groups and people in and around golf to provide strategy, programmes and credible recognition".

GEO Foundation for Sustainable Golf run GEO Certified. GEO Certified is "the most widely regarded and credible sustainability distinction in golf, awarded to golf facilities around the world that meet the international standard of best practice and demonstrate a commitment to a sustainability journey, looking to do ever more for social and environmental value". This coupled with GEO Foundation's OnCourse platform for providing a system for recording environmental and sustainability data, providing analytics and reporting on a course's sustainability performance, whilst allowing

courses to keep up to date with current best practice.

When interviewing national golf associations/federations, a number highlighted courses in their countries that are GEO Certified. For example, in Finland, around 15 golf courses are GEO Certified with 60 using the OnCourse platform. In Switzerland, 30% of courses are GEO Certified with a further 30% in the process of being certified. This shows the commitment in golf to gain international accreditations to demonstrate the commitment to best practice and IPM approaches.

In football, a survey of football facilities in the EU asked what type of IPM approaches they follow. The results are shown in Table 4. It is clear that many carry out IPM/ITM approaches that focus on water and nutrient management, as well as ensuring mowing operations follow best practice guidelines and that weeds and diseases are discouraged from invading the playing surface.

A number of national football associations have published IPM guidelines for their members to help publicise and provide advice on IPM and best management practices. Two good examples are those produced by the national associations of Netherlands (Ernst Bros. 2023) and Germany (DFB 2017). Both give detailed guidance on IPM and how to follow an IPM approach when managing natural turf football pitches.

Table 4. IPM/ITM strategies that football facilities implement.

IPM/ITM Strategy	%
Removing dew from the grass plant in the morning or mange dew in some other way.	17.8
Irrigate to meet plant requirements and not over water.	63.8
Irrigate at appropriate times of the day so the turf is not wet overnight.	34.4
Manage drainage so that the pitch does not hold onto too much water or is too soft.	54.8
Managing wear and pitch usage to minimise stress and grass loss.	65.1
Optimising plant nutrient inputs to only provide what the grass needs and not over apply fertiliser.	60.8
Use of plant biostimulants to help reduce the effect of stresses such as wear, light, drought, temperatures etc.	13.3
Focus on promoting sustainable turf density to minimise weed invasion.	42.2
Modify the growing environment to help support the grass plant (for example use of lighting units or pitch side fans).	9.8
Make sure mower blades are sharp and properly adjusted to minimise leaf wound opening time.	71.6
Mow regularly at an appropriate height of cut to avoid removing too much leaf material and stressing the plant.	80.9
Understand the conditions that favour turf diseases, weeds and pest and actively work to avoid those conditions, thereby promoting the turf and not the turf problem.	39.2
Treat pitch with UV-C light to help prevent disease outbreaks, e.g. SGL UVC180	5.0
Other	7.5

3.3. Are all sports the same or do they have specific nuances to their management?

As shown in this chapter of the impact assessment, turf management is complex and must take into account all aspects of maintaining a permanent playing surface based on the biology of grass plants. Producing a high quality and safe playing surface requires balancing the needs of sport, the biological, chemical and physical environment, whilst also taking into account climate and day to day weather.

As has been discussed, there is significant crossover between sports in terms of the core requirements for turf management and the

processes used to achieve a playable and safe surface. However, there are unique requirements for each sport, because of how they are played and the environments they are played in. This means surface characteristics are different and techniques needed to maintain them are also different. There is certainly no “one size fits all” approach and best practice demands that turf managers maintain there surfaces in a dynamic way, reflecting the surface, the condition of the turf, the growing environment, the resources available and the types of turf issues that have or might be present.



3.4. Opportunities for biodiversity development

Globally, there are 38,000 golf courses which are often located in strategically important locations such as cities and coastlines, protecting areas from development and providing a multifunctional landscape for recreation and wildlife. There are just under 9000 golf courses in Europe, 60% of which are concentrated in five established golfing countries – England, Germany, France, Sweden and Scotland, with the greatest number of courses found in the UK. The UK’s golf courses make up an area of circa 126,000 ha of greenspace and represent 33% of Great Britain’s open green space.



Ecological rough

3.4.1. The importance of golf courses

In urbanised or densely populated areas, where large areas of natural habitat have been lost to housing and infrastructure, the remaining natural areas, even those within reserves or with protected status, are very fragmented, restricting movement of plants and animals, making populations non-viable long-term. Even in more rural areas where agriculture dominates, golf courses can provide essential oases for restoring and enhancing biodiversity in ecologically simplified landscapes.

Table 5. Number of Golf Courses in Europe (Ref: The R&A)

Country	No.
England	2,270
Germany	1,050
France	804
Sweden	662
Scotland	614
Spain	497
Ireland	494
Denmark	346
Netherlands	330
Italy	321
Austria	205
Finland	191
Norway	191
Wales	186
Czech Republic	132
Belgium	121
Switzerland	114
Portugal	106
Iceland	75

Intensive management on golf courses is restricted to the key playing areas of greens, surrounds, tees and fairways but the majority of courses have large rough and ‘out-of-play’ areas, which are only managed infrequently, perhaps annually or every few years and with little or no chemical or fertiliser inputs. On average, around 60% of a golf course is thought to consist of these natural habitats. In the UK, this amounts to around 75,000 ha.

Golf courses provide vital stepping stones for wildlife across urbanised landscapes, as demonstrated by one of the British Trust for Ornithology’s GPS tagged Cuckoos, which was seen to use golf courses around the city of London as he returned to his breeding site on a nature reserve in Suffolk, UK.

Far from being devoid of nature, golf courses are important habitats for wildlife. Around 100 courses in England, 30 in Scotland and several more in Wales and Ireland are designated wholly or in part as SSSI sites and over half of these are sufficiently important to have been designated as European protected sites under the Natura 2000 network, which include Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). SACs relate to the habitat type in general and SPAs relate to areas that provide habitat

for particular assemblages of birds. Throughout Europe, 40% of the total Natura 2000 area is farmland and almost 50% is forests and several golf courses also fall within these designated areas. The main objective of Natura 2000 is to prevent activities that could significantly disturb species or damage habitats for which sites are designated and to take positive measures, if necessary, to maintain and restore important habitats and species to improve their conservation status. Therefore, the way in which the sites are managed is a key factor in achieving their conservation aims.

3.4.2. Biodiversity through golf course management

Many habitats of high ecological value need some form of management to maintain their wildlife diversity and rarer species, otherwise much of the land would naturally revert to woodland over time through natural succession. For example, species rich grassland, heathland and links dunes all need a level of disturbance in the form of grazing, mowing and/or carefully managed clearing or surface scraping to prevent dominant species from taking over and to create gaps for less competitive species that would otherwise be outcompeted. Creation of a mosaic of habitats is ideal for biodiversity.

Golf courses are well-placed to provide this as they undertake management to different intensities to create a diversity of habitats. Furthermore, it is frequently aligned with the clubs wishes to retain desirable golfing features. For example, heathland golf courses will manage ingress of tree saplings and grasses in the heather and cut it annually to retain its vigour. Similarly, thin, wispy rough is desirable on courses to frame golf holes but also be able to find a golf ball in. Fertiliser and water are actively avoided in these areas and the grassland is cut and collected annually or every few years to retain its thin character. Pesticides are rarely, if ever, used in these areas as the golfers appreciate the wildflowers and the expense is prohibitive.

Scientific studies such as work by Tanner and Gange (2005) have demonstrated the positive effects of golf courses on local biodiversity. They studied nine golf courses and nine adjacent habitats (from which the golf course had been created) in Surrey, UK. Two main objectives were addressed: (1) to determine if golf courses support a higher diversity of organisms than the farmland they frequently replace; (2) to examine whether biodiversity increases with the age of the golf course. The study found birds and both insect taxa showed higher species richness and higher abundance on the golf course habitat than in nearby farmland. While there was no difference in the diversity of herbaceous plant species, courses supported a greater diversity of tree species

and bird diversity showed a positive relationship with tree diversity for each habitat type. The courses studied differed in age by up to 90 years, but the age of the course had no effect on diversity, abundance or species richness concluding that golf courses of any age can enhance the local biodiversity of an area by providing a greater variety of habitats than intensively managed agricultural areas.

Similar research undertaken in the greater Helsinki region, southern Finland (Saarikivi 2016) showed how golf courses contribute to the diversity of open green spaces in an urban setting. They studied the biodiversity of established and newly-created golf courses. Their genetic research suggested that the golf courses contributed positively to urban amphibian populations by providing green corridors for dispersal, thus preventing isolation and loss of genetic variability within populations. In addition, hole-nesting passerine birds showed a clear preference for golf course forest edges over the nearby forests and birds also performed better in terms of nest occupancy and number of offspring at golf course forest edges, thus indicating a valuable habitat, which could be further improved with the addition of nest boxes.

Likewise, a study of 23 golf courses in Italy (Sorace and Visentin 2002) evaluated the similarity of the avian community in the golf courses compared to that of the surrounding agricultural and urban landscapes. The golf courses with a larger proportion of forested areas supported higher bird species diversity and higher numbers of bird species of conservation concern and those sensitive to forest fragmentation compared to the surrounding areas.

A worldwide scientific literature review of ecological value of golf courses (Colding and Folke 2009) found 17 quantitative case studies that measured and compared biota on golf courses to that of green-area habitats related to other land uses. Golf courses were found to have higher ecological value in 64% of comparative cases. The value of golf courses significantly increased when compared to land that had high levels of anthropogenic impact, like residential and urban land, and also agricultural and park land.

Furthermore, Terman (1997) found that 'naturalistic' golf courses, those with substantial amounts of native wildlife habitat in out-of-play areas, can have the same species richness as nearby natural areas.



Wild area on golf course in Italy



3.4.3. Rare habitat and species conservation

Golf courses, particularly historic courses, are already supporting and actively promoting conservation of some of the rarest habitats and declining species that require specific management practises to ensure their survival. (Gange *et al.* 2003, Colding and Folke 2009).

Heathland and acid grassland are classified as internationally rare and endangered. In southern England, 70% of heathland has been lost and is designated as UK priority habitat with individual habitat action plans (HAPs) to aid its conservation. A notable proportion of what remains is found on golf courses on over

100 sites (Gange and Lindsay 2002).

Chalk downland grassland and links dunes also benefit similarly from golf course management and preservation. For example, on the Sefton Coast (UK), 20% of the dune system is protected by the presence of golf courses (Simpson 2000). Some threatened species are even more abundant in golf courses than in native habitats (Green and Marshall 1987; Rodewald *et al.* 2005; Smith *et al.* 2005).

Examples of rare or declining species favouring golf courses include Lizard Orchids, Willow Tits, Turtle Doves, Skylark, Chough, Small Blue Butterfly, Duke of Burgundy butterfly and Great Crested Newts. In the UK, some courses have also been



Diversity of habitats on a golf course in Portugal

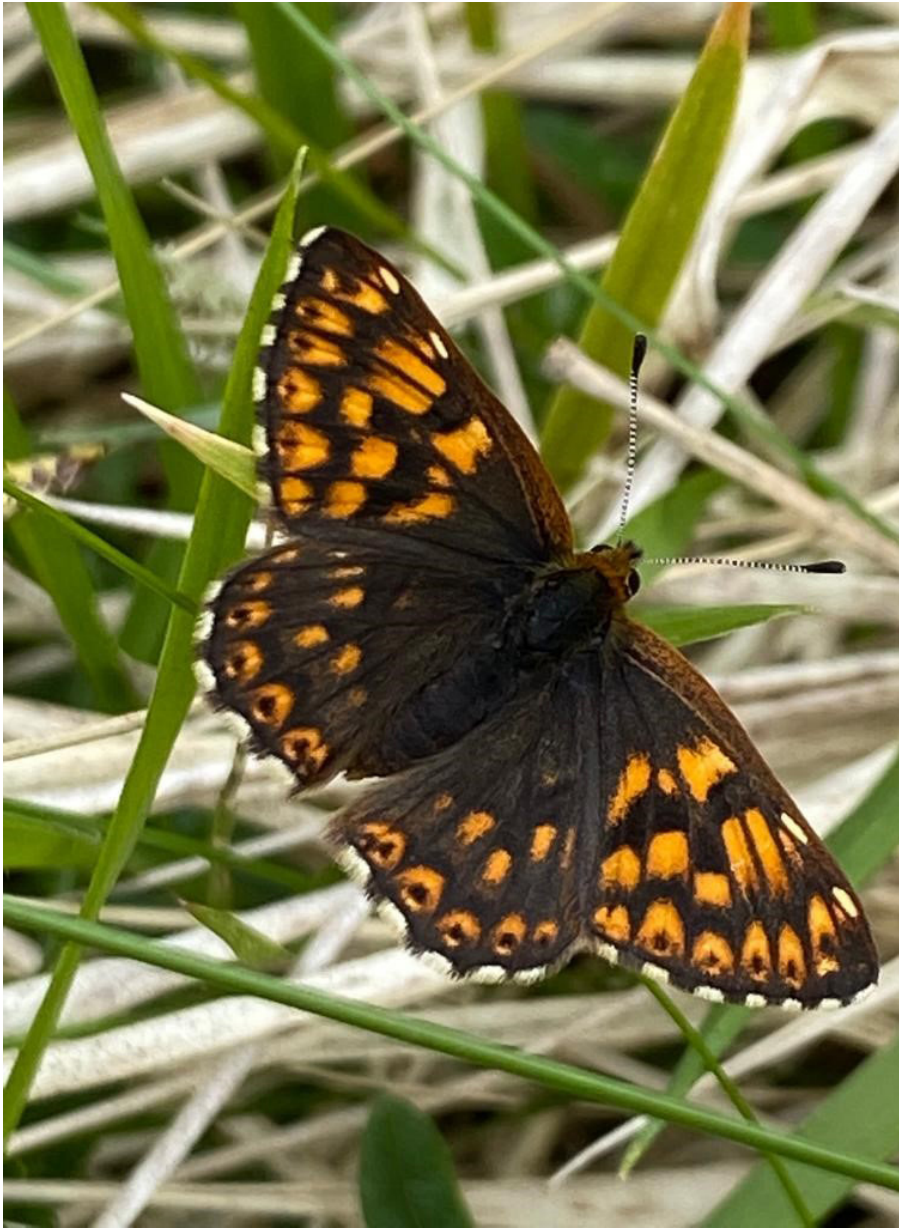
involved in the reintroduction of some of the rarest reptiles, the Sand Lizard and Smooth Snake. Pyle and Kenfig golf course in the south of Wales have recorded probably the UK's rarest bee, the Shrill Carder bumblebee (*Bombus sylvarum*) during the restoration of their dunes systems on this links course.

3.4.4. Ecological corridors

Nature conservation bodies are now putting considerable effort and funding into maintaining or improving connectivity between designated natural areas by establishing 'wildlife corridors' to improve the capacity of species to move between remnant areas of good habitat. This requires engagement with land owners and managers to understand the importance of their individual sites within the wider landscape.

Golf clubs are recognised as playing an important role in this. For example, Llanymynech Golf Club, which sits over the Welsh/English border has recently been awarded £91,000 by Nature Network to help maintain the Llanymynech and Llyncllys Hills Site of Special Scientific Interest (SSSI) and safeguard rare species of butterfly and limestone grassland. The funds will be directed to control bramble, bracken and scrub ingress, prevent spread of Himalayan Balsam, an invasive non-native plant and reintroduce some grazing.

A number of golf courses have been involved with Bumblebee Conservation Trust projects to support rare and declining species. Lydd Golf Club in Kent was part of a landscape-scale project to provide connected habitat for the reintroduction of the Short-haired bumblebee.



Duke of Burgundy butterfly

Since 2013, the Scottish Wildlife Trust have coordinated Nectar Network, a collaborative project with landowners along the Ayrshire coast, including 6 golf courses to provide 30 miles of nectar-rich habitat for pollinators. Similarly, the Sussex Downs Trust created Bee Lines that funds projects supporting chalk downland management, including golf courses.

in 2019 an initiative by the Leicestershire & Rutland Wildlife Trust brought together representatives from over ten golf clubs to share experience on environmental golf course management, including a series of information resources. The group includes greenkeepers, committee members and club managers.

The Dunes 2 Dunes Sustainable Management Scheme facilitated the connection of two important Welsh dune nature reserves, Kenfig Burrows and Merthyr Mawr Warren, designated National Nature Reserve and Special Areas of Conservation. Once part of a massive dune system, these two important ecosystems are now separated by the limestone pavement of Porthcawl Coast, two golf courses and settled farmland. The project required collaboration of nature reserve managers, landowners, 2 golf clubs and farmers to sustainably manage the coastal landscape, improve the ecosystems, increase biodiversity and

connectivity between the two dune systems, exploring the benefits of this management for people, businesses and communities.

Similarly, the Sefton Coast Life Project, an initiative funded by the European Union, involved active co-operation with seven links golf courses along the Sefton coast, in the north-west of UK. The project held a symposium at The Open host golf club, Royal Birkdale that attracted 130 nature conservation specialists from 15 countries to learn how golf and conservation can work together through an integrated approach for effective coastal zone management to address erosion and loss of habitat through scrub encroachment.

3.4.5. Industry and public engagement

Golf course managers and greenkeepers usually already have a close affinity with nature and most are keen to, and already do, manage sensitively for wildlife. A study (Hammond and Hudson 2007) to assess the attitudes of golf course managers to biodiversity and conservation from 94 golf clubs in East Anglia, UK found 90% of course managers considered that golf courses were important for wildlife and over 60% wanted to do more to promote wildlife. Elements of positive management were widespread, although formal

management planning only took place in 43% of the courses surveyed and only 12% had carried out a detailed baseline wildlife survey. Provision of information for course managers, and communication with club members, were revealed as key issues for future improvement.

Golf managers efforts to promote nature are usually well received by their members. A study by Imperial College London (Lyme, 2004) surveyed members at 20 London golf clubs within the M25 to assess the value of nature to them on their respective courses. The findings revealed that 78% agreed that a golf course should always be managed with nature in mind, 67% agreed that GUR (Ground Under Repair) could be used for nature conservation, 68% would like more information regarding wildlife on their own course and 27% were willing to pay an increased course fee to see increases in wildlife.

Golf clubs have been engaging with ecology and conservation for many years, supported by advice from conservation bodies and qualified ecologists. The RSPB have written a guide to habitat management on golf courses (Duff and Symes 2009), discussing the fact that good habitat management for birds will also mean good habitat for other species groups such as plants and insects. Good advice

on evaluating and conserving wildlife and habitats on golf courses has also been produced by other bodies such as the Scottish Golf Environment Group (2002, 2009).

The Scandinavian Turfgrass and Environment Research Foundation (STERF) frequently undertake research into golf course biodiversity and sustainable management. Examples include a project with Norwegian Institute of Bioeconomy Research (NIBIO) 2017-2020 'From dense swards to biodiverse roughs' which provided information on management strategies to enhance diversity of flowering plants and pollinators in roughs. Results were presented as an international webinar. Another was with DOF (Dansk Ornitologisk Forening)-Birdlife Denmark in 2018-2019 with Sydsjællands Golfklub and Dansk Golf Union which looked at strategies to encourage starling (*Sturnus vulgaris*) to settle on golf courses as a natural pest control. Similarly, another project 'Improve Nature Around Golf Courses for More Birds' 2020-2023' looked at what bird species and numbers occur on Danish and Southern Swedish golf courses, how to improve the living conditions for birds and the overall courses nature value, as well as inspire golfers in the Nordic countries to show more interest in birds and nature, and make birdwatchers in the Nordic



countries more aware that golf courses have the potential to be a new arena for birdwatching, resulting in closer collaboration and more overlapping interests between these two groups of stakeholders.

The R&A are funding 3 new projects through 2023-2025 with STERF, the Finnish Golf Union and French Golf Federation & National Museum of Natural History to study biodiversity on golf courses with the aim of enhancing it.

The Hessian Golf Assoc have 54 golf clubs in their region in central Germany and have identified that 35% of their total area (3700 ha) can contribute to biodiversity. Through a joint campaign by the Hessian Golf Association and the Hessian Ministry of the Environment, project 'Golf Course Habitat' established in 2020 is providing assessment of current ecological status and giving simple targeted advice to create additional living spaces for nature.

Almost all golf clubs engage with nature in some way from leaving areas untouched for existing wildlife, putting up bird and bat boxes, sowing wildflower and preserving veteran trees to developing biodiversity and management plans for wildlife enhancement, engaging professional ecology services and establishing working relationships with their relevant natural heritage

agencies or wildlife trusts. Some clubs undertake nature walks for members and guests and have community outreach events such as pond dipping for local school children. These achievements are recognised annually in the Golf Environment Awards, sponsored by key golf industry stakeholders and companies. The awards celebrate clubs and individuals committed to sustainable management, successful ecological projects, habitat creation and management: golfenvironmentawards.com

Industry leading bodies and key stakeholders in golf are also driving sustainability to the forefront of golfing activities:

The Golf Environment Organization (GEO) Foundation aims to accelerate sustainability in golf, principally through fostering nature, taking climate action, conserving resources and strengthening communities. Clubs can become GEO Certified® to demonstrate and be recognized for their environmental and social responsibility throughout the course.

Golf's governing body, The R&A launched Golf 2030 in 2018 to promote sustainable golf course management and give guidance and resources on disease and pest management, resources, biodiversity and climate. In addition, The R&A require clubs that host their tournaments to

implement and be accredited for sustainability initiatives. The R&A employ a qualified ecologist to give ecological and environmental advice to The Open venue courses to ensure sensitive areas are avoided and habitats restored/ improved. The R&A also work closely with The Royal Society for the Protection of Birds (RSPB) who brought the conversation about climate and biodiversity crises to a global sporting stage via coverage by Sky TV from The Open, talking on the enjoyment nature on golf courses can bring, the compatibility with the game of golf and the huge positive impact it could have if all golf courses were managed with nature and climate in mind.

The English Golf Union now aim to deliver Net Zero golf events and advise clubs on how to upgrade their own facilities and behaviours to promote golf as a sustainable sport and act in the

best interests of their local area and community.

The renowned Golf World Top 100 publication has just published a 'Best Sustainable Golf Courses in Europe' list recognising clubs that foster nature, conserve resources, strengthen communities and take action for climate change by reducing their carbon footprint. The majority of these clubs are within the UK.

With over four million people a year registered golfers within Europe, golf courses are well placed to influence people to act for nature and the environment both on their golf course but also in their back gardens and communities.

The importance of integrating biodiversity into the very heart of golf course management has been recognized by a number of European national golf federations. These federations have produced strategies, action plans and guides to help target development of biodiversity and to provide guidance to clubs on how to achieve this (SwissGolf 2022, ffgolf 2017). France has been undertaking an 8 year project to monitor and assess the biodiversity of its golf courses to establish an inventory of natural value on its courses (Roquinarç'h *et al.* 2019). These initiatives demonstrate how golf values and encourages biodiversity development as a core part of golf course management.



Map of GEO certified golf courses
www.sustainable.golf/directory



4. Plant protection product usage

When considering the impact of a potential withdrawal of PPPs on sports turf management, it is important to understand what PPPs are in use by sports turf managers, how much is currently being used and is this broadly similar across all areas of the EU.

Additionally, it is vital to understand how sports turf managers have been engaging with the “minimal” PPP usage requirements of the SUD and what levels of PPP reduction have been made by sport.

4.1. Market overview

Sport is a small market compared to larger markets that regularly use PPPs, such as the agricultural sector. This means that the influx of new solutions, other than biologicals is relatively limited. Over the years there has been a net reduction in the availability of PPP as a result of both legislative change (candidates for substitution, SUD and enhanced environmental laws in some EU countries) and the commercial reality of discovering, developing and bringing to market new solutions, even if they are biologicals or classed as low risk.

4.1.1. What products are available in key EU markets?

It can be difficult to access data on the exact number of formulated products that are authorised and actually available for use on sports surface across all EU countries. This is in part due to how these

Member States log and record authorised plant protection products, i.e. there is great variation in how this information is presented, its accessibility and the level of detail available. For example, a member state may have data logged for golf courses and sports pitches, whereas another may group other amenity areas like hard surfaces or ornamental flower beds into a category that includes sports, making differentiating what is actually able to be used on a specific surface more challenging.

For this impact assessment, the number of active substances in authorised products in a range of European countries has been used as an index of PPP availability (Table 6). Only products that are authorised for professional use have been included and only those used as fungicides, herbicides, insecticides, nematicides and plant growth regulators. Data has been taken either from national databases given on EPPO's website (www.eppo.int/ACTIVITIES/plant_protection_products/registered_products) which lists available PPP databases, or through information supplied by national associations for football or golf. Links to the relevant databases have been given in the references (chapter 7).

The objectives of this chapter are to:

- Evaluate the PPPs currently available for sports use across a range of countries
- Establish the type and level of legal restrictions in place in a range of countries
- Investigate the homogeneity of the PPP market across the EU
- Evaluate how much PPP is being used by sport and looking at football and golf as examples
- Define any regional challenges with PPP use that need to be considered when assessing the impact of PPP withdrawal on sports turf

The European and Mediterranean Plant Protection Organization (EPPO) is an international organization responsible for cooperation and harmonization in plant protection within the European and Mediterranean region. Under the International Plant Protection Convention (IPPC, Article IX), EPPO is the Regional Plant Protection Organization (RPPO) for the Euro-Mediterranean region.

Its aims are:

- To protect plant health in agriculture, forestry and the uncultivated environment
- To develop an international strategy against the introduction and spread of pests (including invasive alien plants) that damage cultivated and wild plants, in agricultural and natural ecosystems and protecting biodiversity
- To encourage harmonization of phytosanitary regulations and all other areas of official plant protection action
- To promote the use of modern, safe, and effective pest control methods
- To provide a documentation and information service on plant protection.

Table 6. Number of active ingredients in the countries selected for this impact assessment.

Country	Biological control	Chemical active substances*
Austria	1	14
Belgium	4	18
Czech Republic	1	0
Denmark	5	9
Finland	1	12
France	5	19
Germany	2	20
Ireland	1	19
Italy	3	13
Netherlands	5	21
Portugal	0	17
Spain	1	10
Sweden	1	13
Switzerland	4	16

* In products intended for professional use

From the list of active substances, there is a lot of variation in the range of compounds available. The Czech database shows there are no chemical products authorised for use on golf courses or sports fields and there is one biological listed. The Belgium region of Wallonia has a PPP and biological ban for sports and golf so has not been included. The availability of active substances reflects the legislation and regulatory environment in each country. It is noteworthy that those countries further down the path of PPP reduction, such as Belgium, Denmark, France

Netherlands and Switzerland (the latter not being in the EU but included for comparative purposes), all have more biological actives available.

However, it is important to note that whilst there may at first glance be a range of active substances available, several factors need to be considered:

- Many formulated products contain multiple active substances (such as herbicides that may contain three actives) which means actual product availability will be less than the number of actives alone.

The reality is that the market for PPPs is not homogenous across the EU.

- A range of actives is needed for rotational management of potential resistance in pests, weeds and diseases. Additionally, active substances work on the target organism in different ways and their optimum use window will vary therefore, to get best effect from PPPs as part of an IPM/ITM there needs to be effective coverage by substances in periods of the year when problems are active and present.
- Bekken *et al.* (2023) demonstrated in their study that three European countries (UK, Norway and Denmark) had an average of 14 active substances available for golf use, whereas three US states had, on average, 237 available. This helps to show the efforts made by European countries to reduce their PPP requirements compared to other regions of the world.
- A consortia of sports governing bodies in France showed that, since 2000 there had been reductions in active substance availability 59% for fungicides, 35% for herbicides and 100% for insecticides. This has been in response to national and EU regulatory change.

4.1.2. How homogenous is the market or is it highly differentiated?

This is a vital question when considering the impact and its scale for sport. To understand if all sports are starting from the same point across the EU or if some are further down the pathway of reduction is critical to be able to assess the impact that further restrictions or withdrawal of PPP would have.

The reality is that the market for PPPs is not homogenous across the EU and is highly differentiated. This is due to the following factors:

- **Variation in legislation** – EU law is the minimum standard to be met and member states can be stricter. This has meant that some countries have been implementing quicker reductions in PPP availability than others.
- **Regional climates** – Across the climates of Europe, from the colder climates of the Nordics with a truncated growing (and sporting) season, to the wetter coastal regions, the continental countries who can have strong seasonality, through to southern Europe where temperatures are higher,

Different countries have employed a range of strategies to bring about changes in PPP usage.

there are variations in how grass grows, the types of grasses able to grow and turf issues that can affect those grasses. All these factors will influence the types of solutions, PPP, biological or cultural that will be needed to tackle those issues.

- **Commercial viability of national markets** – Some countries have a small number of sporting facilities, which means they are a smaller commercial market than those with more golf clubs and football pitches. This will have an impact on the feasibility of how PPPs can be bought to and kept in that market.

What does this mean in practice for PPPs and a potential withdrawal from sport? It means that countries are starting from different positions. For some this may be an advantage in the face of PPP withdrawal (they are further down the line of building the resilience in their sports surface to reduce the need for PPPs), whereas for others, this will be a distinct disadvantage, as any changes are likely to have a greater impact. It is certainly not a level playing field among regions, Member States or even sports. This needs to be considered when policy decisions are made and legislative changes enacted.

4.1.3. Member state specific restrictions and implementation of the SUD

The Socio-Economic Impact Assessment on EU Golf Courses carried out by Chemservice Schweiz, which is included in its entirety in Appendix 1 of this impact assessment, provides a thorough review of the legislative framework for PPP in sport in a range of EU Member states. It is the intention of this section of the impact assessment to highlight the regulatory environment in Member States to help demonstrate how a range of contrasting countries have dealt with the European Commission's proposal.

Some member states have progressed further with minimising PPP use compared to others. To help summarise the level of legislative restriction on PPPs, Figure 9 classifies the level of restrictions.

The SUD clearly pushes users of PPP to minimise their use and to follow IPM principles. This legislation has clearly impacted the legislation of PPP use in a number of European countries. For example, during stakeholder engagement, the Belgian region of Wallonia noted that from June 2018 a complete ban in PPP and biologicals was introduced. There was a very sharp change in legislation with PPPs rather than a phased

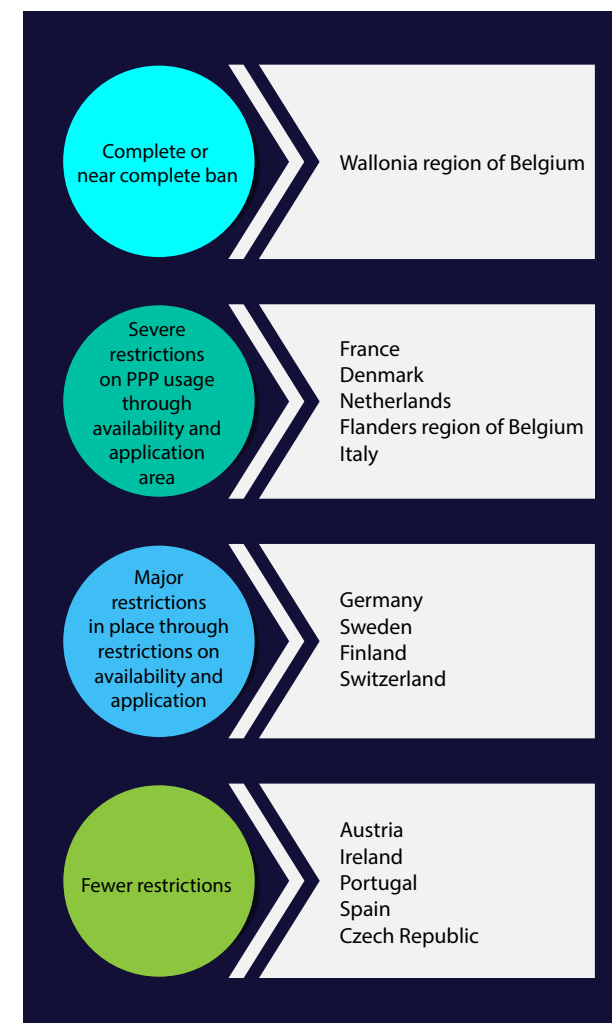


Figure 9. Visual summary on level of restrictions in place in a range of European countries.

reduction. It was reported that this caused a range of severe issues as the sports fields and golf courses were not conditioned ready to be able deal with no PPPs or biologicals.

Different countries have employed a range of strategies to bring about changes in PPP usage. The main strategies employed are summarised in Figure 10. The most common approach has been to restrict the availability of PPP by limiting what can be placed into the market in that country. Another approach used by a number of countries, such as Denmark (Danish EPA 202), Flanders region of Belgium and Italy, require applications of PPP to be recorded and submitted to the competent authority, whether that is a regional authority or a national or federal government. France will soon introduce Platform. Golf, which is an app designed by the sports industry to record among other things PPP applications. One final noteworthy strategy has been restricting what problems can be treated and restricting the size of area that can be treated.

Other initiatives are Switzerland's published strategy and action plan to be PPP free by 2030 (SwissGolf 2023). Additionally, France is going through a phased legal framework (Labbé laws) to reduce PPP inputs for sports leading to a ban by 2025 with PPP only being allowed to be used in exceptional circumstances. All of the measures outlined in this section demonstrate how seriously sport is taking the move to a more sustainable and safer future, with PPP reduction being part of that process.

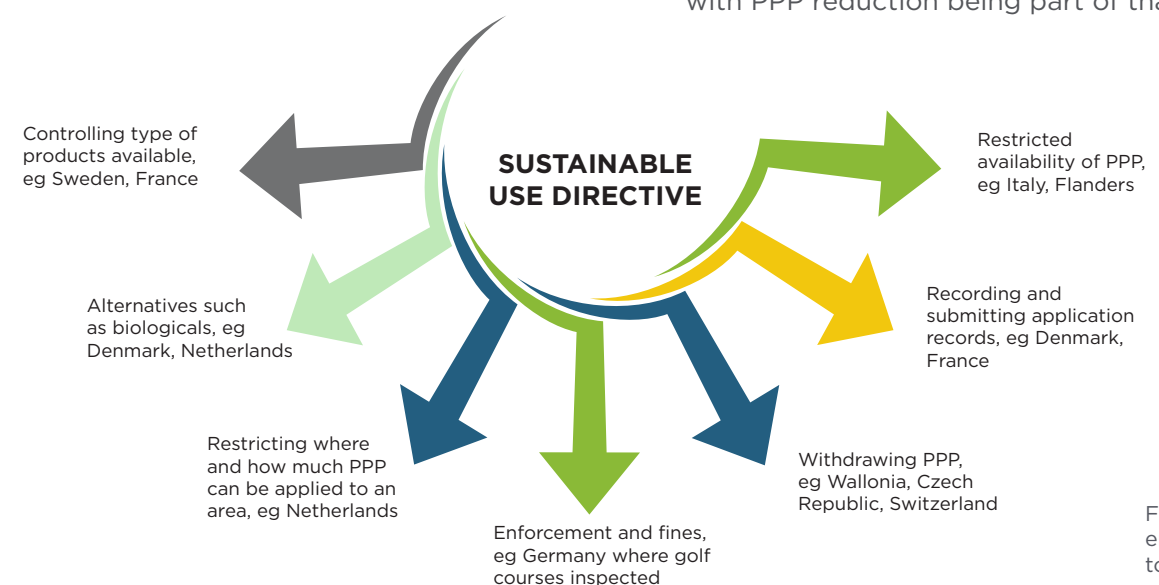


Figure 10. Strategies employed by countries to reduce PPP usage.

4.2. How much PPP is being used by sport?

Obtaining reliable and robust data on PPP usage in sport is a challenge. There are EU and Member State sales data on PPP products, but these are not differentiated out further into individual industries (often it is aggregated into the total amount sold/used). Federal or national governments may have more detailed data on PPP usage, as determined by their own internal legislation, but is it very rare for sport, let alone golf or football to be separated out. This means that national sporting associations are left to gather data from members to demonstrate how much and what types of PPP are being used. As a general rule of thumb, it appears that countries who are further down the line of PPP reduction tend to have more extensive and longer-term data. One of the major challenges for all industries, governments and regulators is to make informed decisions based on good quality, reliable and robust data.

It also has to be acknowledged that PPP usage will fluctuate over time. This can be in the short-term due to short duration or highly variable factors such as weather or global market pricing and resource availability. There are also longer-term changes that happen more slowly, but which will have long-lasting and significant impacts, the main challenge coming from climate change. As climate change occurs, and the scientific

evidence points towards real effects, this will mean that the growing environment for all crops, including sports turf, will change. In addition, it will also increase the risk of different and non-native pests, weeds and diseases to move into EU countries where there may be no natural predators or where they have a competitive advantage compared to pre-existing organisms.

Data for the following sections has come from a number of different sources such as:

- Existing literature/reports/databases from either governmental agencies or sports national associations
- Direct survey data from engagement with PPP end users
- Extrapolation from existing data.

4.2.1. Golf specific use of PPPs

Golf courses comprise a wide range of turf and vegetation environments. However, there are some surfaces that often don't have any PPPs applied, such as the rough and semi-rough. Fairways will tend to have some PPP usage, mostly to tackle weed or insect pest problems (based on national association interviews). Tees will have some PPPs applied and the greatest use of PPPs being restricted to golf greens as this is where the impact of surface imperfections are most keenly felt by the 46 g golf ball,

and also where turf is under the greatest stress due to close mowing and foot traffic.

The sources of data used for assessing PPP usage in golf are diverse and represent a wide range of approaches. Some of the most reliable sources are from countries where logging of PPP application is strictly monitored (for example Denmark with the GreenData programme or the Netherlands as part of the Dutch Green Deal). Other sources include end user surveys and calculation of PPP loadings from baseline information provided to STRI and Chemservice. Often, the indices used, and type of data varies among sources, making direct comparison more difficult:

- Weight or volume of active substance per hectare per year (the basis upon which the metric has been calculated is often unclear, as described below).
 - Calculated based on total treatable area (greens, tees, fairways for example).
 - Calculated based on whole golf course area (a much larger area and therefore the end value will be smaller).
 - Calculated based on just one specific area (area of greens)
- Number of applications made per year.
- Volume of product applied per hectare per year.
- Volume of product in total applied to a particular surface type.

However, having data to build a picture on usage and how it changes among member states and around the golf course is important. Table 7 outlines the available data on PPP usage on golf courses, the basis upon which the data is presented, and the source of these data.

The values from Finland and Germany seem higher than expected given the legislation in each country. This is likely due to there being no standardised metrics in place for calculating active substance applied, some use total course area, others the area of that type of turf (green, fairway, tee etc), whilst some use area treatable (a larger area resulting in a smaller value). It is vital for reporting and assessing changes over time that a standardised metric is used. This is down to individual member states and sports national bodies (governing bodies for that sport in that country) or representational bodies (like greenkeeper associations) independently developing their own metrics. If this was standardised across the EU, it would then be possible to compare each countries data more easily and with greater confidence.

There are a range of pesticide usage amounts across golf courses ranging from low amounts in Denmark (0.02 kg a.s./ha/yr) and Netherlands (0.19 kg a.s./ha/yr) through to higher amounts such as in Germany (2.27 kg a.s./ha/yr)

or Finland (2.54 kg a.s./ha/yr). Average PPP usage from the data provided, including the higher and lower estimate for Finland, calculates as 1.02 kg a.s./ha/yr. When interpreting pesticide usage data, it is vital to understand the factors that can influence the year on year usage rate. A year with a lot of disease due to milder and wetter weather will require more fungicide than a year when conditions are drier. It is also important to understand that those countries with low usage levels correlate with those that are further down the pathway of reduction, but to achieve those levels has taken many years of phased reduction, preparing the turf and golfers for this reality.

Phased and gradual reduction in PPPs applied helps golf surfaces to be conditioned to be managed with lower PPP inputs. It allows IPM/ITM programmes to be established and bedded in, whilst ensuring turf managers time to create the right environment for success (growing environment, soil, water and grass), which is essential if PPPs are to be significantly reduced or even withdrawn. This is what has happened in countries like Denmark, Netherlands, France and Belgium which have all achieved large reductions in PPP usage, but this has taken time to be a sustained success.

Table 7. PPP usage on golf courses.

Country assessed*	PPP used (basis for usage statistics are also provided)	Source of values
Denmark	0.02 kg a.s./ha/yr	Danish Ministry of Environment (2020)
Finland	Values appear to be based on ha of each surface type and not whole treatable area. 1.739 kg a.s./ha/yr Greens fungicide 0.306 kg a.s./ha/yr Greens PGR 0.002 kg a.s./ha/yr Green insecticide 0.094 kg a.s./ha/yr Fairway PGR 0.396 kg a.s./ha/yr Fairway herbicide Total applied = 2.536 kg a.s./ha/yr No. of applications per year: Fungicides on greens 2-3 (5-8 reseeding) Herbicide on fairways 0-3 PGR greens = 8-10, fairway = 0-5 Insecticide on greens 0-1 0.06 kg a.s./ha of total course area/yr, equivalent on 24 ha course of 1.44 kg as/ha/yr	Finish response to European Commission's proposal (2023) GEO Database
France	0.21 – 0.42 kg a.s./ha/yr based on total application of 2.5-5 kg a.s./course/year. Sports active substance accounts for 0.02% of a.s. applied in France. Typically, golf courses make the following number of applications per year (based on severity threshold: Greens = 6-8 fungicides, 0-2 herbicides Tees = 2-4 fungicide, 0-2 herbicides Fairways = 0-2 fungicide, 0-2 herbicide	Chemservice survey French Sport Working Group (2020) based on Ecophyto II plan data
Germany	2.27 kg a.s./ha/yr	Chemservice survey
Ireland	1.5 kg a.s./ha/yr 1.08 kg a.s./ha/yr fungicides to greens 10.87 kg a.s./yr herbicide to fairways & primary rough (equivalent to 0.45 kg a.s./ha/yr 7.2 kg a.s./yr insecticide to greens, surrounds and tees (equivalent to 0.12 kg a.s./ha/yr.	Chemservice survey Golf Ireland (2023)
Netherlands	0.19 kg a.s./ha/yr	Chemservice report based on RIVM (2020).
Spain	1 kg a.s./ha/yr	Chemservice report
Sweden	1.5 kg a.s./ha/yr fungicide on greens 0.26 kg a.s./ha/yr herbicide on fairways	Chemservice survey (response by STERF)
Switzerland	Fungicides 60% courses apply 3-7 times per year. 35% don't apply to tees with 30% applying 1-2 per year. Herbicides Biggest use by far was on fairways with 75% applying 1-2 per year. 0.34 kg a.s./ha over total course area/yr	Sanu (2022)

* Note, Austria, Belgium, Czech Republic and Portugal were not able to provide any data
Abbreviations: a.s. = active substance, ha = hectare, yr = year, PGR = plant growth regulator

During the course of the impact assessment, a number of national golfing bodies were able to provide details on reductions in PPP usage over time. This is important as it shows the progress and pro-active work going on in golf to reduce PPP usage for managing pest, weed and disease problems. Table 8 gives the reductions quoted in publications and stakeholder interviews.

Golf, as part of sport, is committed to reducing PPP usage, but to achieve sustained and achievable reductions to minimise applications of PPP, time is needed to create the conditions for success. It is acknowledged that not everyone has been able to achieve these levels of reduction, but those countries that have been at the vanguard of PPP reduction can provide essential guidance on what worked and what didn't to others. As an example, Figure 11 shows the downward trend in PPP usage and a.s. load over time from Denmark. However, it has taken time to achieve the low level of PPP used and the level and rate of PPP reduction will be based on the starting point of turf in that country, the grasses present, the climate in that country and the solutions that are available to replace conventional synthetic PPPs.

Table 8. Reduction in PPP usage by country.

Country	Reduction in PPP usage	Source
Denmark	90% reduction	Chemservice report
France	Since 2009 the following reductions: Fungicides = 56% reduction in all sport Herbicides = 65% in all sport Insecticides = 100% reduction in all sport	French Sport Working Group (2020)
Ireland	Up to 90% reduction in fungicide use 36% reduction in herbicide use over 7 years	Golf Ireland (2023)
Netherlands	80% reduction from 2015 - 2020	Chemservice report
Sweden	Circa 50%	Chemservice report

Pesticidanvendelse på golfbaner
Udviklingen i samlet mængde og samlet belastning 2013-2020

For 2013-2017 indgår forbrug af insekt-, svampe- og ukrudtsmidler, fra 2018 også vækstreguleringsmidler

År	Anvendt mængde (Kg eller L) af pesticidmidler	Samlet belastning fra de anvendte midler og mængder
2013	4300	5200
2014	4500	4500
2015	2100	3100
2016	1900	3000
2017	1800	2900
2018	1700	2700
2019	1100	1000
2020	1100	1000

— Anvendt mængde (Kg eller L) af pesticidmidler
— Samlet belastning fra de anvendte midler og mængder

Figure 11. Reductions in amount of PPP uses and loading of a.s. in the environment from Denmark from 2013-2020 (From Danish Ministry of Environment 2020).

4.2.2. Football specific usage of PPPs

Football has much less data on PPP usage than golf. This means that for this impact assessment it was vital to obtain data on PPP usage directly from football clubs and facilities. As with golf, a target list of countries was drawn up that covered the range of climates within the EU. An online questionnaire (reproduced in the Appendix) was developed that was quick to complete (no longer than 10 minutes to fill in) and that asked for clubs and facilities to provide the following key information:

- Type of football venue and level of football played
- Country where the pitches/facility was located
- The number of pitches, what type and who maintained them
- The typical pest, weed and disease problems affecting the pitches on site
- The amount of PPP being used (both as number of applications and volume undiluted PPP used)*
- The clubs rating of the impact of a complete withdrawal of PPP from sport
- Had the club or facility been able to reduce PPP usage
- The IPM/ITM measures being carried out by the club/facility.

* Since the survey went to a wide range of countries each with different lists of PPPs authorised for use and to prevent there being a barrier to filling out the form, these simplified metrics were chosen to help increase the return rate of the survey.

Defining the level of football facility

Whilst the distinction between elite and grassroots sport may be specific across different countries and markets within Europe, the classification of football facilities ranging from elite stadia through to grassroots facilities is typically based on who plays on the surface (community amateur, higher league level amateur, semi professional, professional, top level professional league players). In addition, at the semi-professional and professional level the size/capacity of the stadium (<30,000 seats or >30,000 seat) can also be used to differentiate among venues.

The football National Associations were contacted and briefed on what was needed to try and maximise engagement with the survey. The National Associations then sent out an online questionnaire link to clubs and football facilities in their country. The survey clearly indicated the reason for it being sent and the importance of clubs to fill it in. Details of the number of responses, the countries that responded and the type of football played at the facilities are given in Figures 3-5 in section 3. It was clear that the German Football Association had been very successful in getting clubs in their country to respond and the number of responses from Germany were substantially higher than those from other countries.

The results of the survey are broken down into three key graphs:

- If applying PPPs, how many applications are clubs/facilities making?
- What was the total volume of PPP applied?
- Are clubs using PPPs and, if they are, have they made reductions in the amount used?

The first question asked was how many applications of particular types of PPPs were being made in a year on each of the pitches they managed. The results were processed to calculate the percentage of respondents carrying out at least one application of PPP, separated into different PPP types and across different levels of football (Figure 12). What

was clear from these data were that PPP usage (as determined by number of applications) was influenced by the level of football played. The fewest applications were made on grassroots/community level pitches, if PPPs were applied, typically most applied only one application. Facilities where professional level football was played tended to apply more applications of PPPs. The most frequently applied PPP types were fungicides and plant growth regulators (PGRs). Herbicides tended to be applied less frequently compared to other PPP types, which reflects the practice of carrying out intensive annual renovations that often involve stripping the grass surface off the pitch, thereby effectively removing any weed or weed seed near the pitch surface. Pitches hosting higher level amateur and semi professional level football tended to be intermediate between the grassroots/community and professional pitches. On high level amateur and semi professional pitches, if a PPP is applied, many still only apply 1 application, but an increasing number are applying 2 or even three applications. Interestingly, the frequency of herbicide application was not as great as other PPPs and similar to that found on grassroots pitches.

When respondents were asked about the total volume of undiluted PPP (neat concentrate) they applied in a year to each of the pitches they managed, they had an option to consciously select “none” to reflect no PPP usage. Data on the volume of PPP being applied to the pitches in the clubs/facilities surveyed are given in Figure 13. There were very few differences in the trend of volume of PPP being applied between pitches where grassroots/community and higher level amateur and semi professional football were played. The majority of pitches (more than 60%) said they do not apply PPP. For pitches at this level of football the greatest usage volume of PPP was for herbicides. For pitches where professional

football was played, the volume of PPP increased. The largest use of PPP was in fungicides where 63% of clubs/facilities said they had applied at least 1 l of fungicide. The use of PGR and insecticides also increased, compared to pitches where grassroots, high level and semi professional football was played. Interestingly, herbicide application volumes were similar to those applied at venues where lower tiers of football were played. With the increased pressure to produce safe and excellent standard turf inside a stadium environment, which can be a challenging environment to grow turf in, a greater proportion of respondents said that higher volumes of PPPs were being used.

Figure 12. Breakdown of number of the main types of PPPs being applied at different levels of football facility over a year and calculated as the percentage of respondents applying 1 or more PPPs on their pitches.

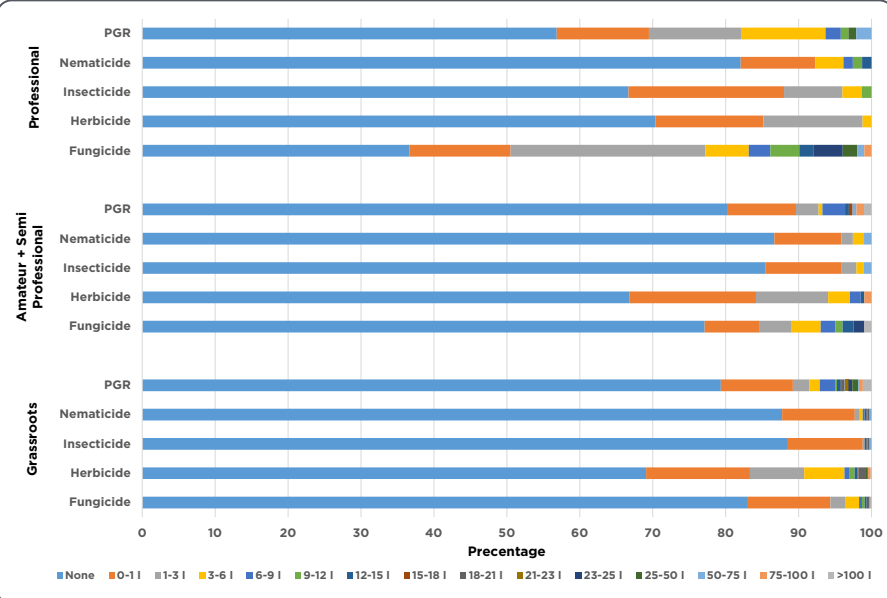
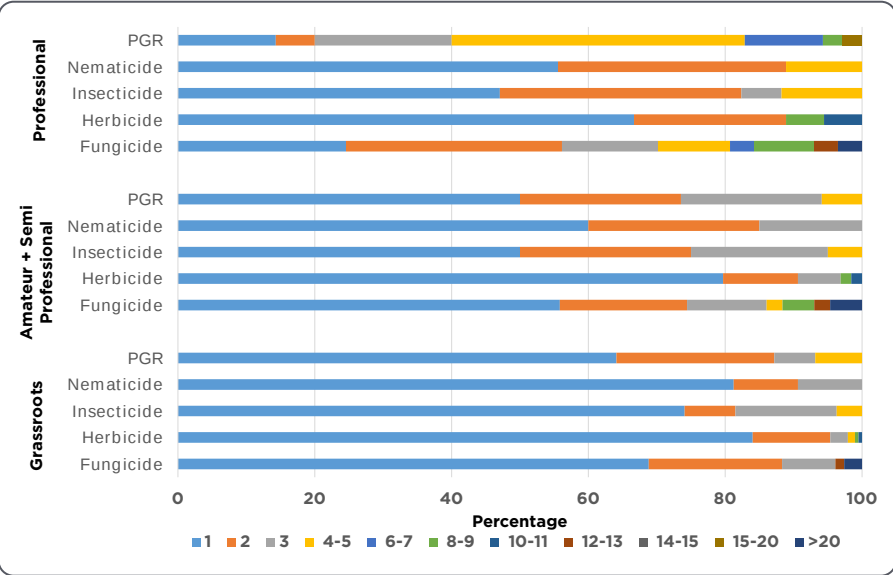


Figure 13. Volume of PPP being applied to pitches, calculated as the percentage of respondents applying none or specific volume ranges of PPP to their pitches.

Finally, clubs/facilities were asked if they had reduced their PPP usage (Figure 14). The trends are as would typically be expected, with more grassroots/community pitches using no PPPs. From STRI's experience, this is because budgets are often low at these clubs/facilities, which means that there are barriers to clubs being able to treat problems they may have and, where possible, they have adopted more cultural practices to help manage turf issues or alternatively, accept the reduction in surface quality. At higher level amateur and semi professional level, more clubs were reducing PPP usage than at grassroots level. For pitches where professional football was played, fewer

pitches were not applying PPPs, but over 50% had actively reduced PPP inputs. This shows that the message on the need to reduce PPPs, especially at a level where greater volumes of PPP are being used, is having an impact.

The results of this survey correlate with those studies in the Netherlands on plant protection product usage on municipality pitches (Schots *et al.* 2020 and Dalhusien *et al.* 2023). Both these reports show that many municipality pitches are not using or well on the way to minimising PPP use.

Whilst there are less sources for evidence for football, this survey has shown that many football surfaces don't have PPPs applied or have low levels of PPP used. There are some pitches where PPP usage is higher, primarily as a result of having professional sport played on it and being located in a more challenging growing environment of a stadium. Financial factors also have to be included here as well, with grassroots and amateur football having less budget to spend on pitch maintenance which then limits PPP options. Additionally, at lower levels of football, the visual quality of pitches can be lower and maybe more accepted at that level, whilst turf managers will also employ alternative cultural techniques as these are often the only ones available on their budget,

4.3. Regional PPP challenges

Pressures and usage of PPPs is not the same across the EU. The EU straddles a number of climatic regions ranging from cold climate with long winters, high risk of snow and ice in the north and hot Mediterranean climate that is in the transition zone between whether cool or warm season grasses thrive. This is important and each climate zone brings its own challenges.

In colder northern countries, like those in Scandinavia (such as Finland and Sweden), climate is a major challenge for plant health. All National Associations in the colder northern countries noted that winter is one of the most challenging periods for sports turf. This is supported by the volume of literature on winter survival that can be found on STERF's website (www.sterf.org/sv/library/articles-and-other-papers) on avoiding winterkill of grass through ice and snow damage and the high risk of disease under these conditions. The IPM issue is that if there is a high disease loading in turf prior to snowfall, the disease will be incubated by the snow and cause extensive damage by the time the snow and ice melts in spring. This is then coupled with a short growing season that starts later and finishes earlier than in other parts of Europe. This means targeted use of PPPs prior to the onset of winter has been an essential part of managing sports turf

in the Nordics as a matter of having grass versus severe turf damage. The key has been to minimise inputs to make sure PPP usage is minimal.

Just as countries in the north of Europe have challenges, so do those in the southern areas. The Mediterranean climate is one that is characterised by hot summers (where temperatures regularly exceed 35°C for long periods and nighttime temperatures are high and often greater than 22°C) but cooler winters. This means that grasses adapted for hot conditions (warm-season grasses) thrive in summer but go dormant in winter which means for winter sports this is real issue for wear damage and recovery. Likewise cool-season grasses thrive in the milder winter temperatures but can't survive the prolonged warm weather. This is why regions like the Mediterranean are classified as transition zone, i.e., where one grass type does not perform optimally all year round (R&A 2023). This means that grasses in this region are, at some stage of the year, growing outside their optimum environmental window making them more prone to pest, weed and disease invasion. This is especially true for cool-season grasses being intensively managed in the summer to keep them healthy, which often happens on golf greens where the cool-season grass creeping bent is grown.

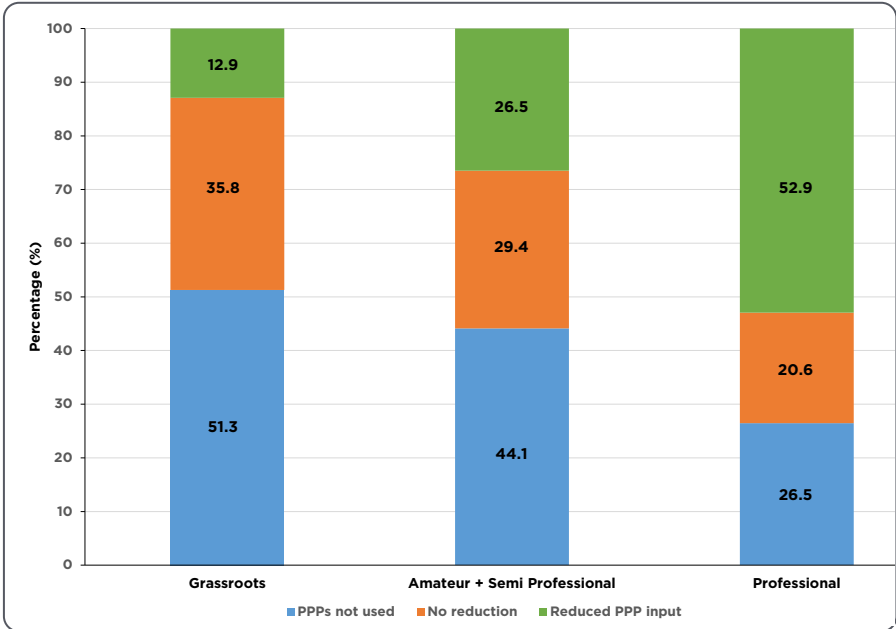


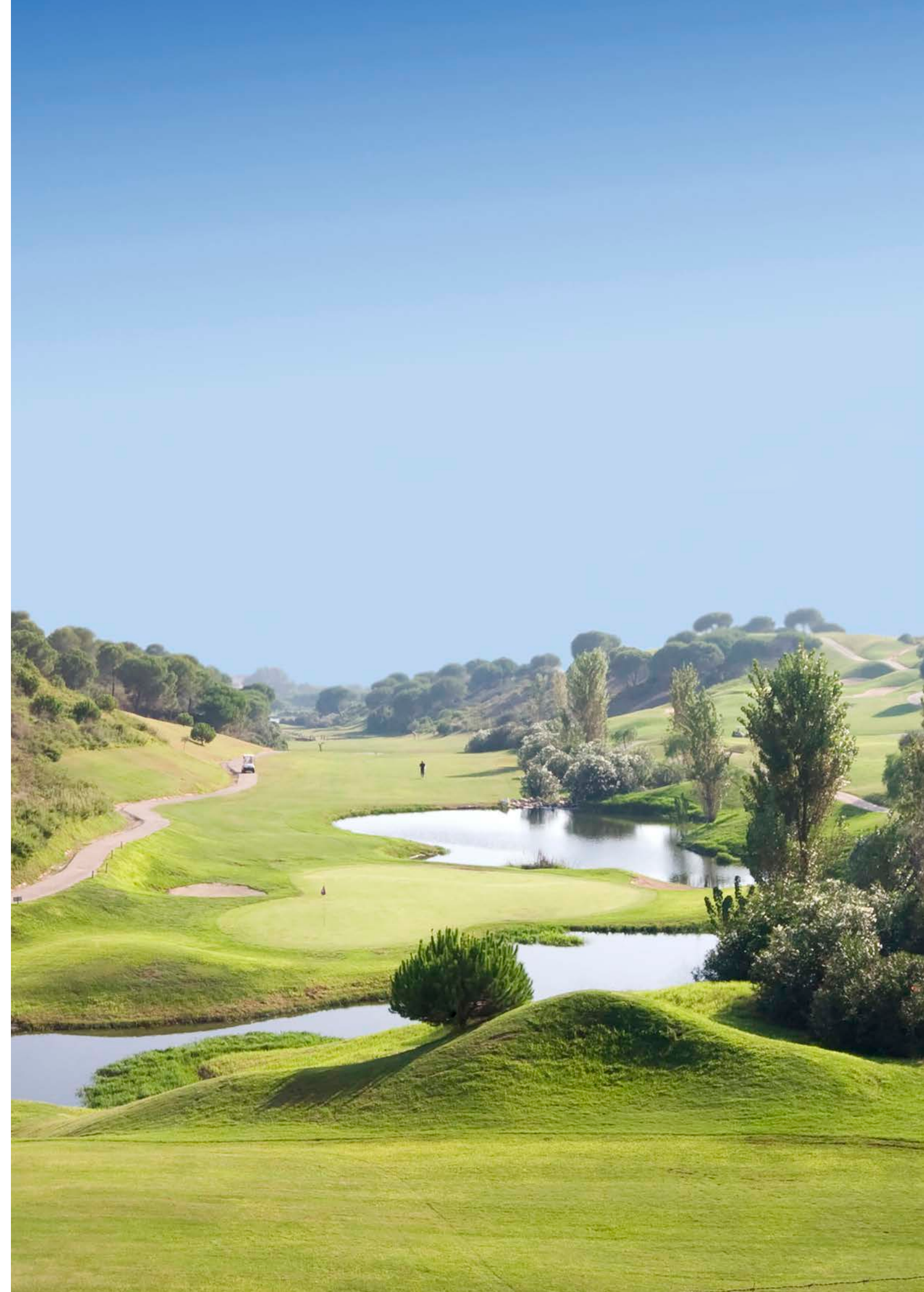
Figure 14. Proportion of respondents who either don't use PPPs, have made a reduction of PPP inputs or who have not reduced PPP being applied.

Why is this an issue? Countries like Spain, Portugal and Italy will all have issues like this to contend with. This can lead to greater turf health issues which makes turf more prone to pest, weed and disease invasion, and therefore greater need for control methods, including PPPs. This is also coupled with these countries tending to have a golf industry that is highly geared to tourism and where tourism plays a large part of the local, regional and national economy. When you overlay climate, high usage levels at key points of the year by tourists and higher potential disease pressure for diseases like dollar spot (which can take hold and spread quickly) the challenges for IPM and PPP usage reduction are more challenging in this region. Work has been done to look at PPP reduction and managing turf using IPM, which was stressed by all National Associations spoken to. There has been a great deal of work done on managing transition zone turf both in Europe and the USA. An example of which can be found in the proceedings of the European Turfgrass Society 6th Field Days in 2019 titled “Transitioning turfgrass: turfgrass management in the transition zone, taking into account climate change and the limitations to the use of pesticides”. During this practical conference, work on the diverse aspects of IPM and plant health were presented including work done on

managing turf diseases with no PPPs.

Finally, the last climate to consider is the humid Atlantic coastal areas. These areas tend to be wetter and so can have mild and humid conditions (Ireland, Netherlands, coastal areas of France). These are ideal for the growth of turf fungal pathogens, resulting in extended periods of the year in spring, autumn and winter when disease can be active. In these regions, disease management tends to be one of the greatest focuses for IPM and PPP usage.

The aim has been to illustrate that turf management and the problems faced by turf managers are not homogenous across regions and that climate plays a significant role in IPM and pest, weed and disease pressure. When you now consider the impacts of climate change in each of these regions, the pest, weed and disease pressures are changing and will continue to change over the coming decades. This leads to an ever moving playing field where turf growing environment, resource availability (e.g. water) and the pests, weeds and diseases will all be changing. Indeed, a number of newer diseases not often seen in Europe are starting to spread northwards including gray leaf spot (*Pyricularia* spp.), which has become more of a common site causing severe infection and damage in perennial ryegrass during the warmer summer months.



5. Impact of plant protection product removal on sport

This section aims to outline the impacts of PPP withdrawal from sport on:

- The management of the playing surfaces
- The operation and finances of sports facilities
- The wider socio-economic functioning of society
- The risks of reductions in sports participation and the health benefits that sport brings
- High profile broadcast sport events.

Sports turf and sports turf managers have to balance constant pressures when considering their turf management plans (Figure 15). These pressures are all acting at once and will have both direct and indirect impacts on producing safe and effective playing surfaces. These pressures change over a number of dimensions and scales:

- **Time** - day to day, season to season, year to year and decade to decade, with the latter being relevant when discussing climate change.
- **Physical geography** - terrain type, latitude, climate, natural resource availability, size of country or available land, natural landscape diversity.



Figure 15. Summary of main pressures that affect the production of a biologically based playing surface that is safe and effective.

TRADITIONAL TURF MANAGEMENT

The central tenets of traditional turf management have encompassed what is now called IPM:

- **Promote strong and healthy grass that is able to withstand play and other turf issues.**
- **Prevent a problem before it occurs, this saves time, resources and money.**
- **Solve the root cause of a problem rather than treating the symptom(s)**
- **Think long-term about how turf is managed and create the right environment for the grasses to be grown.**
- **Choose the most appropriate grass species or cultivar for the job**
- **Use the right tools and products for the job**

- **Political geography** – the heterogeneity of legislation of member states (some countries have stricter regulation than others, even when responding to homogenous EU directives and regulations), as well as direction of travel for regulatory framework in each Member State.
- **Human geography** – population numbers, sports provision requirements, demand for sport facilities and to play sport.
- **Market** – depending on the size of the country and the carrying capacity for sport will affect the size of the market for products and solutions. A smaller market is commercially less attractive than a larger market, which will limit what may be available to turf managers for non-chemical and chemical controls for pests, weeds and diseases.

Sport is a small market sector compared to other users of PPPs, such as agriculture, but it takes its responsibilities seriously when it comes to IPM/ITM. This impact assessment has aimed to show how sport has reacted to the need to minimise PPP usage and to follow an IPM/ITM based approach. IPM/ITM is best practice turf management, and whilst it may not have been called IPM in the past, it always has been at the heart of what

has been termed “traditional management” or “good solid greenkeeping”.

IPM and the many threads that make it up in sports turf are discussed continually in every part of the industry across Europe:

- Scientific, educational and industry related articles, publications and literature, all produced from a wide range of sources but all giving the message of IPM best practice management.
- Educational and training events run by all stakeholders in the industry ranging from scientific conferences, National Association meetings, regional seminars and workshops, formal and informal training courses, product manufacturer/supplier lead training, events and literature.
- Shared knowledge from experts and peers in person or on social media and podcasts.
- Face to face contact with consultants, agronomists and experts who visit turf managers to give practical advice.

Golf courses in particular sit as part of a naturalised but managed ecosystem. In other words, golf courses have to connect to the landscape

in which they sit. This often engenders a feeling of greenkeepers wanting to be good stewards of the land and the plants and animals that live in it, whilst at the same time producing high quality playing surfaces. These aspect of greenkeeping sit alongside each other and work together on golf courses. This can be seen in the way that golf has adopted schemes and projects to increase the ecological and biodiversity value of many courses. Turf managers are focusing on trying to work with nature, looking at how they can manage their nutrient inputs to minimise what is needed and applied, using low nutrient solutions, using biostimulant and organic/organo-mineral fertilisers. On the latter points, sport has been one of the drivers for the changes to EU fertiliser regulations with the increased use and demand for biostimulants and organic fertilisers (neither included in the previous legislation), all to help utilise sustainable sources and to reduce the need to apply PPPs.

Sport is an exemplar of IPM integration. However, sport has not been forthcoming in promoting best practice in the media or in changing public perception about how sports surfaces are managed. There is a perception that sports surfaces are sterile

environments that can only be managed by heavy use of PPPs, fertilisers and water. This could not be further from the truth, which is what the objective evidence presented in the impact assessment has demonstrated. Sport wants to and has actively engaged with IPM and the need to minimise PPP usage. Some countries have led the way and others need to take the learnings from these vanguard Member States and speed up their actions, but sport has listened and is fully engaged. A major failing of sport is that it does not talk about this outside of sport, so the good work done is not obvious to those not in the industry.

An example and a model for the future, is the need for close and active collaboration with regulatory bodies. In countries like Denmark, Netherlands and France, that have achieved the greatest and most sustainable reductions in PPP usage, there has been a close and collaborative approach between sports bodies and those responsible for PPP regulation. Sport is on a trajectory for minimising PPP usage, outlined and demanded by the SUD. With closer and more collaborative co-operation between all PPP stakeholders sustainable, persistent and meaningful changes can and will happen.



5.1. Impact on turf management

As has been discussed in section 4, the availability of PPPs across the EU depends on the legislation in each Member State, which can range from lower intervention approaches (Austria, Spain and Portugal) to higher intervention (Denmark, Netherlands, France, Flanders region of Belgium) through to complete removal of PPPs from sports (Wallonia region of Belgium and Czech Republic). The impact of a complete PPP withdrawal from sport has been approached by taking the individual potential impacts (usually reported by stakeholders) and categorising the severity of impact using a colour coding system:

-  **No to minimal impact**
-  **Low impact** – small but noticeable effect on surfaces, operations/finances, sports facility or players
-  **Moderate impact** – may cause clear impact on surfaces, operations/finances or players
-  **High impact** - may cause significant issues with turf or the operation/finances of the sports facility or players

In this section, the general impacts on turf management are considered under the scenario that PPPs are withdrawn from use in sport. The specific functional impacts, i.e. how sport is played, are considered in the next section. In all cases, the baseline assumption is that best practice turf maintenance is being followed.

Opposite are the impacts for disease control on sports turf:

	Impact	Comment
	Effective disease control under high disease pressure or a rapid infection	There was concern that rapid spread of a disease under conducive conditions may exceed the capacity of non-chemical controls or biologicals to halt the spread of disease.
	Control of disease in extreme northern climates prior to onset of snow cover.	Turf can be devastated, to the extent of having to be completely resown, by turf disease growing under extended snow cover. PPPs form a vital part of managing pathogen population and spores on leaves prior to the onset of snow.
	Control of disease in hot southern climates when disease pressure is high.	Diseases like dollar spot, pythium and brown patch can spread quickly in hot weather. PPPs have been used to manage disease that is not able to be controlled by other means.
	Control of disease in challenging enclosed stadia environments.	Stadia environments are both a poor and stressful growing environment for grass (poor light and airflow, coupled with player damage) and conducive to fungal pathogen growth. Often in this environment disease attacks can be severe and happen rapidly.
	Managing disease during non-sporting events	Often PPPs are a vital part of managing disease activity during non-sporting events on turf. Turf is covered to provide access to staging and pedestrians and this brings severe disease risk. PPPs are essential in the build up to an event of this type and in preventing disease and managing any outbreaks afterwards.
	Control of disease with low-risk or biological solutions.	There are 63 low-risk active substances approved but none are approved for turf or are likely to show activity on turf issues. There are biologicals but it is acknowledged that their efficacy is lower than a PPP due to the vagaries of getting biocontrol to persist and then to the target organism in sufficient concentration to suppress the pathogen and protect the grass plant from further infection.
	Control of disease with non-chemical or biological options in winter when grass is much less active.	Biocontrols are subject to the same environmental stresses as grass and pathogen and if not adapted for winter use, the biocontrol may not survive long enough to be effective. Likewise, if the biocontrol needs the plant to be active (if it stimulates part of the plants biochemistry) then its efficacy will be reduced when the plant is not active.
	Managing disease when it is less virulent and/or non-PPPs are moderately effective	Often non-chemical and cultural approaches are most effective at low disease pressure. Their overall efficacy is not as high as PPPs so often multi-layer programmes need to be put in place that use a wide range of solutions.
	Turf visual quality reduced due to damage.	Can be an issue but in surveys Danish and Dutch golfers were less influenced by this than on the functional quality of the turf. Can be an issue in broadcast event situations or where tourist golf is a big part of the golfing industry.

Opposite are the impacts for weed management in sports turf:

	Impact	Comment
●	Controlling perennial weeds in turf.	Perennial weeds are designed to comeback year after year and often harder to kill due to the presence of below ground regenerative tissues such as rhizomes. Individual plants or small numbers of plants can be removed by hand or other methods.
●	Managing invasive weeds in turf.	Invasive and aggressive weeds that outcompete grasses were of concern. Their management can be difficult due to the ecology of the weeds. It was felt that managing them could be a challenge.
●	Managing weeds on large areas.	Large weed patches can be a problem but also indicate an issue with maintenance or the growing environment. Whilst unsightly there are some options that can be used such a physical disturbance and removal. These however take more time and fuel so increase drain on already tight resources on golf courses.
●	Managing weeds on restricted budgets without PPPs.	At higher levels of football, the whole playing surface can be removed, effectively removing any weeds. Where budgets are more restricted this is not possible. It was felt that those who had adequate resource would be able to divert that into non-chemical controls and those that didn't, would have to live with weedy turf and players would have to accept the presence of some weeds.

Opposite are the impacts put forward for pest management in sports turf:

	Impact	Comment
●	Managing insect pest populations in turf.	Insect pests can be very destructive when present in high populations. There are some limited insecticides available that are vital for badly affected areas. The concern is often not the insect pest itself, but the birds and mammals that hunt them and can decimate the turf in their quest to find the grubs.
●	Managing earthworm casting in turf.	There are no authorised products for this so the situation would be no different to the present time. However, the issue is still there and earthworm casts cause issues on many golf courses, especially those with fine textured soils.

In surveys carried out by Dutch and Danish golf federations, players were asked about their thoughts on various issues that would typically have been managed with PPPs. In both surveys for players to get a good view of the ball on fairways and be able to find their ball in the rough were important. The presence of some disease and even weeds in greens was not an issue, as long as the ball roll was not affected. There was a higher level of tolerance for weeds by higher handicap players, but low handicap players were more critical. This shows communication to players and managing expectations is very important.

A specific concern raised was that of the use of plant growth regulators. They are being used to strategically limit the growth of turf to reduce mowing frequency and therefore reduce CO₂ emissions from the facility associated with less fuel burning. Reduced mowing also frees up resources that can be used for carrying out cultural practices and other tasks such as ecological and wider landscape management projects. Also, the use of PGRs helps turf to withstand stress better, for example low light conditions, as well as improving turf density without having to push grass growth with fertilisers. Their removal under the European Commission’s proposal was a concern expressed by stakeholders in countries where their use to provide environmental and financial benefits is highest (for example Ireland where the mild and moist conditions can mean grass growth at times is at a very high rate).

During the survey of football clubs, they were asked “Please indicate below, using the scoring system provided, how you think your facility will be affected by the removal of PPP”. The scale given was 1= no impact, 5 = moderate impact and 10 = high impact. The results from this survey question are given in Figure 16. All levels of football facility felt there

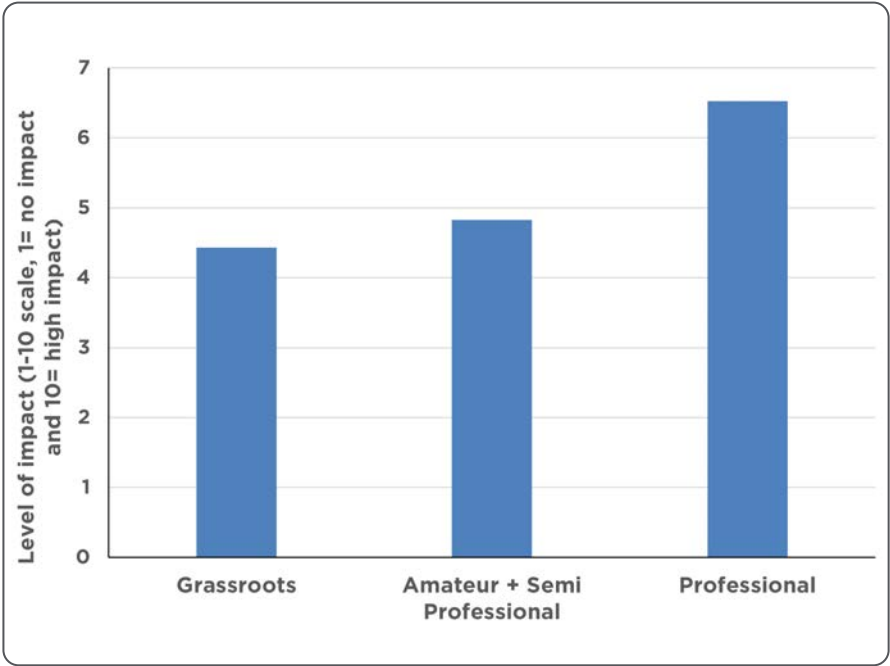


Figure 16. Impact of PPP removal on football facilities at different levels of football.

If a playing surface does not function in its intended role then the playing of sport on it will be compromised.

would be an impact with most saying this would be moderate to moderate-high impact for them. There were few differences between grassroots/ community and higher level amateur + semi professional. However, the impact rating went up at the professional level from an average of 4.6 to 6.5. The numbers of respondents at each level were:

- Grassroots = 302
- Higher level amateur + semi professional = 88
- Professional = 53

One of the important areas of concern was how to meet unknown or emerging challenges. Many stakeholders raised concerns about the impact of climate change on maintaining sports facilities and how this would translate to pest, weed and disease management. Additionally, it was not only the direct effects on pests, weeds and disease, such as virulence of infestation and types of problems encountered, but also other factors such as water availability which has a direct impact on plant health and grass density and therefore IPM. Stakeholders felt that these other pressures will exacerbate any removal of PPPs and that a better approach was to get all Member States to reduce PPP usage to true minimal levels.

In countries where reductions in PPPs have been highest and over a long period of time, it

was not always straight forward to bring about change and there were impacts on playing surfaces, turf managers and players that needed to be managed. However, learnings from what those countries have achieved can be applied to those less advanced with PPP reduction. There are also examples of rapid removals of PPPs, such as in the Wallonia region of Belgium. Here the cut off from having access to PPPs to a complete ban on chemical and biological solutions happened overnight. This meant that turf was not prepared or conditioned for this change. This resulted in severe impacts which are still felt today in terms of managing diseases. This is to be avoided as the conditions for success were not created before the change.

5.1.1. Functional impacts on playing surface

If a playing surface does not function in its intended role then the playing of sport on it will be compromised, and in some cases maybe unsafe to play (if there is insufficient grip or it is unstable or is under water). The effective management of pest, weeds and diseases is vital for maintaining an acceptable level of function of sport playing surfaces. This is often referred to as playing quality or playability.

The functional requirements of individual sports are often different to each other, which is based on how the sport is played. Golf and football have a lot of commonalities in terms of turf management, but there are fundamental differences in how each are played (golf is playing with a lightweight ball around a large linear area and it is important how the ball impacts and rolls on the surface, whilst football has 22 players strategically kicking a larger and heavier ball around a relatively small rectangle of turf that has to withstand the wear, be able to support the players manoeuvring suddenly and with a lot of force, whilst also providing true and consistent ball roll).

The impacts of PPP withdrawal on functional aspects of golf and football playing surfaces have been determined from stakeholder engagement as:

Below are the impacts put forward for pest, weed and disease control on the functioning of golf turf:

	Impact	Comment
●	Impact on the smooth and true roll of a golf ball on the golf green putting surface.	Without PPPs for managing outbreaks of disease or weed invasion, certainly in countries looking to transition from to lower PPP usage but where surfaces were still being conditioned, there was concern that increased scarring or weeds would negatively affect how a golf ball rolled over the surface.
●	Unmanaged weeds in rough areas causing golf balls to become lost and slowing pace of play.	There was concern that reduced management options for controlling excessive growth of weed grasses and broadleaved weeds in rough areas may inhibit players finding balls and slowing pace of play. Slow play means the number of rounds per day is lower and therefore the revenue potential for the club is reduced.

Below are the impacts put forward for pest, weed and disease control on the functioning of football turf:

	Impact	Comment
●	Control of excessive weed growth on bare ground inevitably found on heavily used pitches	Likely to be more of a concern on lower level pitches where usage can be high and budget for maintenance is often low. Weeds, especially perennial weeds
●	Controlling high disease activity, especially in stadia environments where grass is often weaker and conditions are more conducive.	Concern was expressed regarding managing disease in the difficult amphitheatre like modern stadia. At present, PPPs form part of an IPM approach but their use, as has been seen from survey work, is higher in professional facilities for this reason. There are still many professional surfaces managed with no to very few PPPs but they will be training grounds and more open venues.
●	Prevention of loss of grass cover resulting in safety issues with surfaces.	Player traction and therefore the risk of slipping and having an injury was a concern. Especially in professional football where the value of players is very high and the fitness of these elite athletes is a primary concern. If grass cover was lost due to difficult to control disease activity in stadia there were concerns over the playability and safety of pitch surfaces as the loss of grass cover would likely lead to a loss in surface stability and ultimately traction.

The functional turf management impacts for both sports used as exemplars in this impact assessment have focused on ball and player interaction. Another sport where concern has been raised in recent years is horse racing and natural grass equestrian arenas. In this case,

a 400-500 kg animal running at high speed, completing turns or taking off and landing over jumps requires a very strong turf surface. Where grass cover is thin or not strong due to pest, weed or disease pressure, there is an increased safety concern for the horse and its rider.

5.2. Impact on sports facilities

Playing surfaces are located in sports facilities and anything that affects the surfaces or how the sport is played will likely affect how the facilities are run. This section evaluates the concerns raised by stakeholders of impacts of a complete withdrawal of PPPs on the operation and finances of sports facilities. Again, the context to the impact is that sports facilities are following best practice guidance on turf management and operation.

5.2.1. Operational impacts

The operational impacts highlighted by both golf and football of a complete PPP withdrawal from sport were typically the same. The main points raised were on staffing, resources and potential for other environmental impacts such as increased CO₂ emissions. Impacts for both sports have been combined and presented below:



	Impact	Comment
●	Increased labour costs as a result of more time needed to carry out turf management	There was a concern of increased labour costs, in a time of rising costs across the board, of having to devote more time and resource on non-chemical and cultural processes. Once turf is more conditioned to low PPP inputs, this may be less of a critical concern.
●	Increased labour resource to be able to manage some of the worst affected areas more intensively with non-chemical or cultural approaches.	With the need to devote more staff resource to non-chemical and cultural controls, there initially may be a need for additional staff that adds to the cost burden of operating the facility. It was acknowledged that for turf that was more conditioned to reduced or PPP free turf management, along with a shift in player expectations, this impact may be reduced in severity.
●	Risk of not being able to focus attention onto other non-turf projects such as biodiversity projects on golf courses as more staff resources taken up with managing turf.	Was mooted by several stakeholders as a possible concern but was not considered a high risk impact from a sports facility operation point of view.
●	Potential increase in CO ₂ emissions when carrying out turf management	A range of stakeholders had concerns over effects of PPP withdrawal on CO ₂ emissions. With increased mowing due to PGR removal and having to do more physical operation or sprays of non-PPP solutions, the impact on emissions would increase. It was felt that hybrid and battery machines were still too expensive to be affordable by many facilities.

5.2.2. Financial impacts

For any sports facility to be able to sustain itself, it needs to balance its budget. Spending more than you are able to generate in revenue is not a sustainable option for sports facilities. Therefore, any financial impacts on sports facilities, especially those that focus on community or grassroots sport, are critical.

It is often community or grassroots sport that engage with and encourage citizens to participate in sport, but it is also these same facilities and clubs that are often run on the tightest budgets.

From interviews with sports National Associations the following potential impacts on a withdrawal of PPP were highlighted:

	Impact	Comment
●	Increased risk of greater IPM costs, certainly in the short-term whilst turf is conditioned over a period of years	There was concern that conditioning turf to a PPP free IPM model would increase cost due to additional spending on non-chemical options, more frequent applications of biologicals and biostimulant based solutions (potentially having to use a multilayer approach with 3 or more individual products to tackle a particular problem), greater time resource having to be devoted to pest, weed and disease management.
●	Greater financial stress on sports facilities.	Those facilities with less revenue to divert to any increased costs associated with PPP free management were at greater risk of getting into financial trouble.
●	Greater risk of price increase to sports facility users	If the cost of managing turf increased, even if only for a short-term (measured in years until turf conditions are adapted to PPP free management), clubs, especially those on tight budgets, would need to pass on the cost increase to members or users of those facilities.
●	Increased price for participation in club/ grassroots sports may reduce player numbers	Concern was raised by interviewees, in conjunction with cost of living increases, additional costs to users of facilities would impact on participation levels with fewer players taking part, creating both further financial stress on facilities, whilst at the same time potentially impacting player health and wellbeing.

The financial impacts on a withdrawal of PPPs from sport is difficult to assess. This has been acknowledged in the Chemservice report by Drohmann and Dubourg (2023). Hard and reliable financial data projected forward into an uncertain future with multiple co-existing stressors, such as climate change, cost of living increases, labour availability and costs, all adds to the uncertainty of the financial impact. This is also made more complex as the market and commercial situation in all countries are different, with turf maintenance product availability, price and expectation being variable across the EU.

Most associations interviewed in both the Chermervice report and this study had major concerns of increasing costs, although one national association (The Netherlands) noted that cost of pest, weed and disease management had decreased. In contrast, the Wallonia region of Belgium, who had a rapid and sudden withdrawal of PPPs in June 2018 noted that costs for alternative management of pests, weeds and diseases had dramatically increased (the order given was in the mid-tens of thousands of Euros per club per year This is due to turf not having a lead in period of years to be conditioned to be managed without PPPs.

The Chemservice report (Drohmann and Dubourg 2023) found that countries which have a “low intervention” in pest, weed and disease management were spending on average per course €3,250 – €3,625 compared to €14,200 – €23,500 for “high intervention” countries, which would indicate that more inputs are made in higher intervention scenarios. However, it is worth noting that, the cost of pest, weed and disease management is not static, and it dynamically changes compared to the condition and level of adaptation of the turf. Those low intervention countries have had an extended time for gradual PPP reduction, which has conditioned both the turf and the turf managers to be able to better tackle issues. The focus of maintenance in those low intervention countries will have been shifted to focus on root cause preventative management. This means that turf will be naturally more able to cope with issues. This supports the IPM ethos of managing the root causes of issues, focusing on prevention and acting decisively with minimal PPP input. The authors of the Chemservice report also note the difficulty in getting comparable, robust and complete data for analysis.

5.3. Wider impacts

As has been discussed, there are direct and indirect consequences for sport and sports turf management. However, the ripple effect of a potential outright ban on PPPs will extend further. Key amongst these are potential societal impacts on the economic health of sport and the health of EU citizens who are participating in sport and who want to have safe and effective playing surfaces. Whilst not at the forefront of consideration is the potential impact of the European Commission's proposal on broadcast events, which are typically high profile events, where it is vital to have safe and effective playing surfaces that reflect the status of the sport being played. This section of the impact assessment deals with these wider impacts.

5.3.1. Socio-economic

Chemservice (Drohmann and Dubourg 2023) have produced a socio-economic impact assessment for golf. This full report is provided in the Appendices of this report. What is presented here is a summary of the key findings.

The report, based on interviews/questionnaire responses, from golf's national associations highlights a number of key findings:

- Golf courses have already been reducing the use of

PPPs as part of IPM approach, some at a faster pace than others,

- IPM is a fundamental part of how golf courses have approached turf management.
- It acknowledges that reporting systems in individual Member States is variable and with some notable exceptions, are somewhat underdeveloped.
- The golf industry contributes significantly to the local economy with an average estimate of revenue per course of €1 million.
- Some countries have significant tourism components to their golfing economy which needs to be added on top of the course revenue. The two countries with the greatest tourism component were Portugal where the golf and associated tourist activity was estimated at €17.77 billion, whilst in Spain this was €12.72 billion.
- It was difficult with the information provided to establish profitability of courses in each of the countries studied. There was a mixed response to how financially successful golf courses were in each country, but the report noted that members courses only had to cover their costs as they were not so focused on profit, which may be different for courses and countries where tourism is a major component of the local economy.

Summation of the report:

It could be shown that the use of pesticides on golf courses is highly regulated in many EU countries and that further regulatory measures are underway in the different Member States. For various reasons, the current situation regarding the use of pesticides on golf courses varies widely across the EU. Most of the more restrictive regulations in the more intrusive countries have avoided outright bans and allowed specific exceptions for special and targeted circumstances to maintain the quality of play of the golf course when other methods have failed. Most of these hardship cases can be summarised as follows:

- Winter diseases (e.g. *Microdochium nivale*), especially on greens.
- Dollar spot symptoms, caused by various pathogens, primarily on greens but also on tees and fairways.
- Moss on greens.
- Broad-leaved weeds, especially on fairways and semi-rough.
- New diseases and weeds favoured by climate change.

Even taking into account the exemptions, the use of pesticides has decreased significantly in most countries, and much more than in agriculture. Pesticide use now appears to be much higher on arable farms than on golf courses. Reductions of up to 90% have been reported over a 10-year period. In the Nordic and Mediterranean countries, higher pesticide use rates seem to be required due to climatic conditions, while in the more southern countries, higher pesticide use rates are required due to the dependence on international tourism, which expects the sites to be highly aesthetic.

Thus, a blanket ban seems unproportionate, given the significant reductions already existing and the potential socio-economic impacts. The value of revenues obtained by the average golf course can be significant and was estimated at around €1m per course on the basis of survey responses. However, it was not possible to say what the overall impacts of a zero requirement would be on golf in the EU, but there is no reason to doubt that it would be significant and negative. It should be noted that in the EU we have more than 4,500 golf courses and a wider golf industry (including tourism) associated to it.

In general, the golf sector needs more time and a pesticide regulation that allows it to implement the experiences from more progressive countries, as well as exemptions for hardship cases. Furthermore, climatic conditions should be taken into account.

Any further reductions will require resources in the form of education, training and possible resource support. In some countries that have already achieved drastic reductions, further reductions will likely depend on the development of new products, technologies and information.

The potential benefits of physical activity to health are huge.

UEFA has a well advanced programme for assessing the socio-economic impacts of football, particularly at grassroots. To this end, in 2015 UEFA set up its Grow programme at its central strategic development platform. Its aim was to help football's national associations throughout Europe grow the game in a systematic and strategic manner. UEFA said "To help build a coherent business case for investment in mass participation, it sponsored the development of a comprehensive, rigorous football specific social valuing model to establish the impact that non elite mass participation in football has across a spectrum of economic, health and social outcomes". The result was the UEFA Grow SROI Model (Social Return On Investment Model). In simple terms this is cost-benefit analysis that allows governments and national associations to evaluate the social benefits of Europe's most popular mass participation sport.

This programme model clearly demonstrates the value of football (UEFA 2021). Data in this report highlights the model has now been applied to over 9.5 million registered players in 28 countries. Some key statistics are that football contributed:

- €43.6 billion of value into European society.
 - €12.8 billion of economic value directly into the economy through membership fees, job creation and investment in facilities.
 - €12.7 billion of social value into society in terms of positive impact on communities through education, integration, volunteers and crime reduction.
 - €18.1 billion of health value in the form of healthcare savings through improved wellbeing, reduced risk of type II diabetes and heart disease.
- It is fair to say that sport contributes to the social and economic fabric of European society. The risk is that sport, especially at grassroots, can be fragile in terms of being buffered against financial instability and increased costs, due to having to operate on tight budgets. In the short-term at least (measured in years), the complete withdrawal of PPPs will increase the risk of economic shock, with a more measured reduction moving to truly minimised inputs (which are already low on grassroots and amateur sport) leading to sustainable economic, environmental and societal functioning. In the longer-term,

once turf, growing environments and maintenance programmes have adapted and settled the risks will likely reduce.

5.3.2. Health

The benefits of activity and sport on health are now well studied and documented. The link between health and activity and sport is so great that in 2009 the UK Chief Medical Officer noted that "The potential benefits of physical activity to health are huge. If a medication existed which had a similar effect, it would be regarded as a 'wonder drug' or 'miracle cure'". A brief summary of some of the headline health benefits of sport are given in Table 9.

There are a number of thorough reviews that summarise the benefits of sport and exercise on health, wellbeing and mental health (Academy of Medical Royal Colleges 2015, Taylor *et al.* 2015, R&A 2020). The evidence strongly points towards consistent and measurable benefits of sport on physical and mental health.

This is an important consideration in this impact assessment, as if sport, sports facilities and participation are under pressure, these wider benefits on society and EU citizens are likely to be

Table 9. Some of the main benefits of sport and activity on human health.

Disease	Benefit of activity/sport
Coronary heart disease	Moderate activity can reduce risk by 10%
Stroke	Moderately active individuals have a 20% lower risk of stroke incidence or mortality
Type 2 diabetes	Active individuals have a 33–50% lower risk
Colon cancer	Higher levels of activity can have a 40–50% lower risk
Breast cancer	More active women have a 30% lower risk
Osteoporosis	Physical activity reduces the risk of developing issues like hip fractures later in life by 50%
Depression	There is a 20% to 33% lower risk of developing depression, for adults participating in daily physical activity.

Since 2016, The R&A and its partners, including the World Golf Foundation (WGF), the United States Golf Association and the European Tour, have sought to: raise awareness of the health benefits of golf to encourage interest in participation by people of all ages and abilities; improve the sport's image; and increase advocacy for golf by government agencies and public health bodies. In recent years, The R&A has strived to communicate golf's health benefits to a global audience and underline the role the sport plays in health and social well-being.

The Golf & Health Project, supported by The R&A and the other WGF partners, was formed to achieve these aims by producing and publishing high quality science that evidences golf's physical and mental health benefits. The R&A has played a key role in the Project by funding research undertaken by Dr Andrew Murray of the University of Edinburgh, who is the lead research scientist. The R&A has also directly supported other activity, including being the sole funder of a Strength and Balance Study and sponsoring the First International Congress on Golf and Health.

impacted. The impacts put forward by stakeholders in this impact assessment exercise are:

	Impact	Comment
●	Fewer facilities due to operational and/or financial pressures.	Whilst a high severity if this impact happens it is less likely to occur if appropriate measures are taken with legislation.
●	Less participation due to price pressure of having to increase costs to keep facilities operating sustainably.	Concerns were raised about the potential increased costs if PPPs are withdrawn, and the risk increased with sudden withdrawal. Sports facilities, especially at the community or grassroots level are less able to buffer budget increases therefore there is greater chance these will be passed on to players which may deter them from playing.

Sport has a massive benefit to social return on investment and plays a critical role in promoting healthy EU citizens. To do this, there needs to be good quality and safe surfaces upon which sport can be played. Sport is committed to IPM and PPP reduction. In the context of a withdrawal of PPPs, financial and operational shock must be avoided and a longer-term sustainable platform of continued reduction leading to minimal usage is likely to benefit both sport and those that play it from a participation point of view.

5.3.3. Tourism

As has been noted in the socio-economic part of this impact assessment, in some countries, tourism is an important component of the financial sustainability of the golf industry with a significant effect on interlinked industries. During the interviews for this impact assessment, countries such as Portugal, Spain, Italy and Ireland all stressed the importance of golf tourism to the viability of their sports economy. In the Mediterranean countries, the ability to play golf under pleasant warm conditions in winter is very attractive for tourists. Tourist golf in this region is spread across EU and non-EU countries (chief among them being Turkey and Morocco). In Ireland, the make up of Tourists playing golf is different with Trans-Atlantic tourists being the main consumers of tourist golf in Ireland. This was often combined with these visitors heading to the UK to play high profile courses in England, Scotland and Wales. The Irish golf industry was concerned about the competition with UK courses, especially if a PPP ban was put in place and it was more difficult to manage pests, weeds and diseases whilst meeting the expectations of Trans-Atlantic visitors (Golf Ireland 2023).

Opposite are the main impacts put forward by national associations and individual stakeholders concerning a withdrawal of PPP from sports turf:

	Impact	Comment
●	Reduction in visitor numbers coming to play golf as tourists	The product offered is valued highly and expectations are high that turf surfaces will be safe and of excellent quality. A perceived reduction in visual quality or in actual playability is considered a significant impact.
●	To maintain tourist numbers, radical change to costing model	If the overall playability and quality of the playing surface is reduced, the tourist golfer is unlikely to be willing to pay the current price point for playing and therefore prices will have to decrease and volumes of golfers will have to increase to make up the shortfall. However, this then further contributes to the problem of stress and turf health. If a high price exclusive model is chosen, this is unlikely to be compatible with being able to maintain key turf surfaces blemish free which is felt to be the expectation of golfers at this price point.
●	Loss of revenue not just for golf courses but also for the hospitality industry that also relies on the tourists	Significant concern in countries potentially affected by reduced tourist golf that not only golf courses will be affected but also local businesses that service the tourist industry.

5.3.4. Broadcast events

Whilst it is acknowledged that visual quality is not on its own a sufficient reason to not reduce PPP usage to the bare minimum, at the elite level where sport events are broadcast, the expectation and demand is for safe surfaces of the highest possible playing quality and which, visually, also reflect the status of the elite sport being played. Safety, playability and the need to allow the elite professional sports people to demonstrate their skill were flagged as significant impacts if PPPs were

withdrawn entirely. At this level of sport, there is clearly a direct relationship between the quality of the surface and performance of the sports person. An example would be in football, where players at elite level are travelling quicker than amateur

players and aim to make more rapid and higher loaded turns, which necessitates turf strength to be at its optimum. Therefore anything that affects turf strength affects traction, which in turn affects the ability of players to play the game at that level.

	Impact	Comment
●	Potential reductions in playability as a result of not being able to manage high disease pressure in a challenging amphitheatre like environment.	Risk was highlighted that this would hamper players being able to play the game safely at the highest level. Additionally, professional players are often valuable assets and therefore risks to them are also financial risks to clubs or businesses.

5.4. Case studies



Introduction

Craddockstown Golf Club is located in County Kildare, in the province of Leinster, Ireland. With 18 holes and practice facilities spread across 144 acres of parkland, the course is played all year round by members and visitors.



Sport:	Golf
Type of organisation:	Golf club
Country:	Ireland
Location:	County Kildare
Climate:	Oceanic climate
Number of holes:	18
Course type:	Parkland
Course management and maintenance by:	In-house greenkeeping team employed by the golf club
GEO Certified?	No
Used for professional level golf competition	No
Turfgrass species present	Cool season turfgrass species



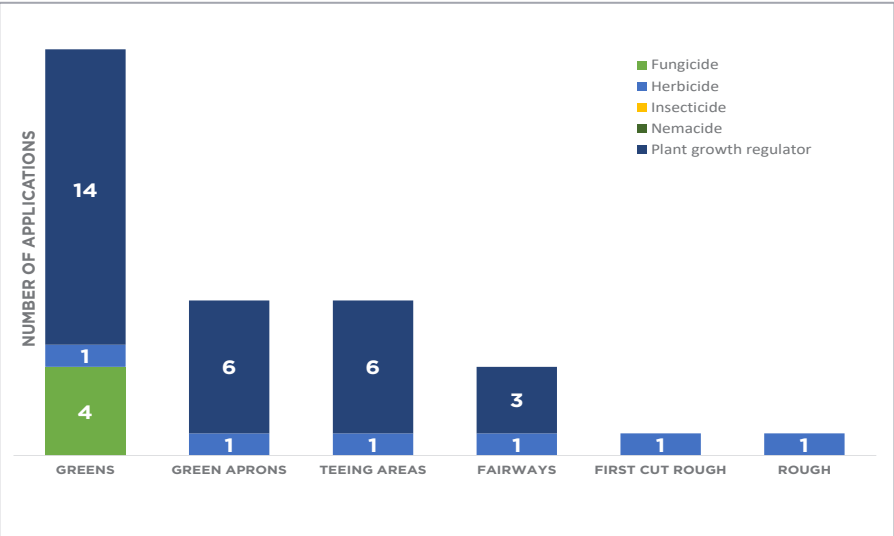
GEO FOUNDATION FOR SUSTAINABLE GOLF

GEO is the international non-profit entity dedicated to helping accelerate sustainability in and through golf.

GEO Certified is a certification, developed to the highest credibility standard, to help golf facilities, developments and tournaments demonstrate and be recognized for their environmental and social responsibility.

Current PPP usage

Key issues requiring the use of PPPs	Turfgrass disease Weeds Insect pests
Areas of the golf course where PPPs are applied	Greens; Green aprons; Teeing areas; Fairways; First cut rough (semi-rough); Rough
Turfgrass diseases experienced	Dollar spot (<i>Sclerotinia homoeocarpa</i>) Red thread (<i>Laetisaria fuciformis</i>) Anthracnose (<i>Colletotrichum cereale</i>) Take-all patch (<i>Gaeumannomyces graminis</i>) Fairy rings
Weed species encountered	Buttercup (<i>Ranunculus repens</i>) Daisy (<i>Bellis perennis</i>) Dandelion (<i>Taraxacum officinale</i>) Greater plantain (<i>Plantago major</i>)
Insect pests encountered	Earthworms (worm casts)



Reducing PPP usage

PPP reduction:	The club have gradually reduced PPP usage over time by spot treating resulting in a decrease to approximately 40 litres of product per year (before mixing with water)
Impact rating:	Impact of withdrawal = 5/10 (moderate impact)

Summary

Craddockstown Golf Club is an example of a parkland golf course whose greenkeeping team have reduced PPP usage over time by embracing ITM techniques and practices. The oceanic climate which is typically characterised by high levels of precipitation with mild and humid conditions is ideal for the growth of turf fungal pathogens, resulting in extended periods of the year in spring, autumn, and winter when disease can be active. In a bid to reduce PPP usage, the club have made efforts to change the agronomic composition of the greens by introducing finer grass species. This has been a long process which has resulted in improvements to playability and turfgrass disease tolerance. Initially the club received complaints from members who felt the quality of the greens had deteriorated, however over time improvements are beginning to be seen. Although there has been a significant reduction in PPP usage, the club still require the use of PPPs in the form of fungicides (applied to the greens), herbicides (spot treatment in all areas of the golf course) and plant growth regulators (applied to the greens, green aprons, teeing areas, and fairways) and felt that the complete removal of PPPs would result in a moderate to high impact.

IMPACT RATING

During the survey of golf clubs, they were asked “Please indicate below, using the scoring system provided, how you think your facility will be affected by the removal of PPPs”. The scale given was 1 = no impact, 5 = moderate impact and 10 = high impact.



Introduction

Galway Bay Golf Resort is located 9 miles from Galway in County Galway, in the province of Connacht, Ireland. The 18-hole Championship Course spread across 81 hectares is parkland in nature although it does have links elements delivering fantastic seas views. The course is played all year round by members and visitors and holds an annual Pro/Am competition. The club has hosted professional European Tour events in the past and has plans to host more professional tournaments in the future.



Sport:	Golf
Type of organisation:	Golf club
Country:	Ireland
Location:	County Galway
Climate:	Oceanic climate
Number of holes:	18
Course type:	Parkland with links elements
Course management and maintenance by:	In-house greenkeeping team employed by the golf club
GEO Certified?	No
Used for professional level golf competition	Yes
Turfgrass species present	Cool season turfgrass species



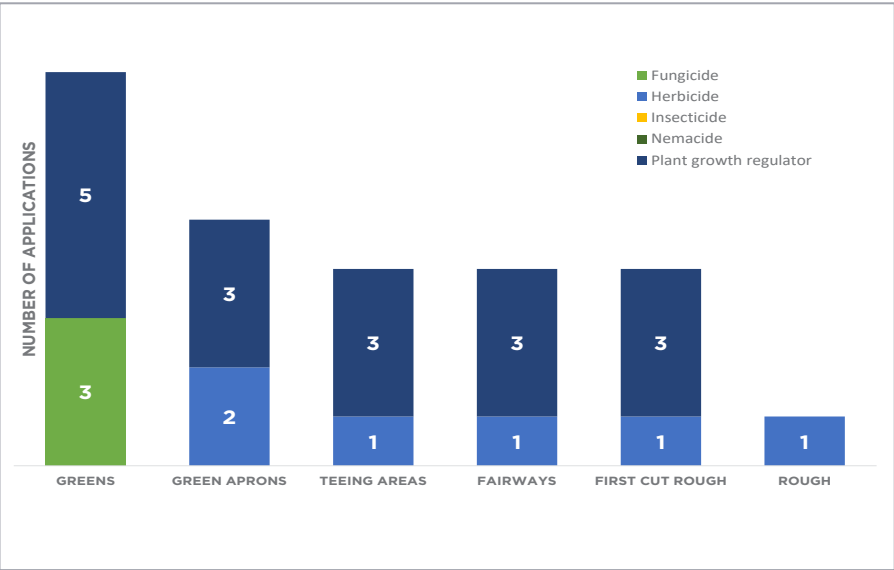
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Current PPP usage

Key issues requiring the use of PPPs	Turfgrass disease Weeds
Areas of the golf course where PPPs are applied	Greens; Green aprons; Teeing areas; Fairways; First cut rough (semi-rough); Rough
Turfgrass diseases experienced	Dollar spot (<i>Sclerotinia homoeocarpa</i>) Microdochium patch (<i>Microdochium nivale</i>) Red thread (<i>Laetisaria fuciformis</i>) Anthracnose (<i>Colletotrichum cereale</i>) Take-all patch (<i>Gaeumannomyces graminis</i>) Fairy rings
Weed species encountered	Buttercup (<i>Ranunculus repens</i>) Chickweed (<i>Stellaria media</i>) Daisy (<i>Bellis perennis</i>) Dandelion (<i>Taraxacum officinale</i>) Greater plantain (<i>Plantago major</i>) White clover (<i>Trifolium repens</i>)



Summary

Galway Bay is an example of a Championship golf course whose greenkeeping team have reduced PPP usage over time by embracing ITM techniques and practices. The club have enhanced the biodiversity of the site by returning approximately 15 acres of intensively managed grassland to natural areas. The oceanic climate which is typically characterised by high levels of precipitation with mild and humid conditions is ideal for the growth of turf fungal pathogens, resulting in extended periods of the year in spring, autumn, and winter when disease can be active. In a bid to reduce PPP usage, the club have made efforts to change the agronomic composition of the greens by introducing finer grass species. Although there has been a significant reduction in PPP usage, the club still require the use of PPPs in the form of fungicides (applied to the greens), herbicides (applied to the green aprons, teeing areas, fairways, semi-rough and rough) and plant growth regulators (applied to the greens, green aprons, teeing areas, fairways and semi-rough) and felt that the complete removal of PPP's would result in a moderate to high impact.

Reducing PPP usage

PPP reduction:	The club have gradually reduced PPP usage over time. Fungicide usage has been decreased by 300 litres of product (before mixing with water)
Impact rating:	Impact of withdrawal = 8/10 (moderate to high impact)

IMPACT RATING

During the survey of golf clubs, they were asked "Please indicate below, using the scoring system provided, how you think your facility will be affected by the removal of PPPs". The scale given was 1 = no impact, 5 = moderate impact and 10 = high impact.



Introduction

Golf della Montecchia is located to the west of the City of Padua in Northern Italy’s Veneto region. With three courses (27 holes) and practice facilities spread over 90 hectares, the site is utilised by members and visitors as well as for professional competitions including Challenge Tour events, the Alps Tour and the PGAI Championship.



Sport:	Golf
Type of organisation:	Golf club
Country:	Italy
Location:	Padua
Climate:	Humid subtropical climate
Number of holes:	27
Course type:	Parkland
Course management and maintenance by:	In-house greenkeeping team employed by the golf club
GEO Certified?	Yes
Used for professional level golf competition	Yes
Turfgrass species present	Located in transitional zone requiring the use of both warm and cool season turfgrass species



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Current PPP usage

Key issues requiring the use of PPPs	Turfgrass disease Weeds Insect pests
Areas of the golf course where PPPs are applied	Greens Green aprons
Turfgrass diseases experienced	Dollar spot (<i>Sclerotinia homoeocarpa</i>) Microdochium patch (<i>Microdochium nivale</i>) Brown patch (<i>Rhizoctonia</i> spp.) Fairy rings Spring dead spot (<i>Ophiosphaerella</i> and <i>Curvularis</i> spp.)
Weed species encountered	Chickweed (<i>Stellaria media</i>) Daisy (<i>Bellis perennis</i>) Dandelion (<i>Taraxacum officinale</i>) Greater plantain (<i>Plantago major</i>) Goosegrass (<i>Eleusine indica</i>) Smooth crabgrass (<i>Digitaria ischaemum</i>) White clover (<i>Trifolium repens</i>)
Insect pests encountered	Cutworms Crane fly (<i>Tipula paludosa</i>) Mole cricket (<i>Grillotalpa grillotalpa</i>)

Summary

Golf della Montecchia is an example of a golf club who have embraced Integrated Turfgrass Management (ITM) techniques including dew removal, optimal irrigation routines, improved drainage systems, optimised plant nutrient inputs, rolling greens to control dollar spot, water pH corrections and iron sulphate applications. The humid subtropical climate is characterized by hot and humid summers, and cool to mild winters where one grass type does not perform optimally all year round. This means that grasses in this region are, at some stage of the year, growing outside their optimum environmental window making them more prone to pest, weed and disease invasion as is evidence by the diseases, weeds and pests. The club have significantly reduced PPP, utilising only fungicides, herbicides and insecticides with these PPPs being applied to the green and green apron areas only. Despite this reduction, the golf club still requires the use of PPPs on the greens and felt that the complete removal of PPPs would result in a high impact.



Reducing PPP usage

PPP reduction:	Gradual decrease of approximately 200 litres of product (before mixing with water) since 2010 followed by a further reduction of 10 litres per year in the last two years
Impact rating:	Impact of withdrawal = 9/10 (high impact)

IMPACT RATING

During the survey of golf clubs, they were asked “Please indicate below, using the scoring system provided, how you think your facility will be affected by the removal of PPPs”. The scale given was 1 = no impact, 5 = moderate impact and 10 = high impact.



Introduction

Dunas Comporta Golf Course is a newly constructed golf course which has opened in 2023 near the village of Comporta, in the municipality of Alcácer do Sal in Portugal. The course has 18 holes set in 34 hectares. The course is characterised by the sand dune setting and is played by members and visitors.



Sport:	Golf
Type of organisation:	Golf club
Country:	Portugal
Location:	Comporta
Climate:	Mediterranean Climate with influences of oceanic climate
Number of holes:	18
Course type:	Links
Course management and maintenance by:	In-house greenkeeping team employed by the golf club
GEO Certified?	Yes
Used for professional level golf competition	No
Turfgrass species present	Cool season turfgrass species



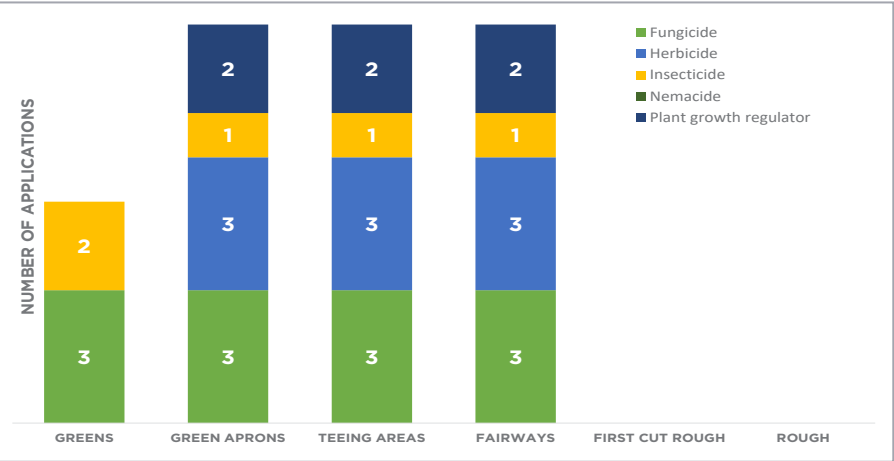
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Current PPP usage

Key issues requiring the use of PPPs	Turfgrass disease Weeds Insect pests
Areas of the golf course where PPPs are applied	Greens; Green aprons; Teeing areas; Fairways
Turfgrass diseases experienced	Dollar spot (<i>Sclerotinia homoeocarpa</i>) Pythium (<i>Pythium</i> spp.) Grey leaf spot (<i>Pyricularia grisea</i>) Rust (<i>Puccinia</i> spp.) Microdochium patch (<i>Microdochium nivale</i>) Red thread (<i>Laetisaria fuciformis</i>) Anthracnose (<i>Colletotrichum cereale</i>) Brown patch (<i>Rhizoctonia</i> spp.) Take-all patch (<i>Gaeumannomyces graminis</i>) Fairy rings Yellow tuft (<i>Sclerophthora macrospora</i>)
Weed species encountered	Yellow suckling clover (<i>Trifolium dubium</i>) Buttercup (<i>Ranunculus repens</i>) Chickweed (<i>Stellaria media</i>) Daisy (<i>Bellis perennis</i>) Dandelion (<i>Taraxacum officinale</i>) Greater plantain (<i>Plantago major</i>) Goosegrass (<i>Eleusine indica</i>) Smooth crabgrass (<i>Digitaria ischaemum</i>) White clover (<i>Trifolium repens</i>)
Insect pests encountered	Leatherjacket larvae (Crane fly larvae) Chafer larvae Cutworms



Reducing PPP usage

PPP reduction:	Newly constructed course – PPP usage has decreased since the surfaces were constructed
Impact rating:	Impact of withdrawal = 10/10 (high impact)

Summary

Dunas Comporta Golf Course is an example of a newly constructed course used by members with a high proportion of usage coming from golf tourism. Sustainability is one of the main goals of the development and the course has been designed with a sophisticated computerised watering system. The site benefits from its proximity to the North Atlantic Ocean, with the sea breezes helping to cool temperatures in the summer, allowing the use of cool season fine grasses such as fescue which have a better disease tolerance. The influence of the oceanic climate however does result in high levels of precipitation with mild and humid conditions is ideal for the growth of turf fungal pathogens, particularly during the Autumn period when disease can be active. The club has reduced PPP usage over recent years between the establishment of the surfaces and the opening of the facility however there is a requirement to apply PPPs selectively to the greens, green aprons, teeing areas and fairways. The club felt that the complete removal of PPPs would result in a high impact.

IMPACT RATING

During the survey of golf clubs, they were asked “Please indicate below, using the scoring system provided, how you think your facility will be affected by the removal of PPPs”. The scale given was 1 = no impact, 5 = moderate impact and 10 = high impact.



Introduction

Kennemer Golf & Country Club is located in the municipality of Zandvoort in the province of North Holland, Netherlands. Originally a 9-hole course, the facilities have been extended to include 27 holes spread across the 90-hectare site. The club has hosted the Dutch Open, a professional level competition in the past, and the courses are played by members and visitors all year round.



Sport:	Golf
Type of organisation:	Golf club
Country:	Netherlands
Location:	Zandvoort
Climate:	Oceanic climate
Number of holes:	27
Course type:	Links
Course management and maintenance by:	In-house greenkeeping team employed by the golf club
GEO Certified?	Yes
Used for professional level golf competition	Yes
Turfgrass species present	Cool season turfgrass species



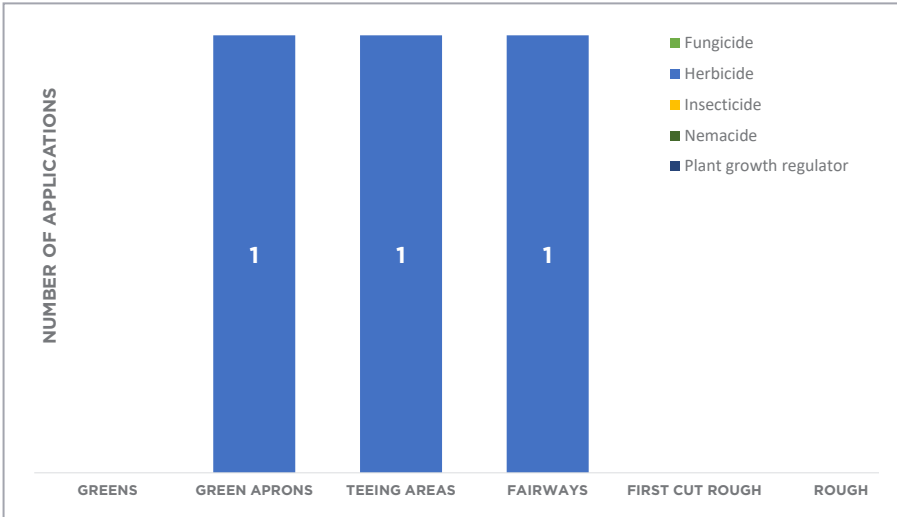
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Current PPP usage

Key issues requiring the use of PPPs	Weeds
Areas of the golf course where PPPs are applied	Green aprons Teeing areas Fairways
Turfgrass diseases experienced	Dollar spot (<i>Sclerotinia homoeocarpa</i>) Microdochium patch (<i>Microdochium nivale</i>) Anthracnose (<i>Colletotrichum cereale</i>) Take-all patch (<i>Gaeumannomyces graminis</i>) Fairy rings Yellow tuft (<i>Sclerophthora macrospora</i>)
Weed species encountered	Yellow suckling clover (<i>Trifolium dubium</i>) Chickweed (<i>Stellaria media</i>) Daisy (<i>Bellis perennis</i>) Dandelion (<i>Taraxacum officinale</i>) Greater plantain (<i>Plantago major</i>) White clover (<i>Trifolium repens</i>)
Insect pests encountered	Leatherjacket larvae (Crane fly larvae)



Reducing PPP usage

PPP reduction:	The club have gradually reduced PPP usage by 70% in the last 5 years
Impact rating:	Impact of withdrawal = 8/10 (moderate to high impact)

IMPACT RATING

During the survey of golf clubs, they were asked “Please indicate below, using the scoring system provided, how you think your facility will be affected by the removal of PPPs”. The scale given was 1 = no impact, 5 = moderate impact and 10 = high impact.

Summary

Kennemer Golf & Country Club is an example of a GEO certified links golf course whose greenkeeping team have managed to gradually reduce PPP usage over time, with reductions in the region on 70% reported in the last five years. The only PPP used by the greenkeeping team is herbicide to control weed ingress on the green aprons, teeing areas, and fairways. Without intervention, weed ingress can overtake by creating large patches of weeds which adversely effect playing quality. Currently, the alternative to treating with PPPs is to physically remove the weeds by hand which is impractical over large areas such as fairways. Despite the implementation of other ITM techniques and practices aimed at limiting weed ingress (such as short mowing, verti-cutting etc), it is not possible to eliminate weed growth. The oceanic climate which is typically characterised by high levels of precipitation with mild and humid conditions is ideal for the growth of turf fungal pathogens, resulting in extended periods of the year in spring, autumn, and winter when disease can be active. The club have reduced PPP usage to point where they felt any further reductions and a complete removal of PPPs would have a moderate to high impact.



Introduction

Furesø Golfklub is located in the town of Birkerød in the northern outskirts of Copenhagen, Denmark. The golf club is a 27-hole facility, divided in the three 9-hole loops spread across the 73-hectare site. In addition, the 27- hole course is complemented by a 9-hole par 3 course. The facilities are played by members and visitors all year round.



Sport:	Golf
Type of organisation:	Golf club
Country:	Denmark
Location:	Birkerød
Climate:	Oceanic climate
Number of holes:	27 + 9 hole par 3 course
Course type:	Parkland
Course management and maintenance by:	In-house greenkeeping team employed by the golf club
GEO Certified?	No
Used for professional level golf competition	No
Turfgrass species present	Cool season turfgrass species



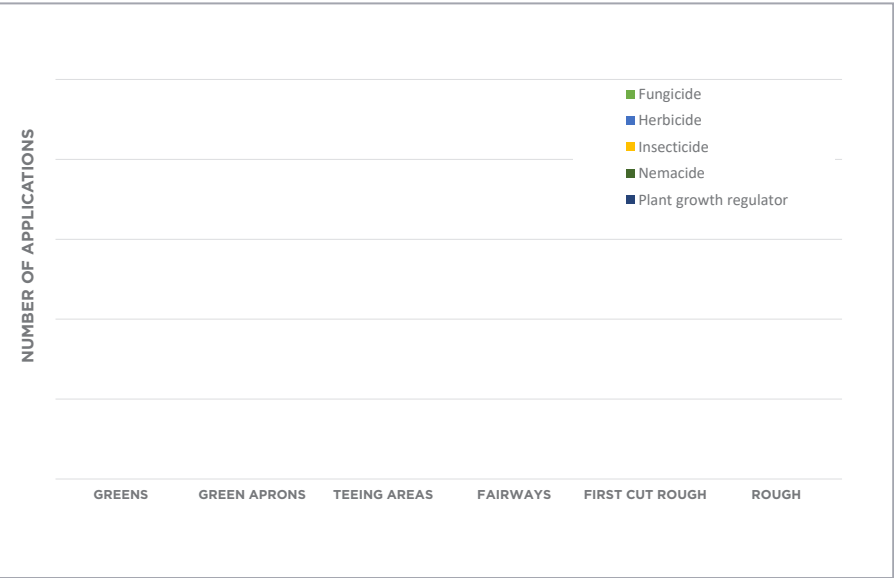
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Current PPP usage

Key issues requiring the use of PPPs	N/A
Areas of the golf course where PPPs are applied	N/A
Turfgrass diseases experienced	Dollar spot (<i>Sclerotinia homoeocarpa</i>) Fairy rings Pink snow mold (<i>Microdochium nivale</i>)
Weed species encountered	Daisy (<i>Bellis perennis</i>) Dandelion (<i>Taraxacum officinale</i>) White clover (<i>Trifolium repens</i>)
Insect pests encountered	Chafer larvae



Reducing PPP usage

PPP reduction:	N/A – don't apply any PPPs
Impact rating:	N/A

IMPACT RATING

During the survey of golf clubs, they were asked “Please indicate below, using the scoring system provided, how you think your facility will be affected by the removal of PPPs”. The scale given was 1 = no impact, 5 = moderate impact and 10 = high impact.

Summary

Furesø Golfklub is an example of a golf club located Denmark where the application of PPPs is highly regulated and restricted at state level. The logging of PPP applications is strictly monitored (in this case via the GreenData programme). Restrictions have been introduced gradually in a phased manner which has helped the surfaces on the course to be conditioned and managed without PPP inputs. This has also allowed time for a comprehensive ITM programme to be established and bedded in. This phased and gradual approach has also allowed the greenkeeping team to create an environment for success via the improvement of soil quality, shade, airflow and the introduction of more disease tolerant grass species which has been essential in allowing the course to be managed without PPPs. Despite this, the course does still suffer from a some turfgrass diseases which are typical of the oceanic climate which is characterised by mild and humid conditions, ideal for the growth of turf fungal pathogens, particularly in spring, autumn, and winter. Turfgrass disease pressure is somewhat lower than would be anticipated in areas in Europe with more extreme northern climates (such as Finland) and hot Mediterranean climates (such as Spain and Portugal). Given the already strict restrictions, the greenkeeping team felt that the European Commission’s proposals would have a low impact.



Introduction

FC Bayern München is a German professional football club. It's professional men's team play in the Bundesliga, the top tier of German football. The club's professional women's team play in the Frauen-Bundesliga, the top level of league competition for women's football in Germany.

The club's stadium, the Allianz Arena, also known as Fußball Arena München for UEFA competitions, is a large 75,000 capacity stadium located in the northern outskirts of Munich. The club's 80,000m² training centre known as the Säbener Strasse site includes multiple natural grass pitches.



Sport:	Football
Type of organisation:	Professional football club
Country:	Germany
Location:	Munich
Climate:	Oceanic climate
Management and maintenance of pitches carried out by:	In-house grounds team employed by the football club
Turfgrass species present:	Cool season turfgrass species
Number of natural grass pitches:	Training pitches = 11 Match pitches (<30,000 capacity) = 1 Match pitches (>30,000 capacity) = 1

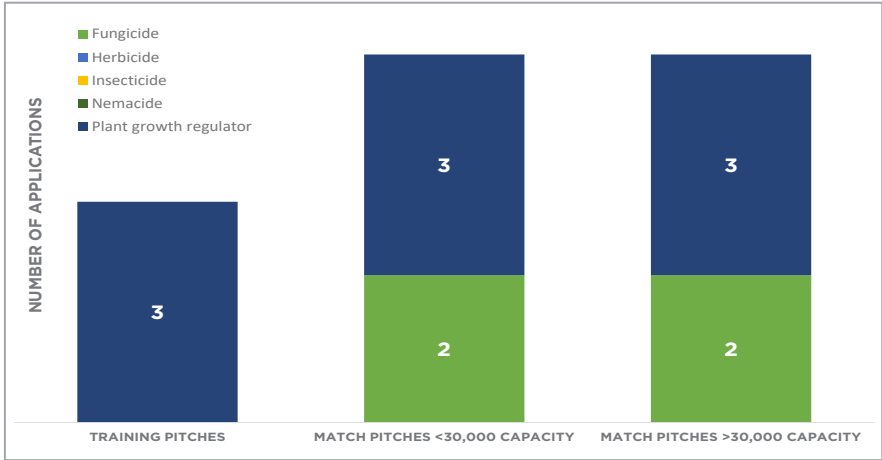
Summary

FC Bayern München is an example of an elite level professional football club whose in-house grounds team have embraced ITM techniques and practices as well as new technologies such as UV-C light to help reduce PPP usage over time. The oceanic climate which is typically characterised by high levels of precipitation with mild and humid conditions is ideal for the growth of turf fungal pathogens, resulting in extended periods of the year in spring, autumn, and winter when disease can be active. Also, the enclosed stadium environment at the Allianz Arena is conducive to turfgrass disease activity due to the lack of air movement within the stadium bowl and reduced light levels reaching the pitch surface. As a result, the club do require some, although minimal, PPP usage and felt that the complete removal of PPPs would result in a moderate to high impact.

Current PPP usage

Key issues requiring the use of PPPs	Turfgrass disease
Turfgrass diseases experienced	Pythium (<i>Pythium</i> spp.) Grey leaf spot (<i>Pyricularia grisea</i>) Pink snow mould (<i>Microdochium nivale</i>)

The grounds team apply PPPs to two of the eleven training pitches (18%) and the two match pitches (including the match pitch at the Allianz Arena).



Reducing PPP usage

PPP reduction:	The club have reduced PPP usage over time and have utilised ITM techniques and modern technologies such as treating the pitch with UV-C light to help prevent disease outbreaks.
Impact rating:	Impact of withdrawal = 8/10 (moderate to high impact).

IMPACT RATING

During the survey of football clubs, they were asked “Please indicate below, using the scoring system provided, how you think your facility will be affected by the removal of PPPs”. The scale given was 1 = no impact, 5 = moderate impact and 10 = high impact.



Introduction

Sevilla FC is a Spanish professional football club. It's professional men's team play in LaLiga, the top tier of Spanish football. The club's professional women's team play in the Primera División de LaLiga de Fútbol Femenino known ad Liga F, the top level of league competition for women's football in Spain.

The club's stadium, the Ramon Sanches-Pizjuan Stadium, is a large 44,000 capacity stadium located in Seville. The club's training centre known as the The Ciudad Deportiva José Ramón Cisneros Palacios, includes multiple natural grass pitches on the outskirts of Seville.



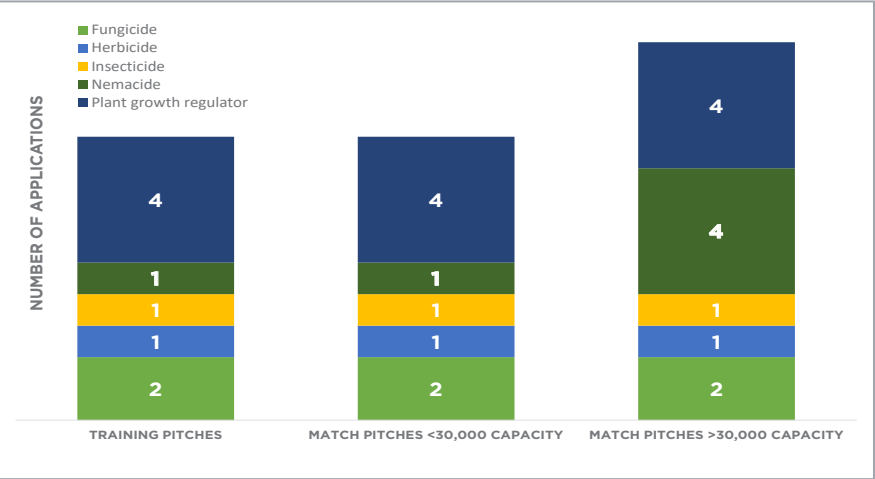
Sport:	Football
Type of organisation:	Professional football club
Country:	Spain
Location:	Seville
Climate:	Mediterranean climate
Management and maintenance of pitches carried out by:	In-house grounds team employed by the football club
Turfgrass species present:	Located in transition zone requiring the use of both warm and cool season turfgrass species
Number of natural grass pitches:	Training pitches = 11 Match pitches (<30,000 capacity) = 2 Match pitches (>30,000 capacity) = 1



Current PPP usage

Key issues requiring the use of PPPs	Turfgrass disease
Turfgrass diseases experienced	Dollar spot (<i>Sclerotinia homoeocarpa</i>) Pythium (<i>Pythium</i> spp.) Grey leaf spot (<i>Pyricularia grisea</i>) Anthracnose (<i>Colletotrichum cereale</i>) Leaf spots (<i>Bipolaris</i> , <i>Curvularia</i> and <i>Drechslera</i> spp.)
Weed and weed grass species encountered	Goosegrass (<i>Eleusine indica</i>) Smooth crabgrass (<i>Digitaria ischaemum</i>) Annual meadow-grass (<i>Poa annua</i>)
Insect pests encountered	Cutworms

The grounds team apply PPPs to all training pitches and the three match pitches (including the match pitch at the Ramon Sanches-Pizjuan Stadium).



Reducing PPP usage

PPP reduction:	The club have reduced PPP usage over time and have utilised ITM techniques to help prevent disease outbreaks. The club have reduced PPP usage by approx. 8 litres of product per year (before mixing with water).
Impact rating:	Impact of withdrawal = 6/10 (moderate to high impact)

IMPACT RATING

During the survey of football clubs, they were asked “Please indicate below, using the scoring system provided, how you think your facility will be affected by the removal of PPPs”. The scale given was 1 = no impact, 5 = moderate impact and 10 = high impact.

Summary

Sevilla FC is an example of an elite level professional football club whose in-house grounds team have embraced ITM techniques and practices to help reduce PPP usage over time. The Mediterranean climate which is typically characterised by hot summers (where temperatures regularly exceed 35°C for long periods and nighttime temperatures are high and often greater than 22°C) but cooler winters. This is why regions like the Mediterranean are classified as transition zone, i.e. where one grass type does not perform optimally all year round. This means that grasses in this region are, at some stage of the year, growing outside their optimum environmental window making them more prone to pest, weed and disease invasion as is evidence by the diseases, weeds and pests experienced at the stadium and training centre. The challenge is particularly great in the stadium due to the lack of air movement within the stadium bowl and reduced light levels reaching the pitch surface. As result the club rely on the application of PPPs to ensure suitable playing surfaces all year round and felt that the complete removal of PPP's would result in a moderate to high impact.



Introduction

Helsingør Kommune is a municipality in eastern Denmark. The municipality covers an area of 122 km² and has a population of 63,399 people. The municipality are responsible for the management and maintenance of 40 natural grass football pitches, 5 of which are used as match pitches catering for grassroots clubs through to semi-professional football clubs including FC Helsingør who play in the third tier of Danish football. The pitch at FC Helsingør was utilised as a training pitch for EURO 2020 where it was used by elite level international teams.



Sport:	Football
Level of football:	High level professional football Semi-professional football High level amateur football Grassroots (community level) football
Country:	Denmark
Location:	Helsingør Kommune
Climate:	Oceanic climate
Management and maintenance of pitches carried out by:	Local authority/municipality
Turfgrass species present:	Cool season turfgrass species
Number of natural grass pitches:	Training pitches = 35 Match pitches (<30,000 capacity) = 0 Match pitches (>30,000 capacity) = 0

Current PPP usage

Key issues requiring the use of PPPs	Turfgrass disease
Turfgrass diseases experienced	Red Thread (<i>Laetisaria fuciformis</i>) Fairy rings Grey snow mold (<i>Typhula incarnata</i>)
Weed and weed grass species encountered	White clover (<i>Trifolium repens</i>) Annual meadow-grass (<i>Poa annua</i>)
Insect pests encountered	Chafer larvae Fever fly larvae

The local authority/municipality do not apply PPPs to any of the natural grass football pitches within the municipality.

NUMBER OF APPLICATIONS	Fungicide	Herbicide	Insecticide	Nematicide	Plant growth regulator
TRAINING PITCHES MATCH PITCHES <30,000 CAPACITY MATCH PITCHES >30,000 CAPACITY					

Reducing PPP usage

PPP reduction:	N/A
Impact rating:	N/A

Summary

Helsingør Kommune is an example of a municipality whose grounds team are responsible for the maintenance and management of a various natural grass pitches catering for all levels of football. The oceanic climate which is typically characterised by high levels of precipitation with mild and humid conditions is ideal for the growth of turf fungal pathogens, resulting in extended periods of the year in spring, autumn, and winter when disease can be active. The threat of snow in Denmark also poses a risk as turf can be devastated, to the extent of having to be completely resown, by turf disease growing under extended snow cover. The municipality reported that they do have issues with various pests and diseases that compromise the playing surfaces, however they don't apply any PPPs due to the local legislation.

IMPACT RATING

During the survey of football clubs, they were asked “Please indicate below, using the scoring system provided, how you think your facility will be affected by the removal of PPPs”. The scale given was 1 = no impact, 5 = moderate impact and 10 = high impact.



Introduction

Relvados e Equipamentos Desportivos, known as RED, is a Portuguese sports pitch contractor based in Maia, a municipality in the Porto Metropolitan Area. RED are responsible for the management and maintenance of 51 natural grass pitches used for professional football. This includes four pitches located in large 30,000 + capacity stadia:

- Estádio do Sport Lisboa e Benfica, Lisbon – Home of SL Benfica
- Estádio do Dragão, Porto – Home of FC Porto
- Braga Municipal Stadium, Braga – Home of FC Braga
- Estádio José Alvalade, Lisbon – Home of Sporting Clube de Portugal (Sporting CP)



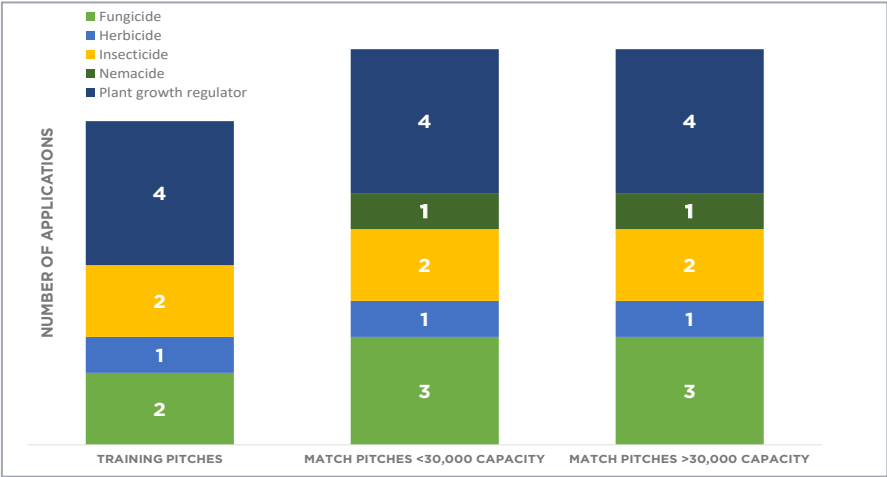
Sport:	Football
Level of football:	High level professional football
Country:	Portugal
Location:	Porto
Climate:	Mediterranean Climate with influences of oceanic climate
Management and maintenance of pitches carried out by:	Contractor
Turfgrass species present:	Cool season turfgrass species
Number of natural grass pitches:	Training pitches = 40 Match pitches (<30,000 capacity) = 7 Match pitches (>30,000 capacity) = 5



Current PPP usage

Key issues requiring the use of PPPs	Turfgrass disease Weed ingress Damage from insect pests and nematodes
Turfgrass diseases experienced	Dollar spot (<i>Sclerotinia homoeocarpa</i>) Pythium (<i>Pythium</i> spp.) Grey leaf spot (<i>Pyricularia grisea</i>) Rust (<i>Puccinia</i> spp.) Microdochium patch (<i>Microdochium nivale</i>) Red Thread (<i>Laetisaria fuciformis</i>) Leaf spots (<i>Bipolaris</i> , <i>Curvularia</i> and <i>Drechslera</i> spp.) Brown patch (<i>Rhizoctonia</i> spp.) Fairy rings
Weed and weed grass species encountered	Yellow suckling clover (<i>Trifolium dubium</i>) Dandelion (<i>Taraxacum officinale</i>) Greater plantain (<i>Plantago major</i>) Goosegrass (<i>Eleusine indica</i>) Smooth crabgrass (<i>Digitaria ischaemum</i>) White clover (<i>Trifolium repens</i>) Annual meadow-grass (<i>Poa annua</i>)
Insect pests encountered	Leatherjacket larvae (Crane fly larvae) Cutworms Nematodes Crane fly (<i>Tipula paludosa</i>) Billbug larvae

The grounds team apply PPPs to 30 of the 40 training pitches under management (75%) and to all the match pitch pitches under management including the four large stadium pitches.



Reducing PPP usage

PPP reduction:	The contractor reported that they have reduced PPP usage by approximately 50%
Impact rating:	Impact of withdrawal = 9/10 (high impact)

Summary

Relvados e Equipamentos Desportivos is an example of sports pitch contractor whose team are responsible for the maintenance of many professional level football pitches. The Mediterranean climate is typically characterised by hot summers (where temperatures regularly exceed 35°C for long periods and nighttime temperatures are high and often greater than 22°C) but cooler winters. This part of Portugal is also influenced by the oceanic climate which result in high levels of precipitation with mild and humid conditions is ideal for the growth of turf fungal pathogens, particularly during the Autumn period when disease can be active. By utilised an ITM based approach to pitch management and incorporating innovative technologies such UV-C light, supplementary lighting units and pitch-side fans, they have reduced PPP usage by 50%. Despite this, the contractor still relies on the application of PPPs and felt that the complete removal of PPPs would result in a high impact.

IMPACT RATING

During the survey of football clubs, they were asked “Please indicate below, using the scoring system provided, how you think your facility will be affected by the removal of PPPs”. The scale given was 1 = no impact, 5 = moderate impact and 10 = high impact.



Introduction

The Proximus Basecamp is the Belgian Football Associations' national training centre located 25 miles south of Brussels in the small town of Tubize in the Wallonia Region of Belgium. The site is spread over 13 hectares of land and includes a total of 8 natural grass football pitches. The training centre is used for training daily by the Belgian national teams and men's and women's youth teams. Professional clubs from Belgium and abroad, as well as other football federations, are frequent users of the training facilities.

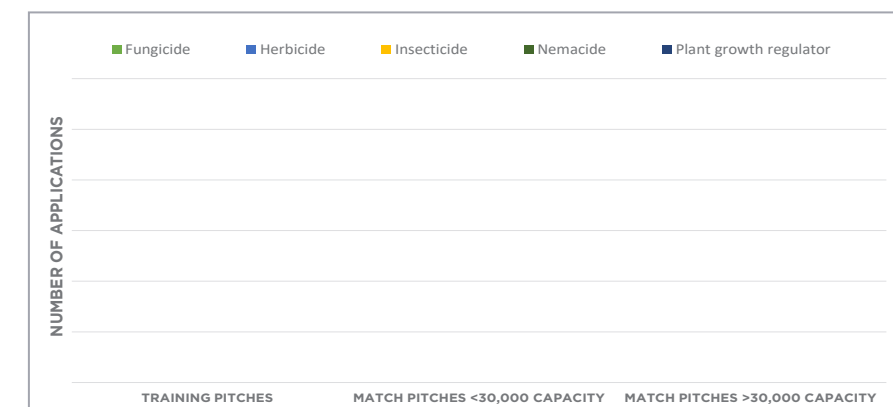


Sport:	Football
Level of football:	National Association
Country:	Belgium
Location:	Tubize (Wallonia region)
Climate:	Oceanic climate
Management and maintenance of pitches carried out by:	In-house grounds team employed by the National Association
Turfgrass species present:	Cool season turfgrass species
Number of natural grass pitches:	Training pitches = 6 Match pitches (<30,000 capacity) = 2 Match pitches (>30,000 capacity) = 0

Current PPP usage

Turfgrass diseases experienced	Pythium (<i>Pythium</i> spp.) Microdochium patch (<i>Microdochium nivale</i>) Red Thread (<i>Laetisaria fuciformis</i>)
Weed and weed grass species encountered	Daisy (<i>Bellis perennis</i>) Greater plantain (<i>Plantago major</i>) White clover (<i>Trifolium repens</i>) Annual meadow-grass (<i>Poa annua</i>)
Insect pests encountered	Leatherjacket larvae (Crane fly larvae) Crane fly (<i>Tipula paludosa</i>)

The Proximus Basecamp is located in the Wallonia Region of Belgium where a complete ban in PPP and biologicals was introduced June 2018. As such the grounds team do not apply any PPPs to the natural grass pitches.



Reducing PPP usage

PPP reduction:	N/A
Impact rating:	Impact of withdrawal = 0/10 (low to high impact)

Summary

The Proximus Basecamp is an example of a professional level training facility whose in-house grounds team have embraced ITM techniques and practices, education, and the study of soil microbiology since the sudden and complete ban on PPP usage was introduced in 2018. Operating in a PPP free region has meant the venue has encountered problems with turfgrass diseases, weed ingress and damage from insect pests which have had a detrimental effect on the playing surfaces. The oceanic climate is characterised by high levels of precipitation with mild and humid conditions ideal for the growth of turf fungal pathogens, particularly in the Autumn months of the year. Despite this, disease pressure is somewhat lower than would be anticipated in areas in Europe with extreme northern climates (such as Scandinavia) and hot Mediterranean climates (such as Spain and Portugal). There are no large stadium structures on the site which would increase disease pressure because of reduced airflow or shading. Given that a ban on PPPs has been in place for 5 years, the grounds team felt that the European Commission's proposals would have a low impact.

IMPACT RATING

During the survey of football clubs, they were asked “Please indicate below, using the scoring system provided, how you think your facility will be affected by the removal of PPPs”. The scale given was 1 = no impact, 5 = moderate impact and 10 = high impact.



Introduction

The DFB Campus is the home of the German Football Association (DFB). The campus opened in 2022 and is located in Frankfurt's city forest on the site of a former racecourse. The site includes 4 natural training pitches used by the National Associations men's, woman's, and youth teams.

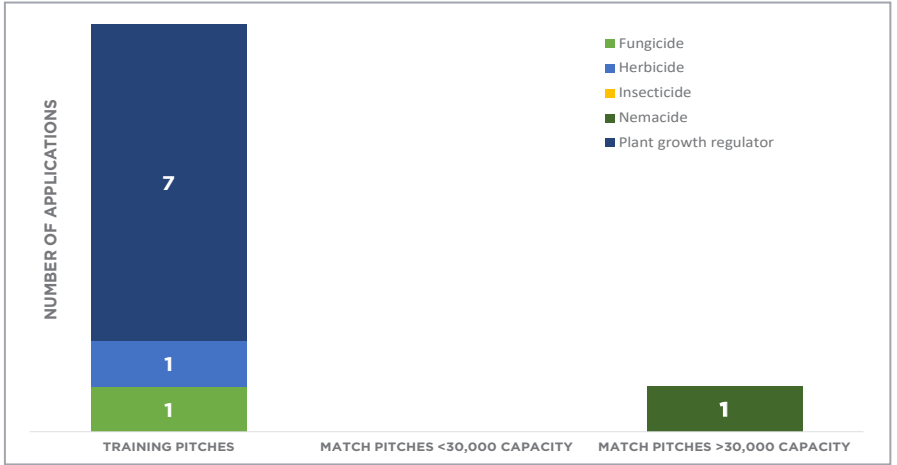


Sport:	Football
Level of football:	National Association
Country:	German
Location:	Frankfurt
Climate:	Oceanic climate
Management and maintenance of pitches carried out by:	Contractor
Turfgrass species present:	Cool season turfgrass species
Number of natural grass pitches:	Training pitches = 4 Match pitches (<30,000 capacity) = 0 Match pitches (>30,000 capacity) = 0

Current PPP usage

Turfgrass diseases experienced	Pythium (<i>Pythium</i> spp.) Grey leaf spot (<i>Pyricularia grisea</i>) Microdochium patch (<i>Microdochium nivale</i>) Red Thread (<i>Laetisaria fuciformis</i>) Leaf spots (<i>Bipolaris</i> , <i>Curvularia</i> , <i>Drechslera</i> spp.) Pink snow mold (<i>Microdochium nivale</i>)
Weed and weed grass species encountered	White clover (<i>Trifolium repens</i>) Annual meadow-grass (<i>Poa annua</i>)
Insect pests encountered	Leatherjacket larvae (Crane fly larvae) Garden chafer (<i>Phyllopertha horticola</i>) Cockchafer (<i>Melolontha melolontha</i>) Summer chafer (<i>Amphimallon solst</i>) Crane fly (<i>Tipula paludosa</i>)

The contractor applies PPPs to all four of the natural grass training pitches on the site.



Reducing PPP usage

PPP reduction:	The venue has only been operational for one year so there has not been any reduction in PPP usage
Impact rating:	Impact of withdrawal = 10/10 (high impact)

Summary

The DFB Campus is an example of a modern professional level training facility where the natural grass pitches are maintained by a contractor. The contractor has embraced ITM techniques and practices and make a relatively small number of PPP applications per year in the form of fungicides, herbicides and plant growth regulators. The oceanic climate which is typically characterised by high levels of precipitation with mild and humid conditions is ideal for the growth of turf fungal pathogens, resulting in extended periods of the year in spring, autumn, and winter when disease can be active. As a result, the contractor does require some, although minimal PPP usage and felt that the complete removal of PPPs would result in a high impact.

IMPACT RATING

During the survey of football clubs, they were asked "Please indicate below, using the scoring system provided, how you think your facility will be affected by the removal of PPPs". The scale given was 1 = no impact, 5 = moderate impact and 10 = high impact.

6. Challenges and opportunities

This chapter aims to:

- Identify the opportunities sport has to promote and further IPM in how it manages its natural turf playing surfaces
- Look at how these opportunities can be harnessed and grown to make sport an exemplar of best IPM practice
- Identify policy options that might be considered on how to further manage PPPs to meet the needs of sport, end users, greater public and the environment
- Review the challenges facing sport now and into the future and how do these interact with PPP use
- Look at what needs to be considered when implementing PPP legislation change in sport
- Identify what steps will be needed to ensure that sport can go further than it already has to deliver safe and effective playing surfaces, whilst minimising PPP use.

This final chapter of the impact assessment looks to summarise the opportunities with PPP reduction in sport, and the challenges associated with PPP withdrawal.

Sport has embraced IPM, whilst the core components of IPM have been implemented as part of good turf management long before IPM was developed as a concept. IPM is a primary source of research activity, solution development and education/ knowledge transfer in sports turf management.

This impact assessment has demonstrated how sport is embracing IPM and in many of the countries assessed, PPP usage had been reduced, in some cases by up to 90%. Some Member States are further down the pathway of reduction than others, but all are implementing systems and processes to continue this process. One issue has been the lack of a harmonised methodology, metric and system for logging, recording and reporting on PPP usage and reductions. All those that have taken part in this impact assessment understand the need to reach minimal PPP usage and to take PPP reduction and IPM implementation as business and operationally critical goals.

Sport offers huge potential to achieving the ideals of IPM and has demonstrated its willingness to implement changes. When viewed from the outside, sport has neither been effective at communicating the work that it is doing to those outside its own industry, nor has it often effectively engaged with regulators and legislators.

Sport also plays a vital role in maintaining the physical and mental health of EU citizens. It helps to avoid social isolation, create participation, continued learning opportunities and a continued engagement with the natural world and the landscapes (physical, social and cultural) in which players live.

However, there are challenges and these should be recognised and addressed. Some of these are outside of the control of sport, whereas others lay within the industry and are within its power to resolve.

6.1. Opportunities

Sport offers opportunities to continue further down the road of PPP reduction through developing and piloting new technologies that can help all crop-based industries. There have been increased efforts made with informatics and data analytics and how these solutions can help with problem identification and optimising the best solutions to tackle the issues at hand.

Sport but especially golf, has tremendous potential to add significant value to the ecology and biodiversity of the local landscape. There are large areas of golf courses that are out of play and form part of a low intensity managed habitat that can be sympathetically managed to actively encourage a diverse range of species of plants and animals native to that area. Whether it is creating or enhancing woodland, aquatic habitats, wildflower and pollinator promoting spaces, through to providing value to local settlements by attenuating and storing excess water, golf courses and other sports facilities have a range of functions that they can fulfil outside of providing playing surfaces.

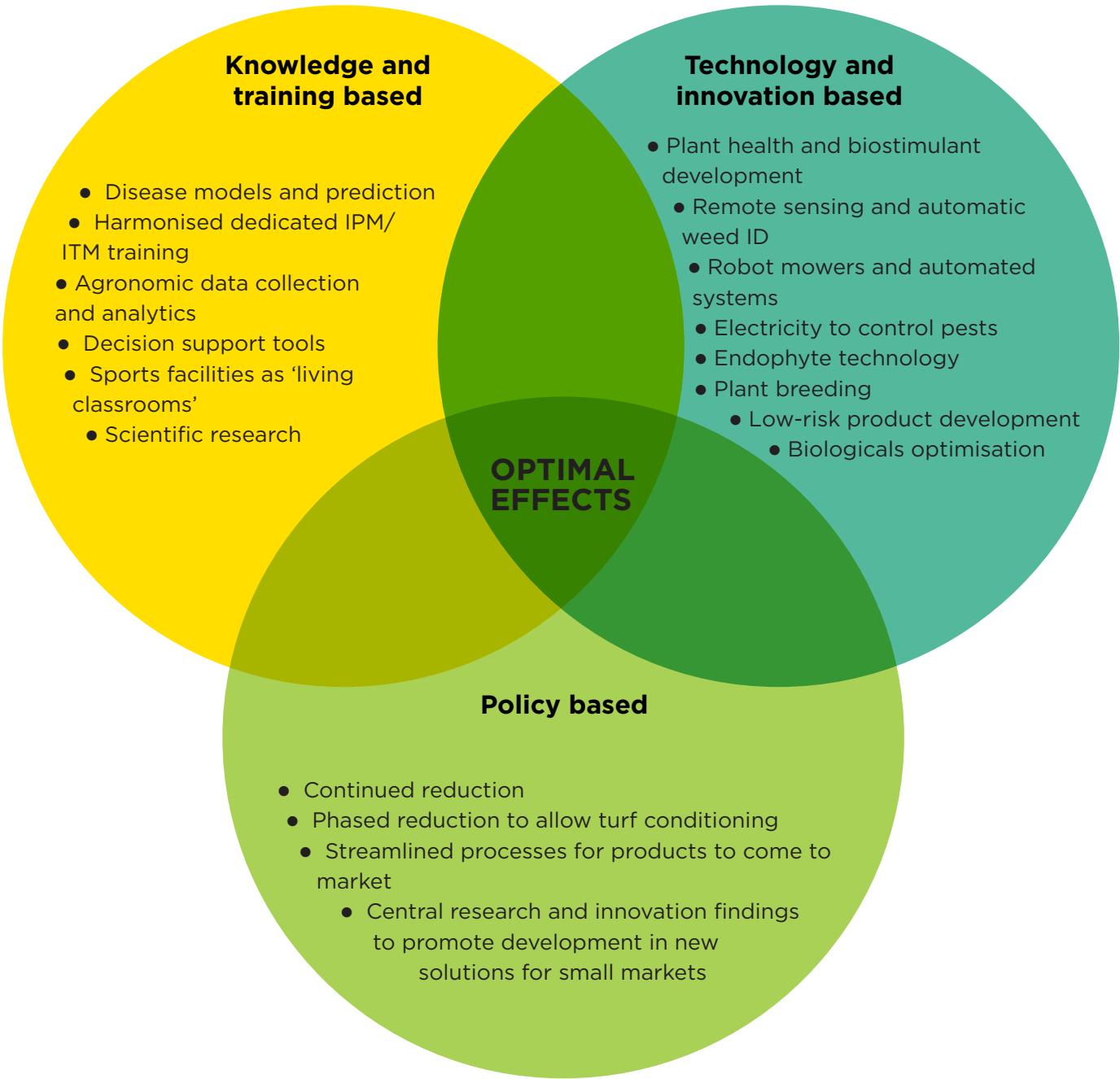
The potential for adding environmental, ecological and biodiversity value, especially in

urban areas, shows that sports facilities can have an impact that is greater than just playing sport. Many sports, including golf and football are looking at how they can maximise the value of their sites. This can be seen in the action plans and strategies produced by national associations to encourage the widest possible take up of these ideas.

Furthermore, sports facilities are taking steps to integrate green infrastructure to reduce their environmental footprint. Whether that is through recycling of organic waste to produce fertiliser and energy, energy creation through solar or wind power or installing green roofs or living walls to help with natural insulation and air conditioning. This fits with the socially responsible ideals that sport wants to live up to.

6.1.1. Technical solutions

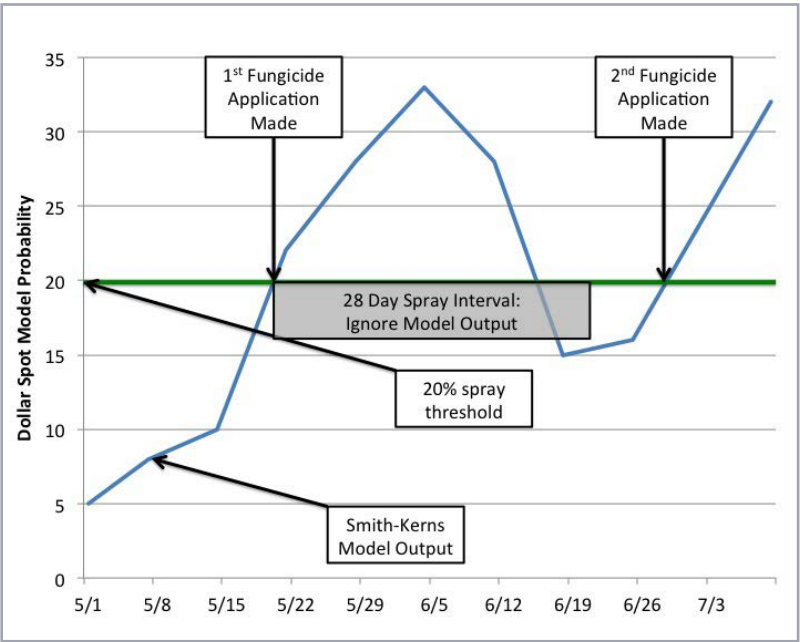
To help further with PPP reduction and looking forward to a future where PPPs on sports turf may not be required, this section looks at a range of current and near future (in development, conceptual, or near market) solutions. The type of solutions will fall into three main categories:



6.1.1.1. Knowledge and training based

There is no use having the right tools if they are not used at the right time. The first group of solutions are knowledge and training based:

Further development and validation of predictive disease models – these are data driven tools that are designed to help turf managers understand when their turf is at risk so that they can modify, if necessary, their preventative disease control programs. These models need to be tested under European conditions, ranging from the cool north through to the warm south.



Automatic agronomic data collection and analysis

– this will help turf managers to gain a greater understanding of the condition of their turf, the state of the growing environment, how the turf is changing and where particular problem areas may be occurring. Solutions like that developed by E-Nano and Labosport can autonomously collect surface playability data, as well as soil and turf conditions and process that data to help turf managers understand potential areas where agronomic issues are developing.



Agronomic decision making tools, including pest, weed and disease identification – knowing what problems occur in an area, what the optimum cultural and non-chemical controls are is essential. Tools are in the market and being developed that can help turf managers to correctly identify their issue and plan effective control measures.

Accessible, harmonised and integrated training – learning about IPM/ITM and gaining effective and recognised qualifications, whilst being able to do this in a way that works around turf manager's jobs is vital. IPM/ITM training is somewhat ad hoc and a more structured approach would help.



Sports facilities as living classrooms – sports turf and facilities can be effective living classrooms as students learn everything from STEM subjects, through to business development, marketing, customer service all in one location. This type of initiative is being run in a pilot programme in Sweden (Szczepanski and Strandberg 2022).

STEM stands for science, technology, engineering and mathematics subjects and would include chemistry, biology, physics and geography. These are key subjects that help humans understand the world around them and how its multitude of components fit and work together.



Harmonised PPP usage data – there is an opportunity to have a harmonised system so that all metrics on PPP usage on sport are comparable across the EU.



6.1.1.2. Technology and innovation based

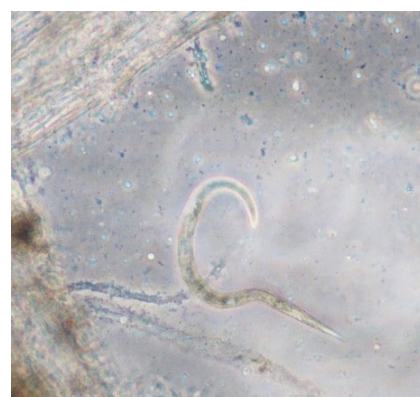
One of the main areas for development has been in the field of technology and innovation. This has encompassed diverse areas from non-chemical product development through to plant breeding, DNA technology and remote sensing technologies. The main technological opportunities to help further reduce PPP usage would include:

Development of plant health and biostimulant products –

Over the last decade there has been an increasing pace in the development of supportive technologies for plant health. These have been aimed at helping plant to fight off or resist pathogen or pest attack and are an essential part of the future of IPM/ITM.



Continued development of biological controls – There has been increasing activity with the development of biological controls, typically focusing on bacteria and fungi for disease control and nematodes for insect control. Micro-organisms are covered by the existing authorisation processes which means there is a high cost and lead time before these solutions are available for end users. However, there are some downsides for biological controls in their efficacy can be strongly affected by environmental conditions, application can be difficult, shelf life is limited and repeated applications are needed, the target often has to be at an early stage in its infection/lifecycle and efficacy is lower than chemical based controls.



New physical cultural controls for weed removal – There has started to be renewed efforts in physical control for pests, weeds and diseases. Recently American researchers have designed a weed removal brush for turf (Henderson 2022). There has also been work to develop robotic solutions to automate the process of hand weeding in turf, e.g. Milati Violette, which detects broad-leaved weeds and then physically removes them (www.natuition.com/en).



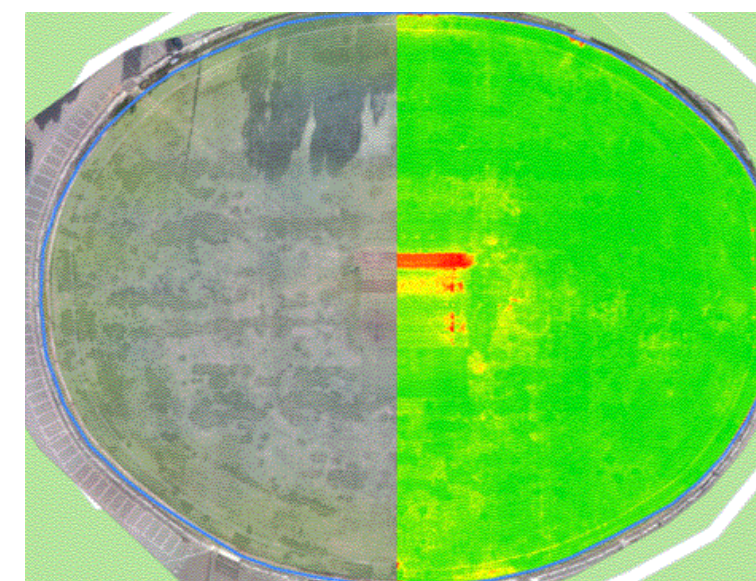
Direct Energy electrical pulses for pest control – Lisi Global, a company in the United States, has developed their DirectTurf system that uses high energy pulses of electricity to control nematodes in turf (www.lisiglobal.com/directturf.html). They are also looking at this technology for a chemical free treatment for insect pests and other soil borne pathogens.



Robot mowers – There has been an increased uptake in robot mowers, especially on golf fairways and lower level football pitches. This has come after the development of larger and more accurate units. There are still no affordable and simple to operate greens robot mowers yet. There is evidence from end user experience and scientific trial work that the use of robot mowers can help reduce disease risk, weed ingress, compaction and the smearing of earthworm casts (Hansen 2022 and Hesselsoe *et al.* 2022). Robot mowers have also been promoted due to the freeing of resource to manage other areas of the course and to reduce CO₂ emissions, especially if the facility has renewable energy generation capabilities.



Multi-spectral and remote sensing technologies – The identification of weeds and the early non-visible symptoms of disease infection have prompted developments in systems that can detect and identify these issues (Hann 2021). The challenge has been to do this with a background of a green turf cover, which is very different to using the contrast of green amongst a background of bare soil. These systems are starting to see their integration into solutions that end users can purchase. Their reliability and cost has been an area for continued development.



DNA rapid diagnostics testing

– The positive identification of a problem to be treated is an important step as part of IPM. Advances in molecular genetics such as qPCR meant that real time DNA analysis is possible. This means samples of a pest, weed or, most typically, a disease can be taken for a rapid DNA test. This helps to take the uncertainty out of the disease diagnosis thereby ensuring the appropriate control and then preventative measures can be taken.



Use of UVC for surface disease treatment

– UVC surface sterilisation has been used on artificial pitches to help control human pathogen populations. This same technology is being used on natural turf pitches to help treat fungal tissues on the upper surfaces of grass plants, thereby suppressing the disease population. This technology is being used on football pitches and is now starting to be trialled on golf greens.



Returfing of pitches

– Whilst not the optimum approach, if a pitch in a stadium is too heavily damaged to be safe or of sufficient quality to play on, a replacement can be installed by means of returfing. This means that spare pitches need to be maintained ready for harvesting. This will result in a greater environmental footprint due to having to maintain a spare pitch and the emissions created by stripping the old pitch and harvesting the new.



Automated spot spraying of weeds in turf

– This type of technology relies on being able to establish the shape of broadleaved weeds and how it differs from grass that makes up the turf. This technology is under development and will help reduce the amount of PPP that is sprayed for targeted weed control.



Grass breeding – Efforts are made to breed grasses with the traits required to meet the IPM challenges faced today and into the future. Focus has always been on healthy and good quality grasses, but increasing emphasis has been on resistance to pest, weed and disease invasion. For example, natural resistance to particular pathogens or higher turf density or wear tolerance to remove niches for weeds to exploit.



6.1.2. Policy options

During the impact assessment, national associations were asked about the level of PPP reduction from current levels they believed could be achieved and over what timeframe. As expected, there were a range of answers, one of the important factors being how great a reduction they had already

made. For those countries like Denmark and Netherlands that have made the greatest reduction, to further reduce their PPP inputs by a further 50-60% would be difficult to achieve, as they are on the bare minimum for their situation. Those countries that had reduced PPP usage less, saw that they had more headroom for reduction. In these countries

values of 50% in 5 years or 60% in 6 years was possible, but only if development of knowledge based and technological developments entered the market quickly and at a price point that was affordable. A 6-10 year time frame for a 60% reduction in countries where PPP was still higher was thought possible.

All those interviewed felt that complete PPP removal was an unrealistic proposition if the sport industry was to continue to grow and raise participation levels. All felt that this would lead to real difficulties for continued operation and financial sustainability of sports facilities.

All of those stakeholders engaged in this impact assessment understood and were actively working toward sustainable reductions in PPP usage. All understood the benefits to humans, wildlife and the environment and all said that reductions in PPPs needed to be phased with a gradual reduction, as has been successful in other countries like Denmark, Netherlands and France. No one argued that PPP reduction was not possible, the only discussion was on the level and timeframe. Both needing to be tailored to reflect:

- The starting condition of the turf in that country and how ready it was for PPP reduction.
- The climate where the facility was located (cold north and hot south both have unique challenges that have necessitated the use of PPPs).
- The rate and affordability that alternative technologies may come on-stream.
- The time taken to develop genuine low risk and biological alternatives that can offer reliable protection under curative conditions, often these solutions are best used preventatively or at the very early onset of an issue developing.

In terms of policy options, the key messages from this impact assessment are clear:

- Sport has been engaging for decades with IPM and best practice management and that has increased dramatically over the past 15 years.
- Sport is already committed to PPP reduction, some are further down the pathway than others but all are on that trajectory.
- A phased reduction in PPP usage is realistic, the level and timeframe is highly dependent on how much progress has been made to date and what is the bare minimum needed, which will vary over time and also regionally based on the local challenges faced (winter kill in the north, heat and high usage in the south).
- A complete withdrawal of PPPs, certainly in the short term (within a decade) would cause unnecessary harm to the operation and functioning of sports facilities. In the longer-term this is an objective that is potentially achievable, but there needs to be significant investment in development, education, solution provision and working with sports facilities to acclimatise their turf to be ready.
- To be able to deliver sustained and sustainable reductions in PPP use, which is where sport is heading and is in alignment with the EU's strategy on reduction, investment in facilitating this is vital if it is to be successful.

6.2. Challenges

As well as opportunities for focused reductions in PPP usage, there are challenges and these challenges become magnified in the context of a complete withdrawal of PPPs. Some of these challenges will be easier to tackle than others, some are global in scope and reach meaning that mitigating the impacts will be difficult. The main challenges to PPP reduction and withdrawal are:

- Climate change
- Water availability
- Energy availability
- Staff resourcing
- Cost of living
- Player expectation
- Microplastics

The impact and interaction with PPP withdrawal are given later in section 6.2.3.

6.2.1. What will the impacts mean for sports turf playing surfaces?

Throughout this impact assessment the implications of a ban on PPPs for sport have been discussed. Sport is fully engaged with IPM and actively reducing PPPs. The main impacts on sports surfaces are:

- A ban will undoubtedly result in negative impacts on turf quality, safety and playability for many (this can be seen from the few examples such as Wallonia where this has already happened). If a ban is phased and gives sufficient time for sport surfaces to be sufficiently conditioned

and the full range of viable alternative solutions brought to market, then any negative impacts will be significantly reduced.

- Those managing turf in the more extreme climates around the EU will be particularly challenged by a withdrawal of PPPs. Managing natural turf surfaces in the cold climates in Scandinavia is challenging, as the double impact of snow and ice on plant health, coupled with disease activity under the snow cover, along with a shorter growing season means that pressure on sports surfaces is enormous. Likewise, in the Mediterranean region where hot summers and cool winters means managing grass at some stage in the year is a compromise. This has to be linked to the high value of the sports industry in this region due to tourism and the increased potential for new pests, weeds and diseases to spread from other areas. All result in pressure on turf management and its capacity to cope with a complete withdrawal in PPPs.
- The development, availability and price of non-chemical solutions is a potential limiting factor. If PPPs are removed there must be a range of viable alternatives that can be used to effectively tackle pest, weed and disease issues, but at a price that sports facilities can afford. If the tools are available but few can afford them, their use and impact will be highly limited.

- The impact of a withdrawal of PPPs will not be the same for each sport and all levels of it. For football, the greatest risk comes at the medium to high level facilities where demand, usage and expectation of a safe and high performance playing surface are at their peak. For golf, the impacts will be felt at all levels but perhaps most keenly at lower level clubs where budgets are more restricted and resource levels are lower.

A complete withdrawal of PPPs for sports turf management will impact the quality and consistency of playing surfaces. The surface is inextricably linked with how sport is played and anything that affects it also affects how the game is played. That said, sport is fully engaged with IPM approaches and reducing PPPs and this is a strategy that should continue for the betterment of all.

6.2.2. What will the impacts mean for the wider socio-economic considerations?

Withdrawal of PPPs will have a direct impact on sport and society. The greatest impact is likely to be experienced in the following contexts:

- The greatest risk of financial impact is likely to be in countries where sports, such as golf, are embedded

in tourism. This is because of expectations of golfers, as well as the need for sports surfaces to withstand high usage levels in some of the most challenging environments in the EU (hot summers and cool winters means there is not one ideal grass that will tolerate both).

- Smaller and less financially resilient facilities will be most at risk as they have less capability to cope with potential increased costs of alternative solutions to PPPs. In the short-term there may also be stress from local competition that puts pressure on their players to move to other clubs that have a greater resource base to be able to better absorb the financial and operational stresses of PPP withdrawal on turf quality and playability.

Sport provides significant direct financial value, but also indirect societal value. The work being undertaken today by UEFA and other researchers demonstrates that for every Euro that is made directly by sport for the economy, there are more than two Euros of value in terms of health and wellbeing and in local communities (crime reduction, integration, education, sense of community). This can only happen if there are successful and financially stable sports facilities in which sport can be played.

6.2.3. What other drivers for change interact with PPP removal?

There are a range of drivers for change that interact with the potential withdrawal of PPPs from sport. These have been summarised as follows:

Challenge	Impact and mitigation
Climate change	• Climate change is the biggest current global threat to humanity. • Climate change is already impacting and will continue to impact to a greater extent, the growing environment for turf and for pests, weeds and diseases. • The exact impacts and what can be expected are changing as science reveals the full extent and consequences of what may or may not happen. • This is going to be a major stressor on all growing industries, sport included, as plant health, growing season, optimal grass type and range of pest, weed and disease problems will be affected.
Water availability	• Plants need water to survive and there are already significant pressures on water usage and availability across the EU. • Conversely, dealing with excess water in winter is also a challenge, and this is often a challenge for sports surfaces in terms of winter playability, but also one where, with appropriate investment, large open green spaces in settlements can add massive social value by being part of flood mitigation. • Sports facilities offer a unique opportunity for complete water management from water harvesting, processing, storage, recycling and flood risk mitigation. • Work is already well underway as to how to manage and maximise water resources for sport, for example that being carried by the R&A as part of Golf Course 2030 (www.golfcourse2030water.com).
Energy availability	• New technologies, especially mechanical solutions such as automated vehicles and robots will be battery powered. • This means that power usage both on the course and in the sports facility itself (lighting for not only buildings but also on playing surfaces to allow nighttime play) is an important consideration and potential cost. • Sustainable and green energy is vital for the success of PPP reduction as many of the solutions will call for increased direct energy demands.
Staff resourcing	• Finding the right staff who want to work on golf courses and football pitches can be difficult. • Understaffed facilities will find it much more difficult to optimise PPP reduction due to pressures on the more limited staff resource. • There needs to be concerted efforts to not only educate existing staff, but provide pathways for effective educational attainment for them. • Likewise, society needs to see these workers as being valued and valuable assets, often they can be seen in a way that does not encourage them or those into the sports industry. • All the health and wellbeing impacts of sport are only possible if there are dedicated people to maintain those surfaces for the players.

Cost of living	• With the cost of living increasing for many due to a variety of factors, this puts pressure on wages and financial resources of sports facilities. • This has a real impact as it can often mean that one of the first budgets to be cut is that of the turf maintenance department. • If that is the case and PPP replacement technologies will come at a price this maybe a real barrier to inhibit the full potential for PPP reduction. • There needs to be support for the sport sector to ensure that it can continue to develop and implement strategies that will result in long-term and sustainable PPP reduction.
Player expectation	• Humans play sport and humans will have an opinion on the facility and the surfaces they play on. • There needs to be continued and continuous engagement with players to ensure they understand the need for PPP reduction and some of the visual impacts of it. • This is a real pressure and sports players, especially in sports like golf, are often not afraid to express their views to those managing the turf. • Players are also more likely to be mobile and will move from one facility to another if they are bothered by the visual aspects of the turf. This the puts direct financial pressure on facilities and ultimately turf managers. • Education and engagement is key and this needs to be supported.
Microplastics	• The issue of microplastics is a topical debate. • It is an issue of concern to many in society and microplastics and plastics as a whole are considered as polluting materials. • This is a challenge, especially for football, where a viable alternative to natural turf is artificial grass. • Some might say that if you can't manage your natural turf PPP free then move to artificial. However, with bans on microplastics in the offing and end of life challenges with artificial carpets is this really a sustainable option? • Additionally, when managing artificial turf, whilst PPPs may not be used, often biocides are. These are to control weed and algal growth as well as increasing use to prevent the risk of human pathogens being sustained in the fibres on artificial pitches.

These challenges that sports facilities are faced with are also major stressors for their operation and financial sustainability. If there are too many stresses all at once harm to sports businesses and facilities will be the result. This is not a reason to stop or slow

down PPP reduction, it is merely a consideration that needs to be made when assessing the best policy to achieve the desired aim – minimal PPP usage on sports surfaces, whilst still allowing sport and sport participation to grow and be sustained.

6.2.4. Bringing products and solutions to market

For sports surfaces to be able to successfully cope with PPP withdrawal (or even further systematic reductions) viable, effective and affordable alternative solutions are essential. Without them, this withdrawal and even further reduction is simply not possible. Sport is already used to utilising

alternatives and implementing programmes for non-chemical control of pests, weeds and diseases that have multiple overlapping layers that need to be phased to have acceptable efficacy. However, much more needs to be done to boost innovation and development, whilst supporting both the innovative industries coming up with these solutions and sports turf managers.

There are a number of steps that need to be taken to speed up the development of viable, effective and affordable PPP alternatives:



It is vital that innovation and development are encouraged, grown and supported.

Without streamlining existing legislation and regulation to speed up bringing solutions to market, thereby removing barriers for entry, the possibility for sustainable and successful PPP withdrawal is minimal. It takes a long time to develop new solutions and to get them to market (based on the approach for chemical solutions, the whole process can be 10-15 years with the last 5-6 years being meeting regulatory requirements). The system needs to be truly harmonised and with standardised implementation that promotes innovation and development, but without being onerous or costly, allowing new innovations to be quickly brought to market and used by an industry that wants them. Sports turf managers would happily not use PPPs if there were alternatives that were efficacious, affordable and easy to use. There must be a true level regulatory playing field to allow innovation to flourish.

It is vital that innovation and development are encouraged, grown and supported. Sports turf is a very small market compared to other users of agrochemicals. Those operating or wanting to operate in this market will

need to be supported through increased investment in R&D and quick and efficient pathways to market, but without compromising the safety of people, wildlife or the environment. If innovators and developers feel there is a viable market, they will devise solutions that will be beneficial to achieving the overall aims of the EU, to reduce PPP use to the minimum, to protect humans, wildlife and the environment and to look to a more sustainable future that is responsive and resilient to the global challenges facing the planet.

All of this is not only essential for sports, but it will also need to be in place to ensure evolution in agriculture remains competitive and whilst becoming more sustainable. Invest now to support the future.

Sport is on the pathway for a more sustainable future. Sport is already actively engaged in this process, only one part of which is reducing PPP usage. Sport is looking for support to ensure that its future continues to be successful and sustainable giving pleasure and health benefits to millions of EU citizens.



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A

Active substance: Any chemical, plant extract, pheromone or micro-organism (including viruses), that has action against 'pests' or on plants, parts of plants or plant products.

Aeration: A physical operation such as solid tining, carried out to ventilate a surface, improve gaseous exchange, surface drainage and root development. Can also be used to help manage and physically remove (hollow tining) excessive organic matter.

Approval (active substance): The process for ensuring that active substances are confirmed that they can be used in PPPs and that they meet the required standards on human toxicology, ecotoxicology, fate in the environment.

Authorisation (formulated PPP): The process by which formulated PPPs are assessed and brought to market, ensuring that they are safe and efficacious to use.

B

Bentgrass: A fine leaved grass commonly used on golf greens and other areas of the golf course. Preference for low input environments but susceptible to a number of the major diseases affecting turf.

Bermudagrass: A warm-season grass commonly grown in monoculture across the whole golf playing area

and can persist under a wide range of mowing heights. Also commonly used on pitches as well. Good drought and disease tolerance, with low nutrient requirements, but needs regular and sometimes intensive physical maintenance to promote healthy turf.

Biodiversity: It is the variety of life found in a place on Earth or the total variety of life on Earth. A common measure of this variety, called species richness, is the count of species in an area. Biodiversity also encompasses the genetic variety within each species and the variety of ecosystems that species create.

Biological control: Control of organisms harmful to plants or plant products using natural means of biological origin or substances identical to them, such as micro-organisms, semiochemicals, extracts from plant products or invertebrate macro-organisms.

Biostimulant: A substance whose function is to stimulate plant nutrition processes independently of the product's nutrient content, with the sole aim of improving one or more of the following characteristics of the plant or plant rhizosphere:

- nutrient use efficiency
- tolerance to abiotic stress
- quality traits or
- availability of confirmed nutrients in the soil or rhizosphere

Brushing (dew removal, debris removal and standing grass up for mowing): The process where a brush is dragged or pushed over a turf surface. Can be done for a number of reasons, from forcing horizontal grass blades to be more upright to allow them to be mown, through to removing dew droplets or gathering surface debris prior to its removal.

C

Canopy: The above ground biomass of grass plants, typically comprised of the leaves of grass plants.

Climate change: Climate change refers to a large-scale, long-term shift in the planet's weather patterns and average temperatures. This means raised air temperatures due to global warming and increase in extreme weather events. The effects of climate change varies depending on geographical location.

Cool-season grass: Grass species adapted to growth in cool, moist, maritime environments with optimal temperatures between 15-25 degrees Celsius.

Cultivar: A variety of a specific turf species that is "cultivated" for certain improvements. Some cultivars were created to develop with improved drought and heat tolerance, disease resistance, or other improvement.

E
Ecological/biodiversity rough: Ecological/biodiversity rough is an area of very low intensity managed turf which is allowed to be floristically diverse to encourage insects, birds and small mammals. Often contains wildflowers to encourage and support pollinator populations.

Ecology: The study of interactions among living things and their environment.

EFSA: European Food Safety Authority

Evapotranspiration: The amount of water lost from the combined effects of evaporation (water that evaporates from the soil) and transpiration (water that evaporates from the plant).

F
Fairway: Fairway is the area of turf between the tee and the green. Often managed with a much lower intensity than greens and less than tees.

Fertiliser: A product whose primary function is to supply essential plant nutrients to allow plant health and/or promote growth.

Fungicide: A product to control or destroy fungal growth. Can be single or multi-site, biochemical and may be effective on external

contact within the grass plant, either in the foliage or the roots or systemically throughout the plant.

G
Golf hole: The area of play on a golf course. Many courses have 18 holes but some only have 9. Comprises a tee, fairway and green surround, golf green, and areas of rough and semi-rough.

Graminicide: A product used to control, destroy or retard the growth of an undesirable grass within a grass surface.

Grass cover/density: The amount of grass in a given area. Thin grass cover (through wear or disease damage) will result in fewer grass plants in an area, as compared to an area with thick grass cover.

Green: Area of close mown turf that is the ultimate target for golfers to play their ball to. Contains the pin and hole in which the golfer must roll (putt) their ball into to complete that hole. Has to be able to withstand heavy wear whilst still maintaining a surface upon which a golf ball will roll smoothly and truly.

Greenkeeper: A person who is responsible for managing the turf and non-turf areas of a golf course.

Groundsperson: A person who is responsible for managing

the playing surfaces (and often non-playing surfaces) at a sports facility, such as a football club or multi-sport site.

H
Herbicide: A product used to inhibit or destroy plant growth.

I
Insecticide: A product used to control or destroy insect pests to prevent them from causing damage to a desirable plant.

Integrated pest management (IPM): The holistic approach to pest management including understanding the impact of the local environment, weather patterns, biological control, habitat management and correct cultural practices.

Integrated turf management (ITM): The holistic sustainable management of turfgrass to produce optimal playing surfaces by a combination of cultural, biological and genetic methods alongside minimal use of plant protection products.

Irrigation: The controlled application of water to replace evapotranspiration loss from the turf.

L
Low-risk active substance: An active substance that poses a low-risk to humans, wildlife and the environment and that

meets the low-risk criteria as specified in Annex II, point 5 of Regulation (EC) 1107/2009.

M
Mowing: The generic term for cutting grass using a mower (cylinder, reel or rotary). Includes pedestrian or walk mowing as well as ride-on machinery.

Mowing height: The length of the grass after it has been mown. The height of the grass will be determined by the sport and area of golf course being mown.

N
Nematicide: A product used to control or destroy nematodes to prevent them from causing damage to a desirable plant.

P
Perennial ryegrass: A hard wearing grass commonly used on pitches and areas of higher heights of cut. Less able to tolerate low heights of cut, but breeding is leading to greens grade plants that can persist under the necessary mowing heights.

Pesticide: A word often used synonymously with plant protection product. These are products that prevent, destroy, or control a harmful organism ('pest') or disease, or protect plants or plant products during production, storage and transport.

Plant growth regulator: A product specifically designed for use in the turfgrass industry to improve sward density and uniformity, reduce clippings production and improve root biomass.

Plant protection product: Product used for controlling a pest, weed or disease problem, or a product classed as a plant growth regulator that in some way alters the growth pattern of a crop.

Playing quality: The ability of a playing surface to fulfil its intended function. A high quality surface is one that excels in fulfilling its function, whilst a low quality surface does not function as intended or to the desired level.

R
Red fescue: A very fine leaved grass (needle thin leaves) that tends to be used on greens and other areas of the golf course where low input maintenance is carried out. Typically planted with bentgrass to give a dense carpet like finish. Susceptible to a number of the major turf diseases.

Rolling: A practice to supplement mowing in order to improve the smoothness of putting surface.

Rooting: Grass roots not only source water and nutrients for

the plant, but also physically anchors the plant in the soil.

Rough: Area of low intensity managed turf that often contrains a particular golf hole. Grass is allowed to grow tall and often flower. Designed to be a penalty to a golfer whose ball lands in it to encourage players to play their ball from the fairway.

S
Safner: Substances added to plant protection products to eliminate or reduce phytotoxic effects.

Scarification: Cultural operation carried out using a machine with vertical blades that cut into the surface, removing plant material, debris at the immediate surface and sub-surface. Can be implemented to tidy up a surface or prior to oversowing and sand topdressing.

Semi-rough: Area of more intensively managed rough that is immediately adjacent to the fairway where grass height is higher than the fairway, but not as tall as that in the rough.

Smooth ball roll: When a golf ball rolls across a surface, smoothness defines the level of vertical deviation of the ball. A less smooth surface, such as one with disease damage, will have a ball that often moves up and down, or even leaves the surface.

Surface traction: The rotational strength of the turf, which is used as an indicator of the level of grip available to players.

Sward: A term used to describe the community of grass plants in an area of the playing surface.

Switching: Removal of surface dew using a switch (a highly flexible fibreglass pole that is moved over the turf in a side to side motion, knocking dew droplets off the surface).

Synergist: Substances added to plant protection products to give enhanced activity.

T

Tee: The area of turf, often raised and rectangular, where the ball is first played from at the commencement of a hole.

Topdressing: The application of bulky material (usually specified as sand) to a surface to improve levels, uniformity and dilute organic matter. Usually followed by brushing or matting.

Transition zone: The zone between cool-season and warm-season climates where both cool- and warm-season grasses are viable for at least part of the year.

True ball roll: When a golf ball rolls across a surface, trueness defines the level of horizontal deflection of the ball. It is often associated with the ball deviating from its intended line from factors other than surface topography and ball velocity.

Turf manager: A person who manages turf surfaces and often used in the context of key decision makers with regard to turf maintenance planning and strategy.

W

Warm-season grass: Turfgrass species adapted to growth at higher temperatures. Usually dormant or injured by cold weather and having an optimum temperature range of 27-35 degrees Celsius.

Wetting agent (surfactant): Any product designed to manage moisture in the profile.

Wildflower: Wildflowers can be any flowering plant. Often those native to site or that type of environment are used. Tend to be included in mixes for their attractiveness to pollinators, whilst being aesthetically attractive to players.

appendices

1. Chemservice's Socio-Economic Impact Assessment
2. Golf Survey – carried out by interview
3. Football Survey – carried out by Survey Monkey

Socio-Economic Impact Assessment
on EU Golf Courses
concerning the Implementation of the
Sustainable Use of Pesticides Regulation (SUR)

for

European Golf Association (EGA)

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27th of June 2023

Final Report

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- Confidential -

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Executive Summary

This study has been undertaken in the context of the Sustainable Use of Pesticides Directive (SUD), and a proposal by the European Commission to replace this EU Directive with the Sustainable Use Regulation (SUR), a Regulation which aims to cut pesticide use across the EU, and to ban its use in “sensitive areas”. The SUR proposes that sports grounds would be designated as sensitive areas, and hence that use of pesticides on golf courses would be banned completely, from the entry into force (sometime after 2024).

The European Golf Association (EGA) commissioned this socio-economic impact assessment to find out what the consequences would be of a short-term ban on the use of pesticides on golf courses and to present these results to the SUR policy makers.

Data and information were collected through literature searches, database reviews, key informant interviews and the creation of a customised questionnaire developed for the relevant national golf association in the EU. Responses with completed questionnaires from 11 National Golf Associations were received. It should be noted that the survey covers the most important golf countries in the EU and questionnaires were only sent to those countries.

They key findings of the analysis and interpretation of the information collected are as follows:

- Pesticides on golf courses are already highly regulated in many EU countries. The current regulatory situation varies widely across the EU.
- Most of the more restrictive regulations in the more proactive countries have avoided outright bans and have allowed specific exceptions for special and targeted circumstances when other methods (e.g. IPM) have failed.
- The use of pesticides on golf courses has decreased significantly in most countries in the last 10-years, and much more than in agriculture. Reductions of up to 90% have been reported.
- Climatic conditions (North and South) and dependence on international golf tourism (expectation of highly “aesthetic” courses) are factors of golf course pesticide use.
- The value of revenues obtained by the average golf course can be significant and was estimated at around €1m per course. It was not possible to say what the overall impacts of a “zero-pesticide” use would be on golf in the EU, but there is no reason to doubt that it would be significant and negative.
- This report was able to demonstrate how much more widespread IPM-type practices have become in golf in recent years, than was previously perceived, and how much pesticide reduction has already taken place. This misperception is likely to be at least due to the rather underdeveloped reporting systems in many countries, which make it difficult to monitor use levels and trends.

The authors of the report therefore believe that a short-term ban is disproportionate given the significant reductions that have already occurred and the potential socio-economic impacts. Furthermore, exceptions should be granted for hardship cases where alternative methods to pesticide use have so far failed.

In general, the golf sector needs more time and a pesticide regulation that allows it to implement the experiences from more progressive countries, as well as providing for

exemptions for hardship cases. Furthermore, the diversity of climatic conditions should be taken into account in any overall EU regulatory approach.

1. Introduction and Background

The *EU's Green Deal*¹ and *Farm to Fork Strategy*², which aim to protect human health and the environment from the possible risks and impacts of pesticides, will soon come into effect and is set to have a profound impact on golf courses.

According to numbers from the Irish Golf Association (Golf Ireland)³, golf's overall and average usage of pesticides is relatively minimal with golf courses accounting for 0.17% of sprayable hectares for fungicides, 0.05% of active ingredient of fungicides, 2.54% of sprayable hectares for plant growth regulators, 0.5% of the kilograms of active ingredient in plant growth regulators, 0.18% of sprayed hectares for herbicides, 0.4% of the kilograms of active ingredient in herbicides.⁴ These numbers can differ within the EU Member States.

The draft *Sustainable Use Regulation (SUR)*⁵, which aims to reduce general pesticide use by 50 %, is targeted at agriculture but also bans pesticides on golf courses and other public spaces deemed "sensitive areas". The proposed ban would stop the use of fungicides that curb disease on greens and herbicides that control weed growth in rough and fairway areas. If the SUR is passed into EU law, golf clubs will be prohibited entirely from using several pesticides in their agronomic programmes. Specifically, it will preclude the use of plant growth regulators, fungicides and herbicides which are critical to turfgrass management.

The SUR is intended to replace the **SUD** (*Sustainable Use of Pesticides Directive*)⁶, as the latter has not been effectively implemented everywhere in the EU. The implementation is expected in 2024.

In some countries specific restrictive measures on pesticide are already in place, based on the SUD. Examples are the Netherlands, having avoided a complete ban on pesticides with specific derogations for specific and targeted circumstances towards a workable situation. Another example is Denmark, which uses digital systems to closely control, regulate and reduce pesticide use annually. Further examples of significant pesticide use reduction after specific governmental interference are the region of Flanders in Belgium and specific Golf Clubs in other countries. They all have in common that for some applications exemptions for pesticide use exists on Golf Courses.

These countries have demonstrated that combined with specific governmental initiatives, a comprehensive reduction in pesticide use is feasible, but that it is impossible to achieve an acceptable standard in playing quality without national and regional derogations. A complete ban would remove the vital flexibility of the industry to take appropriate action in certain circumstances in order to preserve the playing quality of the golf course when other methods have failed.

¹ A European Green Deal (europa.eu)

² Farm to Fork Strategy ([europa.eu](#))

³ Home - Golf Ireland

⁴ EU's Green Deal and Farm to Fork Strategy set to have profound impact on golf courses - Google Search

⁵ SUR Proposal R1 - version for RSC meeting clean LW (004) - additional changes from table (003) (europa.eu)

⁶ SUR Proposal R1 - version for RSC meeting clean LW (004) - additional changes from table (003) (europa.eu)

On the other hand, there are countries and regions which have for different reasons not been able to reduce the use of pesticides significantly. One reason is the fear of devastating their regional golf business due to competition with neighbouring countries, where complete pesticide bans are not yet an issue and the courses are designed and maintained to the highest standard. This applies to the Mediterranean region with Spain and Portugal competing with Turkey, Morocco and the Gulf region (Dubai, Abu Dhabi) or even Florida. The situation is quite similar for Ireland, vying with Scotland, England, Wales and Northern Ireland.

The statements of experts, federations and greenkeepers, as identified by the literature review, are similar in one point - that the European golf sector does **currently not have all the non-chemical solutions to meet the challenges that a complete pesticide ban would bring** to the golf sport. Wallonia and Italy are good examples. Wallonia has introduced a complete ban without derogations, according to EGA there is evidence that shows a loss in golf club membership to neighbouring Flanders and impact on the ability of Wallonian golf course to hold top quality tournaments.

Should a complete EU pesticide ban come into effect, greenkeepers would, for example, have to avoid fungal diseases on greens or fairways, larvae or beetles in the fairways either by systematic preparatory work as far as possible or combat them without any pesticide use. Already now, according to the argumentation of the Europe-wide umbrella organization of greenkeepers (FEGGA)⁷, pesticides are only used in a very targeted, infrequent and dosed manner.

The European Golf Association (EGA) commissioned the consulting firm Chemservice to perform this independent Socio-Economic Impact Assessment on the impacts of a pesticide ban on golf courses in the EU, based on interviews, questionnaires and literature searches.

1.1 What are Pesticides

Plant protection products (PPPs)⁸ are “pesticides” that in general protect crops or desirable and useful plants. They are primarily used in the agricultural sector but also in forestry, horticulture, green urban areas, amenity areas (like golf courses), along transport networks such as roads and railways, and in home gardens. They contain at least one active substance, are mixtures and may also contain other components including safeners and synergists. EU countries authorise plant protection products on their territory and ensure compliance with EU rules. They are mixtures of one or more formulated active substances and co-formulants that are widely used to protect plants by repelling, mitigating or destroying harmful organisms. Since pesticides can have harmful effects on the environment and on human health, they are strictly regulated at EU level.

The term “*pesticide*” is often used interchangeably with “*plant protection product*”, however, pesticide is a broader term that also covers non plant/crop uses, for example biocides. They are intended for one of the following uses:

- 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 (e.g. **fungicides, insecticides**);

- Influencing the life processes of plants, such as substances influencing their growth, other than as a nutrient (e.g. **plant growth regulators**, rooting hormones);
- Preserving plant products, in so far as such substances or products are not subject to special Community provisions on preservatives (e.g. extending the life of cut flowers);
- Destroying undesired plants or parts of plants, except algae unless the products are applied on soil or water to protect plants (e.g. **herbicides/weedkillers** to kill actively growing weeds);
- Checking or preventing undesired growth of plants, except algae unless the products are applied on soil or water to protect plants (e.g. **herbicides/weedkillers** preventing the growth of weeds).

A plant protection product (“pesticide”) usually contains more than one component. The component that works against pests/plant diseases is called an “active substance”. Active substances can be chemicals or micro-organisms, including pheromones (hormones) and botanical extracts.

Before pesticides can be placed on the market or used, they must be authorised in the EU country concerned. Regulation (EC) No 1107/2009⁹ lays down the rules and procedures for authorisation of PPPs. A zonal system¹⁰ of authorisation operates in the EU to enable a harmonised and efficient system to operate. The EU is divided into 3 zones: North, Central and South. EU countries assess applications on behalf of other countries in their zone and sometimes on behalf of all zones. Regulation (EC) No 1107/2009 provides for a general system of zonal evaluation. Europe is divided into 3 zones for authorisation of pesticides (Figure 1 and Figure 2).

These zonal authorisations intend to respect that across such zones there are similarities in climate, agronomy and pest biology, as well as sensitivity to plant protection products¹¹. In order to develop a trials programme to demonstrate the efficacy of a pesticide across an authorization zone, there are a number of factors and principles that should be considered.

⁷ FEGGA | The Federation of European Golf Greenkeepers Associations

⁸ Pesticides (europa.eu)

⁹ 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 (europa.eu)

¹⁰ Microsoft Word - Pt. A 07.02 Guidance Document on Zonal Assessment (rev. 11) JAN 2021_FINAL revision CLEAN 4 (europa.eu)

¹¹ PPP Auth (europa.eu)

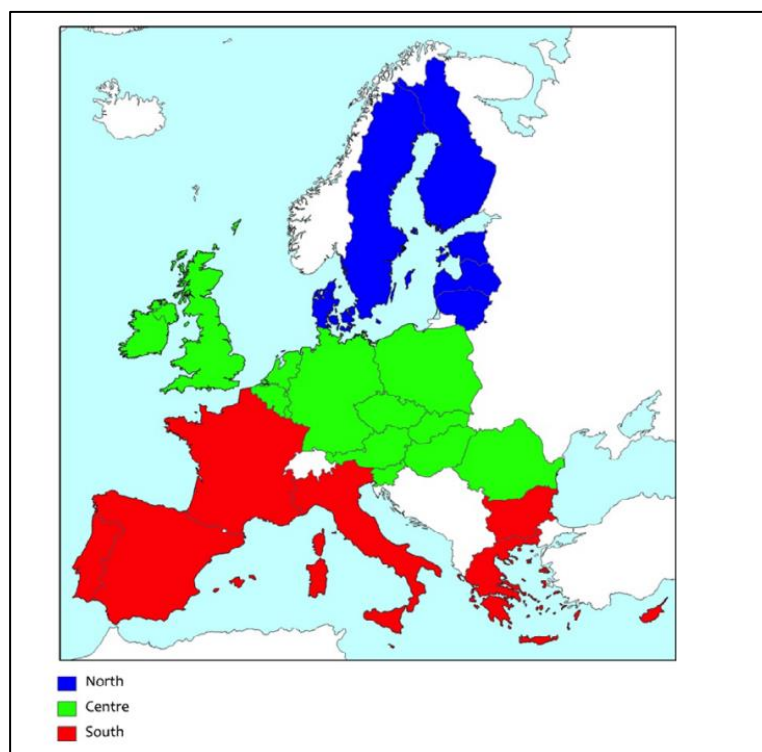


Figure 1: Authorisation zones under the PPP regulation.

24.11.2009	EN	Official Journal of the European Union	L 309/39
ANNEX I			
Definition of zones for the authorisation of plant protection products as referred to in Article 3(17)			
Zone A — North			
The following Member States belong to this zone:			
Denmark, Estonia, Latvia, Lithuania, Finland, Sweden			
Zone B — Centre			
The following Member States belong to this zone:			
Belgium, Czech Republic, Germany, Ireland, Luxembourg, Hungary, Netherlands, Austria, Poland, Romania, Slovenia, Slovakia, United Kingdom			
Zone C — South			
The following Member States belong to this zone:			
Bulgaria, Greece, Spain, France, Italy, Cyprus, Malta, Portugal			

Figure 2: Definition of authorisation zones in the PPP regulation text.

There are different types of application that can be submitted depending on the intended use of the PPP, the Member State(s) for which the PPP is required and the regulatory status of any existing authorisations.

1.2 EU Regulatory Framework on Plant Protection Products (Pesticides)

As referenced to before, the **authorisation** of pesticides is laid down in the Regulation (EC) No 1107/2009 concerning the placing of plant protection products (PPPs) on the market in the European Union. The controls of the use and placing on the market of pesticides (PPPs) are performed by EU Member States.

Directive 2009/128/EC¹² aiming to achieve sustainable use of pesticides in the EU (SUD) was adopted in 2009 with the aim to reduce the risks and impacts of pesticide use on human health and the environment and to promote the use of integrated pest management (IPM) and of alternative approaches or techniques, such as non-chemical alternatives to pesticides to reduce dependency on the use of pesticides. The most important measures of the SUD, beyond setting quantitative use reductions, were:

- Implementing IPM¹³, for all EU farmers to apply from 2014, so professional users of pesticides switch to practices and products with the lowest risk to human health and the environment among those available for the same pest problem. The importance is to give priority to preventative elements.
- Giving priority to non-chemical alternatives, "Member states shall take all necessary measures to promote low pesticide-input pest management, giving wherever possible priority to non-chemical methods".
- Ensure that pesticide use is minimised or prohibited in specific areas.
- Establishing appropriately sized buffer zones to protect non-target aquatic organisms and safeguard zones for surface and groundwater used for the abstraction of drinking water, where pesticides must not be used or stored.

Since being a "Directive", the SUD gives individual EU Member States flexibility to implement pesticide reduction targets and national strategies. It greatly restricts pesticide use on **Golf Courses** in the EU, however, EU Member States have the possibility to implement the requirements according to their own needs.

As part of the implementation, EU Member States were obliged to establish National Action Plans (NAPs) by 2013 to set up their quantitative objectives, targets, measures and timetables to reduce risk of pesticides. In **2017**, the European Commission prepared a commenting¹⁴ on the lacking implementation of the SUD, encouraging Member States to revise their NAPs accordingly, but, as the report that the European Commission prepared in **2020**¹⁵ shows, this has not happened.

The European Parliament prepared a report on the European Commission's first SUD evaluation and the European Council held a round table of ministers to welcome the report but no official "Council Conclusion" was prepared.¹⁶ In 2020 the European Court of Auditors prepared several special reports¹⁷ highlighting the failure of EU pesticide regulation, first in a report concluding that there has been "little progress" in the implementation of the SUD,

¹² 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 pesticidesText with EEA relevance (europa.eu)

¹³ Integrated Pest Management

¹⁴ SANTE/11319/2017-EN CIS (europa.eu)

¹⁵ SANTE/11319/2017-EN CIS (europa.eu)

¹⁶ Texts adopted - Sustainable use of pesticides - Tuesday, 12 February 2019 (europa.eu)

¹⁷ Special Report 05/2020: Sustainable use of plant protection products: limited progress in measuring and reducing risks (europa.eu)

then in a report¹⁸ concluding on the failure in EU actions to protect biodiversity (in particular pollinators).

In December 2019, the European Commission presented its European Green Deal¹⁹ aiming at making the EU's economy sustainable. On 20 May 2020, the European Commission published the Biodiversity²⁰ and Farm to Fork²¹ strategies. Both strategies envisage as a central measure a 50 percent reduction in the use and risk of pesticides throughout Europe by 2030. On 25 May 2020, the European Commission sent its report²² to the 27 EU Member States and the European Parliament. The Commission report concludes that the aim of revising the SUD includes the 50% reduction in use and risk of chemical pesticides by the 2030 target.

As a consequence of the identified serious deficiencies in the implementation, application and enforcement of the SUD, the Commission was urged to introduce stricter rules in the form of a Regulation at EU level to increase coherence and to introduce more effective policies in individual Member States. The harmonisation of national pesticide-use policies should help to improve the functioning of the internal market and to reduce trade distortions between Member States. Therefore, on 22 June 2022 the Commission issued a proposal for a Regulation on the Sustainable Use of Plant Protection Products (SUR).²³

The overall target of the **SUR** is to establish a 50% reduction goal of pesticide use for agriculture by 2030. In public parks or gardens, playgrounds, recreation or sports grounds (incl. golf courses), public paths, as well as ecologically sensitive areas a total ban on all pesticides is proposed (Art.18). The following main policy options were assessed against a likely Baseline Scenario, where the SUD remains unchanged.

- Option 1:

The EU targets to reduce pesticide use by 50% and reduce pesticide risks by 50% to be achieved by 2030 remain non-legally binding. Advisory systems and guidance for pesticide users would be improved. Precision-farming techniques would be promoted to cut the use of – and risk from – chemical pesticides.

- Option 2:

The 50% reduction targets would become legally binding at EU level. Member States would set their own national reduction targets using established criteria. These national targets would then be legally binding (under national law) and subject to governance mechanisms linked to regular annual reporting by Member States. The use of more hazardous pesticides would be prohibited in sensitive areas such as urban green areas. Professional pesticide users would need to keep electronic records on pesticide use and on IPM to help reduce pesticide use. National authorities would collect and analyse those records to monitor progress and devise corrective measures at the national level if necessary. Independent advisory services would advise pesticide users on alternative techniques and IPM.

- Option 3:

This Option would be similar to Option 2. However, under Option 3, the 50% reduction targets would become legally binding at both EU and national level. The use of all chemical pesticides would be prohibited in sensitive areas such as urban areas and protected areas in accordance with Directive 2000/60/EC, Natura 2000 areas etc.

The preferred option of the Commission is Option 3, except for the targets, where Option 2 is preferred. In this case, the targets to reduce both pesticide use and pesticide risk by 50% would become legally binding at EU level, with Member States setting their own national reduction targets under national law.

Because the Commission's proposal is seen as too ambitious and affecting a disproportionately high area of Member States' territory, Member States have strongly argued in favour of a reduced scope - both in terms of the proposed ban and the areas affected. In EU Council Working Party meetings in October and November 2022, Member States converged that alternative approaches should be explored on the definition and scope of the proposed ban on plant protection products. In response to Member State requests, the Commission developed a Non-Paper²⁴ as basis for further discussions. The following elements which could have an impact on Golf Courses were deliberated by the Non-Paper:

- Reducing the scope of "sensitive areas"
- Reduction of the total area covered by the definition of sensitive areas so that Member State efforts can focus on those areas deemed most relevant to pesticide use.
- Moving away from a total ban towards a restriction of use of the least harmful pesticides, prioritising biocontrol and low-risk products.
- Maintaining ambition regarding the protection of the general public, vulnerable groups and pollinators.
- Allow practical derogations on pesticide use for the control of quarantine pests and invasive alien species.

Moreover, Commission is preparing an additional study to prepare an impact assessment, as per the Council request.

1.3 Introduction to current Pesticide Use on Golf Courses

Golf courses, like other landscaped areas, do in general use pesticides to control pests and diseases that can damage the turf (grass) or other plants on the course. Pesticides can include herbicides to control weeds, insecticides to control pests (grubs and beetles), and fungicides to control fungal diseases. Golf courses typically have an Integrated Pest Management (IPM) plan in place, which is an approach to pest control that focuses on using a combination of techniques to manage pests in an environmentally responsible way. This can include cultural practices, such as proper fertilization and irrigation, and biological controls, such as using beneficial insects to control pests.

However, the use of pesticides is not universal across all golf courses and the approach and frequency of use varies. Some golf courses may use organic or chemical-free methods to maintain the course, while others may rely more heavily on pesticides.

¹⁸ [Special Report 15/2020: Protection of wild pollinators in the EU — Commission initiatives have not borne fruit \(europa.eu\)](#)

¹⁹ [A European Green Deal \(europa.eu\)](#)

²⁰ [Biodiversity strategy for 2030 \(europa.eu\)](#)

²¹ [Farm to Fork Strategy \(europa.eu\)](#)

²² [SANTE/11319/2017-EN CIS \(europa.eu\)](#)

²³ [SUR Proposal R1 - version for RSC meeting clean LW \(004\) - additional changes from table \(003\) \(europa.eu\)](#)

²⁴ [pesticides_sud_sur-non-paper_en.pdf \(europa.eu\)](#)

As a Golf Course consists of different course types (greens, fairways, tees, and roughs) that are maintained differently, therefore the use pattern of pesticides on a golf course do differ. The **Tee** is where the hole begins. Each round starts here, where the Tee shot takes place. The **Fairway** is the stretch between the Tee and the Green, also known as “the short grass”, because it is mowed short and will give the player a nice lie for the next shot. The **Green** is where the hole is located. Its grass is cut short so the ball can roll easily. The **Collar** is a ring of ring of grass around the green that is slightly longer grass than the green itself. The height of the grass is similar to the fairway. Collar is a synonym of “**Fringe**”. The **Rough** is one of the areas in a golf course you want to avoid landing your ball. It lines the fairways and has longer grass. **Semi-rough** is the term used to describe the half-high grass between the fairway and the rough. The semi-rough usually has a height of 30 to 50 mm. The golf semi-rough has the function of stopping balls. show schematically a golf course.

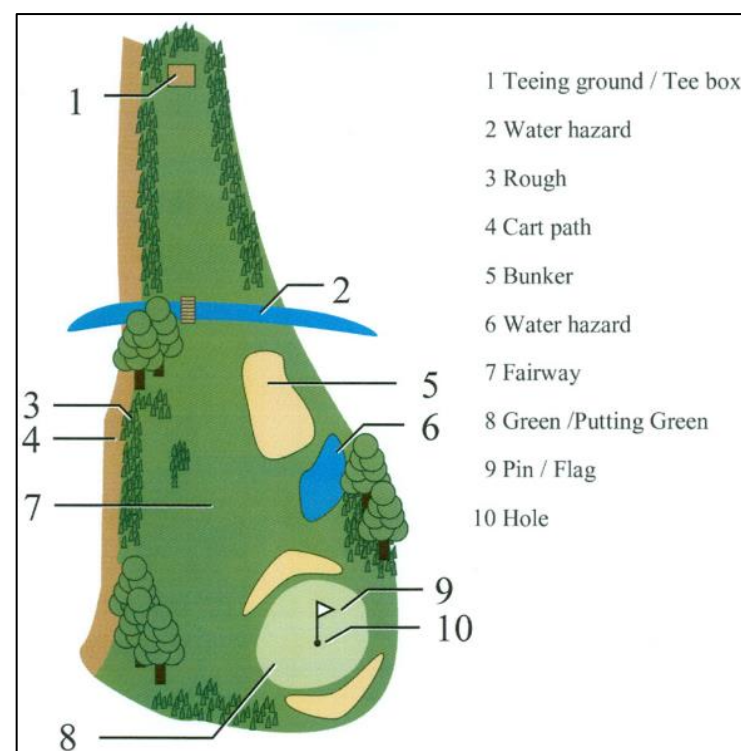


Figure 3: Golf Course Diagram. 1: Tee area; 2: Penalty area; 3: Rough; 4: Card path; 5: Fairway bunker; 6: Penalty area; 7: Fairway; 8: Putting Green; 9: Flagstick; 10: Hole.²⁵

According to the reviewed literature and the feedback received from the European Golf Association (EGA)²⁶ and on the received questionnaires from national golf associations, pesticides are used on fairways and greens and to a lesser extent on tees and roughs. In a number of situations the use of pesticides is still necessary, because even with the best management and maintenance practices and the application of the principles of Integrated Pest Management (IPM), in many cases the situation is not sustainable. Such a situation may be due to pests, diseases or weeds.

²⁵ [Water | Free Full-Text | Golf Course Irrigation with Reclaimed Water in the Mediterranean: A Risk Management Matter \(mdpi.com\)](#)

²⁶ [European Golf Association \(ega-golf.ch\)](#)

They should be only used as the last resort when there is no other alternative for controlling a problem. Diseases, pests and weeds keep reappearing despite good management, and the only alternative to chemicals is to mechanically remove the pest root by root and leave a clearing.

Fungicides are used to fight mold/fungi, which only need to be controlled on Greens and Collars. Dollar Spot^{27,28} for example is caused by the fungus *Clarireedia jacksonii*. This disease affects highly managed turf stands worldwide and is one of the most common diseases found attacking fine turf. It is characterized by small, round, bleached to straw coloured spots. On golf courses and other closely mowed turf, spots are generally 2-7 cm in diameter and often sunken; on high mown turf, they may be as much as 15 cm across. Where disease is severe, these spots may coalesce to form large, irregular areas of blighted turf. Another example of turf grass disease is the Fusarium patch²⁹ (also called pink snow mold or Microdochium patch). In many cool season grass species, it is caused by the fungus *Microdochium nivale*. These two cause the most problems. Both fungi increase their surface area dramatically if no action is taken. As a result the green becomes bumpy and poorly playable. If you do nothing about fungi, they will cause a dirty turf grass. The recovery time for the turf is considerable and can take up to half or three quarters of a year. During this time, good quality golf is not possible. The consequences of not intervening can be significant due to golfers' dissatisfaction for lack of fair playability of the sport.

Insecticide consumption varies over time and geographically, as there are variations in where, when and how severe the infestation of insect pests is. Typical harmful insects are nematodes, grubs and leatherjackets (larvae of crane fly), they directly affect the grass roots and making it weaker, providing fungi and weeds a chance to establish themselves. However, the main effect is the damage caused by a predator in the search for this food³⁰.

Herbicides are used mostly on the fairways and maintained roughs in order to control weeds (like Dandelion, Plantain, Pigweed, Daisy, Honesty, Clover, Buttercup, Birdsfoot Trefoil). Without interventions they overgrow the turf grass and steadily taking over by creating plaques of weed. This adversely effects the playing quality. Alternatively, the weeds would have to be eradicated by hand. This can be maintained for a while if the weeds exert little pressure. Despite good use of IPM and manual removal, it is not possible to prevent overgrowth and potential of the weed getting interwoven with the turf. Moreover, manual staking of large areas (a golf course is on average 70 ha) is many times more expensive, with maintenance budgets already under pressure³¹. Short mowing of these weeds is not always effective, the weeds come back and even multiply stronger.

Of all the factors that affect pesticide use on Golf Courses the most important is Geographic Location³². Mild climate areas generally have fewer disease and insect problems than climates featuring extended periods of heat and humidity. The relatively low stress environments of Northern Europe have lower pest pressures than Southern Europe. In-between areas often have the greatest

²⁷ [Turf: Dollar Spot | Center for Agriculture, Food, and the Environment at UMass Amherst](#)

²⁸ [Dollar Spot | GreenCast | Canada](#)

²⁹ [Fusarium patch - switch hitting it! | Pitchcare](#)

³⁰ [chafer-grub-leather-jacket-leaflet.pdf \(bigga.org.uk\)](#)

³¹ Feedback from Questionnaires and reviewed literature.

³² [\(PDF\) Pesticides on Golf Courses: Mixing Toxins with Play? \(researchgate.net\)](#)

stresses of all because they have extreme weather conditions in winter and summer. Grass species adaptation is an important factor affecting pesticide use.

Attempting to grow cool season grasses in warm season areas will ultimately require more disease and insect control efforts than growing grasses where they are best adapted.

In recent years, methods have been developed to maintain turfs in a way that pushes back weeds and fungal diseases so that fewer herbicides and fungicides need to be used, such as mowing methods and ensuring that the turf is not over-compacted but properly aerated.

2. Baseline Scenario

The “Baseline” is the scenario in the absence of any further regulatory measures or intervention being implemented to reduce the environmental risks from pesticide use. The baseline scenario basically describes the “business as usual” situation.

For various reasons, the current situation regarding the use of pesticides on golf courses **varies greatly across the EU**. There is therefore no uniform base line across the various EU countries. In some Member States (with “higher interventions”) rather restrictive measures on pesticide use in sport and golf are already in place, based on the SUD. After targeted pressure from their national governments implementing the SUD, these countries have demonstrated that a drastic reduction in pesticide use is feasible, but that it is impossible to achieve an acceptable standard in playing quality without specific and targeted use of pesticides. A complete ban would remove the vital flexibility of the industry to take appropriate action in certain circumstances/hardship cases, in order to preserve the playing quality of the golf course when other methods have failed.

On the other hand, there are countries and regions where for different reasons governmental pressure in implementing the SUD has been less and subsequently lower pressure in reducing pesticide use drastically (“countries with lower interventions”). One reason might be the fear of devastating their regional golf business due to competition with neighbouring countries, where complete pesticide bans are not yet an issue and the courses are designed and maintained to the highest standard. Another reason is obviously climatic circumstances, and in very general terms the difference between climatic pressure in the Mediterranean, winter-protection to prolonged snow and ice cover in the North and the more temperate middle of Europe.

Countries with more restrictive measures are for example the **Netherlands**, having avoided a complete ban on pesticides with specific derogations for specific and targeted circumstances towards a workable situation. Another example is **Denmark**, which uses digital systems to closely control, regulate and reduce pesticide use annually. Further examples of significant pesticide use reduction based on monitoring are **France** and the region of **Flanders** in Belgium. They all have in common that for some specific applications and situations exemptions for pesticide use exist on Golf Courses.³³

Countries which for several reasons were so far not able to reduce the use of pesticides significantly and based on monitoring data are for example **Spain** and **Portugal**. One reason is the fear of devastating their regional golf business due to competition with neighbouring countries, where complete pesticide bans are not yet an issue and the courses are designed

and maintained to the highest standard, when it comes to maintaining the thick perfectly manicured and weed free turf on greens and fairways. This applies to the Mediterranean region with Spain and Portugal competing with Turkey, Morocco and the Gulf region (Dubai, Abu Dhabi) or even Florida in the USA.

The situation is quite similar for Ireland, vying with Scotland, England and Wales.³⁴ In addition, some EU Member States have launched programmes implementing IPM but have not been able to reach the level of reduction as by the more sportsgrounds specifically regulated countries. Countries in this category are for example **Germany**, **Sweden** and **Ireland**. Various examples of the status of pesticide use in several countries are described in more detail below.

A significant amount of the information and data was obtained via a Questionnaire (attached as Appendix) answered by the National Golf Associations of the respective countries, but as well via literature and database searches and interviews with selected individuals. The Questionnaires were different for already specifically restricted countries and less specifically restricted countries.

2.1 Denmark

No of Golf Course:	186
Total Land Area covered by Golf Courses:	13,000 ha
Total Revenue:	€ 223 Mio.
Total Profit:	No information
Total No of Employees on Golf Courses:	1,800
Average Pesticide Use per Course/hectare:	0.02 kg active ingredient/ha/year

Denmark is a prime example concerning the reduction of pesticide uses on golf courses. In 2005, a voluntary agreement was reached between the Danish Golf Courses and the Danish Minister for the Environment to reduce the use of pesticides on golf courses. The agreement was that by 2008 golf courses should have reduced consumption to 0.1 kg of active substance per hectare. However, in 2008, the consumption was 0.23 kg active substance per hectare and thus far from sufficiently reduced. Subsequently, the consumption decreased, but without reaching the target. Following a political agreement in 2011, obligatory rules entered into force in 2013 on the use of pesticides by golf courses, including a cap on pesticide loads, and thus for the consumption of pesticides. A requirement was introduced that golf courses must report annually pesticide consumption and the size of the course areas via the national Golf Association (Danish Golf Union)³⁵ to the Danish Environmental Protection Agency³⁶. The new legislation was based on the following principles³⁷:

- Maintain low pesticide loads on Danish golf courses to the benefit of golfers and the environment, and without this negatively affecting the playing quality of golf courses, e.g. by continuing the focus on integrated pest management (IPM).
- Continue to enhance knowledge and knowledge-sharing of actors in the golf sector, and in particular among greenkeepers.
- Continue dialogue-based inspections of golf courses.

³⁴ Interview with Niels Dokkuma from the European Golf Association.

³⁵ [Forside | Dansk Golf Union](#)

³⁶ The current rules are laid down in Executive Order No. 1774 of 30 Nov. 2020 on the use of plant protection products on Golf Courses; [The Golf Order \(retsinformation.dk\)](#)

³⁷ [Publikation \(europa.eu\)](#)

³³ Interview with Niels Dokkuma from the European Golf Association.

- Follow developments in pesticide consumption on golf courses through annual statistics on pesticide loads in accordance with the political agreement in this area.
- The golf industry will continue to receive information, advice and guidance on the use of pesticides and alternative methods to control pests, e.g. through information campaigns on how to reduce the use of pesticides.

Figure 4 from the Danish EPA³⁸ shows the total pesticide consumption and the total load for all golf courses in Denmark for the period 2013-2020. It shows that the use of pesticides in total could be significantly reduced by a factor of 5 within 6 years (2013 - 2019). In 2019, the curve flattens and no further cuts are made.

Analysis of the pesticides used reveals, that the consumption of insecticides fluctuates over time and geographically due to fluctuations in where, when and how extensive the infestation of the harmful insects is. The total herbicide load has not changed much over the years and remained low. The consumption of fungicides is fairly stable over the years and reflects a continuing need for fungicide control on greens.

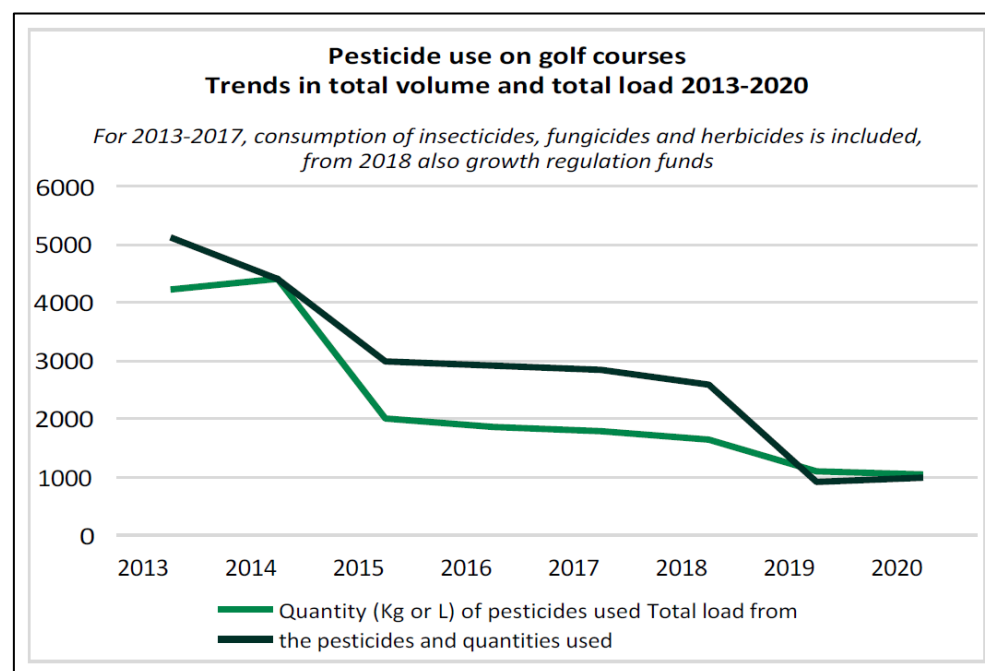


Figure 4: Trend of pesticide use from 2013 – 2020 on Danish Golf Courses.

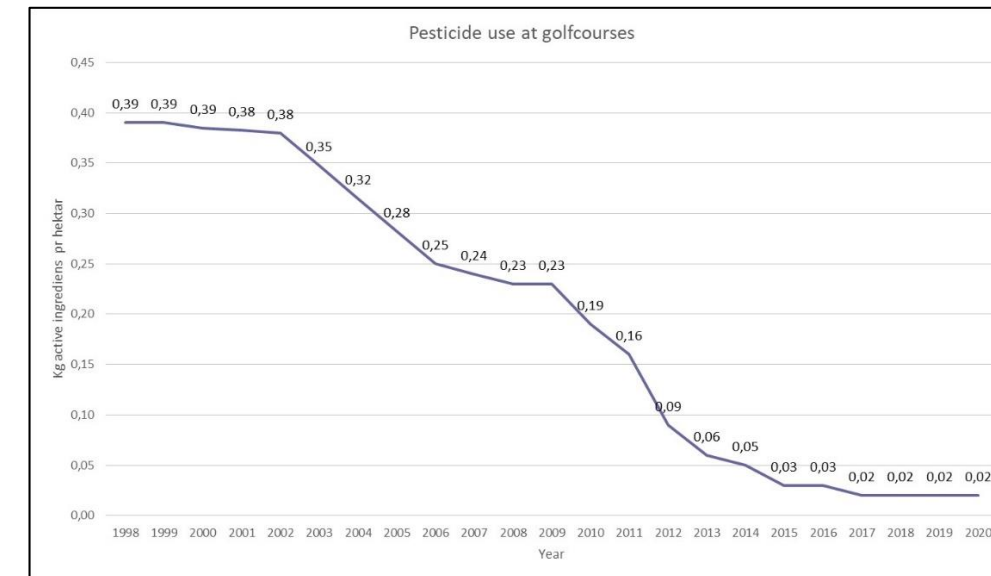


Figure 5: Trend of pesticide use on Danish Golf Courses from 1998 – 2020: kg active ingredient/ha.

Further information and statistics on the golf industry's pesticide consumption and impact can be found on the Danish Environmental Protection Agency's website³⁹.

The current average rate of pesticide application per year, course and ha in Denmark is **0,02 kg** of active ingredient in the pesticide formulation.

As pest management practices, pesticides are sprayed only on greens 3-times a year against "Snow Mold". Herbicides are used on fairways and semi-roughs once a year. 20% of the golf courses are using plant growth regulators (PGRs) in order to suppress seedheads and leaf growth. PGRs were originally developed to control plants in low turfgrass maintenance areas like roughs. Insecticides are not used at all. All golf clubs apply IPM strategies to prevent pests, such as balanced irrigation and fertilisation, and over-seeding with new, vigorous grass varieties (1-2 times per year).

Pest control practices vary throughout the year, so that herbicides are used in spring and fungicides in autumn/winter. From a legal point of view, there is no possibility to treat fungi in summer. Climate and soil conditions are also important for pest control. Pesticide reduction was mainly achieved by:

- More robust grass-species;
- Higher efficiency pesticide products with lower active ingredient content;
- Improved management practice focusing on IPM;
- Better communications about the expectations from the golf players;
- Enhanced education/training of greenkeepers;
- Certified sprayers, better and more precise equipment.

Due to the new pest control methods, negative effects such as the increased occurrence of weeds on the fairways, insect attacks, more fungal infestation on the greens, poorer quality of play, more mechanical processing and higher labour costs could be observed. In addition, there is great damage caused by beetles and leather jackets as well as larvae-eating birds.

³⁸ Report from Danish EPA, May 2022.

³⁹ [Pesticides on golf courses \(mst.dk\)](https://mst.dk/da/tema/pesticider-og-plantebeskyttelse/pesticider-og-plantebeskyttelse)

On the positive side, greenkeepers are better trained, apply IPM and focus on reducing pesticides and their impact. In addition, grass quality and biodiversity have improved.

In order to further reduce the use of pesticides in Denmark, Europe-wide research is needed, as well as further development of organic products and less hazardous and more effective pesticides. In addition, training/education of greenkeepers is crucial.

According to the Danish Golf Association, it is difficult to determine the minimum level of pesticide use in connection with acceptable course quality. Maybe golf courses in the lower to middle category can do without pesticides. Danish golf courses today are about where the middle and upper category golf courses are. The switch to zero-pesticide use would lead to more weeds on fairways, roughs and semi-roughs, as well as greater problems with insects and larvae and probably more frequent green damage from fungi.

Based on a recent surveys⁴⁰, the Danish Golf Association has clarified the **satisfaction of golfers** with the course quality of all Danish golf courses. It was reported that the Danish golf clubs invested massively in greenkeeper education, turfgrass research and golfer information. Basically, an increase in weeds on the courses could be observed due to significant reduction in pesticides. Still, the majority of golfers were not unhappy. Only the better players tend to complain about the lower quality. The main conclusions of that survey are as follows:

- There is no evidence of a significant improvement in the player experience on greens and fairways with increased pesticide use.
- The low-handicap players (HCP <10) are the most critical (ca. 7% of players).
- Golf is mainly played for exercise and socialising.
- Golfers think the golf course is well cared for.
- Weeds and fungi are generally not a problem.
- The game of golf is not affected by damage to the course.
- Greens must be even.
- You have to be able to find your ball in the Rough.
- A good overview on the fairway is important.
- The teeing grounds must be flat and grassed (less important than greens).

According to feedback from the Danish Golf Association 10% of all Danish golf courses are “pesticide-free”. The Royal Copenhagen Golf Club⁴¹ (a natural golf course) banned the use of pesticides completely by 2011. The golf course is constructed on government owned land and therefore the use of pesticides was restricted. On average greens are mowed at 4.2 mm, fairways at 14 mm and tees at 9 mm. The biggest challenge according to the Head-Greenkeeper is to keep the amount of weeds at an acceptable level⁴². Greens are fertilised two to three times a year with granular applications. The irrigation strategy is to apply water infrequently but “deep” to reach a soil moisture level of 15-20 % after irrigation. During the summer months syringing cycles are used to cool off the plants. Greens are maintained by frequent cutting, mowing and rolling. Aerification is carried out before September to allow full recovery before colder winter month. Further practices such as brushing or verticutting are not being practiced. Biological products such as seaweed are used as an organic fertiliser

source. The Greenkeeping team maintains green speed between 9 and 10 feet throughout the season.⁴³ Weeds establish opportunistically, hence whenever there is an opening in the turf swards, weeds can and will invade if seeds are present and the conditions are favourable for germination. Herbicides have not been used for the last 15 years and therefore weeds are present in all playing areas. On greens and approaches spot treatments of iron sulphate (60 kg/ha) are used to weaken the weeds and allow the surrounding turf grasses to outcompete the weeds over time. Greenkeepers spend a lot of time on spot treating weeds with iron sulphate, which seems to work well, however this procedure is very time consuming and therefore expensive.

Related to fungi, snow mold has been a main concern. As the greens improved in terms of grass species composition, infiltration rates and management practises, snow mold in the fall and winter is not a big concern anymore. Dollar spot is a new issue because no fungicides are used anymore. In case of disease outbreak a very low dose of nitrogen is applied to promote grass growth and recovery.

Damage from grubs is not a major concern. Most problems arise from birds damaging turf in search for grubs to feed on. In addition ants are occasionally produce soil casts on green surfaces, which disrupt playing quality similar to worm casts. Worm castings used to be an issue particularly on greens. However, by increased topdressing rates over the years, which reduced soil fertility and worm casts have more or less disappeared.

Most issues at Copenhagen golf course arise by not having fairway irrigation and fairly infertile soil. Installation of fairway irrigation and draining systems is a cost which can be considered in a socio-economic impact analysis.

2.2 The Netherlands

No of Golf Course:	251
Total Land Area covered by Golf Courses:	10,765 ha
Total Revenue:	€ 262 Mio.
Total Profit:	€ 53 Mio. in 2018
Total No of Employees on Golf Courses:	2,180 (FTE in 2018)
Average Pesticide Use per Course/hectare:	0.19 kg active ingredient/ha/year

In the Netherlands, there were negotiations between the sports sector and the government in 2015 that led to a so-called Green Deal. It pertains to the established Green Deal Sport Fields agreement between the Ministry of Infrastructure & Environment, Ministry of Welfare & Sports, the sports sector and suppliers, on phasing out pesticide use. Within the framework of the Dutch Green Deal⁴⁴ and the SUD, a working group was set up with representatives of the Government and different national sports associations in order to address the reduction of pesticides outside of agricultural uses. It was agreed to implement a monitoring plan and establish a baseline in 2015, an interim evaluation in 2017 and a final evaluation in 2020. The data analysed concerns data from golf and other field sports.⁴⁵ It should be noted that the Dutch Green Deals represent an interactive approach by which the government provides

⁴⁰ Power Point Presentation from Golf Denmark (Danish Language) provided by EGA.

⁴¹ [Københavns Golf Klub - Golf i unikke og smukke omgivelser \(kgkgolf.dk\)](https://www.kobenhavns-golfklub.dk/)

⁴² RASEN, TURF, GAZON, 4/2019.

⁴³ [ra0419_s79bis82.pdf \(golfmanager-greenkeeper.de\)](https://www.ra0419_s79bis82.pdf)

⁴⁴ [English | Greendeals](#)

⁴⁵ [Memo Monitoring GD Sport_RIVM_1.0.pdf](#)

scope for innovative and sustainable initiatives originating in the community. There is no direct relationship to the EU's Green Deal⁴⁶.

As a result of the activities, a new regulation in the Netherlands has banned the professional use of plant protection products outside agriculture uses since November 2017.⁴⁷ However, exceptions were made to that ban, including for (parts of) sports fields based on playability for fair competition of sports. The exemptions are laid down in Article 8.4 and Annex XVII the Dutch Plant Protection Products and Biocides Regulation (IENM/BSK-2015/238900).⁴⁸ The exemptions are applicable if it can be demonstrated that the use of pesticides is necessary:

- For the control of quarantine organisms, invasive alien species or plants or their products that pose a threat to human health;
- For the safe use of enterprise activities and facilities;
- For the practice of sport in areas that cannot be otherwise used and maintained.

The wording that the ban is not applicable on specific areas for sports and recreation is as follows:

.....sports fields for the organized practice of sports in the open air, as far as the playable part of the site is concerned, including a limited zone around it that is necessary for the practice of the sport, but excluding the not grassy areas and the parts marked "no" in Annex XVII....⁴⁹.

Table 1: Annex XVII Exemptions related to Golf Courses, as referred to in Article 8.4(1)(a).

Scientific name	Dutch name	Green	Fringe, Collar	Fore green	Tees	Fairways	Maintained- Rough	Rough	
<i>Plantago spp.</i>	Plantain	no	maximum 20% per year ¹ in compliance with damage threshold ² ¹ If a percentage is noted (e.g. 20%) the application is permitted, but may be applied on no more than 20% of the area during the year. ² Observing a damage threshold, prior to applying a plant protection product, is part of the application of Integrated Pest Management (IPM).					no	
<i>Veronica filiformis</i>	Turner Prize								
<i>Veronica arvensis</i>	Veldereprijs								
<i>Taraxacum officinalis</i>	Dandelion								
<i>Bellis perennis</i>	Daisy								
<i>Trifolium spp.</i>	Clover								
<i>Polygonum aviculare</i>	Pigweed								
<i>Hypochaeris radicata</i>	Pigweed								
<i>Ranunculus repens</i>	Creeping buttercup								
<i>Achillea millefolium</i>	Yarrow								
<i>Cerastium fontanum</i>	Hornflower								
<i>Cirsium arvense</i>	Field thistle	No						spots	
<i>Jacobaea vulgaris</i>	Jacob's wort								
<i>Rumex obtusifolius</i>	Sorrel								
<i>Sagina procumbens</i>	Reclining fat wall	10%	No						
<i>Growth regulator</i>	grass growth inhibitor	No							
<i>Melolontha melolontha</i>	Chickadee	Yes						no	
<i>Amphimallon solstitialis</i>	June beetle								
<i>Tipula spp</i>	Emelten	Yes		no					
<i>Clariireedia spp. (vml. Sclerotinia homoeocarpa)</i>	Dollar spot	2x/year in compliance with damage threshold		no					
<i>Microdochium nivale, Fusarium nivale</i>	Snow mold	1x/year in compliance with damage threshold		no					

⁴⁶ [A European Green Deal \(europa.eu\)](https://european-council.europa.eu/media/en/press-communications/2020/07/Pages/euco-2020-07-23-01.aspx)

⁴⁷ [Government Gazette 2016, 12110 | Overheid.nl > Official announcements \(officiële bekendmakingen.nl\)](https://www.rijksoverheid.nl/onderwerpen/plantbescherming/publicaties/2017/11/23/verordening-plantbescherming)

⁴⁸ [wetten.nl - Regulation - Regulation on plant protection products and biocides - BWBR0022545 \(overheid.nl\)](https://wetten.nl/Regelgeving/Regelgeving%20plantbeschermingsmiddelen%20en%20biociden/BWBR0022545/overheid.nl)

⁴⁹ [wetten.nl - Regeling - Regeling gewasbeschermingsmiddelen en biociden - BWBR0022545 \(overheid.nl\)](https://wetten.nl/Regelgeving/Regelgeving%20gewasbeschermingsmiddelen%20en%20biociden/BWBR0022545/overheid.nl)

The current exemption list for the control of weeds, insects and fungi was prepared in 2017 through consultations between the Ministry, Sports Federations and independent consultants.⁵⁰ Introduced were those species that have been found to multiply persistently and invasively.

In summary, the Netherlands sports sector has fully implemented the SUD and IPM after a ten-year process with the government (Ministry of Infrastructure). It is part of the culture in maintenance to aim for zero use while maintaining quality for fair competition, so that the use of pesticides is the exception or the last resort when all other options are insufficient. All components of integrated pest management are considered, e.g. intensive scouting, monitoring, increased use of models to predict disease and insect activity, etc.

According to the feedback from the ⁵¹ Netherlands Golf Federation, pest management practices do vary during the year. Diseases such as *Dollar Spot* are treated in summer and diseases such as *Microdochium nivale* in winter. Weeds need to be treated mainly in spring. Primarily, however, the focus is on prevention and the use of all possible (cultural) practices to prevent the development of pests.

The most important factor for determination of the pest management practices is a fair competition and playing quality as well as the availability of authorised pesticides.

The annual average rate of pesticide application per course of active ingredients was reported to be **0.19 kg/ha**.⁵² From 2015 to 2020, the amount of active pesticide ingredients was reduced by 80 % based on governmental analysis of representative monitoring data. This significant reduction was achieved by:

- A culture change (addressing all stakeholders), change in perception;
- Focus on prevention;
- Planned IPM approach;
- Integrated Turf Management
- Providing right tools for greenkeepers;
- Adopting practices from frontrunners and learning from others;
- Invest & push innovation.

It is important to note that after some years of investments, the overall costs did decrease by up to ca. 20% since less manhours were necessary and the overall pesticide and product expenses, due to more conscious maintenance. This conclusion is also supported by a governmental study on weed management on hard surfaces in order to implement the ban outside of Agri- and Horticulture. This is summarized in a document from the Dutch Government.⁵³

The positive outcome of this drastic pesticide reduction has been more structural year round higher playing quality for 10-12 months of the year instead of just 3 summer months of high

⁵⁰ [blg-1035033.pdf \(officiële bekendmakingen.nl\)](https://www.rijksoverheid.nl/onderwerpen/plantbescherming/publicaties/2017/11/23/verordening-plantbescherming)

⁵¹ [The official website of the Royal Dutch Golf Federation - NGF](https://www.rijksoverheid.nl/onderwerpen/plantbescherming/publicaties/2017/11/23/verordening-plantbescherming)

⁵² Governmental monitoring program 2015-2018.

⁵³ [NL response to questions Council Decision 2022_2572 lf.docx](https://www.rijksoverheid.nl/onderwerpen/plantbescherming/publicaties/2017/11/23/verordening-plantbescherming)

quality per year. A survey (comparable the one in Denmark) also shows good to excellent golfer satisfaction with playing quality despite drastic reductions.⁵⁴ The survey in the Netherlands was completed by 1,274 golfers and 322 golf course managers (greenkeepers, members of course committees, club and course managers, directors). This makes it a representative study on the basis of which reliable statements can be made. The main conclusions of the study are as follows:

- The majority of golfers are quite or very satisfied with the playing quality of their course. 39 % identify the maintenance on their course “reasonably good”, 45 % think it is “very good” and 8 percent “excellent”.
- For 16 % of golfers, the quality of their golf course has been a reason to switch to another club.
- The majority of golfers don't see fungi and weeds as a big problem at this point, as long as there is no impact on the ball roll and it doesn't become too difficult to find the ball.
- Golfers care most about a reliable ball roll on the greens, a good position on fairways, foregreens and raked and well-groomed bunkers and flat teeing areas.
- In the eyes of golfers, greenkeepers should pay the most attention to the greens (1), fairways (2), bunkers (3), tees (4), semi-rough (5).
- There is a clear distinction between the wishes of single-digit handicappers and players with handicaps over 10. Single handicappers are more demanding and critical than others. The HCP category 37+ is “the fastest satisfied”. In this context, it is important to know the percentages.
- 2.69 % of Dutch golfers have an HCP under 10, 45.88 % equal to or between 10.0 and 36.0. 44.60 % have an HCP equal to or between 36.1 and 54.
- The main reasons why people play golf: 1 physical movement, 2 the social aspect, 3 nature experience.

From this study it can be concluded that it is possible to drastically reduce pesticides during a few years of transitioning while maintaining playing quality and satisfying golfers.

Based on the current processes and available substances it is expected, that another 10% of pesticide use can be reduced by 2025 (2015 as baseline). Via newer product generations (low-risks/biologicals), precision techniques, predictive models, research, training and communication and other measures, another reduction will likely be possible. However, specific exemptions are needed (e.g. maximum surface area treatment), otherwise no fair competition and reasonable sport quality would be possible.

It was reported by the Netherlands Golf Federation, that there was a lot of fear in the beginning to drastically reduce the use of pesticides. However, with a solid approach and a few years' time drastic reductions were possible with lower expenses and more structural quality has been the experience in the Netherlands. European Tour events (KLM Open), Ladies Open and even the Solheim Cup are played on golf courses with close to zero pesticide use after transitioning in several years' time. Frontrunners are just spot spraying weeds with an herbicide (i.e. 0.5 l/year/course), once every year. Fungicide application happen only partially to a few selected greens or up to one or two times a year and barely any insecticides were used (only on a few selected courses with very difficult circumstances), but currently no

⁵⁴ [The results of a survey of golfers and golf course managers on maintenance - NGF](#)

labelled insecticides are available. The maximum usage is embedded in the law with a total ban on professional use outside of agri- and horticulture and with specific derogations based on specific areas vital to the sport and maximum surface area treatments. It was commented that this is a workable situation after going through a transition period.

2.3 Sweden

No of Golf Course:	450
Total Land Area covered by Golf Courses:	30,000 ha
Total Revenue:	No information
Total Profit:	No information
Total No of Employees on Golf Courses:	2,250
Average Pesticide Use per Course/hectare:	0.26 kg active herbicide/ha fairways/year 1.5 kg active fungicide/ha greens/year

The use of pesticides related to the SUD requirements is laid down in the Swedish Board of Agriculture Regulation SJVFS 2015:49⁵⁵ as well as the Swedish Pesticide Ordinance (2014:-425)⁵⁶. According to Section 40 of the Swedish Pesticides Ordinance, a licence from the municipality is required before pesticides can be applied on a professional basis on sports and recreation grounds, like golf courses. Applications for licences must be assessed on the basis of what is known as the “product choice principle”, which means that if several products are available, the product which is least dangerous to human health and the environment must be chosen. On the 24th of March 2021 the Swedish Government decided on an amendment of the Swedish Ordinance^{57, 58}, applicable as of 1st October 2021.

The amendment implies a ban of the use of plant protection products in very sensitive areas, golf courses were not included.

The Swedish Government has also decided that the Swedish Chemicals Agency may decide on exemptions from the ban. Exemptions can be granted for active substances in plant protection products, provided that the substances pose only limited risks to human health and the environment.

The Swedish Environmental Protection Agency, the Swedish Board of Agriculture and the Swedish Chemicals Agency (KEMI) have a shared responsibility regarding guidance for the municipalities concerning enforcement of the use of plant protection products. In order to strengthen the enforcement, shared projects have been performed. The three agencies have worked together during 2018 in a joint enforcement project on the use of plant protection products at golf courses. Within the project, enforcements have been performed in 53 municipalities and in total 133 enforcements were performed at golf courses. This comprises close to 30 % of the golf courses in Sweden.⁵⁹

The inspection results showed that:

⁵⁵ [SJVFS 2015:49: Statens jordbruksverks föreskrifter om dokumentationskrav för yrkesmässiga användare av växtskyddsmedel | lagen.nu](#)

⁵⁶ [pesticides_sup_nap_swe-rev_en.pdf \(europa.eu\)](#)

⁵⁷ [Ban on use of plant protection products in certain areas - Kemikalieinspektionen](#)

⁵⁸ [Search the database - European Commission \(europa.eu\)](#)

⁵⁹ [Nationellt tillsynsprojekt om hantering av växtskyddsmedel ISBN 978-91-620-6883-7 \(naturvardsverket.se\)](#)

- All pesticide users had valid permissions and training.
- Most users know and use IPM and BMP (Integrated Pest Management/Best Management Practice) according to directives by the Swedish Board of Agriculture and to new knowledge delivered by STERF (see below) are implemented on Swedish golf facilities.
- 91 % of the golf courses only use products with valid authorizations in Sweden.
- Almost all users store the products and document they use in agreement with the legal requirements. They use adequate buffer zones and they have valid permission for the use of the equipment for application;
- 73% of the facilities reported that continuing education takes place and 70% hire advisers to maintain competence in the status of grass and pest identification. 53% use the knowledge library provided by STERF, and 43% take the help of a plant pathology laboratory.
- 62% of golf facilities implemented adapted nutrition programmes to prevent **fungal diseases**. Other strategies include choosing a suitable grass type (37%), reducing shading (35%), avoiding slopes (34%), and other methods (14%).
- To prevent **weed problems**, golf courses use several measures, including adapted mowing height, nutrition, support seeding, repair of plant cover damage, and variety selection. Additionally, some courses work manually, have prevention plans, and use beneficial fungi and customized irrigation. On average, each facility uses 4-5 different measures to prevent weed problems.
- The most common aids used to monitor the need for control in **IPM** include regular inspection, hiring a consultant, analysis of pests in the laboratory, and forecasting models and warning services. Some businesses also use other aids, such as ocular inspection, feeling, experience, weather forecasts, and control of grass growth. On average, 2 -3 aids are used per facility to monitor the need for combat.
- **Plant protection measures used in IPM:** hand cleaning, mechanical weed control, chemical control, benefiting beneficial organisms, biological control with bacteria or beneficial fungi, and thermal control. Other measures include foam stream, nutrition programmes management, and the use of various agents and manures. On average, 2.8 different plant protection measures are used per facility.
- **Follow up that there was a good effect of the control measures:** Inspect the treatment sites, with 87% of facilities doing so. Other measures used to follow up include hiring advisers, documenting in an application journal/management plan, using reference box/zero box, and taking analyses to see how the fungal pressure is after control. Some businesses also use photographs to determine if the mushroom is alive. On average, 2-3 measures are used per operation to follow up that there had been a good effect of the control measures.
- **Documentation:** 82% of golf facilities, the conditions of use for plant protection products match the information in the application journal, and in 95% of cases, all use of plant protection products is documented in a spray journal. 75% of golf courses inform the public about the spread of plant protection products at least one week before the spread. Reasons for not meeting the information requirement included short notice decisions and the risk of fungal attacks spreading further.
- **Spray operators:** All sprayer operators who used plant protection agents in class 1L and 2L had the correct use permit, according to the inspection.
- **Spreading equipment:** In 99% of operations where plant protection agents are used, an annual technical review of the spreading equipment is carried out before use.
- 53% of the Swedish golf courses use the STERF knowledge library⁶⁰.

STERF is an independent research foundation that supports existing and future R&D efforts and delivers “ready-to-use” research results that benefit the golf and turfgrass sector. It was

⁶⁰ [Startsida | STERF - Scandinavian Turfgrass Environment Research Foundation. Ready-to-use research results](#)

set-up in 2006 by the golf federations in Sweden, Denmark, Norway, Finland, Iceland and the Nordic Greenkeepers' Associations. Research funded by STERF is carried out at universities or research institutes (or equivalent) where most relevant research capacity is concentrated. STERF helps to strengthen research capacity by encouraging and supporting networks and collaborating actively with international key organisations in the field of turfgrass management. STERF also arranges innovation workshops to help identify the golf and turfgrass industry's future research needs, where researchers and industry representatives contribute to the planning process. STERF receives funding from participating golf associations, complemented by funding from other sources. STERF operates a digital knowledge library based on Integrated Pest Management and provides information on various relevant issues relating to golf courses and green spaces on its website, along with sector-specific guidelines.

According to the response to the Questionnaire from the Swedish Golf Association⁶¹, during winter and spring season, basic IPM and BMP are applied. In summer month pesticide control of “*Dollar Spot*” is applied and in autumn “*Snow Mold*” control using pesticides is needed. As most important factors for the pest management the IPM/BMP strategy set by the Swedish Board of Agriculture including education and advisory to minimize pesticide use and the climate conditions have been identified, in conjunction with sunlight, drainage and grass species.

Over the last 10 years a reduction of some 50% of pesticide use is estimated, thanks to following IPM/BMP, replacing preventative applications with curative ones and application of new knowledge via the STERF database. Costs for R&D over the last 10 years is approx. € 2.5 Mio. The golf clubs invest ca. € 0.5 per member and year. In summary the costs decreased on pesticides but increased on other items (e.g. sand, fertilisers, grass, sees, irrigation system).

2.4 France

No of Golf Course:	740
Total Land Area covered by Golf Courses:	33,000 ha
Total Revenue:	€ 750 Mio.
Total Profit:	No Information
Total No of Employees on Golf Courses:	8,960
Average Pesticide Use per Course/hectare:	0.21 – 0.42 kg active ingredient/ha/year

In 2014 a law was implemented in France in order to better regulate the use of pesticides in non-agricultural applications (Labeé Law)⁶², because no progress was being made in the reduction of pesticide use in the public and private sector. Since 1st of January 2017, the State, local authorities and public institutions can no longer use pesticides to maintain green spaces, walks, forests and roads. In 2022 the law was amended, prohibiting the use of pesticides in public green spaces. As of the 1st of July 1 2022 it applies to private property and public uses.⁶³ Golf courses - in particular tees, fairways and greens - have been exempted so far, if access to

⁶¹ [Allt du vill veta om golf - Golf.se](#)

⁶² [LAW No. 2014-110 of 6 February 2014 to better regulate the use of phytosanitary products on the national territory \(1\) - Légifrance \(legifrance.gouv.fr\)](#)

⁶³ [Environnement -Interdiction des pesticides : de nouveaux lieux concernés depuis le 1er juillet 2022 | Service-public.fr](#)

the course is under control. However, a full ban of pesticide use on golf courses will be in force from 1st of January 2025 with specific derogations. As a result of these regulatory activities, the use of pesticides in non-agricultural applications dropped significantly in France.

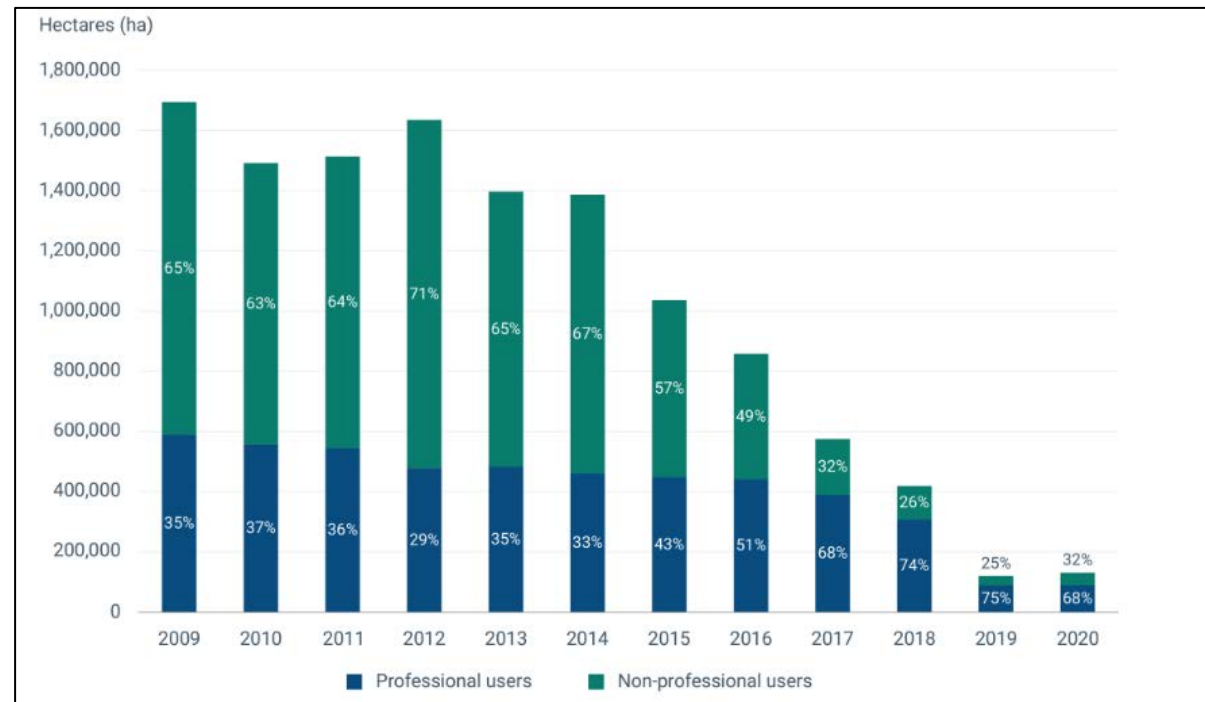


Figure 6: Trend in pesticide use in non-agricultural areas in France⁶⁴.

Consequently, the Labbé Law has played an important role in reducing the non-agricultural use of pesticides, which fell by 92% between 2009 and 2020 according to the French Ministry of Agriculture and Food.⁶⁵

Related to golf, the pest management practices today involve the use of pesticides to control weeds, diseases on greens and insects and larvae that feed on grass roots. “Dollar Spot” and “Pyricularia” (Rice Blast Disease Fungus) occurs in spring and autumn, whereas “Snow Mold” (Microdochium) appears in winter, therefore fungicides are used throughout the whole season. Herbicides and insecticides are used from spring to autumn.

It is important to note, that there are **significant climatic differences** and thus diverse pesticide uses patterns between North and South as well as Atlantic coast and the Mediterranean area (French Riviera). On average, the annual consumption of active ingredient per course was reported to be 2.5 – 5 kg per course. Since the courses have ca. 12 ha size where pesticides are used, a rate of **0.21 – 0.42 kg** active ingredient per year would result. Compared to 2009 related to sports and turf fields, this would be a reduction of 50%. About 70% of the total area of the golf courses is maintained without the use of pesticides⁶⁶. A further significant reduction of pesticide use in short time will have an unacceptable impact on course quality. However, the French Golf Association⁶⁷ is stated in their response to the questionnaire, that an acceptable quality level of golf courses can be achieved, if enough time

and the possibility to adopt the pest management practices is provided. Within 3 years a further reduction of 60%, in 5 years 80% and within 7 years 90% are feasible.

In this respect, innovation in terms of predictive models associated with localized applications, education programs on IPM and the development of biocontrol products, would be needed. In addition, climatic variations within Europe needs to be taking into account, as well as differences in soil and predominant turfs.

2.5 Finland

No of Golf Course:	142
Total Land Area covered by Golf Courses:	11,790 ha
Total Revenue:	€ 120 Mio.
Total Profit:	No information
Total No of Employees on Golf Courses:	2,000
Average Pesticide Use per Course/hectare:	2.5 kg active ingredient/ha/year ⁶⁸

Finland is a country of contrasting seasons and specific climate, with short summers, when the sun never sets, and long dark and cold winters. Today there are about 140 golf courses and around of 140,000 affiliated Finnish golfers. Remarkably, Finland has the 10th highest number of registered golfers in Europe, according to the Finnish Golf Union.

The Finnish National Action Plan (NAP) on the Sustainable Use of PPPs⁶⁹ for 2018 – 2022 does not explicitly include measures for sports fields and golf courses. Further information on the implementation status of the SUD in Finland related to golf courses could not be found.

Usual pest management practice is to keep the turf healthy and strong. Almost all courses in Finland are using fungicides if needed in autumn, just before the occurrence of permanent frost and snow, to prevent damages under snow cover. Also insecticides and herbicides are used only if needed. PGRs are used only on greens to obtain high quality and robust surfaces.

Main use of fungicides is from August to December. PGR's are used from June to September. Herbicides are sprayed once or twice if needed (May or July). The most important factor on pest management is climate. The average rate of pesticide application per course/ha and year is on average **0.06 kg active ingredient/ha**.

Consumption has been constant over the last 10 years, and thus at the same level. The use of fungicides was reduced somewhat due to new and more efficient pesticide formulations for turfs and increasing knowledge about IPM. On the other hand, the use of PGRs increased after they became available for turf in 2016. Additionally, the level of greenkeeping has evolved to a more professional level. Costs for pest management increased approx. 3- to 4-times. Important to note, that the costs for pesticides is in the range of 70% for the pest management, in the Netherlands it was < 1% and in Denmark 2%.

Related to the effects on course quality the respondent communicated that due to the use of pesticides, the standard could be lifted to international level and Finland could be a potential

⁶⁴ [Ministère de l'Agriculture et de la Souveraineté alimentaire - DGAL \(2022\).](#)

⁶⁵ [Indicateurs des ventes de produits phytopharmaceutiques | Ministère de l'Agriculture et de la Souveraineté alimentaire](#)

⁶⁶ [Golf : fin de l'usage des produits phytosanitaires | FFGolf](#)

⁶⁷ [Fédération Française de Golf \(ffgolf.org\)](#)

⁶⁸ Based on practices implemented in the country this number is too high to our mind.

⁶⁹ [pesticides_sup_nap_fin-rev_en.pdf \(europa.eu\)](#)

organizer for international competitions for amateur or professionals due to the high quality level of golf courses.

In case pesticides (fungicides and PGR) are used on greens only, the amount could be reduced to ca. 2 kg/ha. If the use of pesticides were to be completely restricted, the quality of the greens would completely collapse in the first few years and the golf season would be shortened because the grass on the greens would have to be resown every year. Resulting into higher costs in course management and potential close down of clubs. Finally, Finland's northern climate should be taken into account, as it significantly influences the use of pesticides.

2.6 Germany

No of Golf Course:	729
Total Land Area covered by Golf Courses:	51,000 ha
Total Revenue:	€ 760 Mio.
Total Profit:	No information
Total No of Employees on Golf Courses:	7,950
Average Pesticide Use per Course/hectare:	2.27 kg active ingredient/ha/year ⁷⁰

Since 2012, golf courses have fallen into the category of "areas for the general public" according to the German Plant Protection Act (PflSchG)⁷¹, which is quite close to what is meant by "sensitive areas". On these areas only pesticides can be used, which:

- are authorised as a low-risk plant protection product in accordance with Article 47 of Regulation (EC) No 1107/2009;
- have been examined by the Federal Agency of Consumer Protection and Food Safety (BVL) within the framework of an authorisation procedure and found suitability for use on land intended for the general public;
- have been approved on the basis of its properties by the Federal Agency of Consumer Protection and Food Safety (BVL) for use on land for the general public.

Consequently, pesticides are not restricted on golf courses, as long as they have been approved for use on land for the general public. The German Golf Association (DGV)⁷² is providing a list of approved pesticides⁷³ for golf course in Germany, including fungicides, herbicides and insecticides.

The DGV responded that the usual pest management practices include as preventive measure the use of more resistant grass species and varieties for seeding and overseeding, balanced water management, correcting nutrient deficiencies, weed management and mechanical maintenance. Any site conditions that may limit the vitality of the grass or favour a pest are corrected. Intensive and frequent monitoring, diseases forecasting models, weather forecast are the basis for the decision-making. Biostimulants are also used to get stronger and healthier turf. If available preference is given to the use of biological products. To control

grubs and crane fly, nematodes are used. Spraying is conducted with drift-reducing nozzles and partial applications are already a standard. Finally, the greenkeepers investigate and document the success of the IPM measures.

The practices vary with the weather conditions. High amounts of dew or guttation are removed, "*Dollar Spot*" is prevented via smooth rolling. Beside efficacy of measures and availability of pesticides, experience of green keeping and know-how on impact of weather conditions are key factors for the determination of the pest management practice. Comparable to Finland, ca. 50% of the pest management costs are associated to pesticide use. The average rate of pesticide application of active ingredient was reported with **2.27 kg/ha**. As described in Footnote 68, this quantity seems to be very high. The total amount results from the addition of the active substances applied per ha/year reported in the Questionnaire. It could be high because only some of the pesticides are applied to certain areas of the golf course, but this is not taken into account when calculating the total amount, e.g. greens and tees only 5% of the total golf course area, but where most pesticides are applied. Since 2012 the use rate was reduced, but no numbers were provided to what level.

Similar to the responses from the French Golf Association, DGV replied that a further significant reduction of pesticide use in short time will have an unacceptable impact on course quality. For a further reduction of 60%, 6 years of transition would be needed. As key success factors more education and intensive training, assistance through consulting, R&D and best practice usage, as well as the development of alternative and less hazardous pesticides (biological products), were found to be crucial. An adequate time for transition to adapt the pest management practices is need for any further pesticide use reductions. If this cannot be guaranteed, then the quality level will drop with serious consequences for the economic stability of the golf clubs.

In summary, managing golf courses entirely without pesticides is extremely difficult and unrealistic in the short term. At least products against "*Dollar Spot*" and "*Microdochium Patch*" as well as herbicides to control "*Dandelions*" and "*Daisies*", are needed.

2.7 Ireland

No of Golf Course:	379
Total Land Area covered by Golf Courses:	18,950 ha
Total Revenue:	€ 272 Mio.
Total Profit:	No information
Total No of Employees on Golf Courses:	9,000
Average Pesticide Use per Course/hectare:	1.5 kg active ingredient/ha/year

The Sustainable Use Directive (SUD) was transposed into Irish law by Statutory Instrument No. 155 of 2012, European Communities (Sustainable Use of Pesticides) Regulations 2012.⁷⁴ This law does not restrict the use of pesticides on golf courses.

The average size of Irish golf course properties is in the region of 50 hectares. The area on which pesticides can potentially be applied is in the region of up to 26 hectares (52%). Golf courses can be divided into the following areas Greens (1.0 ha), Tees (0.65 ha), Fairways and Semi-Rough (24.00 ha). The remaining area of golf course properties consists of, roughs, woodland, hedgerows, wetland, wildflower meadow, water bodies, etc. Because of the cool

⁷⁰ The quantities reported seem to be very high. The total amount results from the addition of the active substances applied per ha/year reported in the Questionnaire. It could be high because only some of the pesticides are applied to certain areas of the golf course, but this is not taken into account when calculating the total amount, e.g. greens and tees only 5% of the total golf course area, but where most pesticides are applied.

⁷¹ [PflSchG - nichtamtliches Inhaltsverzeichnis \(gesetze-im-internet.de\)](#)

⁷² [DGV-Serviceportal \(dgv-intranet.de\)](#)

⁷³ [21032023_PSM_Tabellen.pdf \(golfmanager-greenkeeper.de\)](#)

⁷⁴ [S.I. No. 155/2012 - European Communities \(Sustainable Use of Pesticides\) Regulations 2012. \(irishstatutebook.ie\)](#)

mild climate in Ireland pest and disease pressure is reduced. As a consequence, pesticide usage is low but is nevertheless a very important tool in managing pests, diseases and weeds. Greenkeepers are reluctant to apply pesticides except where there is a real need. Another primary reason why pesticide use is low is related to cost. The cost of spraying the greens with one application of fungicide is approximately €1,200. Greenkeepers are under constant pressure to limit costs which includes pesticide purchases. Compliance with IPM is also high in Irish golf course. 95% of clubs surveyed in Ireland reported that they practice IPM. The climate has no influence on the pest management and does not vary throughout the year.

According to Golf Ireland, their clubs operate with narrow margins and do not want to spend any unnecessary expenditure on spraying. The playability of the course is central to the players experience and enjoyment of the sport, therefore pesticides need to be used to guarantee equal competition on the courses. The rationale for pesticide use on Irish Golf Courses is:

- Produce consistent playing surfaces;
- Maintain grass cover;
- Control Weeds;
- Control grass diseases on greens;
- Control the vertical growth of the grass;
- Produce dense grass cover;
- Provide fair competition.

The average course applies approx. 100 litre of pesticide product per course and year. Assuming a worst case concentration of 50% active ingredients in the formulation leads to an estimate of 1-1.5 kg of active ingredient per ha. This number is confirmed by the contribution of Golf Ireland to the public consultation to the EU's proposal for the SUR.⁷⁵ Within the last years the pesticide use was significantly reduced, herbicide use by 36% in the last 7 years, and fungicide use by 90%. At present insecticide use is very limited on Irish golf courses. In 2015 "Chlorpyrifos" was used for the control of Chafers and Leatherjackets. This product has been withdrawn from the market and replaced with more effective products. The use of growth regulators commenced in the early 2000's. It has proved to be a very useful tool in improving the quality of playing surfaces.

Reduction was possible due to IPM, more efficient spraying techniques (e.g. windfoils and antidraft nozzles) and via fungicide substitution – as mentioned above. Further short term reduction on pesticides would lead to unacceptable impacts on course quality. If sufficient time would be granted, further reduction seems possible by applying the following:

- Integrated Pest Management practices, including further development and application of "precision techniques";
- Greenkeeper training and education;
- Collaborative research and innovation;
- Equipment registration;
- Digital recording of all applications including types, doses and timings of any application;
- Recommended processes and criteria for possibility of exemptions and "emergency use licensing".

⁷⁵ gov.ie - Public consultation on the EU Commissions proposal for a Sustainable Use of Pesticides Regulation (www.gov.ie)

Golf Ireland noted that golf courses are particularly important and contribute to social and economic benefits. Compared to the total area in Europe where pesticides are applied, these areas are extremely small and spread pesticide quantities low. Thus, the benefits far outweigh the risks of pesticides to man and environment according to Golf Ireland.

2.8 Czech Republic

No of Golf Course:	106
Total Land Area covered by Golf Courses:	3,180 ha
Total Revenue:	No information
Total Profit:	No information
Total No of Employees on Golf Courses:	9,000
Average Pesticide Use per Course/hectare:	No information

According to the *National Action Plan on the Safe Use of Pesticides in CZ*⁷⁶, golf courses have been identified as potential sources of active substance residues in the environment as applications outside of agricultural sector. However, no actions against pesticide use on golf courses are included. The NAP states as well, that the number of effective substances in authorized preparations is insufficient to ensure the functioning of anti-resistant strategies, especially with regard to the introduction of new harmful organisms.

The response on the Questionnaire from the Czech Golf Associations⁷⁷ confirms the statement in the NAP and expresses the concern, that in the country no pesticides for turf grass protection are authorized. Pest management practices are described by using agro-technical practices, that includes different aerifications, removal of weed layers, sand topdressing, pesticides application, fertilization, irrigation and proper drainage installation with maximal water retention. The IPM measures are most intense during the growing season from April to October. Most pesticides are used on greens in winter when there is no snow. Due to absence of authorized products, only fungicides and growth regulators are used on greens and tees, herbicide and insecticides are not applied. Therefore, the quantity of pesticides used on golf courses went down significantly in the last 10 years, however, no numbers were provided. In contrary, fertiliser use did increase dramatically.

Fluctuations and unpredictability of the climate make pest control more complex, in addition to the geographical differences (N-S and W-E).

Information on the average rate of pesticide applications where not provided.

2.9 Italy

No of Golf Course:	370 (incl. small facilities)
Total Land Area covered by Golf Courses:	10,500 ha
Total Revenue:	No information
Total Profit:	No information
Total No of Employees on Golf Courses:	3,000
Average Pesticide Use per Course/hectare:	0.04 kg active ingredient/ha/year

⁷⁶ pesticides_sup_nap_cze-rev_en.pdf (europa.eu)

⁷⁷ Czechgolf.federation.cz | Czechgolf.generation.cz (cgf.cz)

From the responses of the Italian Golf Federation⁷⁸ to the questionnaire and the literature review, it is not clear what the current legal situation is in Italy regarding the use of pesticides on golf courses. It seems that in Italy the municipalities are primarily responsible for restricting the use of pesticides on public land. Some sources⁷⁹ indicate that Italian Golf courses and public spaces must be managed without conventional pesticides, unless derogations exist. Furthermore, there do not seem to be any well-functioning and approved pesticides for the Golf sector on the market. Therefore, pest management practice is driven mainly by IPM and cultural practices according to organic farming to increase the pest resistance of turf. Pesticides are only used as a last resort. Moreover, biostimulants and microorganisms are used. Biostimulants cannot be assigned to either pesticides or fertilizers. This means that they neither have a defensive character against pathogens nor a significant nutrient content. However, they strengthen the resistance and tolerance of plants to abiotic stress factors such as heat and drought, have a positive effect on crop yields, crop quality and soil fertility. Biostimulants include microorganisms, algae preparations, plant and animal extracts, as well as humic and fulvic acids, most of which are effective in the rhizosphere, the root zone of plants. It was communicated, that some biological products (biopesticides) were introduced too, but only a few were successfully tested on turfgrass.

The practice hardly changes during the year, weeds, insects and diseases have to be controlled all year round. An average rate of pesticide application of ca. 2 kg active ingredient for an 18-hole course was reported. Assuming an average size of 50 ha would result in a consumption of 0.04 kg/ha. The introduction of the new practices resulted in about 30 % higher costs of pest management.

The playability of the courses did decrease, particularly in summer due to the difficulty to control weeds and diseases. The complaints of golfer did increase. A further reduction in the use of pesticides will cause a further decrease of turf quality and playability coupled with increased maintenance costs in order to recover the turf at the end of the summer, e.g. with overseeding. Therefore, minimal use of pesticides should be allowed as a last control strategy when other options are not effective. The number of treatments during the year could be limited for each product (e.g. 2 applications/a) and only applies on the greens with low risk products (e.g. bio-pesticides used in organic farming). It was reported that it is almost impossible to maintain a golf course in Italy without any pesticides, because weather conditions are unpredictable and the outbreak of diseases, the germination of weeds and the emergence of pests might be strongly favoured at some point during the year. Finally, organic farming is known to be more labour intensive.

A case study⁸⁰ was conducted at *Golf della Montecchia*, a course which transitioned to pesticide-free management practices by applying organic farming principles since 2015.

One key factor identified was the grass species composition of playing areas. Greenkeepers were switching from warm season grasses in the summer to cool season grasses in the winter (through overseeding) on the tees, fairways and greens. In addition, in summer as little as possible fertiliser was applied to maintain consistent growth of “*Bermudagrasses*” and allow

⁷⁸ [Federazione Italiana Golf - Il sito Ufficiale \(federazioneitaliana.org\)](http://www.federazioneitaliana.org/)

⁷⁹ [OnCourse | Report \(gardagolf.it\)](https://www.gardagolf.it/)

⁸⁰ [ra0419_s79bis82.pdf \(golfmanager-greenkeeper.de\)](https://www.golfmanager-greenkeeper.de/)

recovery from winter dormancy. Towards the autumn fertiliser rates are reduced to prepare the turf for dormancy but still enough to allow the cool season mixture to germinate and establish before the winter. Additional practices applied are aerification, verticutting and tining.

According to the investigation by MINELLI et al.⁸¹, the conversion to “*Bermudagrass*” after 2010 resulted in less mowing (-27 %), fertilisation (-53%), coring (-50 %), topdressing (-20 %) but a 172 % increase of verticutting.

2.10 Spain

No of Golf Course:	420
Total Land Area covered by Golf Courses:	21,000 ha
Total Revenue:	€ 12,700 Mio.
Total Profit:	No information
Total No of Employees on Golf Courses:	121,000
Average Pesticide Use per Course/hectare:	1 kg active ingredient/ha/year ⁸²

The golf sector in Spain attracts ca. 1,195.000 foreign golf tourists per year. Of these, 98.6% come from Europe. The sector generates €12.700 billion and creates 121.393 jobs in Spain. Therefore golf has an outstanding importance to the Spanish economy.⁸³

The SUD is implemented in Spain via the *Real Decreto 1.311/2.012 sobre el Uso Sostenible de Fitosanitarios*⁸⁴ According to the Spanish Golf Federation⁸⁵, this legislation is very restrictive and requires careful control of the pesticides that are applied. Where pesticides are applied and why, as well as the entire operation must also be supervised by a specialized advisor in pesticide handling (ROPO Advisor). This legislation states also that sport areas (including golf courses) shall be considered as specific areas and as such the competent authority shall ensure that the use of pesticides is minimised or prohibited by adopting appropriate risk management measures and by giving priority to the use of low-risk plant protection products.

Pest control includes in general all cultural measures carried out on the golf courses (mowing, fertilisation, irrigation) and aims to manage strong grass and habitats in such a way that potential pests do not exceed the established tolerance thresholds. However, sometimes threats occur where normal work and the adaptations made are not enough, so biological control agents, biostimulants and, as a last resort, pesticides have to be used.

The greenkeepers need to be able to treat “*Dollar Spot*” and “*Fusarium*” with fungicides, beetles via insecticides and herbicides as pre-emergency tools against weeds. Due to climatic conditions, pesticides are mainly used in summer. In the last 5 years the use of pesticides in has decreased, as there are only 3 approved pesticide products left. Should there be a ban on pesticides in the short term and as planned by the SUR, this would make the existence of golf

⁸¹ [ra0419_s79bis82.pdf \(golfmanager-greenkeeper.de\)](https://www.golfmanager-greenkeeper.de/)

⁸² According to the results compared, the competitive situation and the climate, this number seems to be quite low.

⁸³ [Golf attracts 1.2 million foreign tourists every year \(investinspain.org\)](https://www.investinspain.org/)

⁸⁴ [Real Decreto 1311/2012, de 14 de septiembre, por el que se establece el marco de actuación para conseguir un uso sostenible de los productos fitosanitarios. \(boe.es\)](https://www.boe.es/)

⁸⁵ [REAL FEDERACIÓN ESPAÑOLA DE GOLF \(rfegolf.es\)](https://www.rfegolf.es/)

courses in Southern Europe impossible. The reason for this is the climatic differences and the associated greater threat from pests as well as the lack of winter dormancy. The turf would be overgrown with annual weeds that cannot be controlled and would therefore disappear. At the beginning of winter and summer, leading to a lack of cover and a progressive loss of the grass. Nematodes, insects and especially fungal diseases would be uncontrollable and in most cases would significantly affect playability, according to the response to the questionnaire. A reduction of 60% is hardly achievable as well.

2.11 Portugal

No of Golf Course: 99
Total Land Area covered by Golf Courses: 2,800 ha
Total Revenue: € 180 Mio.
Total Profit: No information
Total No of Employees on Golf Courses: 8,000
Average Pesticide Use per Course/hectare: No information

The climate in mainland Portugal is predominantly influenced by latitude, orography and its proximity to the Atlantic Ocean. Portugal has a Mediterranean type of climate characterized by warm and dry summers and cool and wet winters. Changes in the climate and more climatic extremes cause problems for course managers in Portugal. Extremes like heat and drought that result from climate change are starting to impact the game - both the players' comfort and the course conditions. Turf does best in an environment with limited variability, and changes in weather patterns will result in the need for course management to adjust to such circumstances.⁸⁶

Related to pesticides use, Portugal is included in the Zone C (South) along with Bulgaria, Cyprus, France, Greece, Italy, Malta and Spain). The application of the SUD took place in two phases. The Decree-Law no. 86/2010⁸⁷ was implemented on July 15, 2010, which turned compulsory the inspection of equipment for application of plant protection means. In 2013 the Law 26/2013⁸⁸ of April 11 was introduced, regulating all aspects of the sale, distribution, marketing, transportation, storage and application of pesticides.

According to the Portuguese Golf Association's⁸⁹ response, the pressure to control pests and diseases is very high, which requires a lot of maintenance. The main pest control practices are the IPM principles, which do not differ throughout the year. Approximately 50% of the pest management budget is spent on pesticides. Reducing the use of pesticides by 60 % would take about 10 years. This process could be supported by adapting turf varieties to climatic conditions and by more resistant grass.

⁸⁶ [Golf Course 2030 Portugal.pdf \(kc-usercontent.com\)](#)
⁸⁷ [Decree-Law No. 86/2010 establishing the mandatory inspection regime for equipment aimed to the application of plant protection products authorized for professional use. | FAOLEX](#)
⁸⁸ [por122607.pdf \(fao.org\)](#)
⁸⁹ [FPG - Federação Portuguesa de Golfe - Golfe Portugal](#)

2.12 Summary of Responses on the Baseline

Table 2 summarises the responses obtained from five “higher intervention” countries regarding their socio-economic baseline. The largest country by area is Sweden, with 450 courses occupying 30,000 ha, giving an average area of 67 ha. The largest courses are located in Finland, where 142 courses occupy just under 12,000 ha, or over 80 ha each. This compares with Italy, where the average course comes in at 28 ha, although this includes all golfing facilities, including shorter courses and driving ranges. The overall average computes to 54 ha.

Table 2: Responses from “higher intervention” countries on the socio-economic baseline.

	Italy	Denmark	Sweden	Finland	Netherlands	Total
Number of golf courses	370	186	450	142	251	1,399
Total land area	10,500	13,000	30,000	11,790	10,765	76,055
Area/course	28	70	67	83	43	54
Total revenue €m	Industry					466
						615
Revenue per course					1.04	1.06
Total profit					53	
Employees	Industry					11,230
Employees per course	0	8.1	9.7	5.0	14.1	8.0

Only three countries reported estimates of the total revenue earned by golf courses, which translate into revenue per course of between €0.85m and €1.25m per year, for an average of just over €1m. Only one country (Netherlands) reported an estimate of total earnings in the golf sector, being approximately twice the revenues earned by courses directly. The Netherlands reported a profit margin of just over 10% at the sectoral level. Finland reported that overall its courses break even. Other associations did not provide profitability estimates. Finally, regarding employment, all five associations reported estimates of the number of people employed by golf courses directly, with an average of eight per course, ranging from five in Sweden up to 14 in Finland. It is not known whether these figures relates to positions or full-time equivalents (FTEs), which could account for some of the variation.

Table 3 summarises the responses obtained from six “lower intervention” countries regarding their socio-economic baseline. It can be seen that there is considerable variation across these countries in terms of the land dedicated to golf. France and Germany both report over 700 golf courses, occupying 33,000 ha and 51,000 ha respectively, while Portugal and Czechia report only around 100 courses each, taking up around 3,000 ha. The result is a range of average golf course size of 28 ha to 70 ha, with an average of 53 ha.

Table 3: Responses from “lower intervention” countries on the socio-economic baseline.

	France	Portugal	Germany	Ireland	Czechia	Spain	Total/Average
Number of golf courses	740	99	729	379	106	420	2,473
Total land area	33,000	2,800	51,000	18,950	3,180	21,000	129,930
Area/course	45	28	70	50	30	50	53
Total revenue €m	Industry					12,718	
							1,969

Revenue per course		1.03	1.80	1.04	0.72		1.01
Total profit						2,000	
Employees	Industry	15,000	17,000		9,000	121,000	
	Courses	8,960	8,000	7,950		1,500	
Employees per course		12.1	80.8	10.9		14.2	29.5

Four countries reported estimates of the total revenue earned by golf courses, which translate into revenue per course of between €0.72m and €1.8m per year, with an average of just over €1m, which is remarkably similar to the average reported for “higher intervention” countries in Table 2. The €1.8m estimate is from Portugal, which has a highly developed golf tourism sector (although all of these respondents reported tourism to be “very important” to golf in their country). The Portuguese association also reported a figure of €17.8bn for the earnings of the golf sector in total, meaning that golf courses themselves earn only 1% of total golf-related revenues. This compares with the 50% reported by France, which is approximately the same as the ratio reported by the Netherlands (Table 2). Spain reported a total industry revenue of over €12bn per year but did not say how much of this is earned by courses directly. It is worth noting that Spain reports over four-times as many courses as Portugal.

Spain reported a total industry profit of €2bn per year. France reported that 1/3 of courses make a profit, 1/3 break even, and 1/3 are loss-making. However, none of these respondents reported estimates of the profitability of golf courses. (Profitability is a moot concept as far as golf clubs are concerned, given that many of them are run on a mutual (member-owned) basis.)

Finally, regarding employment, four associations reported estimates of the number of people employed by golf courses directly. The average computes as 29.5, but this is distorted by the very high response of 80 per course reported by Portugal, which could also include workers employed in hospitality and other activities related to golf resorts, rather than specifically on courses. Removing this figure drops the average to 12, still higher than reported by most “higher intervention” countries (Table 2) but comparable, especially accounting for possible FTE measurement (and, for instance, the seasonality of tourism-related employment).

Table 4 summarises the responses of associations from the “higher intervention” countries on their baseline pesticide management. Due to a degree of ambiguity in the wording of these questions, the responses are subject to some uncertainty of interpretation. In particular, some responses seem to cover grounds maintenance generally, rather than pesticide management in particular. In addition, the responses indicate considerable variation in practice across the countries concerned. Pesticides are a major proportion of costs in Finland, but, due to previous efforts, barely feature in Denmark and Sweden and are entirely absent in the Netherlands. These three countries report a higher proportion of costs spent on labour, perhaps reflecting more intensive management of pests and weeds (IPM). Despite this, reported annual costs per course are between €1,000 - €3,500, compared with €8,000 in Finland.

Table 4: Responses from “higher intervention” countries on the pesticide management baseline.

		Italy	Denmark	Sweden	Finland	Netherlands	Average
Cost/course	Lower		1,000	3,000	8,000	1,000	3,250
	Upper		2,000	3,500	8,000	1,000	3,625
Cost/ha	Lower		14.31	45.00	96.35	23.32	45
	Upper		28.62	52.50	96.35	23.32	50
Split	Labour	30%	60%	50%	10%	60%	42%
	Pesticide	10%	2%	4%	70%	0%	17%
	Fertiliser	20%	5%	15%	0%	3%	9%
	Machinery	20%	25%	15%	20%	30%	22%
	Other	20%	8%	16%	0%	7%	10%

Despite the uncertainties in some of the answers, responses to baseline pest management from “lower intervention” countries (Table 5) provide some interesting comparisons with Table 4. Most obviously, costs per course are comparable or higher than Finland, and significantly higher than the other countries reported in Table 4. Thus, costs were lowest in France and Germany at €5,000 per course, but €15,000 per course in Spain and €36,000 per course in Portugal. France also estimated an upper bound of €35,000 per course. The result is an average cost per course of between €14,200 and €23,500, at least four-times the average reported in Table 5. The result is a cost per hectare which varies between €70 and €1,300, with average around €400 - €500, compared with €50 in “higher intervention” countries.

Table 5: Responses from 'lower intervention' countries on the pesticide management baseline.

		France	Portugal	Germany	Ireland	Czechia	Spain	Average
Cost/course	Lower	5,000	36,000	5,000	10,000		15,000	14,200
	Upper	35,000			12,000			23,500
Cost/ha	Lower	112.12	1272.86	71.47	200.00		300.00	391.29
	Upper	784.85			240.00			533.84
Split	Labour	55%	22%	25%		55%	70%	45%
	Pesticide	8%	54%	50%		2%	5%	24%
	Fertiliser	10%	9%	0%		5%	10%	7%
	Machinery	15%	11%	25%		20%	10%	16%
	Other	12%	4%	0%		19%	5%	8%

Interestingly, the share of inputs between labour, pesticides, fertilisers, machinery and “other” does not vary particularly between the two sets of countries, suggesting that the difference is “more inputs” of all kinds being used in the “lower intervention” group.

Another interesting feature is that, despite being significantly lower than costs shown in Table 4, three respondents in the “higher intervention” group reported that management costs had increased in recent years due to the need to cut down on pesticide use and adopt more integrated practices. One reported no change, and one reported that costs had fallen. The “lower intervention” group were not asked what had happened to management costs in recent years, but one (with no data) reported that pesticide use has fallen.

Responses to the question on current pesticide use were mixed. Answers were provided by all “higher intervention” countries, but only three of the “lower intervention” countries responded. The interpretation of all responses is hampered by ambiguity in the wording of the question, which means it is difficult to determine whether responses relate to pesticide use per course, per hectare, per hectare on each part of the course and so on. As a result, information on pesticide use was sought from other sources, including national reports and information held by the GEO Foundation for Sustainable Golf⁹⁰, to supplement and triangulate the questionnaire responses.

The results of this exercise are summarised in Table 6. Responses are grouped in terms of the “higher intervention” and “lower intervention” groups (upper and lower panel) and are provided in the second column (AI kg/ha), with upper and lower bounds if the response provided them. Comments are provided on those responses where it is deemed appropriate, including whether there are question marks over interpretation. The final column presents our suggestion of what might be a best estimate of pesticide use in each country.

Table 6: Estimates of pesticide use across survey respondents.

AI kg/ha			Comment	Possible value
Higher	Lower	upper		
Italy		0.07	Based on reported 2kg/course	0.07
Denmark		0.02		0.02
Sweden	0.26	1.5	Lower figure relates to herbicide on fairways; higher to fungicide on greens	0.17
Finland		2.5	Figure seems high; might relate to AI/course, or AI/applied hectare. GEO figure is 0.06/ha	0.06
Netherlands		0.19		0.19
Lower				
France	0.06	0.11	Based on reported 2.5-5kg/course	0.11
Portugal				
Germany		2.32	Based on application rates (see text)	1.25
Ireland		1	Based on 100l/course; assumed max 50% AI	1
Czechia				
Spain		1	This seems low but no other information is available	1

The best estimate in some cases simply represents the figure provided by the responding association, because it is considered the information available to them in responding is reliable and the figure seems in line with expectations. In other cases, quantities per course were translated into a per hectare value using the total course hectares also reported for that country. However, there is uncertainty about whether quantities were reported per hectare across the entire course or per hectare only where pesticides are applied. Given that around 50% of a course is not expected to receive any pesticide at all, this could make a big difference to the estimates, and hence hinders comparisons.

The Ireland response was provided in terms of product volume, and this was translated into a kg estimate by assuming a maximum 50% active ingredient (50%) concentration. Review of

⁹⁰ <https://sustainable.golf/>

information on some herbicide and pesticide products approved for use on golf courses in Germany⁹¹ indicates that this assumed concentration might be too high, a conclusion which would be supported by the value of 0.71kg/ha for the United Kingdom (which might be expected to have similar use patterns as Ireland) provided by the GEO Foundation.

The response for Sweden provided a figure for pesticide use on fairways and another for use on greens. This was translated into a ‘per hectare’ figure by applying the course proportions provided for Ireland: 2% of course area taken up by greens, 1% by tees (assumed to be the same as greens, although this is probably an overestimate), 48% by fairways and 49% other areas (including rough, woodland, water, car parks etc) where it is assumed no pesticide is used. This produces a figure of 0.17kg/ha across an entire course.

Finland reported a figure of 2.5kg/ha, which is high compared with the figure of 0.06kg/ha from the GEO Foundation, and higher than expected given understanding of practice in that country. It could be that the 2.5kg/ha figure relates only to use on greens and other high-intervention areas, and 0.06kg/ha is more representative of average use across the entire course. The two figures would be approximately consistent if the Ireland course proportions are applicable and 2.5kg/ha are applied only to greens and tees, with no pesticide used elsewhere (in which case an average figure of 0.08kg/ha is obtained). The 0.06kg/ha figure is taken to be the most comparable with other obtained in this study. (However, it should be noted that Finland also reported a much higher cost per course for grounds management, and a higher proportion of that spent on pesticides, than other countries, which would be consistent with a higher average rate of pesticide use.)

The response from Germany provided details of a typical pesticide application regime, based on the approved pesticides for golf courses referred to above. Two of the identified products are recommended for all areas of a course, while the other two are meant for greens only. Taking the application rate and frequency for each pesticide, and assigning the course area proportions for Ireland, gives an overall application rate of 1.25kg/ha across an entire course.

In summary, very low levels of pesticide use (below 0.1kg/ha) are reported and/or estimated for Denmark, Italy and Finland. Low levels (less than 0.2kg/ha) are reported/estimated for France, Sweden and the Netherlands. Moderate (c.1kg/ha) levels are reported/estimated for Spain, Germany and Ireland. No figure is reported for Portugal or Czechia (although Czechia reports that pesticide use is not permitted at all on golf courses in that country). For comparison, figures of 0.71kg/ha and 0.34kg/ha were provided for the United Kingdom and Switzerland respectively by the GEO Foundation. Note, however, that there is some uncertainty in interpreting these figures due to the different ways to report pesticide use.

Finally, by way of reference, Eurostat estimates that around 350,000 tonnes of pesticides (active ingredient) were sold in the EU in 2021.⁹² Eurostat also reports around 178m hectares of land dedicated to agriculture in the EU, around 75% of which is arable or mixed use (49%

⁹¹ https://www.golfmanager-greenkeeper.de/fileadmin/content/Importe_gk_ra/2023/0123/21032023_PSM_Tabellen.pdf
⁹² https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agri-environmental_indicator_-_consumption_of_pesticides

arable).⁹³ Although not all pesticides are used on farmland, it can be assumed this accounts for the very large majority. This implies a basic level of use of around 2kg/ha across all farms, or possibly 4kg/ha across all arable farms.

3. Experience of Recent Pesticide Reductions

The prospects for future pesticide reductions, whether via a version of SUR or some other mechanism, depend on the experience of countries which have already reduced pesticide use (significantly) and the circumstances facing countries which would need to reduce their pesticide use further (significantly). The experience of the former group informs the prospects for further reductions in the latter group (and on EU golf courses as a whole).

Responses to the questionnaire and reviewed literature indicate that nearly all countries report that pesticide use has fallen significantly in recent years. France reports a fall of 50% since 2009, Sweden a similar reduction, Netherlands an 80% reduction over the period 2015-2020, and Denmark a reduction of 90% since 2009. Other countries report decreases, but do not provide estimates of how much. Only Finland reports no change overall, with reductions in (e.g.) fungicide use being offset by increases in the use of (e.g.) plant growth regulators.

Countries report the adoption of IPM practices as well as government regulation as reasons for the reductions. Germany reported that, since 2012, the German Plant Protection Act (PflSchG) has put golf courses under the category “areas for the general public” which is quite close to what is intended with “sensitive areas” in the SUR. This has limited the amount of pesticide which can be used and encouraged the adoption of IPM. Spain reports that a change in the law means that only three pesticide products can be used on golf courses, which has led to a reduction in availability and use. As reported above, France golf courses now operate under the Labbé Law, according to which pesticides are allowed only on greens, fairways, tees and sports fields where access is controlled, with a complete ban planned from 1st January 2025. Czechia reports that pesticide use is not permitted at all on golf courses in that country. In The Netherlands, the government’s Green Deal is seen as the driver of the uptake of IPM and the 80% pesticide reduction. Pesticide use on golf courses is regulated in both Denmark and Sweden and their national associations point towards the work by STERF which has helped to achieve this reduction and mitigate its effects on course quality.

In other words, pesticide use is already heavily regulated in many countries of the EU (and this is not necessarily a complete picture, but simply reflects what was reported in questionnaire responses), and pesticide use has already fallen significantly across the golfing sector. Pesticide use does vary across countries, but there are different underlying drivers depending on geographical location (north-south) and market (predominately domestic and/or local tourism vs international tourism). More southerly countries seem to need higher rates of application because of climate, but more southerly countries are also more likely to be dependent on international tourism, which expects high course aesthetics (and hence higher application rates). It is interesting that France reports a range of pesticide use of 2.5kg-5kg per course, which could reflect the difference in application regime between more northerly and more southerly courses.

⁹³ https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Farms_and_farmland_in_the_European_Union_-_statistics#Farms_in_2020

Respondents in “higher intervention” countries were asked about their experiences of reducing pesticide use in recent years. All referred to aspects of IPM, as well specifically to factors such as more resistant grass species, better understanding of the optimal timing of intervention, more precise equipment (e.g. targeted sprayers) and more effective plant-protection products. The need for education and culture change was also emphasised. Denmark and The Netherlands specifically referred to a need to change the perception amongst players about what a golf course should look like. All agreed that this process had taken several years to effect and had benefitted from the provision of information and education by relevant organisation (e.g. STERF).

The Netherlands response indicated that reductions in that country had actually reduced the costs of pest management on courses. Initial costs of training etc were now resulting in cost savings up to 20% through less intense management, less labour input and lower pesticide application. However, this was not an experience reported by other countries. Sweden agreed that initial investment costs had been necessary (STERF was reported to have cost €2.5m over 10 years, and a figure of €0.5 per member per year was reported for clubs, although the basis for this figure and what it covers are not clear), but that savings in terms of reduced pesticide use had been offset by increased expenditure on items such as fertiliser, sand and irrigation, leaving the overall position cost-neutral on an ongoing basis. Denmark reported initial investment costs of €115k per year, primarily on research, followed by product testing, training and public information. An ongoing cost increase of 20% was estimated, due to higher labour input and the need for more mechanical equipment. Italy reported a 30% increase in costs, due to increased spending on machinery, fertilisers and organic products, and education. Finally, Finland reported a 300% increase in the costs of pesticides, as well as higher costs for machinery and other products. It is relevant here that Finland reported that 70% of costs of pesticide management went on pesticides themselves (Table 4), far higher than any other country (Portugal was second, on 54%), with only 10% on labour and 20% on machinery. This points to a very particular pest management regime in this country, and one which could be particularly susceptible to a requirement to make further substantial reductions in pesticide use.

In terms of impacts on course quality, most “higher intervention” respondents report that quality has decreased following recent changes in pest management, although perhaps with some benefits. Italy and Sweden mention only negative impacts; the former indicates that weed and disease control has become much more difficult, especially in the summer, with players complaining about the playability of greens. Sweden refers to it being harder to protect against damage in the winter months, resulting in poorer course quality in spring. Denmark also mentions decreased playability, with more weeds on fairways, more fungal attacks on greens, and insect damage – although it is acknowledged that turf quality and biodiversity might have improved.

The Netherlands reports that the “drastic” pesticide use implemented in recent years has not cut course quality in the summer months. However, associated changes in practice have meant that better quality is now achievable with less pesticide than previously, which has resulted in higher course quality in the rest of the year so that, overall, playability has increased. This indicates that significant cuts to pesticide use do not affect course quality negatively. Making these improvements clearly takes time and resources, however.

Only Finland reports unambiguously positive impacts from its recent changes, but as already discussed, this has not been due to a reduction in overall pesticide use but more to a switch to better use of better products. The result is that the Finnish association now considers its courses to be approaching international standard and a candidate for organising major international tournaments.

“Lower intervention” countries were not asked explicitly about their recent experience of reductions because it was considered that they would have much experience to report. This has proved to be incorrect. In fact, one of the interesting and important findings of this research is that it has demonstrated how much more widespread IPM-type practices have become in golf in recent years, than was previously perceived, and how much pesticide reduction has already taken place. This misperception is likely to be at least due to the rather underdeveloped reporting systems in many countries, which make it difficult to monitor use levels and trends.

4. Prospects for Future Pesticide Reductions

Contrary to the previous paragraph, all countries were asked how they considered the prospects for future pesticide reductions. It was thought the “higher intervention” countries might have a view about whether any significant further reductions are available to them at all, and whether there is some “minimum” level of pesticide use which they feel they need to maintain. The SUR proposes to mandate the same percentage reductions in pesticide use in all countries, and ban use on golf course entirely, irrespective of current levels and previous reduction measures. The views of “lower intervention” countries were sought to understand what types of reductions they feel might be achievable over what time period, and what the barriers to achieving those reductions might be.

Only Italy of the first group was unambiguous in stating that further reductions in pesticide use would only increase costs and reduce turf quality and course playability even further than had happened already. The association reported that Italian clubs are already experiencing widespread complaints from players about course quality and are fearing that it could lead to a loss of international visitors. It is therefore understandable that they would resist reductions which they feel could result in even more negative pressure.

Others in the group were more cautiously optimistic about the possibility of future reductions. There was a general need expressed for improved products, equipment and training to permit such reductions. Finland felt that a 50% reduction would be possible, but at the risk of reducing quality and shortening the playing season. Lower standards would need to be accepted on fairways, but reducing of application on greens should be avoided as these would have the greatest physical and economic impact on clubs. The Netherlands also reported that a further 50% cut (from current levels) might be possible, even with current products and methods.⁹⁴

⁹⁴ Note: Respondents were not asked about the costs of achieving these additional reductions. As most reported that costs had had to increase to achieve existing reductions, it is reasonable to assume that future reductions could not be obtained without a further cost increase.

All respondents agreed that some minimum level of application should be allowed and that a complete ban on pesticide use had been or would be unsustainable for the sector. Denmark felt that lower-end clubs could maybe manage without pesticides, but good playing standards demand a level of application at least as high as currently. The Netherlands also reported that good standards can be achieved currently with very low levels of pesticide use, but this depends on the course and the circumstances of the club concerned – however, as a general rule, a zero pesticide requirement would prevent fair competition and make a reasonable standard of play impossible. Other associations also felt that a zero pesticide rule could seriously undermine individual clubs and the sector as a whole in their country. There is a need to ensure a minimum number of treatments is guaranteed, or that certain areas of the course (in effect, greens) are protected, and that rules reflect local climatic conditions – a point made most strongly by Finland.

Unsurprisingly, maybe, no member of the “lower intervention” group felt that a 60% reduction in pesticide use from current levels would result in acceptable course quality levels on the basis of current pest management practices alone. All respondents (and not all associations responded to all of these questions) felt that changes would be required, and time allowed to affect them, if acceptable standards were to be maintained. Portugal and Germany were prepared to suggest that 60% reductions could be achieved with acceptable playing standards, with better varieties of grass suited to the climate (Portugal) and better products and access to training and expertise (Germany) seen as key. Even then, a period of between six and ten years was deemed necessary. Portugal remarked on the highly commercial nature of the golf sector in that country, and particularly its links to tourism, which would make unmitigated quality reductions very difficult to bear. The risks associated with this outcome were seen as a barrier to the adoption of new practice and reduction targets, due to the high economic costs potentially associated with them.

The French association felt that 60% reductions could be achieved within three years, and as much as 90% reductions after seven, but only if clubs had access to better training and products, and information technology which would enable them to use them more effectively (e.g. modelling of the impact of ultra-localised interventions). Costs were seen as a barrier, as well as the variation in climatic factors across the country.

All countries in this group felt that zero use of pesticides on golf courses was unrealistic. Pest management, and associated regulations, need to recognise that climatic and other factors which lead to different requirements in different locations – one size does not fit all. Ireland pointed out that good quality of playing surfaces, especially on greens, is perhaps the key aspect of the sport, and at the very least the special role of greens in golf should be recognised and protected, particularly given the relatively small land area concerned.

5. Costs of pesticide reductions

The information available to this study, from Questionnaire responses and the general literature, does not allow an accurate estimate of the costs of pesticide reductions to be obtained. Too many data are missing, or reported in incompatible ways, or are difficult to interpret with any confidence. As a result, only illustrative analysis is possible.

We can take Denmark as an example, given its relatively developed information gathering and good understanding of past development in the golf sector. Figure 5 indicates that, over the last 10 years, pesticide use has fallen by around 90% in Denmark, from around 0.2kg/ha active ingredient, to around 0.02kg/ha now. With an average reported course size of 70ha, that represents a reduction of around 12.6kg per course per year. In turn, it is reported that these reductions have been achieved at a cost of around a 20% increase in pesticide management costs for each course. (It is not stated over what period this 20% increase occurred, and hence what percentage reduction in use it achieved, but it seems reasonable to assume that it refers to more recent changes in practice rather than a view over the entire last two decades.) Costs per course are indicated at between €1,000 and €2,000 per year, meaning a 20% increase would be around €170 - €340. This means that pesticide reductions were achieved at a cost of around €13 - €26 per kg per year, not excluding initial investment costs in training, research and so on.

This is only an illustrative calculation and it is not clear how reliable an estimate is the result. In principle, however, it could be compared with the cost of achieving pesticide reductions in other sectors (e.g. agriculture) to assess whether it is a better use of resources to obtain reduction in golf or elsewhere. It has not been possible to identify an estimate of the costs of pesticide reductions in other sectors for this report. However, we would strongly advise policy makers for comparing those costs (e.g. with the agricultural sector).

The SUR proposes that golf course should be classified as sensitive areas and that no pesticide use at all should be allowed on them. No responding country association feels that this is a sustainable objective, and all felt that the impacts of their golf sectors would be dramatic and negative. (Time to achieve zero was not a factor.) The value of revenues obtained by the average golf course can be significant (estimated at around €1m per course on the basis of survey responses for this survey), but can be much higher than that in some circumstances, especially where courses are attached to holiday resorts. It is not possible to say what the overall impacts of a zero requirement would be on golf in the EU, but there is no reason to doubt that it would be significant and negative.

6. Conclusions

This study has been undertaken in the context of the SUD, and a proposal by the European Commission to replace that EU Directive with the SUR, a Regulation which aims to cut pesticide use across the EU, and to ban its use in “sensitive areas”. The SUR proposes that golf courses would be designated as sensitive areas, and hence that use of pesticides on golf courses would be banned completely, from the entry into force (sometime after 2024).

From this study, it can be shown that the use of pesticides on golf courses is highly regulated in many EU countries and that further regulatory measures are underway in different Member States. For various reasons, the current situation regarding the use of pesticides on golf courses varies widely across the EU. Most of the more restrictive regulations in the more proactive countries have avoided outright bans and allowed specific exceptions for special and targeted circumstances to maintain the quality of play of the golf course when other methods have failed. Most of these hardship cases can be summarised as follows:

- Winter diseases (e.g. *Microdochium nivale*), especially on greens.

- Dollar spot symptoms, caused by various pathogens, primarily on greens but also on tees and fairways.
- Moss on greens.
- Broad-leaved weeds, especially on fairways and semi-rough.
- New diseases and weeds favoured by climate change.

Even taking into account these exemptions, the use of pesticides has decreased significantly in most countries, and much more than in agriculture. Pesticide use now appears to be much lower on golf courses than on arable farms. Reductions of up to 90% have been reported over a 10-year period, e.g. in Denmark. In the Nordic and Mediterranean countries, higher pesticide use rates seem to be required due to climatic conditions, while, in particular in the more southern countries, higher pesticide use rates are required as well due to the dependence on international tourism, which expects the sites to be highly aesthetic.

Thus, a blanket ban seems disproportionate, given the significant reductions already existing and the potential socio-economic impacts. The value of revenues obtained by the average golf course can be significant and was estimated at around €1m per course on the basis of survey responses. While it was not possible to say what the overall impacts of a zero requirement would be on golf across the EU, there is no reason to doubt that it would be significant and negative. It should be noted that in the EU there are more than 4,500 golf courses and a wider golf industry (including tourism) associated to it.

In general, the golf sector needs more time and a pesticide regulation that allows it to implement more broadly the experiences from more progressive countries, as well as the exemptions for hardship cases. Furthermore, climatic conditions should be taken into account.

Any further reductions will require resources in the form of education, training and additional resource support. In some countries that have already achieved significant reductions, further reductions will likely depend on the development of new products, technologies and information.

In fact, one of the interesting and important findings of this research is that it has demonstrated how much more widespread IPM-type practices have become in golf in recent years, more than was previously perceived, and how much pesticide reduction has already taken place. This misperception is likely to be at least due to the rather underdeveloped reporting systems and lack of good statistical data and information in many countries, which make it difficult to monitor use levels and trends of pesticide uses.

Appendix 1: Questionnaire for “Higher Intervention” Countries

The Golf Sector in Country: XXXXX

- 1. Number of golf courses: XXX
- 2. Total land area covered by golf courses (hectares): XXX
- 3. Total revenue of golf courses (€m): XXX
- 4. Total profit of golf courses (€m): XXX
- 5. Total number of employees on golf courses: XXX
- 6. How important is international tourism to golf in your country?

Very important	
Somewhat important	
Not important	

- 7. If very important, which countries do most tourists come from?

- 8. If very important, which countries does your country compete most with?

- 9. Comments:

Pest Management Practice in Country: XXXX

- 10. Please briefly describe usual pest management practice on golf courses in your country.

- 11. How do pest management practices vary through the year (if at all)?

- 12. What factors are most important in determining pest management practices in your country, and why? (e.g. climate, tradition, cost, product availability, others)?

13. What is the total average cost of pest management per course (€)? XXXXXXXX
14. What is the split of the costs of pest management across different inputs (labour/pesticide/machinery/other (please specify))?

Labour	XX %
Pesticide	XX %
Fertilizer	XX %
Machinery	XX %
Other	XX %

15. What is the average rate of pesticide application per course/hectare (kg active ingredient)? XXXX
16. Comments

Prospects for pesticide reductions in Country XXX

In recent years, there has been pressure at the European Union level to reduce pesticide use, including on golf courses, but some countries have already been strictly regulated by their respective governments to reduce pesticide use on golf courses even further.

Over the years, greenkeepers have learned to adapt their methods in such a way that they can now achieve good quality levels, and at comparable overall cost. However, it was determined that some minimum level of pesticide use is necessary and cannot be avoided if course quality is to remain acceptable.

17. How much would you estimate pesticide use has reduced in your country over the last 10 years? Do you have any formal reports and quantitative data to support this?

18. How has pest management changed to permit these reductions in pesticide use?

19. What costs were incurred in making these changes (training, machinery, new products, public information, others)?

20. How do the total costs of pest management now compare with before these changes?

Same		Comments
Higher – how much	XX %	
Lower – how much	XX %	

21. Have there been any negative (or positive) effects on course quality? Please explain.

22. Do you think further reductions in pesticide use could be achieved in future, whilst still maintaining course quality? If yes, how much reduction at what costs?

23. What do you think is the minimum level of pesticide use consistent with acceptable course quality? Please explain.

24. What would be the impacts on course quality of moving to zero pesticide use?

25. What impacts would this have on the golf sector in your country?

26. Comments

Appendix 2: Questionnaire for “Lower Intervention” Countries

The Golf Sector in Country: XXXXX

1. Number of golf courses: XXX
2. Total land area covered by golf courses (hectares): XXX
3. Total revenue of golf courses (€m): XXX
4. Total profit of golf courses (€m): XXX
5. Total number of employees on golf courses: XXX
6. How important is international tourism to golf in your country?

Very important	
Somewhat important	
Not important	

7. If very important, which countries do most tourists come from?

8. If very important, which countries does your country compete most with?

9. Comments:

Pest Management Practice in Country: XXXX

10. Please briefly describe usual pest management practice on golf courses in your country.

11. How do pest management practices vary through the year (if at all)?

12. What factors are most important in determining pest management practices in your country, and why? (e.g. climate, tradition, cost, product availability, others)?

13. How important are course aesthetics in deciding pest management practices in your country?

Very important	
Somewhat important	
Not important	

14. How important is equal competition in deciding pest management practices in your country?

Very important	
Somewhat important	
Not important	

15. What is the total average cost of pest management per course (€)? XXXXXXX

16. What is the split of the costs of pest management across different inputs (labour/pesticide/machinery/other (please specify)?

Labour	XX %
Pesticide	XX %
Fertilizer	XX %
Machinery	XX %
Other	XX %

17. What is the average rate of pesticide application per course/hectare (kg active ingredient)? XXXX

18. Compared with five years ago, has the rate of pesticide application increased (how much?)/decreased (how much?)/stayed the same? Do you have any formal reports and quantitative data to support this?

19. If the rate of pesticide application has changed, what have been the reasons for that?

20. Comments

Prospects for Pesticide Reductions in Country: XXXX

In recent years, there has been pressure at the European Union level to reduce pesticide use, including on golf courses, but some countries have already been strictly regulated by their respective governments to reduce pesticide use on golf courses even further.

Over the years, greenkeepers have learned to adapt their methods in such a way that they can now achieve good quality levels, and at comparable overall cost. However, it was determined that some minimum level of pesticide use is necessary and cannot be avoided if course quality is to remain acceptable.

21. What do you think would be the effect on course quality of introducing these reductions in your country, *without changing other aspects of pest management practice*?

	Impact on course quality	
Reduction	Acceptable (Y/N)	Unacceptable (Y/N)
60%		
80%		
90%		

22. Given enough time and the chance to change pest management practices, do you think acceptable course quality could be achieved with these reductions in pesticide use?

Reduction	Acceptable quality achievable (Y/N)
60%	
80%	
90%	

23. What period of time do you think would be needed to change management practices and achieve acceptable quality levels (or would acceptable quality not be achievable)?

	Time to achieve acceptable quality	
Reduction	Years	Not achievable
60%		
80%		
90%		

24. Apart from time, what else do you think you would need to achieve these types of reductions in pesticide use (resources, training, assistance, others?)?

25. What are the main barriers to reducing pesticide use in your country ?

26. What do you think is the minimum level of pesticide use needed to achieve acceptable quality in your country?

27. How and why do you think pest management needs to differ between your country and countries already at a minimal level as per sport specific governmental restrictions? Do you have any quantitative data to support this?

28. Comments

Golf survey

Clients: UEFA & EGA

Project: Impact assessment on the removal of pesticides by the new EU regulations on the sustainable use of plant protection products

Date: April 2023

Introduction

The European Commission has put forward a new Sustainable Use Regulation (SUR) governing the use of Plant Protection Products (PPPs). In its current form, this new regulation would mean that PPPs, including fungicides, herbicides, insecticides, and plant growth regulators, would be withdrawn from use for those managing "sensitive areas" which would include all sports turf.

STRI has been commissioned by UEFA and the EGA to put together an impact assessment on how the removal of PPPs would affect sports facilities (with a focus on football and golf courses). We are looking to collect data to understand:

- How much, and what types of PPPs are used across the EU and at different levels of sport?
- The awareness of Integrated Turf Management (ITM) and how this is being implemented across the EU and at different levels of sport?
- The impact of the withdrawal of PPPs on turf management, facility operation and finances/budget.

This is a vital opportunity for individual golf courses to put forward the efforts they are making to use ITM based approaches, reduce PPP use and, most importantly, to identify the impacts (turf, operational, financial, and social) to their facility.

Rather than trying to contact all golf courses in your country (given the time constraints for producing the Impact Assessment), we have agreed to contact key national stakeholders. This will be done through an online video call. The aim of this process is to gather information and data for each of the selected countries.

This document has been circulated prior to the call to allow time for stakeholders to look out any information and data that they can provide on the topics highlighted in the following section.

Where PPP is used in the following questions, this means all authorised products in the following categories:

- Fungicides
- Herbicides
- Insecticides
- Nematicides
- Plant growth regulators

Information/data required

- Do you have, or are you aware of, any sources of data on PPPs available in your country?
- Do you have, or are aware of, any sources of data on the quantities of PPPs being used on golf courses, and is this split into different playing surfaces (greens, tees, fairways etc)?
- Is there any data available on current and historical PPP usage? The aim is to identify any reductions in overall PPP usage, whether that is for an example golf course, or as the industry in the country as a whole.
- Are there any restrictions to PPP availability/use in your country? When and what restrictions had a significant impact?
- Case studies of how golf courses are responding to existing restrictions that are in place in a number of EU member states (if you have restrictions, how are golf courses coping, what are they doing differently, and how is this affecting both turf management and the performance of the playing surfaces?).
- Do you have any information on how IPM/ITM techniques are being used by golf courses in your country to reduce or even eliminate PPP usage?
- What IPM/ITM training and knowledge sharing is being done in your country within the golf industry?
- What is likely to be the impact of a total ban on PPP usage on golf clubs in your country, and do you have any data (such as risk assessment-based approach) that might back up these impacts?
- How prepared are golf courses in your country to be able to cope with a ban on PPP usage?
- By what percentage (%) do you think it would be possible to reduce PPP usage by in your country, and what would the timescales be?
- What innovations are being used in your country to help reduce the need for plant protection products?
- Through this process, we are also looking for specific examples of:
 - o Best practice being followed
 - o Restrictions on PPP usage and their impacts
 - o The extent and nature of the challenges likely to result from the SUR
 - o What are the opportunities that might arise from the SUR

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Appendix 3



The impact of the removal of Plant Protection Products (PPP's) on sports turf

Welcome to this survey carried out by STRI on behalf of UEFA and the European Golf Association (EGA)

The European Commission has put forward a new Sustainable Use Regulation (SUR) governing the use of Plant Protection Products (PPPs). In its current form, this new regulation would mean that PPPs, including fungicides, herbicides, insecticides and plant growth regulators, would be withdrawn from use for those managing "sensitive areas" which would include all sports turf.

STRI has been commissioned by UEFA and the EGA to put together an impact assessment on how the removal of PPPs would affect sports facilities. We are looking to collect data to understand:

- How much and what types of PPPs are used across the EU and at different levels of sport?
- The awareness of Integrated Turf Management (ITM) and how this is being implemented?
- The impact of the withdrawal of PPPs on turf management, facility operation and finances/budget.

This is a vital opportunity for individual sports facilities to put forward the efforts they are making to use ITM based approaches, reduce PPP use and, most importantly, to identify the impacts (turf, operational, financial, and social) to their facility. Please answer all questions on the basis that the SUR will be enacted in its current form and that PPPs will no longer be available in the near future.

Where PPP is used in the following questions, this means all authorised products in the following categories:

- Fungicides
- Herbicides
- Insecticides
- Nematicides
- Plant growth regulators

The questionnaire should take approximately 10 minutes to complete, and you will require information on your PPP usage.



The impact of the removal of Plant Protection Products (PPP's) on sports turf

1. Which category best describes your organisation

- ☐ Professional football club
- ☐ Amateur football club
- ☐ Local authority/municipality
- ☐ Pitch maintenance contractor
- ☐ Other (please specify)

2. In what country is your organisation based?

3. Who is responsible for the management of the natural grass (including hybrid) pitches at your facility?

- ☐ Volunteer grounds people
- ☐ Local authority/municipality
- ☐ In-house grounds maintenance team employed by the facility or club
- ☐ Contractor
- ☐ Other (please specify)

4. Please select the box which best describes the level of football played on the natural grass (including hybrid) pitches that you manage. (You may select multiple options)

- ☐ Grassroots (community level) football
- ☐ High level amateur football
- ☐ Semi-professional football (lower professional leagues or associated training ground)
- ☐ High level professional football (training facility)
- ☐ High level professional football (stadium pitch)
- ☐ Other (please specify)

5. How many natural grass (including hybrid) pitches are you (or your organisation) responsible for managing? (Please enter a number against each category)

Training pitches

Match pitches (<30,000 capacity venue)

Match pitches (30,000+ capacity venue)

6. How many natural grass (including hybrid) pitches do you typically apply plant protection products to? (Please enter a number against each category)

Training pitches

Match pitches (<30,000 capacity venue)

Match pitch (30,000+ capacity venue)

* 7. How many applications of PPPs do you make in the following categories over a typical 1-year period?

	Training pitches	Match pitches (<30,000 capacity venue)	Match pitches (30,000 + capacity venue)
Fungicide			
Herbicide			
Insecticide			
Nematicide			
Plant growth regulator			

* 8. How many litres (before mixing with water) of PPP's do you apply on the natural grass/hybrid pitches over a typical 1-year period?

	Training pitches	Match pitches (<30,000 capacity venue)	Match pitches (30,000 + capacity venue)
Fungicide			
Herbicide			
Insecticide			
Nematode			
Plant growth regulator			

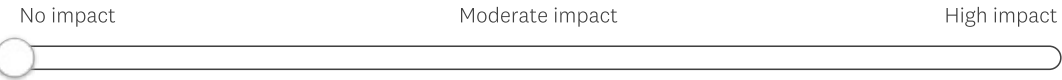
9. Have you reduced the amount of PPP's you apply to your pitches over time?

- ☐ Not applicable - we don't apply any PPP's
- ☐ No - we've not reduced PPP usage
- ☐ Yes - we've reduced our PPP usage. Please specify how approximately many litres of product (before mixing with water) you've managed to reduce PPP usage by

10. Do you implement any of the following integrated pest management (IPM)/integrated turf management (ITM) techniques to help reduce the amount of PPP's applied to natural grass (including hybrid) pitches? Please select all techniques that you implement

- ☐ Removing dew from the grass plant in the morning or mange dew in some other way.
- ☐ Irrigate to meet plant requirements and not over water.
- ☐ Irrigate at appropriate times of the day so the turf is not wet overnight.
- ☐ Manage drainage so that the pitch does not hold onto too much water or is too soft.
- ☐ Managing wear and pitch usage to minimise stress and grass loss.
- ☐ Optimising plant nutrient inputs to only provide what the grass needs and not over apply fertiliser.
- ☐ Use of plant biostimulants to help reduce the effect of stresses such as wear, light, drought, temperatures etc.
- ☐ Focus on promoting sustainable turf density to minimise weed invasion.
- ☐ Modify the growing environment to help support the grass plant (for example use of lighting units or pitch side fans).
- ☐ Make sure mower blades are sharp and properly adjusted to minimise leaf wound opening time.
- ☐ Mow regularly at an appropriate height of cut to avoid removing too much leaf material and stressing the plant.
- ☐ Understand the conditions that favour turf diseases, weeds and pest and actively work to avoid those conditions, thereby propomoting the turf and not the turf problem.
- ☐ Treat pitch with UV-C light to help prevent disease outbreaks, e.g. SGL UVC180
- ☐ Other (please specify)

11. Please indicate below, using the scoring system provided, how you think your facility will be affected by the removal of PPPs.



12. Have you encountered any of the following problems on any of the natural grass (including hybrid) pitches that you manage?

- ☐ Turf diseases
- ☐ Weed invasion
- ☐ Damage from insect pests
- ☐ Damage from nematodes

13. If you would like to participate further by providing additional information, please provide contact details and one of the team will be in touch to gather this information (typically this will be done in English via an online video call):

Name

Company

Address

Address 2

City/Town

State/Province

ZIP/Postal Code

Country

Email Address

Phone Number

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