UEFA PITCH QUALITY GUIDELINES - 2025 EDITION

CONTENTS

Disclaimer

These guidelines have been drafted to provide generic advice in respect of pitch design, maintenance, preparation, management, monitoring and assessment. UEFA has taken all reasonable care to ensure that the information contained in these guidelines is accurate in all material respects. However, neither UEFA nor any of its representatives, agents or employees make any representation or warranty or accept any responsibility for the accuracy or completeness of any of the information contained in these guidelines, nor shall they be liable for any loss or damage suffered by any party in their application of these guidelines. Independent advice should always be sought from an expert for specific and tailored guidance in respect of each individual pitch.

INTRODUCTION

Pitch presentation and playing conditions need to be of the highest quality for professional football matches. In practice, this means that pitches should:

- be well-drained, smooth and level;
- be safe for the players;
- allow for optimal play;
- have a good visual appearance.

Pitch conditions influence the quality of the football being played and are a reflection of the competition, the stadium, the host club/national association and the country. Every pitch should be comparable in appearance and performance to other pitches considered to be of a similar international standard.

It is very important that all parties work as a team to ensure the best possible playing conditions and visual appearance. Not only must players be able to perform to the best of their abilities on a smooth and stable playing surface; it is also important to ensure that matches are not compromised by a pitch's inability to cope with adverse or challenging weather conditions.

This document provides an overview of the pitch quality guidelines for stadiums hosting UEFA matches, including:

- pitch construction and infrastructure requirements;
- pitch maintenance and match preparation guidelines;
- pitch quality assessment and monitoring procedures.
- sustainability and Integrated Turf management practices

The guidelines include tasks to be carried out when overseeing pitch preparations for UEFA matches. As such they are aimed primarily at those responsible for pitch management, strategy and resource planning. Given the wide geographical spread of countries that host UEFA matches and the significant differences in climatic conditions experienced, some of the content of this document is inevitably fairly generic. It is therefore very important for those applying these generic guidelines to be fully familiar with any local specificities and constraints that will affect the development and management of their respective pitches (e.g. weather conditions, availability of materials and equipment, local competence and support services).

2 KEY ROLES AND RESPONSIBILITIES

2.1 Responsibilities of the head groundskeeper

The head groundskeeper is responsible for the successful delivery of the pitches used for matches and training sessions at his or her stadium. The importance of this job cannot be overestimated as the groundskeeper's abilities will be on public display, on-site and in the media, through the appearance and performance of the pitch.

The key responsibilities of the head groundskeeper in relation to UEFA matches are:

- agronomic tasks relating to pitch preparation and maintenance;
- operational tasks relating to pitch preparation and maintenance;
- accommodation of official training sessions;
- post-match pitch repairs;
- dealing with challenging weather conditions before and during matches.
- liaising with UEFA Match operations and venue teams regarding Pitch protection maps and other matters

These responsibilities are fulfilled by:

- ensuring that all equipment is properly calibrated, well maintained and functional;
- thoroughly planning all staffing and pitch maintenance activities according to the schedule of events to be held at the stadium;
- ensuring that all staff perform their tasks to the best of their abilities;
- managing and coordinating staff to ensure the various pitch-related tasks are conducted as required;
- carrying out mowing, fertilising, spraying and specialist tasks;
- keeping accurate notes and records;
- reporting pitch ailments, problems and issues immediately;
- ensuring that the pitch is immaculately presented;
- maintaining the necessary range and stock of fertilisers, plant protection products and other consumables;
- monitoring weather conditions closely.

The head groundskeeper should keep a diary of all pitch operations carried out by his or her staff. This diary is an operational document which should be available for review by UEFA, stadium management officials and turf consultants. The head groundskeeper is also responsible for coordinating equipment operators and divot repair staff. It is the head groundskeeper's responsibility to ensure that such staff are adequately trained and supervised.

Increasingly there is a need for Groundskeepers to carry out their responsibilities in a sustainable way taking into account best practices in all of their day to day tasks, this guideline will share some suggested examples of best practice when it comes to sustainability and reference can also be made to the UEFA Sustainable infrastructure guidelines

https://editorial.uefa.com/resources/027b-168e898b309b-c76f49dada9e-1000/the_uefa_sustainable_infrastructure_guidelines.pdf

2.2 Responsibilities of pitch contractors

If outside pitch contractors are used for pitch maintenance and renovation activities, it is important that they understand their role and responsibilities in the delivery of pitches for UEFA matches.

A pitch contractor is expected to:

- provide maintenance equipment as per UEFA's guidelines and recommendations;
- ensure that backup equipment is available and that if equipment is being shared between sites, it is always available where it is required;
- ensure that the products recommended and required for pitch maintenance are available on-site;
- ensure a sufficient number of staff are available to perform the activities required;
- ensure all staff are fully trained and competent to carry out their work in a safe and high-quality manner;
- ensure staff carry out the tasks and functions expected of them to a high standard and on time.

Even if outside pitch contractors are used for pitch maintenance and renovation activities, it is recommended that every stadium has a direct employee with qualifications and/or experience in turf management to oversee the contractors' operations and performance.

2.3 Responsibilities of turf consultants

UEFA may appoint turf consultants for specific matches and/or to provide ongoing pitch monitoring through the UEFA Pitch Quality Support Programme.

Turf consultants are expected to:

- develop a good understanding of a specific pitch's history and the current resources and capabilities available for its management (UEFA issues a standard pitch construction and management questionnaire for this purpose);
- carry out site visits to assist with pitch maintenance and preparation;
- advise on pitch operations and check that pitch operation teams are effective and efficient;
- carry out pitch performance tests and make recommendations accordingly;
- provide support and advice on pitch preparation, maintenance, use and repair;
- identify and advise on high-risk or high-priority pitch performance issues;
- update UEFA's databases on pitch characteristics and performance.

The role of the consultants includes providing advice and guidance as to the best practices when it comes to sustainable pitch management processes.

3 PITCH DESIGN AND INFRASTRUCTURE

3.1 Key considerations

For a pitch to be well designed, constructed and maintained, the following six points must be adequately addressed in light of local resources and conditions:

1. Selection of construction method and materials
2. Design and quality of drainage, irrigation and undersoil heating systems
3. Availability and quality of maintenance equipment, systems and consumables
4. Availability of supplementary lighting and pitch covers where the natural conditions are not suitable for year-round growth
5. Use of appropriate materials for weed, disease and pest control
6. Staff training and turf industry support services

A badly designed, constructed or maintained pitch will negatively affect the quality of play, limit the number of matches that can be played, increase the risk of matches being cancelled and be expensive to maintain. Many site-specific factors need to be considered when constructing high-quality pitches, including:

site-specific factors need to be considered when constructing high-quality pitches, including:

- the drainage and geotechnical characteristics of the site;
- the load-bearing strength and shape of the formation layer (sub-base);
- the extent of shade and restricted air movement;
- the need for undersoil heating and/or pitch cover systems (UEFA has specific expectations in relation to undersoil heating and pitch cover systems in certain environments, as stipulated in the UEFA Stadium Infrastructure Regulations (2025 edition) and section 3.5 of this document);
- the events schedule and planned usage of the pitch, including non-sporting events such as concerts;
- the risk of matches being cancelled as a result of the weather (e.g. in case of heavy rainfall, ice, snow, extreme heat or drought);
- the implications of retrofitting infrastructure (i.e. installing a new pitch in an existing stadium);
- the time available for pitch construction and turfgrass establishment (grow-in);
- the resources and budget needed to construct and maintain the pitch.

Some stadiums may appoint their own specialist turf consultant to:

- determine precise pitch design requirements;
- ensure that construction work is carried out in application of appropriate standards and suitable materials;
- provide an ongoing management programme for the pitch, including for any non-sporting events.

3.2 Drainage and profile design

A pitch that drains freely is better able to provide the required playing characteristics on the surface. The minimum design for a professional football pitch usually includes an imported sand-dominant root zone overlying a pipe-drained sub-base (Fig. 1), together with an automatic pop-up irrigation system. In some cases, the sand-dominant root zone can be created by mixing known quantities of a carefully selected sand with the existing soil in order to improve the physical properties of the surface layer.

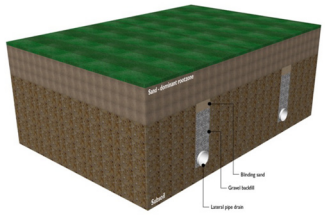


Fig. 1. Sand-dominant root zone overlying a pipe-drained sub-base

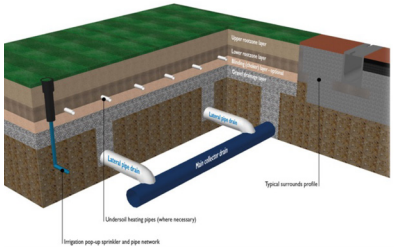


Fig. 2. Conventional sand-over-gravel suspended water table pitch design with automatic pop-up

Ideally, there should be a constructed gravel drainage layer between the sand-dominant root zone and the underlying pipe drainage system (Fig. 2). A gravel drainage layer is primarily used in wet areas, where good drainage is essential, but it can also be useful in dry climates, where water tends to be held in the sand profile layer.

The selection of compatible materials for the different layers is critical to the success of this type of pitch construction, as is the correct calculation of the sizing, depth and spacing of lateral and main drainage pipes to a suitable outfall.

Laboratory analysis of all materials (sand, gravel, etc.) used to build any pitch is absolutely essential in order to ensure that materials with the right particle sizes are used. Specialist advice should always be sought.

Additional pitch infrastructure components may include:

- specialist turf reinforcement systems;
- undersoil heating systems;
- pitch cover systems;
- vacuum and ventilation systems for large stadiums with particularly difficult growing environments;

Many of these additional components are elaborated on below. The use and choice of such additional components will depend on the climate and local weather patterns, the micro-climate within the stadium bowl (e.g. light, airflow and ventilation), the species and cultivar of turfgrass being grown, the desired pitch quality and the budget available.

3.3 Irrigation systems

There are several systems used to irrigate pitches (e.g. self-travelling sprinklers, static sprinklers, canon sprinklers and pop-up sprinklers). It is strongly recommended that only fully automatic pop-up irrigation systems be installed in pitches used to host UEFA matches, because such systems are easier to control and manage and ensure uniform distribution of water, fast irrigation times and a syringe cycle of water post-match and at half-time. An automatic pop-up irrigation system also can apply water during the night, thereby reducing evaporation losses.

The effects of climate change can cause substantial damage to football infrastructure and these risks need to be acknowledged, addressed and mitigated. More detailed information on this topic can be found in the Sustainablility and ITM appendices.

Fig. 3. Types of irrigation systems used in the sports turf industry. From left o right: cannon type, self-travelling type, static type and pop-up type. Only automatic pop-up irrigation systems are considered appropriate for pitches used to host UEFA matches

Like with pitch drainage and profiles, designing a fully automatic pop-up irrigation system is a specialist task. The most important considerations are:

- the supply, storage and quality of irrigation water (mains, bore hole, etc.);
- the quantity of irrigation water required;
- the uniform application of irrigation water;
- the number and arrangement of irrigation heads;
- 'block' or 'individual head' control.

A suitable system may have around 20 pop-up sprinkler heads per pitch but some have 24 to 35 with full overlap between adjacent sprinklers (Fig. 4). Most existing irrigation systems have solid plastic sub-surface infield sprinkler heads with a small diameter at the surface (approx. 50mm). Infield sprinkler heads tend to be located 10-15mm below the soil surface and should not be detectable on the surface. However, some pitches will have much larger sprinkler heads; in these situations, the irrigation head must be suitably protected with a turf cup. The ultimate aim is player safety – any irrigation system that is not safe for players is unacceptable. Ground staff must ensure that sprinklers do not wash out the area around the head. Grass coverage must be uniform around irrigation heads and erosion must not be allowed to occur.

Alternative irrigation options include perimeter pop-up sprinklers with mobile sprinklers in the centre of the pitch. However, coverage is less uniform with such systems and there is greater reliance on ground staff to carry out the irrigation.

Care should be taken to use water in an efficient way including where possible systems that collect and re-cycle rainwater.

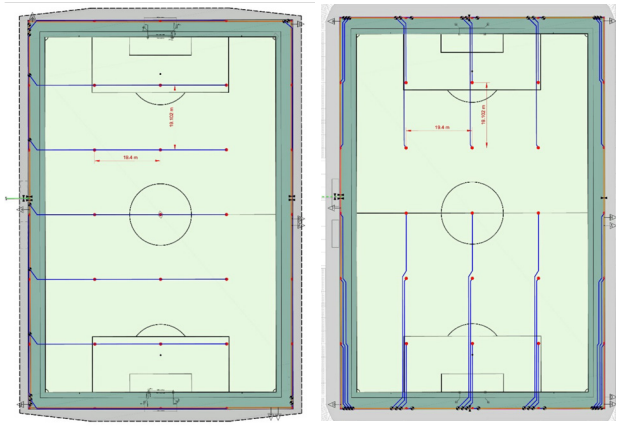


Fig. 4. Example of a 'block' type irrigation design (left) v individual head control layout (right), with both designs showing 'head-to-head' coverage

It is advisable to have one person working at a stadium who is skilled in the basic servicing of the minor components of fully automatic irrigation systems, including servicing pop-up sprinklers and valves and changing sprinkler heads and nozzles. In the absence of a capable member of ground staff, it is worth having access to an irrigation engineer who can be on standby for matches.

To guarantee irrigation systems perform properly, regular checks should be made to ensure that:

- all sprinklers pop up;
- all sprinklers rotate and all at the same speed;
- all sprinklers retract correctly;
- no nozzles are blocked;
- no sprinklers are leaking (i.e. no wet patches on the pitch);
- all sprinklers are set at the correct level so that they do not pose a safety risk for players;
- all sprinklers are aligned correctly (vertically);
- all sprinkler nozzles are of the correct size.

A reliable supply of water must be available. This is often a bore hole source, although sometimes the mains water supply is used. The quality of water is equally important as turf quality can be significantly diminished if the water contains a high level of dissolved salts, particularly in drier climates.

Irrigation requirements may reach 8-10mm per day in Mediterranean, continental and subtropical climates (64-80m3 for an 8,000m2 pitch), although requirements will be significantly lower in cooler, more temperate climates. In case of failures in the water supply, it is advisable to have sufficient water storage on-site (in tanks) to ensure a safety margin of at least 24 hours until the water supply can be restored.

3.4 Specialist turf reinforcement systems

Turf reinforcement systems attempt to combine the playing quality benefits of natural turfgrass with the practical strengthening and engineering advantages of artificial materials. Turf reinforcement systems can be grouped into three broad categories:

1. Intact fabrics or artificial turf carpet placed into or a little below the surface, filled with a sand-based material in which natural turfgrass is grown. This type of system lends itself to being used as part of a big roll turf system for the immediate establishment of a playable surface or rapid repair of damaged areas on an existing surface.

2. Individual strands of artificial turf fibres usually 200mm long, stitched vertically into the sand-dominated profile to a depth of 180mm at very close centres (typically 20mm), leaving 20mm of the artificial turf fibres above the surface like blades of grass. This type of system is particularly good for maintaining surface smoothness and the appearance of turfgrass once the natural turfgrass has worn away.

3. Randomly oriented elastic material or plastic (e.g. polypropylene) fibres or mesh elements that are incorporated into the upper layer of the sand-dominated profile usually before it is laid but sometimes in situ. These systems are profile stabilisers and may increase the load-bearing strength and shock absorbency properties of the root zone.

The expression 'hybrid' systems now seem to be commonly used to describe turf reinforcement systems because of the mixture of natural and artificial materials they represent. Key considerations when deciding whether to install a turf reinforcement system into a sand-dominated root zone and which type of system to install include:

- the cost of the system;
- the specific features of the system in relation to the intended use of the playing surface;
- the intended management/maintenance requirements of the playing surface;
- the species of turfgrass grown;
- the longevity of the system (can it be easily renovated?);
- the cost of disposal (is the product classified as hazardous waste?).

Fig. 5. Types of turf reinforcement system. From left to right: carpet, stitched and fibre

It is strongly recommended that all clubs/national associations hosting UEFA matches invest in reinforced pitches. There are many systems available to suit different budgets and stadium business models. A three-year period is a good timeline to allow for planning and installation.
over the course of the previous club and national team competition cycles a trend can be seen with elite venues increasingly opting for the stitched and carpet hybrid models. in particular where venues stage final tournaments such as a UEFA European championships, such systems provide an insurance policy to provide a stable surface across several match days, Match Day minus 1 training sessions and ceremony rehearsals. Likewise if managed correctly these systems can also be compatible with the modern Stadium events operations approach to hosting concerts or non-sporting events at any stage in the calendar year.

Locally sourced materials should be utilised where possible to reduce transport distances and minimise the overall carbon footprint of the imported materials. Consideration should also be given to the choice of materials to ensure they are from sustainable sources with a low environmental impact. Further information can be found in the UEFA Sustainable infrastructure Guidelines document: https://documents.uefa.com/v/u/vA3mtxAaLUaDx6ASuM7Ifg

3.5 Undersoil heating and pitch cover systems

Undersoil heating systems use buried water or glycol-filled pipes (a few systems use electrical wires instead of pipes) to heat the profile in order to help maintain a frost and snow-free profile during winter months and speed up turf recovery at the end of the winter period. The heating unit in undersoil heating systems (typically a gas or oil-fired boiler) usually has low, high and standby modes with intermediate settings for frost, severe frost, ice and snow.

Key considerations:

- An undersoil heating system should be installed if local climatic conditions regularly result in frost or snow.
- Venues with a lesser risk of frost or snow should at least invest in pitch cover systems so that some protection is available if and when required.
- Undersoil heating pipes should be at least 250mm below the surface to allow ground staff to carry out essential pitch maintenance.
- The pipes are typically spaced 250-300mm apart.
- Undersoil heating systems are often divided into separate zones on the pitch so that each zone can be heated individually. This is particularly useful if some sections of the pitch receive more prolonged shade than others during winter months.
- Undersoil heating systems should be installed under the entire natural turf area, including the surrounds (minimum of 2m for assistant referees and player over-runs).
- A consistent and known depth of installation is vital to avoid potential damage from maintenance operations and the installation of stitched turf reinforcement systems

At the time of writing Energy costs are increasing at a great rate due to a variety of global factors putting pressure on commercial and domestic energy use. This increase in costs should be considered when looking at potential pitch heating solutions and other infrastructure.

The design and installation of undersoil heating systems is a specialist task. Some systems involve laying the heating pipes in special racks directly on top of the gravel drainage layer (Fig. 6), while other methods of installation involve drawing heating pipes through the profile from the surface using special tractor-mounted equipment

Fig. 6. Racks used over the gravel drainage layer to support undersoil heating pipes prior to root-zone placement

Fig. 7. Installing undersoil heating pipes through the profile

Fig. 8. Completed installation

Fig. 9. Pitch covers can be used in conjunction with undersoil heating to maintain turfgrass growth through winter

It is strongly recommended that all appropriate stadiums that have undersoil heating systems and are used to host UEFA matches provide certification at the beginning of the season to demonstrate that their heating boiler has been properly serviced and is ready for the forthcoming winter.

3.6 Vacuum and ventilation systems

It is important to consider the need for vacuum and ventilation systems at stadiums with challenging growing environments and/or major matches to host (e.g. finals or final tournaments). Such systems:

- are powerful pumping and air-distribution systems designed to blow conditioned air into the profile;
- can decrease or increase soil temperature to extend the growing season or control turfgrass dormancy (Fig. 10);
- can also be switched to suction mode to remove excess rainfall from the surface in a matter of minutes, for example if there is a severe thunderstorm shortly before the start of a match.

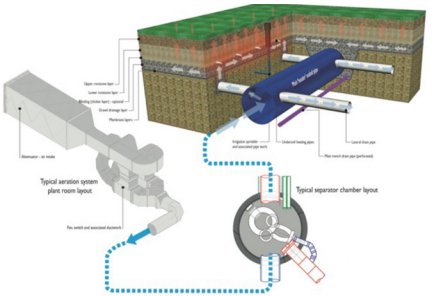


Fig. 10. Schematic diagram of a pitch vacuum and ventilation system (left) and installed blower unit (right)

Pitch side fans are also used in hotter climates to provide airflow within a stadium and a degree of surface cooling (Fig. 11). Some fans simply blow air across the pitch, while others produce water vapour to give an additional degree of cooling at the pitch surface, although care must be taken with the management of such fans, to avoid increasing the risk of turf disease.

Fig. 11. Examples of pitch side ventilation and cooling fans used to manage turf health

3.7 Artificial lighting systems

Appendix 4 (section 4.1.1) provides details on how to achieve optimal natural sunlight levels. In many cases, however, the stadium design and/ or location will make artificial lighting necessary.

Artificial lighting rigs can supply sufficient photosynthetically active radiation to promote the active growth of temperate (cool- and warm-season) turfgrass in stadiums and allow acceptable recovery from wear and tear. It's important to note that the required lighting hour period is dependent on the natural light transmission to the playing surface, playing schedule, maintenance and environmental conditions.

The light output from artificial lighting rigs includes a photosynthetically active wavelength of 400-700nm (Fig. 12). Light levels are measured in units of µmol/m^2 (micromoles per square metre).
Key considerations:

- The largest rigs currently on the market have a lighting footprint of between 360 and 440m^2.
- A lighting configuration of 3, 6 or 9 large rigs for the full pitch and multiple small rigs for high wear areas is commonly used
- A light transmission analysis, insights into the playing schedule, and the climate statistics are needed to calculate exactly how many lighting rigs are required to provide sufficient light coverage of a football pitch
- Fertiliser and irrigation programmes should be adjusted when lighting units are in use.
- The power source layout will need to be considered before installation.
- The average use of a full system of units varies between 5,000 and 30,000 hours per season.

Traditionally, the lighting rigs that were used had conventional high-pressure sodium lamp technology (HPS), which also provides a source of heat – a useful attribute in cooler, temperate climates. However, the market is transitioning to lighting rigs with light-emitting diodes (LED), which is a more sustainable solution with agronomical benefits. LED lighting rigs with infrared have the ability to control light and heat separately. This offers better control of the microclimate and enables energy savings.

The main advantage of grow lighting technology is that it ensures a better, safer, and more consistent playing surface throughout the year. In the past, returfing was necessary to maintain good pitch quality during the winter playing season. Nowadays, returfing has become redundant most of the time, proving the cost-effectiveness of grow lighting technology.

Fig. 12. Lighting rigs with folding arms

It is strongly recommended that all stadiums that are used to host UEFA matches and have a known shade problem carry out a light/shade study of their pitch to ensure that sufficient lighting rig resources are provided for adequate grass growth in all areas of the pitch.

In summary, the combination of undersoil heating, pitch covers and artificial lighting rigs is very effective in cold climates, keeping cool-season pitches playable during winter months (Fig. 13).

Fig. 13. Combination of lighting rigs and pitch covers

3.8 Turfgrass selection

A stadium's choice of turfgrass will depend on its location and climate. This is another highly specialist area, on which these guidelines can provide only very basic instruction.

There are two main types of turfgrass – cool-season turfgrass and warm-season turfgrass. The two types vary considerably in their basic biology and climate adaptation, and both can be found on pitches in various locations across countries that host UEFA matches:

- A light transmission analysis, insights in the playing schedule, and the climate statistics are needed to calculate how many lighting rigs are required to provide sufficient light coverage of a stadium pitch.
- Fertiliser and irrigation programmes should be adjusted when lighting units are in use.
- The power source layout will need to be considered before installation.
- The average use of a full system of units is varies between 5,000 and 30,000 hours per season.

The species of turfgrass selected will depend on factors such as tolerance to heat or cold, drought resistance and disease resistance. Extensive turfgrass breeding work has been carried out to improve the wear tolerance and local adaptation of individual cultivars (varieties) of each species.

Turfgrass selection is particularly tricky in those parts of the world that experience a relatively wide range of temperatures, in particular those countries with continental transition zone climates and some Mediterranean/dry summer subtropical climates. In such climate zones, cool-season grasses are poorly adapted to summer conditions, when high temperatures, water availability and possible salt accumulation may be significant issues. Conversely, warm-season grasses are intolerant of the colder winter conditions and tend to go brown and dormant. Consequently, it is often necessary to overseed warm-season turfgrass with a cool-season species before the onset of winter. Such transitioning represents the most challenging aspect of turf management.

3.9 Pitch perimeter

Ideally, there should be a minimum of 1m of natural turf extending beyond the touchlines of any pitch, with good quality artificial turf extending another 2 to 3m or as far as the advertising boards, depending on the space available (Fig. 14). The artificial turf should replicate as closely as possible the quality of the natural turf in terms of surface hardness, vertical deformation and energy restitution.
There are numerous examples of players suffering injuries when running on artificial turf in the pitch perimeter due to several factors including the poor quality of the product and the playing surfaces having different performance qualities including hardness, deformation and energy restituiton

Fig. 14. Ideal scenario of at least 1m of natural turf extending beyond the touchline

4 PITCH MANAGEMENT

4.1 Staff resources

Pitch maintenance before and after matches requires sufficient numbers of staff with the necessary training. The exact number of staff required will be influenced by the amount and quality of machinery and other equipment available, whether any of the work is carried out by external pitch contractors and whether ground staff have other duties around the stadium.

As a general indicator, the following numbers of ground staff are recommended for major stadiums:

- Core staff: up to 5
- Additional staff for matchdays: minimum of 3 or 4
- Additional part/full-time staff: 8 to 10

The above numbers are based on the need to be able to prepare pitches with a short turnaround time between matches, deal with the many pitch-related liaison activities that arise on matc

4.2 Equipment

Table 1 below provides an overview of the minimum equipment recommended to ensure a pitch is well maintained throughout the season. This list is by no means exhaustive and specialist advice should be sought on a case-by-case basis.

Equipment	Description	Quantity	Required specifications
Mowers	[1]Pedestrian cylinder mower	2 (min.) 4 (preferred	• 700-900mm mowing width • Mowing height range inclusive of but not restricted to 10-40mm • 6-8 blade mowing cylinders • Capable of delivering >90 cuts per linear metre and mowing the pitch in 3-4 hours • Interchangeable cassette system for brush and verti-cut units (strongly recommended)
	[1]Pedestrian rotary mower (for pitch clean-up)	4	• Self-propelled • Rear roller mounted • Mowing height range inclusive of but not estricted to 20-50mm
	[3]Ride-on cylinder mower	1 (backup)	• 1.5-2m mowing width • 8-10km/h mowing speed • 6-8 blade mowing cylinder • Capable of delivering >90 cuts per linear metre • Mowing height range inclusive of but not restricted to 10-40mm

Aerators	[2]Deep aerator	1	• Capable of operating to a depth of >200mm • Modern 'fast type' capable of aerating a pitch in 6-8 hours • Capable of operating at a heave angle of >20o where required
	[2]Shallow aerator	1	• Can be tractor-mounted, but ideally pedestrian • Aeration depth of <150mm • Capable of close tine spacing (<40mm) • 800-2,000mm operating width
Seeding unit	[2]Dimple seeder	1	• Must be dimple type, not disc type • Operating width of 1.5-2m • Capable of applying seed at a rate inclusive of but not limited to 5-40g/m2
Spray unit	[2]Self-propelled (preferable) Tractor-mounted and pedestrian are suitable alternatives	1	• Capable of applying 200-800L/ha • Tank capacity >300L (mounted) and >100L (pedestrian)
Tractor unit	[3]Compact tractor	1	• 20-40hp • Turf tyres essential • 3-point link attached
Line marker	[1]Wheel-to-wheel or spray-type marker	1	• Marking width of 120mm
Drag brushes	[1]Pedestrian brushes for dew removal and light grooming	1	• 1.5-2m width
Fertiliser spreaders	[1]Pedestrian fertiliser spreaders	2	• Spread width inclusive of but not limited to 2-6m
4 Water clearers	Pedestrian foam-backed roller with an integrated	1	• 60L per minute collection capacity

Equipment	Description	Quantity	Required specifications
[1]Miscellaneous	tank to collect water		
	Pedestrian roller squeegee	4	• 1m width
	Divot forks	8	• 4 tines • 100-150mm tines
	Spring tine rakes	6	
	Turf Doctor or hexagonal turf plugger	2	• Will not work on a hybrid turf reinforced pitch
	Wetting agent applicator gun	2	
	100m hose pipes with appropriate irrigation connection	2	
	500m polyethylene builder's line	1	
	100m steel measuring tape	1	
Lighting rigs			• Site and pitch-specific (essential for large stadiums)
Pitch covers and germination sheets			• Site and pitch-specific (all stadiums should have germination sheets)
Pitch side fans			• Site and pitch-specific (e.g. very enclosed stadiums)

[1] Items considered to be essential and should be permanently available on-site.
[2] Items necessary but may be available on a short-term contractual basis.
[3] Not essential but would help to speed up some maintenance operations.
[4] Particularly for high rainfall areas.

Table 1. Recommended maintenance machinery and other equipment for stadium pitches

4.3 Maintenance operations

Pitch maintenance requirements are site-specific and determined by local climatic and weather conditions as well as the intrinsic qualities of each pitch. It is difficult to be prescriptive but the following sections summarise the principal maintenance activities required, including specific mowing requirements for UEFA matches.

4.3.1 Mowing and pitch presentation

The purpose of mowing is to ensure that the grass is a suitable height for matches, as well as to remove debris from the surface after matches. Regular mowing improves turfgrass density and allows the UEFA mowing pattern to be created for presentational purposes. It is essential for mowing blades to be set up properly and kept sharp to ensure a good quality of cut.

Cylinder mowing for grass cutting and match presentation is probably the most important task a groundskeeper carries out. Rotary mowing should be used only for cleaning up the playing surface (e.g. removing divots after a match).

- The acceptable grass height depends on the time of year and whether the grass is a warm-season or cool-season type. UEFA regulations state that grass height may not, in principle, exceed 30mm but 28mm is a better maximum. In any case, the entire playing surface must be cut to the same height.
- The height of grass should be the same for both training sessions and matches.
- If deemed necessary by the referee or a UEFA match officer, the head groundskeeper may be requested to cut the grass again for a training session and/or a match (note: sufficient time must be allowed to complete such operations – typically up to 6 hours, to allow time for additional line marking if required).
- Grass should be cut in straight lines, across the width of the pitch, perpendicular to the touchline. No other form of grass cutting (diagonal, circles, etc.) is permitted for UEFA matches.
- length ways stripes are permitted in order to improve the appearance of the pitch when viewed from behind the goal, although the final cuts should always be width ways to emphasize the UEFA mowing pattern.
- The first four bands of the pitch should always be exactly 5.5m wide. The five remaining bands in each half should then be of a uniform width, finishing at the halfway line (on 105m pitches these bands will be 6.10m wide; for shorter pitches the width of these bands should be adapted accordingly).
- To maximise the definition and clarity of bands, pitches should be cut into this pattern (using a cylinder mower) on MD-2 at the latest and for all subsequent mowing before the match.

- Check mowers for oil and leaks before starting.
- Check the height and quality of cut across the entire cylinder. This is carried out using an Accu-Gage or height-of-cut (HoC) bar. All mowers must cut newspaper cleanly before being used on the pitch.
- Mowing bands should be set out using string to ensure even, straight lines.
- Mow the line along the string first, always with the most-experienced, lead operator mowing along the string and another operator following along the centre of the bay.
- Mow straight lines at a comfortable walking pace; do not race the mowers and ensure there are no skips.
- Empty the boxes on the mowers when they are three-quarters full and keep a record of the amount of clippings removed to help determine nutrient applications.
- Stop mowers off the pitch if streaks appear and adjust the settings accordingly.
- Try not to spin mowers on the turf as this will damage the turf.
- Do not drive mowers on hard surfaces with the front roller down as this may affect the height of subsequent cuts.
- The final two cuts should be made towards the main camera position.
- Dew brushing (see section 4.3.2 below) should always be carried out first to try to get the driest possible leaf to mow.

Note that during UEFA matches, the reproduction, whether real or virtual, of logos or emblems is forbidden on the field of play, the goal nets and the areas they enclose, the goals themselves and the corner poles. They are permitted only on the flags.

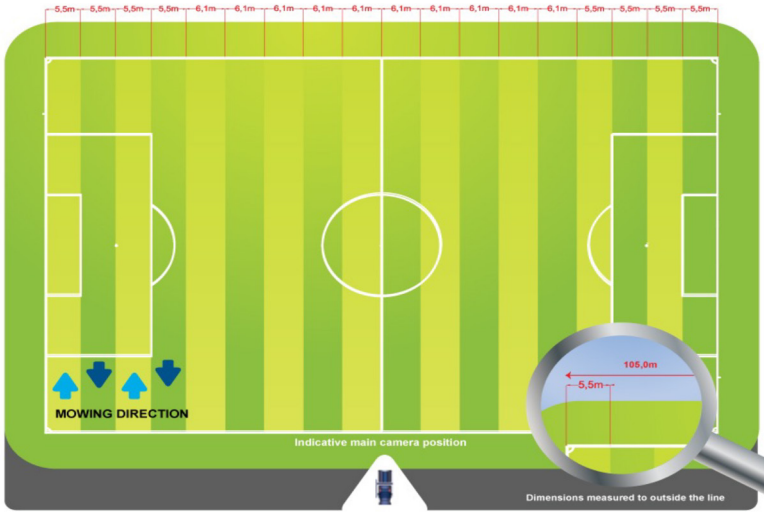


Fig. 15. UEFA mowing pattern

4.3.2 Brushing

The purpose of brushing is to:

- Stand the grass up after matches to give better growing conditions and more effective cutting;
- Reduce the risk of algae forming on the surface;
- Spread or work sand topdressing into the surface;
- Disperse dew that may form on the pitch and thereby reduce the risk of disease attacks.

Various brush types are available but the best is a pedestrian drag brush, which is dragged across the surface within the mowing bands (Fig. 16). More aggressive brushing may be needed to stand the grass up for cleaner cutting or to pull out post-match debris. These types of brushing are generally performed using tractor-mounted brushes. Aggressive brushing should not be used on young seedlings.

If a brush is not available, dragging a long, heavy water hose or rope can also help remove dew from the surface of the pitch. One person should hold each end of the hose or rope and drag it up and down the pitch, while ensuring that each pass overlaps the last until the entire pitch has been covered.

Fig. 16. Pedestrian brush being used to stand grass up ahead of mowing

4.3.3 Pitch dimensions and line marking

Line markings must conform to the International Football Association Board Laws of the Game[1]. Clear, well-defined lines are essential for pitch presentation and it is recommended that only proprietary line marking compounds be used. The most common types of line marker are wheel-to-wheel transfer markers, combinations of wheels and a belt, or spray-type line markers. Where no other equipment is available, lines can be painted by hand using a brush or roller.

***If a venue is staging other sports that include line markings within the field of play such as NFL or Rugby league, specialist products should be used that allow for a quick and clear removal as well as considering application rates of such products.**

Key considerations:

- Pitches used for UEFA competitions must measure 105m x 68m (Fig. 17).
- Pitch markings must be white, perfectly straight or curved as required and all of equal width, ideally the width of the goalposts but never more than 12cm wide.
- Lines in goalmouths must be in line with the backs of the goalposts.
- Penalty spots must be solid spots 200mm in diameter, while centre circle spots must be solid spots with a diameter of 240mm.
- The technical area must be marked with dashed lines, extending up to 1m parallel to the touchline and up to 1m from either side of the relevant team bench..
- Lines are considered part of the areas they delimit (e.g. the pitch length is measured from the outside of each goal line).

https://www.theifab.com/laws/chapter/21/section/17/

Line marking machines should be filled off the pitch before marking and sealed correctly, ensuring that the transport wheels do not transfer any paint.

Other points to consider:

- Check the line marker for leaks before starting.
- Set out the lines with string and leave the string in place until the line is dry, otherwise it will transfer paint.
- Lines must be painted at a slow walking speed, consistently and layer by layer; it normally takes at least two applications to achieve the correct level of brightness.
- A bucket of warm water and a soft brush/sponge should be used to remove any paint transferred accidentally when marking out lines. If paint transfer is a problem, the wider ground staff team should be consulted to resolve the problem.
- On matchdays, lines should be marked after the final cut, allowing sufficient time for them to dry before training, warm-ups and any other maintenance that is required (typically 1-1.5 hours before kick-off).
- The need for corner dashes (see Fig. 17 below) must be confirmed with UEFA.

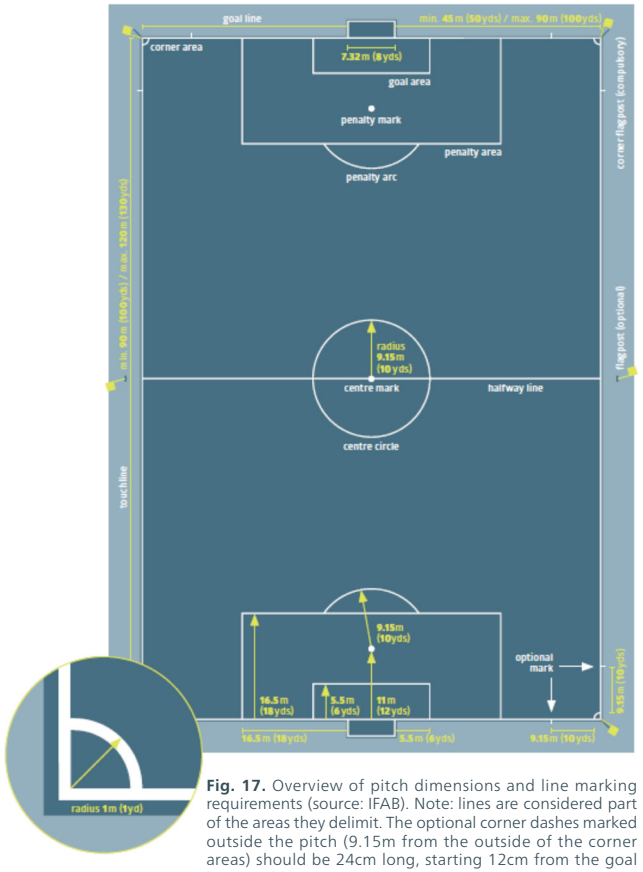


Fig. 17. Overview of pitch dimensions and line marking requirements (source: IFAB). Note: lines are considered part of the areas they delimit. The optional corner dashes marked outside the pitch (9.15m from the outside of the corner areas) should be 24cm long, starting 12cm from the goal line/touchline.

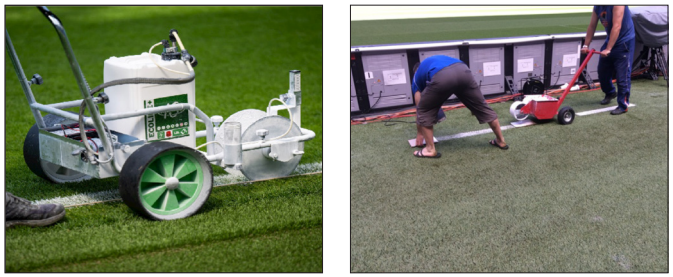


Fig. 18 Wheel-to-wheel line marking following a string line (left) and marking out dashed lines (right)

4.3.4 Irrigation

Irrigation is used not only to maintain a dense, actively growing turfgrass sward and provide optimum soil moisture conditions for turfgrass establishment, but also to:

- wash in fertilisers and other chemicals applied to the pitch;
- moderate playing conditions (e.g. by watering the pitch at half-time to influence the 'slickness' of the surface);
- improve surface stability on sand-dominated profiles which may lose stability if they dry out too much;
- periodically 'wash' the turf, flush the profile and remove excess salts;
- syringe' the surface during peak summer temperatures to minimise the risk of heat stress.

When the irrigation system is being run, the groundskeeper must know the volume of water that is being applied per minute and per run in cubic millimetres (mm3). Ideally, all water applications should be decided following a moisture assessment of the pitch using a soil moisture meter. It is important, particularly on pitches with a high sand content, to irrigate the pitch adequately before use to ensure the stability and binding of the root zone. Pre-match irrigation requirements are covered in section 5.4 (Pitch Watering).

Using water in a sustainable way is an important part of best practice and becomes increasingly important in the context of global warming and climate change.
Investment in systems and processes that allow for the use of water in the most efficient manner should be considered as a priority across stadium and training centre pitches

4.3.5 Fertiliser application

Fertilisers provide a range of essential nutrients to support turfgrass growth, help the grass to recover from damage and improve the colour of the grass for pitch presentation. It is essential to apply fertilisers accurately and uniformly, following a sound, well-developed fertiliser programme.

Granular fertiliser application

Granular fertilisers are applied using either tractor-mounted spreaders or, preferably, hand-operated pedestrian spreaders (Fig. 19). Uniform application is required to prevent streaks, burns or light and dark lines, which can cause problems in terms of both the appearance and the playability of the surface. Uniformity is usually achieved by applying the required quantity of fertiliser in two applications at right angles to each other (see Fig. 19).

- Mark out the spreading width with markers such as flags or cones before spreading.
- Set up and calibrate the machine off the pitch. Calibration should be carried out on a turf surface similar to that of the pitch to ensure consistency of application is achieved (width of spread).
- Do not overfill the spreader.
- Do not try to pick up flags while spreading.
- Operate the spreader at an even pace.
- Do not apply extra fertiliser to the surrounds or ends of runs; ensure these areas are included in the initial application.
- Plan the operation carefully before starting.
- Keep records of the product used and the rate at which it is applied.
- Double-check that the product being used is recommended for the pitch in question.
- The pitch may need to be watered after fertilisation to prevent scorch. Always follow specific recommendations.
- Take extra care when applying fertilisers close to matchday because any mistakes (overlaps and/or missed areas) will be picked up on camera.

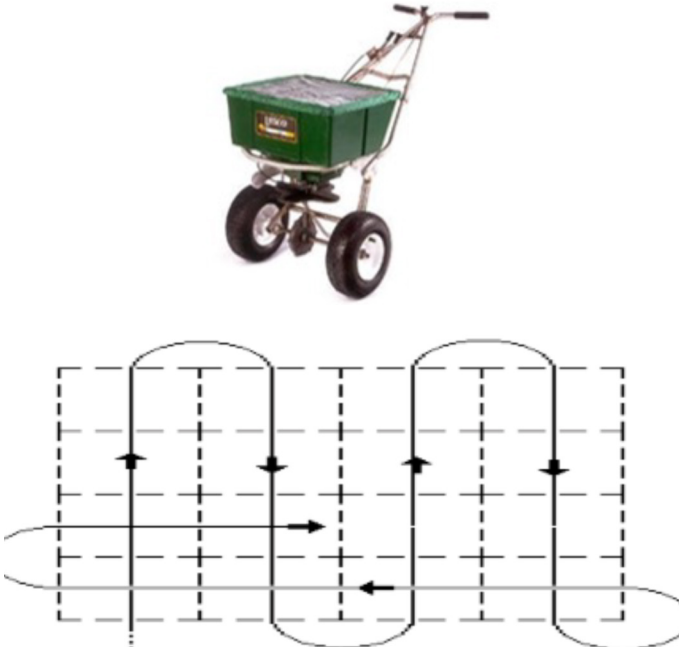


Fig. 19. Pedestrian fertiliser spreader and typical application pattern

Liquid fertiliser, surfactant and pesticide application

Sprayers are used to apply liquid fertilisers, surfactants and any necessary plant protection products (Fig. 20). Spraying, also known as foliar feeding, offers more control over grass growth, particularly in a stadium environment.

- Mark out the spraying width with markers such as flags or cones before spraying.
- Put out safety warning flags on the pitch before spraying.
- Set up and calibrate the sprayer off the pitch.
- Ensure that (1) the correct nozzles are used; (2) the correct pressure is reached; (3) the machine is fully flushed of previous products used; (4) there are no leaks; and (5) all nozzles are operating correctly.
- Always test with water first on a hard standing area. The rate delivered from each nozzle can be easily measured using a measuring jug and timer. Check product labels and use the recommended water volumes. Do not assume that all products can be applied in the same concentrations.
- Do not overfill the sprayer.
- Only allow trained personnel to use the sprayer and ensure they wear personal protective equipment (PPE) at all times.
- Make sure all usage and products comply with local and national legislation.
- Keep the sprayer at an even pace and speed.
- Do not apply extra spray to the surrounds or ends of runs; ensure these areas are included in the initial application.
- Plan the operation carefully before starting.
- Keep records of the product used and the rate at which it is applied.
- If applying iron or liquid fertiliser, do not walk or drive on freshly sprayed areas as footprints and equipment tracks will show up.
- Allow for a minimum of around four hours' drying time.
- Generally speaking, spraying should not be done in direct sunlight; evening or early morning is best.
- Double-check that the product being used is recommended for the pitch in question.

Fig. 20. Dedicated sprayer

At the time of writing (January 2023) a potential restriction regarding the use of all synthetic plant protection products is being discussed by the European Commission. Maintaining an awareness of which products are legally available and adapting Turf management practices to the new challenges of losing access to certain products will be crucial to groundskeepers at both the elite and grass roots levels.

4.3.6 Aeration

The successful aeration of a pitch depends on the equipment used and the timing of the operation in relation to the condition of the pitch.

Shallow pedestrian aerators

A shallow pedestrian aerator creates a network of holes in the surface of a pitch to improve water infiltration and air exchange. It can also achieve a controlled drop in hardness before a match without affecting pitch presentation. The depth to which the machine works can be adjusted and a number of different tine sizes can be used. Most operations are carried out with 6mm, 9mm or 12mm tines to soften the pitch. A range of tine sizes should be available. The impact of aeration on surface firmness should be ascertained before proceeding to treat the pitch.

- Carry out all operations within the mowing bands, which should be marked out using string.
- Ensure all tines are tight and of the correct diameter and length.
- Have a second operator walk behind the machine during set-up to ensure it does not rip the ground and the tines do not work loose. It is good practice to have an observer walk behind the machine at all times to make sure the tines do not work loose. If a tine is lost, operators must retrace their steps until it is found. Under no circumstances should tines be left in the pitch.
- A roller must be fitted to the rear of the machine.
- Test and check the depth and consistency of aeration.

Tractor-mounted deep aeration units

If used correctly, tractor-mounted deep aeration units can:

- relieve compaction in the profile and so promote better root development, air exchange and water infiltration;
- modify the firmness characteristics of the playing surface;
- emove fine material and organic matter that accumulates on the surface layer;
- create holes within the pitch that can be backfilled and stabilised using sandy materials;
- help iron out minor undulations.

The working depth of tractor-mounted deep aeration units will depend on the make and model of the machine and the tines used. It is good practice not to carry out deep aeration too soon before a match (i.e. no less than two to three weeks beforehand) and, as with shallow aeration, the impact of deep aeration on surface firmness should be ascertained before proceeding to treat the pitch.

- Place flags on the pitch to mark out areas to be avoided before aerating to avoid damaging sprinkler heads and other services.
- Ensure all tines are tight and of the correct diameter and length.
- Have a second operator walk behind the machine during set-up to ensure it does not rip the ground and the tines do not work loose. If a tine is lost, operators must retrace their steps until it is found. Under no circumstances should tines be left in the pitch.
- Ensure no tines spring back with the safety kick brake, as this can damage turf.
- The aeration machine must be of the same working width or wider than the tractor on which it is mounted.
- A roller must be placed on the rear of the machine and turf guards should be fitted.
- The depth of aeration should be tested regularly for consistency and uniformity.
- Buried service pipes (e.g. undersoil heating and irrigation pipework) must be avoided.

Fig. 21. Shallow aerator (above) and deep aerator (below)

Note that deep aerators are not an alternative for shallow pedestrian aerators; both are considered necessary for pitches on which UEFA matches are played.

4.3.7 Seeding/stolonising or turfing

The decision to turf a pitch is generally taken out of time-based necessity or in a crisis; for optimum long-term results, seeding or stolonising is preferable. In both cases, the machines used should operate with 'turf fingers' to prevent lifting.
Seeding or stolonising a pitch:

- is generally accepted to be superior to turfing, both from an agronomic perspective and in terms of playing quality;
- results in a more homogeneous profile, which in turn will usually produce better surface infiltration performance and root growth than turfing;
- is significantly cheaper than turfing;
- avoids compatibility problems between the turf and the underlying root-zone material, which in turn can lead to playing quality issues during matches;
- offers the opportunity to optimise cultivar selection for a given location to establish the sward.

Turfed pitches are usually playable much sooner than seeded or stolonised pitches. Although it is recommended that even turfed pitches be given at least a week to 'bed in', they could be playable after just a few days depending on the format and quality of the turf used.

A seeded or stolonised pitch, on the other hand, will take upwards of 50 days (seeds) or 100 days (stolons) to become confidently playable, depending on the growing conditions, the availability of lighting rigs and covers, the skill of the turf manager and the species/cultivars used. Specialist advice should generally be sought.

Fig. 22. Root development in a turfed pitch (top) compared with an adjacent pitch that was seeded (bottom)

4.3.8 Thatch removal and control

Thatch removal and control is carried out by means of scarification, during active growth periods when there is sufficient time for recovery before a match. Scarification removes excessive organic matter from the surface and upper root zone and cuts any lateral or creeping grass growth to give a denser, stronger sward, which in turn can help improve player traction. It also opens the surface of the pitch and weakens unwanted coarser grasses for removal prior to overseeding.

A wide range of equipment is available, varying from rake attachments and harrows to powered reel-type scarifies with rotating blades that cut into the turf surface. Any debris from these processes must be removed from the pitch. The most aggressive form of scarification involves machinery that can physically skim off the surface to a working depth of up to 20mm in one pass, in an operation known as 'fraise mowing'.

Fig. 23. Different types of thatch control and removal. From left to right: complete surface removal, deep scarification and verti-cutting. All three types have very different aims and objectives

4.3.9 Topdressing

Topdressing is carried out to:

- improve surface levels;
- dilute fine mineral and organic matter that accumulates on the surface of the pitch;
- improve drainage;
- provide a firmer playing surface;
- stabilise channels created by aeration work.

In cooler and wetter climates, pure sand is normally used but there are very specific requirements. If the sand is too fine it will tend to hold water and may impede drainage; if it is too coarse problems may be encountered in terms of stability, complaints from players and damage to mowers. In hotter, drier climates a mix of sand and soil or organic matter is often used as this can improve water and nutrient retention. It is recommended to have a soil particle size distribution analysis carried out to check that any new material that is added is compatible with the existing root zone. In terms of equipment, rotary and drop spreaders are recommended as these ensure a uniform application of topdressing material.

The amount of topdressing applied depends on several factors, including the time of year, the type of turfgrass and the use of turf reinforcement systems. Typically, if topdressing is required during the playing season, then only light applications should be made (<20 tonnes per pitch). Conversely, topdressing during renovations typically involves much larger quantities (60-80 tonnes per pitch).

4.3.10 Weeds, pests and diseases

Selecting the right turfgrasses and applying good management practices helps minimise problems with weeds, pests and diseases. Hand weeding can be used to remove some weed types but is not effective against all, especially those with underground plant material (e.g. roots or tubers) from which the weed can recover.

When treatment becomes necessary, it is important for the problem to be identified correctly and for an appropriate herbicide, fungicide or pesticide to be used. There are strict regulations concerning the use of such chemicals on turf and all applicable legislation covering the chemicals used and the method of application must be complied with at all times. The application rate is also very important, and plant protection products must be applied with a properly calibrated sprayer.A diary should be kept on-site by the head groundskeeper, with regular updates on observations made and work carried out. A wall calendar may also be used to highlight breaks in the playing season when remedial work can be carried out. A specific timeline should be incorporated into the maintenance programme leading up to any important event.

Whilst proposed restrictions regarding the use of PPP were not passed by the European Union it is expected that further restrictions on the use of PPP's will be proposed in the near future. Further information can be found in the Annex focussing on ITM

4.3.11 Preventive maintenance planning

Preventive maintenance plays a vital role in the provision of high-quality playing surfaces. It is considered best practice to try to identify potential problems before they appear.

Typical problems include one or a combination of the following:

- pest damage;
- disease outbreaks;
- heat stress;
- frost and snow;
- drainage, algae and black layer issues;
- loss of ground cover;
- shallow rooting and surface instability;
- poor micro-levels (e.g. following localised turf repairs);
- accumulation of organic matter on the playing surface;
- infestations of undesirable weed grasses (e.g. annual meadow-grass (Poa annua)).

Pitches should be monitored routinely, as early diagnosis and treatment will speed up recovery. Monitoring should involve a combination of visual checks of turfgrass health (e.g. daily), soil profile and root examinations using a soil corer (e.g. monthly), the use of specialist equipment that can help direct match preparations (e.g. Clegg soil impact testers and soil moisture meters), and the routine monitoring of weather conditions (e.g. daily). The following weather websites are useful:

www.yr.no
www.forecast.io
www.metoffice.gov.uk
www.msn.com/en-gb/weather

A photographic inventory of common problems associated with pitch presentation and playability is included in Appendix 2. In the event of pitch issues encountered by clubs or national associations hosting UEFA matches, the club/national association should make UEFA aware of the situation immediately. UEFA turf consultants are available to conduct site visits, give advice on remedial works and produce site-specific maintenance schedules as required.

4.3.12 Dealing with actual or anticipated heavy rain

Step one is to study the weather forecast several times a day to get a good picture of changeable weather patterns (see recommended websites above). There are only two options for preventive aeration before rain arrives – deep aeration or shallow pedestrian aeration (guidelines on both are given in section 4.3.6) and/or the use of a waterproof pitch cover system. Like preventive aeration, the use of cover systems relies on the heavy rainfall being anticipated and the pitch being covered in advance.

In case of standing water following heavy rainfall during a match, the head groundskeeper should have a team of around eight staff available to hand-fork the wet areas in order to move the water through to the gravel layers below the upper 150mm of the surface (assuming a gravel layer is pre-sent). It would be prudent to also have a shallow aerator on standby to tackle any larger areas effi-ciently in the event of standing water affecting play but it is not a good idea to use such machines if water is already ponding on the surface, except in an absolute emergency.

If available, water clearers either in the form of pedestrian roller squeegees or foam-backed rollers with an integrated tank to collect water (see Table 1 in section 4.2) should be used to help clear standing water from a pitch.

4.4 Managing pitch use

Sustainable levels of pitch usage are heavily influenced by:

- the quality of the construction;
- the turfgrass species used;
- the standard of maintenance;
- the time of year;
- the quality of pitch required;
- the effects of shade and reduced air circulation in an enclosed stadium environment.

Excessive pitch use will increase maintenance demands and reduce the quality of the playing surface. For UEFA matches, presentation and playing quality are both of paramount importance. A pitch protection policy should therefore be implemented to optimise the experience of the two teams playing any UEFA match. This policy will help ground staff carry out their pitch preparation and matchday duties. Such a policy should include:

- limiting the intensity of use before the match;
- avoiding using the pitch for training in adverse weather conditions (particularly on MD-1);
- avoiding using the pitch when it is badly waterlogged or frozen, particularly after partial thawing when the surface is soft but the underlying layer is still frozen;
- limiting team warm-ups where possible (around 70% of damage to goal areas is typically caused during match warm-ups);
- avoiding all non-essential on-pitch activities;
- encouraging repetitive work, such as 'fast feet' fitness exercises, to be carried out off the playing surface;
- encouraging the use of portable goals and mini-pitches at right angles to the normal direction of play, to spread the wear across the pitch and avoid concentrating wear within the main goal areas;
- identifying 'pitch protection zones' and displaying them in both teams' changing rooms to help reduce the risk of unnecessary damage to weaker parts of the playing surface, such as shaded areas and goalmouths.

Playing or training on pitches that are in poor condition can cause damage that will affect the pitch for the remainder of the season.

5 MATCH-PLAY PITCH PREPARATION

5.1 Planning

Weather conditions should be monitored on a daily basis so that a risk management strategy can be deployed in the event of adverse weather conditions. Such strategies are likely to be pitch-specific and depend on the type of pitch construction, the infrastructure available and the weather forecast.

To avoid conflicts between stakeholders and operations, it is important that pitch maintenance operations in the lead-up to a match respect UEFA's requirements, which may include:

- infrastructure set-up, e.g. the installation of LED boards;
- the use of pitch infrastructure elements (e.g. pitch covers and artificial lighting rigs);
- media and camera positions;
- team warm-up area requirements;
- team seating requirements and technical area markings;
- team and referee training sessions on MD-1;
- UEFA's countdown to kick-off on matchday;
- matchday pitch activities (e.g. ceremony rehearsals, goal-line technology testing and pre-match irrigation).

Pitch maintenance operations are likely to involve the following:

1. **Pitch preparation for official training sessions**
- Installation of (temporary) goalposts/nets
- Hosting and supervision of training and feeding of information to UEFA
- Divot repairs
- Surface clean-up after training (rotary)
- Cylinder mowing
- Removal of (temporary) goalposts/nets
- Pre-match irrigation (to be approved)

2. **Pitch preparation for the match**
- Nutrient or iron applications (no closer than 24 hours before the match)
- Plant protection/chemical applications (no closer than 48 hours before the match)
- Brushing
- Cylinder mowing
- Line marking
- Pre-match irrigation (to be approved)

3. **Matchday operations**
- Cylinder mowing (double mow if possible, de-pending on kick-off time)
- Re-marking of lines
- Installation of goalposts/nets
- Installation of corner poles and flags
- Irrigation (to be approved)
- Ceremony operations (if any)
- Match observation, including player-surface interaction
- Divot repairs after warm-up and before kick-off
- Divot repairs at half-time
- Divot repairs at full time

4. **Post-match operations**
- Removal of goalposts/nets
- Removal of corner poles and flags
- Clean-up of debris with rotary/suction mowers
- Preparation for next match (recommence cy-cle of operations from 1 above)

For fertiliser applications made prior to matchday, ground staff must comply with the relevant product health and safety regulations, for example in terms of the timing of the last applications. Likewise, in the unlikely event of any chemicals having to be applied for weed, pest or disease control, the relevant health and safety procedures and regulations must be followed to ensure the safety of the players and referees. UEFA must be notified of any such applications immediately.

5.2 Pitch equipment

5.2.1 Goals

A goal must be placed on the centre of each goal line. The distance between the posts must be 7.32m and the distance from the lower edge of the crossbar to the ground must be 2.44m.

No additional structural elements or physical support may be used inside the net or in its immediate surroundings other than bars fixing the goal net to the ground and goal net stanchions behind and outside the net. The aim is to ensure that no element of the goal structure enables the ball to rebound onto the field of play (from outside or inside the goal) once it has crossed the line and that the goal structure does not cause any injuries to players. To this end, goal frames may be recessed into the ground (Fig. 24).

Fig. 24. Goal frames recessed into the ground If screws or any other elements used to support the goal structures are deemed a potential hazard, additional protection such as tape or padding must be used (Fig. 25)

Fig. 25. Goal structures requiring further protection for player safety

[2] See Law 1 (The Field of Play) of the Laws of the Game for more details: www.theifab.com/laws

Any additional poles supporting the goal net (goal-net stanchions) should be positioned at a 45-degree angle relative to the back corners of the net and, where possible, at a distance of at least 2m from the back of the net. If positioned between the goal line and advertising boards, stanchions must be covered with a padded material at least 4cm thick, to avoid injuring any players or creating a safety hazard, and be a uniform non-white colour.

Fig. 26. Goal stanchion visibility and safety

Posts and nets have to be installed for official training sessions but also for the pitch inspection on matchday morning (10:00 local time), the end-to-end test that afternoon, and goal-line technology (GLT) set-up and testing as requested and scheduled by UEFA. It is best practice to remove posts and nets after each match to allow maintenance procedures to proceed unhindered across the entire turf surface. On matchdays, it is also good practice to check the nets following the pitch set-up, following the team warm-ups and at half-time. A net repair kit should be available to repair any holes. Two spare goals with identical goalposts (nets already attached) must be stored close to the goals with easy access to the pitch, and the removal and replacement of goals should be tried and tested well before the match.

Further information can be found in article 7 of the UEFA Stadium Infrastructure Regulations 2025 edition
https://documents.uefa.com/r/PxVtjcYr9Ntgwd0wYgq2xw/hKWsOdHKRMVU9QSfCR4kOw

Note that FIFA has created a Quality program for Football Goals

https://www.fifa.com/technical/football-technology/standards/football-goals/fifa-quality-programme-for-football-goals

5.2.2 Corner flags

Flag posts at least 1.5m high, each with a non-pointed top and a flag, must be placed at each corner of the field of play.

Corner flags and poles must be installed for official training sessions and for the pitch inspection on matchday morning (10:00 local time). A spare set of identical flags and poles must be available on matchday and stored at an agreed location. These must be quickly available should a pole break or need replacing for any other reason during the match.

Corner flags and poles should be removed at the end of the match (i.e. on matchday still) and safely stored away.

5.3 Pitch surrounds

5.3.1 safety for players, team officials and referees

The area immediately adjacent to the pitch ('safety zone') must be safe for the players and referees.

If the stadium is used for other sporting events such as athletics, additional high-quality artificial turf must be installed around the field of play, solidly fixed to the ground and marrying seamlessly with the natural turf (Fig. 27).

Any artificial turf installed around the pitch for UEFA matches on a temporary basis (e.g to cover a running track or extend the substitutes warm-up area) must be green and match the colour of the natural turf as closely as possible. This rule does not apply to permanently fixed artificial turf that may be of different colours in the pitch surrounds, including when making up part of the warm-up area.

Fig. 27. Extension of turf perimeter around the field of play using high-quality artificial turf

Any access lids and service boxes located within the safety zone must also be securely and safely covered with artificial turf that is a similar colour (if not the same colour) as the surrounding natural turf (Fig. 28), ensuring that no trip hazards are created in the process.

Fig. 28. Access and service boxes within the safety zone around the field of play

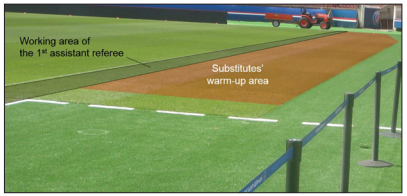


Fig. 29. Example of an ideal substitutes' warm-up area, with 20m x 4m of natural turf

Fig. 30. Example of a substitutes' warm-up area that uses high-quality artificial turf

5.3.2 Safety corridor

At stadiums where the substitutes warm-up areas are adjacent to the field of play, a safety corridor is required immediately behind the touchline. In principle it must be at least 1m wide and be marked out as follows::

- using a dashed line (50cm dashes spaced 1m apart) in a discreet shade of the same colour as the surface on which it is painted
- rom the edge of the technical area to the corner flag;
- This applies to both warm-up areas and secures the working areas of the safty corridor on the one hand and other hand it ensures that players who run torwards or alongside the touchline do not have to slow down unnecessarily or risk clashing with substitutes who are warming up.

Fig. 31. example of line markings for a safety corridor

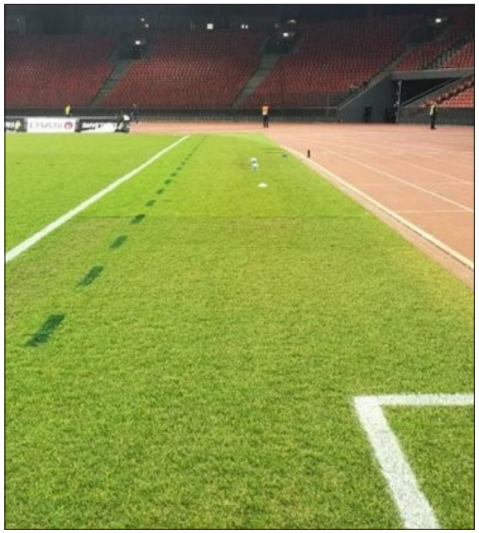
Additional guidelines in relation to the technical area

If the boundary of the technical area is further than 1m from the touchline (e.g. 1.5m), safety corridor should be aligned with the edge of the technical area, provided this leaves enough space for the substitutes' warm-up area.

If aligning the safety corridor with the edge of the technical area would not leave enough space for the substitutes' warm-up area, the dashed line marking safety corridor working area should remain 1m from the touchline (i.e. independent of the technical area).

Additional guidelines in case of different surfaces

The boundary of the safety corridor should be 1m from the touchline, even if this means it encompasses a mix of natural and artificial turf. The priority is to ensure the first assistant referee has the necessary space to operate in.



A dashed line indicating the boundary of the safety corridor should be marked 1m from the touchline, even if the natural turf extends to the same point and the switch from natural to artificial turf provides a kind of natural segregation. This to ensure consistency at all venues where the substitutes' warm-up area is adjacent to the pitch.

A dashed line indicating the boundary of the safety corridor should be marked 1m from the touchline, even if a limited amount of natural turf extends beyond this point. From experience, substitutes are likely to encroach on the first assistant referees' working area otherwise.

5.3.3 Advertising boards and camera positions

The impact of advertising displays and camera positions on pitch maintenance operations (mowing, fertilising, irrigation, aeration, etc.) must be planned and allowed for well in advance, and access to specialist equipment and lighting rigs must be provided should they be required in the lead-up to a match.

In principle, LED advertising boards are installed in advance and should not be moved without consulting the UEFA signage team first. Only in exceptional circumstances will it be possible to move such boards. The grass in front of boards should be cut by hand using a technique that will not damage the screens. Large cameras and rigs will be used on the pitch surface during matches, with photographers and others needing access to the areas behind the LED boards. It is important to ensure that the turf in these areas is well aerated and maintained so that it does not wear heavily but also does not hold water. It is very important to check and maintain these areas after matches.

Interview positions will also be earmarked in advance and these may require additional maintenance or protection to maintain full grass cover throughout the event.

5.4 Pitch watering

The head groundskeeper is asked to provide an irrigation system map (Fig. 32), indicating the full coverage of all sprinklers and to describe in detail how the irrigation system works (e.g. "There are 6 rows of 4 sprinklers which work in succession; rows and individual sprinklers can be deactivated individually; duration of a full cycle is 18 min," etc.).

The head groundskeeper is also asked to confirm the system used to ensure uniform pitch watering within a five-minute window (e.g. which sprinklers are activated and how long the minimum cycle lasts).

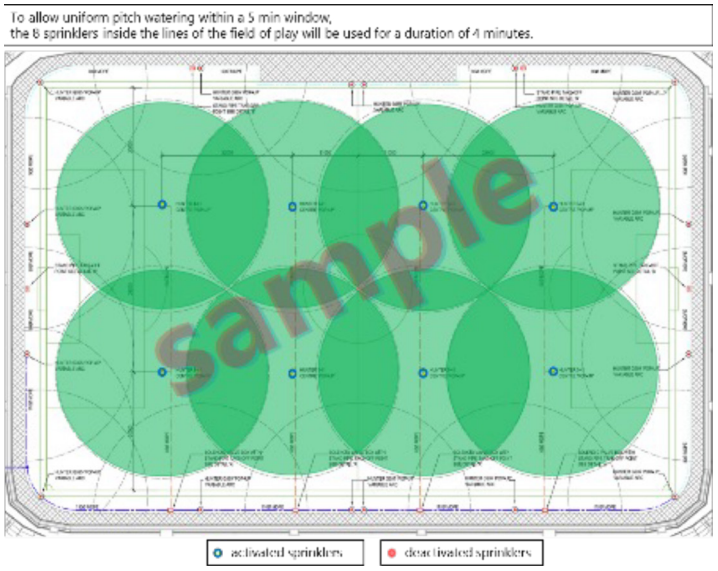


Fig. 32. Example of irrigation system information to be supplied to UEFA

The schedule for pitch watering on matchday must be communicated by the host club/national association in advance of the match.

As a rule, pitch watering must finish 60 minutes before kick-off. However, additional irrigation (i.e. moistening of the grass surface) between 60 minutes before kick-off and kick-off may take place, provided the sprinkler system installed in the stadium technically permits it:

- between 10 and 5 minutes before kick-off; and/or
- during half-time (for no longer than 5 minutes).

All pitch watering must:

- ensure the whole pitch is irrigated evenly;
- be considerate of other activities and infrastructure, such as pre-match ceremonies, team

warm-ups, pitch repairs, broadcasting equipment and LED boards situated around the pitch.

The referee is always entitled to request changes to the pitch watering schedule. All irrigation systems should be switched off and isolated during matches (except at half-time, of course). The head groundskeeper must ensure that the irrigation system cannot be switched on accidentally or come on automatically during play.

Where possible irrigation systems should be installed and practices should be carried out that consider using water in the most sustainable way including the recycling of rain water.

5.5 Retractable roofs

Where available, retractable roofs should be used to protect pitches from inclement weather in the lead-up to matches.

If a stadium has a retractable roof, UEFA must be informed of any constraints that could prevent the roof from being closed in specific conditions (e.g. in the event of strong wind or rain/snow, or if people are already inside the stadium).

5.6 Training sessions and warm-ups

5.6.1 Teams' MD-1 training sessions

Weather and pitch conditions permitting, the teams are allowed to train on the pitch on which the match will be played for a maximum of one hour the day before the match. Subject to the same conditions, the referees may also hold a training session in the stadium the evening before the match, as long as this does not interfere with the teams' training sessions.

The head groundskeeper should advise UEFA about areas of the pitch that should ideally be avoided in order to preserve the pitch in the best possible condition for the match. This may be done by means of a pitch protection map.

Pitch watering may take place in advance of MD-1 training sessions.

In addition to the two fixed goals, the teams should have two portable goals each for their training sessions and one portable goal each for their pre-match warm-ups (unless removing these goals before kick-off would be an issue). Materials such as cones and markers should also be made available to the teams (if requested).

UEFA reserves the right to cancel training sessions in the stadium if holding them could render the pitch unfit for the match. In this case, the host club/national association must make available an alternative training ground that has been approved by UEFA in advance.

5.6.2 Teams' pre-match warm-up

The head groundskeeper should advise UEFA about areas of the pitch that should ideally be avoided in order to preserve the pitch in the best possible condition for the match (pitch protection map).

5.6.3 Referees' pre-match warm-up and post-match cool-downs

A specific area of the pitch must be reserved for the referees' pre-match warm-up, on the opposite side of the pitch from the players' tunnel. Ground staff should mark out the referees' warm-up area using cones/markers (Fig. 33) and remove the cones/markers at the end of their warm-up.

If a pitch protection map was provided for the teams' MD-1 training sessions and pre-match warm-ups, it should apply equally to the referees' post-match cool-down. In the absence of such guidance, the UEFA venue director/Match Manager will identify a suitable area for the referees' cool-down in cooperation with the head groundskeeper.

Post-match cool-downs should last approximately 20 minutes and consist of light running and stretching activities rather than extensive drills using football equipment (balls, portable goals, etc.). No fast-feet activities should take place on the field of play.

Fig. 33. Referees' pre-match warm-up area

5.7 Zone 1 tour/Pitch inspection

At 10:00 local time on matchday morning, the UEFA delegate, the referee observer, a representative of the referee team and the venue director/match manager may jointly undertake a brief inspection of the pitch and its surrounding areas if the Match Day organisational meeting is taking place at the stadium and all parties are present.

UEFA and the head groundskeeper must ensure that all equipment that will be used on and around the pitch during the match is in position for this inspection.

The following aspects will be checked:

- Pitch/field of play
- Goal dimensions and nets (incl. attachments)
- Line markings
- Technical area
- Fourth official's position
- Advertising boards
- Camera positions at pitch level
- Stretchers/injury cart position
- Pitch doctor's position
- Players' ambulance position
- Corner poles and flags
- Spare goals
- Referees' dressing room
- Both teams' dressing rooms
- Doping control station
- Medical room

5.8 Post-match repairs

Post-match repairs should be completed immediately after each match. The two most immediate tasks required are divot repairs and rotary mowing to remove loose material from the surface (Figs. 34-36). Minor divot repairs involve no adding of sand or displacement of the root zone but instead:

- forking of the profile to restore levels;
- easing of the turf in from both sides;
- stretching of the turf to close the gap;

A full pictorial guide on divot repairs is available from UEFA.

Fig. 34. Minor divot repair – to be carried out at half-time and immediately post-match

Fig. 35. Half-time pitch watering and divot repairs

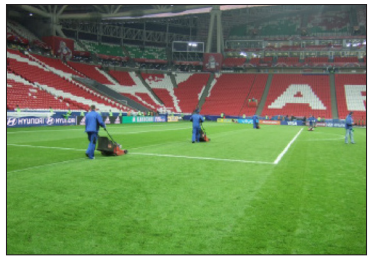


Fig. 36. Post-match clean-up

5.9 Pitch assessments

During the lead-up to a match, pitch performance should be monitored regularly by the stadium's in-house pitch maintenance team. Such monitoring helps provide objective data that can be used to guide and inform the maintenance programme. Monitoring is also extremely valuable in assessing trends that might be occurring over time, for example in relation to pitch firmness, and to ascertain where intervention might be necessary.

The basic tools for routine in-house pitch assessments are outlined in Table 2 below:

Equipment required	Pitch characteristic assessed	Photo
2.25kg Clegg soil impact tester**	Surface hardness (six readings are taken in each test position – see Fig. 37 in Appendix 4)	
Grass height prism gauge	Grass height (four readings are taken in each test position – see Fig. 37 in Appendix 4)	
50mm soil corer for profile observation and root assessment*	Rooting depth Depth of main root mass Extent and prevalence of anaerobic conditions/layering/ thatch	
soil moisture meter**	Volumetric soil moisture content (four readings are taken in each test position – see	
Portable traction apparatus***	Surface traction (four readings are taken in each test position – see Fig. 37 in Appendix 4)	

* Not practical on some forms of hybrid reinforced turf, for which wider split corers that can be hammered into the profile are required.
** Equipment requires routine calibration.
*** Alternative traction apparatus may be used, provided the appropriate preferred and acceptable ranges are respected as per Appendix 4 (section 4.4).
Table 2. In-house pitch assessment tools

Further detailed information on the preferred test ranges that make up the FIFA Standard for Natural playing surfaces can be found in Annex 3.

5.10 Emergency returfing

Over the course of a playing season and following regular assessments of pitch condition by the head groundskeeper and potentially a UEFA turf consultant appointed as part of the Pitch Quality Support Programme, it may become apparent that a full turf replacement is needed.

The combination of inclement weather and excessive usage of a pitch often causes playing surfaces to deteriorate rapidly. Although full returfing during the season is relatively rare, it is imperative that UEFA be contacted immediately if any pitch issues arise. Such contact will enable UEFA to provide assistance and hopefully minimise the risk of a major returfing being required in the middle of a season, prior to a UEFA match. UEFA can also assist with turf-farm approvals and monitoring of the installation if returfing is required.

In the event of returfing, an approved contractor should be appointed, and plans put in place to ensure a successful transition of the playing surface. The new turf should be installed at the earliest possible opportunity to allow the sward time to establish into the existing construction.

APPENDIX 1
GLOSSARY

APPENDIX 1 – GLOSSARY

Term	Description
Aeration	Operations carried out to increase drainage and air exchange and to encourage better root development.
Annual meadow-grass	A cool-season grass species (Poa annua) usually considered to be a weed species.
Bermudagrass	A machine with a line of nozzles on extending arms used to spread liquid chemicals.
Brush	A device consisting of bristles held in a suitable frame, used to sweep grass.
Clay	Soil particles smaller than 0.002mm in diameter. Clay-rich soils usually have poor drainage characteristics and retain water.
Cutting height	The height above ground level at which the sward is cut.
Cylinder mower	A grass mower with a cutting blade that moves in a vertical plane and cuts using the action of the cylinder blades against the sole plate.
Disease	A pathological condition, usually the result of a fungal infection often associated with environmental stress, which affects the quality of grass.
Drag mat	A flexible steel mat which is pulled along to work in top dressings, particularly on undulating turf surfaces.
Drainage system	A network of drains designed to remove excess water from a pitch.
Fertiliser analysis	Identification and measurement of the percentage of nitrogen, phosphorus, potassium and other plant nutrients found in a fertiliser.
Fungicide	Any chemical which controls or destroys the growth of a fungus.
Grass	Any of various plants having slender leaves characteristic of the grass family.
HemiView analysis	The analysis and computer modelling of the natural light distribution in a stadium using computer-generated or actual stereographic images.
Hollow tine	A form of aeration in which cylindrical tines are used to remove cores from the soil.
Insect	Small arthropod animal of the class Insecta, which as an adult has three pairs of legs, a body segmented into head, thorax and abdomen, and usually two pairs of wings. Insects include flies, crickets and beetles.
Irrigation	The controlled application of water to turf.
Kentucky bluegrass	A cool-season grass species (Poa pratensis), also known as smooth-stalked meadow-grass in some countries.
Line marker	A machine used to mark lines on a pitch.
Mower	A grass cutting machine
Peat	Material consisting largely of undecomposed or partially decomposed organic material accumulated under conditions of excessive moisture. Often used to improve water and nutrient retention.
Perennial ryegrass	A cool-season grass species (Lolium perenne).
Pest	An insect, grub or other soil organism that may cause damage to grass.
Pesticide	Any substance or mixture of substances intended to prevent or control any unwanted species of plant or animal, including any substance intended for use as a plant growth regulator, defoliant or desiccant. This includes fungicides, herbicides and nematocides.
Pipe drain	A trench containing a drainpipe backfilled with a suitable gravel.
Renovation	The act of repairing an area of turf by cultivating, re-levelling and reseeding, particularly carried out at the end of the playing season.
Roots	The underground portion of a plant that serves as support, draws minerals and water from the surrounding soil, and sometimes stores food.
Root zone	A mix of sand and soil or sand and organic matter used as the growing medium for grass.
Rotary mower	A powered mower that cuts turf using the high-speed impact of a blade or blades rotating in a horizontal cutting plane.
Sand	Granular mineral material ranging from 0.05mm to 2mm in diameter. Sand materials are regularly used in pitches because of their good drainage and other physical properties.

Scarifier	A machine used to cut through horizontal growth and thatch with a raking or vertical cutting action.
Seashore paspalum	A warm-season grass species (Paspalum vaginatum).
Seed	The reproductive structure of a plant, containing an embryo, food supply and protective coat. Seeds are used for the establishment of grass.
Silt	Intermediate-size fine particles between 0.002mm and 0.05mm in diameter. Silt-rich soils tend to have poor drainage characteristics and retain water.
Slit drainage	A drainage system in which a series of sand and/or gravel-filled channels link the pitch surface with porous aggregate over pipe drains allowing excess surface water to bypass the soil.
Slit tine	A knife or bladed tine.
Smooth-stalked meadow-grass	A cool-season grass species (Poa pratensis), also known as Kentucky bluegrass in some countries.
Sod	Strips of turfgrass, usually with adhering soil, used in vegetative planting (also known as turf in some countries)
Soil	The natural medium for plant growth, consisting of mineral particles mixed with organic matter.
Solid tine	A spike or blade used to create holes in the turf surface during aeration work.
Spiker	A machine used to create aeration holes in turf.
Stolon	Vegetative material (a sprig, rhizome or tiller or a combination thereof) used to establish turf, usually for warm-season grass species.
Stone	Large particles of mineral matter or rock typically greater than 10mm in diameter.
Sweeper unit	A machine with a rotating brush and collector.
Tall fescue	A cool-season grass species (Festuca arundinacea).
Thatch	A layer of intermingled dead and living shoots, stems and roots that develops between the zone of green vegetation and the soil surface.
Turf	1) The grass-covered surface of the ground, growing within the upper soil layer. (2) Strips of turfgrass, usually with adhering soil, used in vegetative planting (also known as sod in some countries)
Vacuum unit	A suction device mainly used to lift grass clippings and other debris from the surface of a pitch.
Verticutting	The use of a machine with vertically rotating blades that cut into the turf to remove thatch or cut stolons.
Verti-Drain	A tractor-drawn turf aerator which can break up deep compaction by means of tines.
Weed	An unwanted grass or broad-leafed plant whose negative values outweigh the positives in a given situation.

APPENDIX 2

APPENDIX 2 – PHOTOS OF COMMON PITCH PROBLEMS AND MAINTENANCE ISSUES

Fig 37. Poor surface stability, most likely caused by poor rooting and a lack of surface moisture, with no turf reinforcement system.

Fig 38. Poor surface levels in a re-turfed goalmouth.

Fig 39. Leaking irrigation sprinkler head – if not repaired, surface damage will be extensive.

Fig 40. Irrigation system with low sprinkler pressure – leads to poor irrigation coverage.

Fig 41. Damage to the artificial turf perimeter caused by poor mowing practices.

Fig 42. Weak pitch perimeter caused by low light levels and excessive traffic.

Fig 43. Hand forking to remove surface water.

Fig 44. Heavy rainfall on a pitch with poor surface drainage – such conditions can lead to matches being abandoned.

Fig 45. Poorly performing undersoil heating system failing to keep the surface uniformly free of frost and snow.

Fig 46. Poor-draining soil-based turf placed over free-draining root zone – will not perform well under heavy rainfall.

Fig 47. Invasion of annual meadow-grass (Poa annua) causing poor aesthetic appearance – resurfacing required.

Fig 48. Lack of weed control on artificial turf perimeter leading to poor aesthetic appearance.

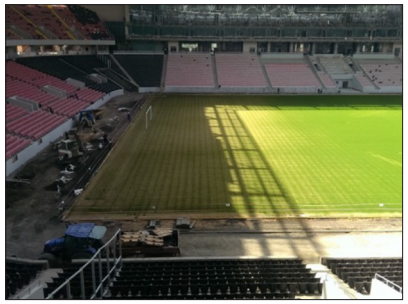


Fig 49. Effect of shade on turf establishment – artificial lighting rigs will be essential in winter to maintain growth.

Fig 50. Excessive pitch damage caused by overloading the turf protection system during a concert.

Fig 51. Pitch without undersoil heating – unable to produce adequate grass cover for a UEFA match.

Fig 52. Spraying of pitch colourant on a dormant natural turf pitch.

Fig 53. Surface algae as a result of thin turf cover, heavy shade and excessive soil moisture.

Fig 54. Goals not removed prior to mowing – poor maintenance practice that creates unnecessary wear in the goalmouths.

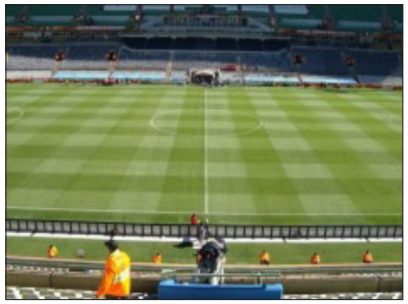


Fig 55. Lengthways (goal-to-goal) mowing too strong – cross-pitch stripes should be dominant.

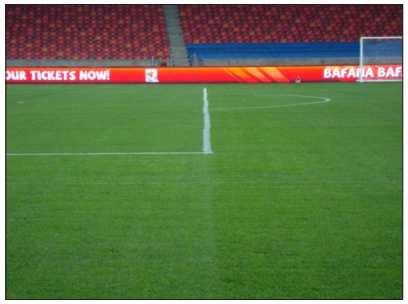


Fig 56. Wavy lines caused by mowing being carried out after line marking.

Fig 57. Heavily worn patches – to be disguised with fresh dried grass clippings two to three hours before a match.

Fig 58. Wet paint – accelerate the drying of line marking using a leaf blower.

Fig 59. Poor interface between natural and artificial turf at the perimeter of a pitch – a major trip hazard and likely to cause player injury.

Fig 60. Dangerous irrigation sprinkler within the field of play.

APPENDIX 3

APPENDIX 3 – Integrated Turf Management (ITM) and sustainable pitch management

3.1 Integrated Turf Management for football pitch management

What is tegrated turf management and why is it important for football pitch management?

What is integrated turf management and what does it mean?

Integrated turf management (ITM) is the sports turf equivalent of a concept known in other growing industries as IPM or Integrated Pest Management. What does this really mean? The essence of ITM is a way of managing turf that looks to create healthy grass that performs optimally, but in a way that considers all the factors needed to produce high quality turf. ITM focuses on promoting turf health by creating the optimum environment for grass, whilst at the same time, tackling the underlying issues that can cause playing surface or pest, weed and disease problems. At its core, ITM is about producing a high-quality natural turf playing surface by using turf maintenance practices that focus on preventing surface problems rather than trying to solve issues or symptoms when they occur.

ITM is most commonly associated with the management of pests, weeds and diseases. By understanding the underlying reasons why a pest, weed or disease has occurred on a pitch, it is possible to best target the curative treatments to stop the issue currently affecting the turf, whilst at the same time putting in place plans to prevent future outbreaks from occurring. To be effective, it is essential to understand the biology and ecology of a pest, weed or disease. Armed with this information it is possible to create a growing environment that promotes healthy turf, whilst discouraging the pests, weeds and diseases that affect the playing surface.

The ITM triangle in Figure 1 can be useful for understanding why a particular pest, weed or disease is affecting a pitch. What this diagram shows is that for a problem to occur and for symptoms to be visible on the playing surface three criteria need to be met:

Habitat – a pest, weed or disease needs somewhere to exist. For example, a disease needs a host to be present, which in the case of a pitch is the grass. At the same time, we need the grass to produce a high-quality playing surface. For football pitches, like all other turf sport surfaces, there is always a potential habitat for pests, weeds and diseases.

Environment – a pest, weed or disease needs an environment that is favourable for their survival and growth. For example, weeds need gaps in the turf canopy to provide a space for their growth, therefore if the turf is dense and there are no gaps it will be much harder for weeds to grow.

Pest, weed or disease – there needs to be a population of a pest, weed or disease present for a problem to occur, therefore if its population is controlled before an issue occurs, turf will not be affected and there will be no need to use a chemical control. For example, if a disease lives in thatch when it is not infecting grass plants, then managing and controlling the level of thatch will also reduce the ability of the pathogen to build up to a sufficiently large population to cause an infection.

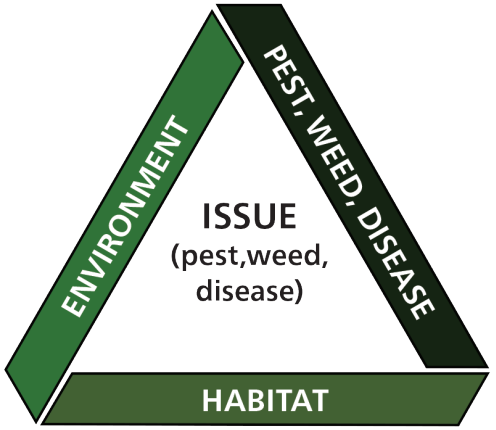


Figure 1. ITM triangle that can help to visualise the relationships between the factors that allow pests, weeds and diseases to affect turf.

Plant Protection Products

What are plant protection products (PPPs)? These are regulated products, often called pesticides, which are used to chemically prevent or control pests, weeds or diseases. They contain at least one active substance and have one of the following functions:

- Protect plants against diseases. For example, fungicides to control fungal diseases.
- Protect plants against pests. For example, insecticides to control insect pests.
- Influence the life processes of plants (such as substances influencing their growth but excluding nutrients). For example, plant growth regulators.
- Destroy or prevent growth of undesired plants or parts of plants. For example, herbicides.

The ITM triangle is not only a conceptual mode of how and why a pest, weed or disease issue has occurred, but it is also a practical tool to help turf managers to understand what can be done to manage a problem. If all the three criteria in the ITM triangle are not met, the pest, weed or disease will not be able to affect the turf surface. Some examples of how this can work for football pitches are given in Table 1.

Table 1. Examples of how to use the ITM triangle to identify strategies to prevent pest, weed or disease issues from occurring.

Problem	Habitat	Environment	Population
Fungal disease infection such as microdochium patch	Pitch management aims to have full grass cover so there will be a habitat for disease to infect. ITM management: • Keep grass healthy so it is less susceptible to diseases.	Need conditions that allow a disease to develop such as mild and humid weather with high leaf wetness. ITM management: • Reduce humidity by increasing airflow • Reduce leaf wetness by removing dew. • Minimise damage to leaf which can cause entry points for disease (sharp mower blades and spreading of wear). • Reduce excess thatch accumulation.	There needs to be a pathogen population present to infect turf. ITM management: • Don't allow disease infections to go untreated. • Look at non-PPP programmes to help preventatively manage a pathogen population. • Control risk of fungal pathogen population building up by creating conditions that don't favour disease growth.
Weed invasion of turf	Weeds need gaps in the grass canopy to grow. ITM management: • Keep grass canopy dense to prevent a habitat for weeds to grow.	Weeds need resources to be able to grow and compete with grass. ITM management: Ensure grass is healthy and has all essential nutrients and water. Don't over feed or over water which might provide resources for weeds. Keep grass canopy dense with no gaps (spread wear damage and ensure maintenance operations don't thin turf at high risk times of year).	Weeds will propagate with seed or through the spread of vegetive material. ITM management: • Use sterilised or certified weed free products (such as top dressing or soil amendments). • Control any weeds that do occur before they flower and set seeds
Pest attack such as root feeding nematodes	Football pitches need grass therefore there is a habitat for pests such as nematodes to infect. ITM management: • Keep grass healthy so it is less affected by nematode activity. • Adjust watering to more frequent but lower doses if roots are becoming damaged and root length is adversely affected. • Use foliar applied fertilisers to negate root damage caused by nematodes whilst helping to boost plant health.	Pests, such as plant pathogenic nematodes, will infect susceptible grasses if they are present. ITM management: • If available, use less susceptible grass cultivars or species. • Create drier rootzone conditions, as nematodes need soil moisture to survive.	• There needs to be a population of pests there to infect turf and cause damage. ITM management: • Reduce the abundance of pests by maintaining less favourable soil conditions for their growth. • Control population with non-chemical control products (if available). • Use a nematicide if available to reduce the pest problem. • Use physical disruption on larger pests to reduce its population, taking care not to damage the turf. • Use sterilised or pest free growing media or products.

3.1.1 Why is ITM important?

Integrated Turf Management is a fundamental part of football pitch maintenance. It is not a new concept and groundskeepers have been using ITM based approaches for decades, but they may not have known it or been able to give it a specific name. ITM is present in all aspects of football pitch preparation and management, whether at a professional club or at a grass roots facility. For day to day management, ITM is important for the following reasons:

- Reduces the frequency and intensity of pest, weed and disease issues.
- ITM focuses on preventing problems before they occur.
- Aims to maintain optimum turf health.
- Promotes targeted use of resources to produce hight quality turf.
- Looks to reduce inputs of all resources to the minimum required.
- Encourages a sustainability focussed approach to turf management.
- Ensures that users comply with legislation requirements.

ITM is a core component of managing pest, weed and disease problems. This means that it is strongly associated with both the use of plant protection products and the regulations surrounding the development, supply and use of these solutions. As legislative pressure increases on the use of plant protection products across all growing industries, ITM is vital to being able to use plant protection products sustainably and to minimise their use. Over recent years there has been significant pressure on the use of plant protection products across all industries including football. This means that ITM is a focus for regulators as a strategy to promote and enact reductions in the use of plant protection products. As a result, integrated turf management should be at the heart of all football pitch management programmes. It is essential that football can demonstrate that playing surface management is as sustainable as possible and that best practice methodologies are being followed and that a forward-thinking approach to preventative turf maintenance is followed.

Is ITM a "one size fits all" or prescriptive approach? No, it is not. Its core focus is to get groundskeepers and pitch managers to look at their turf and assess its condition and what it needs to ensure it is healthy and that the conditions that favour a pest, weed or disease attack are not created. It is about understanding the needs of the pitch and managing it accordingly. To achieve this, an ITM based approach has to be dynamic and look to meet the needs of the turf now and in the future.

3.1.2 Intergrated Turf Management and turf manintenance on football pitches

Integrated turf management practices include the same processes that are carried out on a professional football pitch as part of routine maintenance. The key difference between routine maintenance and following an ITM programme is in the underlying philosophy of what and when management practices are carried. The main focus of ITM management practices is on promoting a healthy grass plant and preventing pests, weeds or diseases from occurring in the first place.

The guidelines presented in this whole document outline the key maintenance practices used for preparing a professional football playing surface and they are relevant to ITM turf management. In the following sections, specific management practices have been outlined and their relevance for ITM detailed. This is to assist groundskeepers in evaluating their maintenance practices and programmes to ensure that they can fulfil the requirements of an ITM preventative programme for managing pest, weed or disease pressures.

3.2 Mowing

Mowing a football pitch is the most commonly used maintenance practice and one of the most important, not only for preparing a high quality playing surface, but also for preventing disease outbreaks on turf. The key considerations when mowing as part of an ITM programme are outlined below:

- **Frequency of mowing** - turf should be mown frequently to remove growth from that 28-48 hours rather than allow the plant to grow excessively and then remove a significant portion of the photosynthetic material which can lead to turf stress. As a rule of thumb, best practise dictates that no more than 1/3 of the leaf tissue should be removed from a grass plant in one mowing operation. If required, or during periods of strong growth, it will be necessary to adjust height of cut progressively to bring the final height to the desired level over a number of mowing operations. However, it is better to control growth to allow recovery from wear damage without over stimulating the grass plant to grow. Overgrowth of grass can result in increased stress and greater risk of disease or pest attack due to reduced turf health and grass density.
- **Blade sharpness** - whenever turf is mown, the physical removal of leaf tissue results in a wound to the plant. Any wound in leaves or stems can result in increased risk of disease outbreaks as fungal spores and mycelia have a direct route into plant tissues. It is therefore important that wounds caused by mowing can heal as quickly as possible, and the best way to achieve the quickest wound healing is to ensure that mower blades are at optimum sharpness. Less sharp mower blades result in turf tearing and bruising which can increase recovery time giving fungal diseases a greater opportunity to infect the plant. During periods of naturally high disease pressure, it is vital that mower blades are sharpened frequently and checked regularly to minimise risk of disease infection.
- **Leaf wetness** - the cleanest cut is obtained when the leaf surface is dry. It is therefore best to plan mowing operations when the leaf is dry. Dew removal prior to mowing ensures that plant surfaces are as dry as possible, resulting in a clean cut that will heal in the quickest possible time.

3.3 Irrigation

Irrigating natural turf pitches is an essential maintenance operation to provide the grass with sufficient water, whilst optimising ball movement over the turf, surface hardness and surface stability. In the context of ITM, irrigation plays several key roles:

- **Plant health** - ensuring that turf has adequate water to replace that lost by evapotranspiration is critical for maintaining healthy grass, as the water is not only needed for structural support in the plant, but also for facilitating biochemical reactions in cells. When turf is under stress, it is vital to ensure that watering is adjusted to help grass plants cope and recover from that stress. For example, if there is an outbreak of root feeding nematodes, irrigation inputs need to be adjusted (less per application but more frequently) to account for the additional stress and the reduced water absorption potential by roots damaged by nematode activity,

- **Leaf wetness** - fungal pathogens cause some of the most destructive diseases on football turf and require the plant's surface to be moist to allow spores to germinate and mycelia to infect leaf tissue. During periods of high stress or where there is a high population of pathogen, it is critical to keep the leaf surface dry as this will deter or slow the rate of infection. Therefore, if there is high risk of fungal disease activity, keeping the plant dry will help to prevent infection. Appropriate timing of irrigation to ensure that the leaf does not stay wet for extended periods of time is a good ITM practice. This means irrigating first thing in the morning or when the leaf has a chance to dry rather than irrigating last thing at night when there is a high chance turf will remain wet for an extended period of time overnight.

- **Optimum soil water content** - it is important to balance irrigation inputs to meet grass health requirements and to replace water losses by evapotranspiration whilst, at the same time, ensuring that the soil or rootzone is not kept too wet. If a soil or rootzone is kept consistently wetter than optimum, it can result in the net accumulation of soil organic matter in the form of thatch and it is in thatch where a number of the key destructive fungal pathogens survive when not infecting grass plants. Balancing water content and irrigation to meet plant health, whilst providing good playing performance but without encouraging fungal pathogens is a core component of ITM.

3.4 Fertilisers and plant nutrition

Groundskeepers apply fertiliser to help provide essential nutrients needed by turf that cannot be supplied from the growing medium alone. The removal of leaf biomass, which is a source of organic nutrients that can be recycled, means there is a net loss of nutrients from a growing medium which must be replaced through the application of fertiliser. Key considerations for ITM use of fertilisers and plant nutrients are given below:

- **Plant health** – there are two aims of fertiliser application on football pitches, the first being to promote plant health, whilst the second is to help turf repair or regrow plant biomass caused by wear and play. Balancing the need for plant health and growth ensures that the plant is robust and able to withstand play and stresses such as those that may occur from turf pests, weeds or diseases. The mantra is "a healthy plant is a robust and resilient plant".

- **Under application** - not providing adequate nutrition for turf will result in a weaker grass plant that is less tolerant of wear and is less able to withstand pest, weeds or disease pressures. Therefore, supplying adequate fertiliser to meet plant requirements is a vital part of an ITM approach.

- **Over application** – applying more fertilisers than the plant needs can be highly problematic when managing natural grass football pitches. Over application of fertiliser can create uncontrolled growth that can lead to a weaker grass plant that is more susceptible to plant stresses and fungal disease. It is therefore essential that nutrient inputs are balanced according to the requirements of the plant and not a desire to produce excessive and lush growth. Additionally, over application of fertilisers is not a sustainable approach, as it increases the risk that nutrients are not able to be used by the plant and are available to be leached into drainage water contributing to aquatic pollution.

- **Algal growth**- algal layers on the rootzone or soil surface are an issue as they block regrowth of grass, reduce surface traction due to thinner grass cover and algae's inherently slippery nature, whilst also looking unsightly. Algal layers occur in areas where grass cover is thin and where the pitch surface is moist and shady, which means they can be very prone to develop in shadier areas of stadia and areas were grass cover has reduced. Fertiliser inputs can have a significant effect on the risk of algal growth occurring. Over application of fertiliser can encourage algal growth, since algae are plants and will utilise the nutrients in fertilisers to boost their growth, therefore consideration needs to be given when applying fertilisers in shady and damp environments with reduced grass cover.

- **Biostimulants** – these are products that aim to help promote plant health and growth but do not contain nutrients that would be found in fertilisers. Their use has become more common in all areas of turf management, as they focus on promoting plant health and reducing turf stress, which makes them a valuable tool in an ITM programme. However, biostimulants are most effective in situations of high stress or where there are health issues, but not all solutions will provide the optimum effect under any set of conditions. Biostimulants often work best when used under specific conditions or as part of a programme of mutually supportive technologies. This means it is vital for groundskeepers to ask suppliers about what a biostimulant does, how to get the best from it and the scientific evidence to support the products claims. For example, if a product is used under adverse or sub-optimal conditions it may provide little to no benefit to a pitch.

3.5 Thatch management

Thatch comprises a mat or layer of organic matter that contains live tissues, partially decomposed dead matter and well broken down organic materials. The recycling of organic matter provides a positive contribution to plant nutrition and soil biological functioning. However, when organic matter builds up excessively forming a spongy, water retentive layer at the top of the soil or rootzone profile, this can have a wide range of impacts on turf health, surface playability (soft and unstable playing surface), water retention and drainage, as well as pest, weed and disease activity. Thatch is a habitat that many plant pathogenic fungi can live in when not infecting turf, therefore if there is too much thatch there is a risk of disease populations increasing which can then infect grass when conditions are conducive.

An essential ITM process is controlling thatch and its accumulation. This often takes the form of the following maintenance activities:

- **Soil or rootzone water retention** - ensuring optimum soil/rootzone air:water balance helps to ensure that organic residues from plant growth are rapidly broken down and do not accumulate. Under persistent wet soil conditions, the rate of organic matter breakdown declines and the rate of accumulation of thatch increases. Aeration is often carried out to help improve air:water balance in the pitch profile helping to control organic matter breakdown rates. Likewise, careful management of irrigation applications to help ensure that the pitch profile does not remain wet are also critical.

- **Physical removal of organic detritus** - the use of scarification and grooming to physically remove organic detritus from the surface of the pitch is essential for keeping thatch under control. If the organic materials are removed they cannot form a thatch layer that can cause a multitude of agronomic and playability issues.

- **Top dressing** - the application of sand or rootzone helps to physically dilute organic matter, to reduce thatch density and increase the rate of decomposition. For non-hybrid pitches this is a vital maintenance technique, as it not only benefits thatch control, it also helps to improve pitch water infiltration and surface hardness characteristics. For hybrid pitches, top dressing should be carefully managed as it can be more problematic as it risks burying the reinforcement fibres, reducing their effectiveness in protecting the grass plants and on surface traction (player grip).

- **Controlling growth** - managing growth rates so that recovery from play is optimised but that turf does not grow excessively is important. If turf growth is not controlled, inputs of organic matter increase which may exceed the ability of the soil ecosystem to breakdown these organic materials causing thatch to build-up.

3.6 Surface water management

On sports surfaces, one of the most common ITM problems is turfgrass disease and football pitches are no exception. Turf diseases can occur at numerous points of the growing season depending on the type of turf being grown, the environment it is being grown in, and the health of the grass. Whether using warm season or cool season grass, the presence of turf diseases at seeding, establishment or a fully mature sward usually results in surface damage. From an ITM perspective, managing surface water, i.e. water that sits on the leaf surface or on top of the growing medium, is critical to successful disease management.

Most fungal pathogens require water droplets to be present on a leaf surface to enable spores and mycelia to grow and attack plant tissues. If the leaf surface is dry, spores and mycelia cannot survive and therefore cannot infect plant tissues resulting in no disease outbreak. Therefore, managing water on the leaf surface, especially at periods of high disease pressure, is critical to preventative disease control.

There are a number of ITM strategies that can be used to keep a grass leaf surface drier and less prone to disease outbreak:

- Dew removal with brushes or other physical mechanisms (such as a hose dragged over the surface) to knock water droplets off the leaf.

- Increasing air flow across the turf surface or the use of pitch side fans to dry the leaf surface more quickly.

- The use of dew control surfactants that prevent water droplets from forming on the leaf surface during dew formation or following irrigation.

- The importance of appropriate control of excess water on the surface of turf leaves cannot be underestimated. The rule of thumb is “a dry leaf surface is one which is much less prone to fungal growth and attack”.

3.7 Use of supplemental lighting

The use of supplemental lighting to help grass plants grow in shady environments or to provide heat to the grass canopy during cooler winter months in colder climes has been a major technological development over recent decades. It cannot be underestimated, the value that the use of supplemental lights has had on the production of high-quality year round playing surfaces in shady and challenging enclosed growing environments of stadia. It can be argued that this has been one of the biggest technological innovations in football pitches since the evolution of sand-based and hybrid pitches.

However, like any tool, the use of lighting rigs has to be carefully balanced with the needs and requirements of the turf they are being used on. Grass plants have adapted and evolved to grow in a world where there is a diurnal cycle, in other words where there is a distinct day and night. This means that grass plants are not adapted to grow 24 hours a day in light. There are key physiological and biochemical processes that require the plant to have darkness. This means that it is important that lighting rigs are deployed to account for this, otherwise plants can become overstressed with continual growth. This can lead to increased susceptibility to disease or the turf canopy will grow excessively as individual grass plants compete for light, which means they again will be more susceptible to turf diseases.

Unquestionably, lighting units are an essential part of producing year round optimum football turf in a stadium environment, but they must be used according to the needs of turf with allowance for grass plant to rest.

3.8 Health versus growth

When managing a high quality football pitch, it is tempting to think that a healthy plant is a vigorously growing plant and in some cases that is correct, but in other circumstances growth or uncontrolled growth can be highly undesirable. Growth is essential to allow recovery from wear damage, to allow grass plants to mature and the turf canopy to thicken. However, this needs to be achieved whilst promoting a healthy grass plant, because the rule of thumb is a healthy plant is a more robust and resilient plant. The aim of an ITM based programme for football pitches needs to balance the need for biomass replacement and turf recovery with promoting a healthy plant. A simple way of thinking about this is a healthy plant with healthy growth will provide the optimum playing surface that is more robust and able to withstand both play and pest, weed and disease pressures.

3.9 Use of plant protection products

Integrated turf management looks to minimise the use of plant protection products by tackling the root causes of turf issues, such as the presence of pests, weeds and diseases. However, there are times when the use of PPPs are necessary (if they are available and legally able to be used in that country) to help manage a problem and prevent the build up of a pest, weed or disease population. There are some golden rules that must be followed if PPPs need to be used which are outlined below:

- **IDENTIFY** - Has the pest, weed or disease been correctly identified.
- **ELIMINATE** - Assess if there are solutions available that will resolve or manage the issue without the need to use a PPP.
- **CHECK** - Check what is legally available to use in your country/region.
- **EFFECTIVE** - If a PPP is to be used, choose one that will be effective against the problem being treated and with the least impact on people, wildlife and the environment.
- **INSTRUCTIONS** - Study the instructions and make sure to follow the directions for use.
- **COMPLY** – Ensure that the laws and regulations relevant to your city, state, region or country concerning PPPs are followed.
- **EFFICACY** - Use the PPP at the right dose rate and at a timing for best efficacy.
- **RISK** - Make sure risk assessments have been completed and followed to ensure staff, players and spectators are protected and do not come into contact with the PPP.
- **ENVIRONMENT** - Don't cause pollution or don't treat areas that don't need it.
- **DISPOSAL** - Dispose of all waste safely, in accordance with local laws and regulations.
- **PREVENT** - Understand why the problem occurred and prevent it from happening again – if there is no pest, weed or disease issue, it won't be necessary to consider applying a PPP.

It is best practice if we can avoid the need to use a PPP, but if it is allowed and necessary, it needs to be used for optimum efficacy.

3.12 Design of football pitches and the growing environment

Whilst it is difficult to adjust the design of a football pitch profile or stadium infrastructure, when there is an opportunity, ITM should form part of the design decision making. What does this mean in practice? When designing the physical infrastructure of a pitch and its surrounding environment, it is important and will become even more important in the near future, that the needs of the turf and its health are given maximum consideration. It is possible to have a beautiful and high-tech stadium, but if you don't have grass you can't play the game of football.

This means that when designing a pitch profile, it is essential to balance the following:

- Water and nutrient retention – it is important that the pitch profile can support the needs of grass to ensure that it is healthy. If too little nutrient or water is retained, turf can become over stressed and more susceptible to wear and pest, weed or disease issues. If the profile is too water retentive it may result in a softer playing surface that is at risk of excessive thatch build-up and greater pest, weed or disease activity.

- Draining excess water – allowing excess water to move away from the immediate playing surface is critical to maintaining an all season natural turf playing surface that has optimum hardness, ball and player interaction characteristics. To achieve this, there needs to be a balance between drainage of excess water in a timely manner, whilst retaining enough for healthy plant growth.

- Hybrid or non-hybrid turf – whether or not to use a hybrid playing surface (rootzone reinforced, stitched or carpet) typically depends on the standard of play and level of wear. Hybrid turf is designed to protect turf and to maintain player grip. This can help alleviate turf stress, making it more resilient and less prone to agronomic issues. If the level of play is high and hybrid turf is not used, there is greater risk of turf thinning and bare areas that can be colonised by weeds and algae.

- Compaction risk – compaction of a soil or rootzone often results in shallow rooting, greater water retention, poor drainage and greater turf stress. The design of a profile needs to consider the level of compaction risk to help ensure the playing surface is not only of high quality, but also that the sub-surface growing environment for grass is also optimised.

The wider growing environment in the stadium bowl is also a critical factor in ITM management as it creates a microclimate that affects all aspects of grass growth. Many of the maintenance approaches outlined in these UEFA Pitch Guidelines focus on mitigating those effects. However, if it was possible to reduce or remove the need for the mitigations, whilst still fulfilling the function of the stadium that has to be the best outcome. When designing a stadium the following turf factors should be considered:

- **Level of shade and natural light** – turf photosynthesises to produce carbohydrates and generate energy. If there is insufficient light turf will become stressed and therefore more prone to pest, weed and disease attack. The design of a stadium is the key determining factor in how much shade and natural light the pitch receives. The best practice ITM approach would be design stands that minimise shade, whether that is by architectural design increasing the size and dimension of the oculus in the roof or for example by including light transmitting panels in the building structure to allow more light to reach the pitch. One thing is for certain, the more shaded the pitch the more challenging the growing environment for turf and the more stressed the grass is, the more prone to damage and pest, weed and disease attack it will be.

- **Airflow** – putting stands up around the full perimeter of a pitch reduces airflow over the pitch surface. This has significant impacts on leaf wetness and disease risk. More and more stadia are looking at including architectural features that assist with increasing airflow over turf. This is an essential strategy for helping to minimise disease outbreaks and the need to use fungicides.

- **Rainfall** – just as ever more enclosed stadia create shade and reduce airflow; they can also limit rainfall on the pitch. Whilst this can be a beneficial effect in very wet weather, the variable wetting of the pitch across its area can result in agronomic differences in the turf. This may make it more difficult to irrigate the pitch, as there needs to be independent head control for pop-up irrigation to even out the water content of the pitch profile, as well as careful monitoring of spatial pitch water contents. Designing stadia with greater control over rain inputs to the pitch can help with long-term ITM planning.

- **Temperature** – reduced airflow and differential shade can result in variable temperatures around the stadium bowl. For transitional grass pitches, this can have a large impact during late Spring/early Summer and in Autumn, when grass species are being transitioned. Sunnier areas in the middle of the pitch may be easier to transition than the cooler and more shady areas, resulting in turf with a variable composition, which makes programming turf maintenance inputs much more difficult. Strategies that create more open and lighter stadia bowls with better airflow will help with ITM programmes.

3.14 Best practices for Integrated Turf Management of football pitches

Firstly, it is important to understand that best practice is ITM and ITM is best practise. In other words, if a turf manager follows best practice, they will be carrying out ITM for their pitch. As a simple summary, Figure 2 outlines the main best practise steps that can be followed if following an ITM approach. Further information on each of these action steps in Figure 2 are outlined below in more detail.

Figure 2. Action steps for best practice ITM on football pitches

- **Pest, weed and disease identification** - it is essential for a groundskeeper to know what problems have occurred on their pitch in the past or that are affecting it currently. To be able to do this, it is vital that a pest, weed or disease issue is correctly identified so that the best possible immediate treatment can be provided and the most appropriate preventative programme is actioned. If help is needed with identification, seek guidance from agronomists, pitch specialists, other groundskeepers, as well as identification books and guides widely available online or is physical forms. Some common turf disease that can affect football pitches are given in Table 2.

- **Understanding the problem** - once a pest, weed or disease problem has been identified, either historical or a current issue affecting the pitch, understanding the root causes of why that issue has occurred is essential. It is therefore important to understand the biology and ecology of the pest, weed or disease, so that the root cause can be identified and appropriate maintenance inputs made to prevent the issue from occurring in the future.

- **Tackling the immediate issue** - if a pest, weed or disease problem is severe, immediate treatment may be required. This will often mean application of an appropriate plant protection product, if allowed by local or national legislation. It is vital to assess if an issue can be tackled with non-chemical means or without having to resort to application of a plant protection product. However, it may be necessary to apply a plant protection product to prevent further spread of a problem and to control the build-up of the pest, weed or disease population. However, this should not be the default position when managing pest, weed or disease issues, as ITM emphasises preventative management.

- **Prevention is better than cure** - as has been highlighted so far, ITM strongly focuses on the prevention of problems because this means that turf damage does not occur. However, for preventative management to work effectively, it is critical that a groundskeeper understands the reasons why a particular problem is affecting their turf. This relates back to the conceptual model presented in Figure 1 which shows that ITM management is focussed on promoting plant health, whilst providing an environment which favours grass and not a pest, weed or disease.

- **Monitor, monitor, monitor** - managing a football pitch means that it is important to continually monitor and assess the condition of the playing surface. The early detection of any issues that might cause damage to the playing surface is essential to effective preventative management. Detecting conditions that might favour a pest, weed or disease prior to or at the early stages of an outbreak is vital for preventing turf damage and allowing maintenance programmes to be adjusted.

Table 2. Some common turf diseases that can affect football pitches

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)

When it comes to ITM on football surfaces, Figure 3 helps to illustrate the hierarchy of management practices that should be followed. Each level in the hierarchy is outlined in further detail below:

- **Prevention** - the largest part of ITM focusses on implementation of preventative measures to control the habitat, environment and population of a pest, weed or disease to stop it from ever becoming an issue. For example, the use of supplementary lights to keep turf dense and the surface dry to prevent algal/bacterial mats from growing on a pitch surface.

- **Cultural and physical** - the next largest component of turf maintenance operations should focus cultural and physical approaches. These rely on the physical disruption of pasts, weeds or diseases and managing the pitch profile or growing environment to ensure their populations don't build-up to a level that causes a problem in the first place. For example, use of brushes and sideline mounted fans for reducing leaf wetness and potential for fungal disease growth.

- **Biological** - Biological controls are a new area of development for football pitch management with ever more solutions being developed and coming to market aiming at the early control of pest, weed or disease problems. However biological approaches often require repeat applications at relatively high intensity, coupled with specific requirements for the application of the biological control agent. The cost of biological controls can also make them less attractive to turf managers. These provide challenges for biological controls, but their long-term integration in to pitch management programmes will be essential when further restrictions on plant protection products inevitably happens. For example, the use of bacterial inoculants to help manage fungal disease pathogen populations.

- **Chemical** - the final option is to use a dedicated plant protection product to control a population of pests, weeds or diseases, either before it builds up or to cure a problem that has occurred. The use of plant protection products under ITM is not prohibited but should be considered as a tool that can be used to assist and certainly not the first line of defence. A key aim of ITM is to minimise the use of plant protection products and when they are used, that they are deployed to their best effect for the minimum dose required. For example, the use of herbicides to control weeds growing in a pitch prior to flowering (after flowering most weeds will produce seeds and either die back or become dormant).

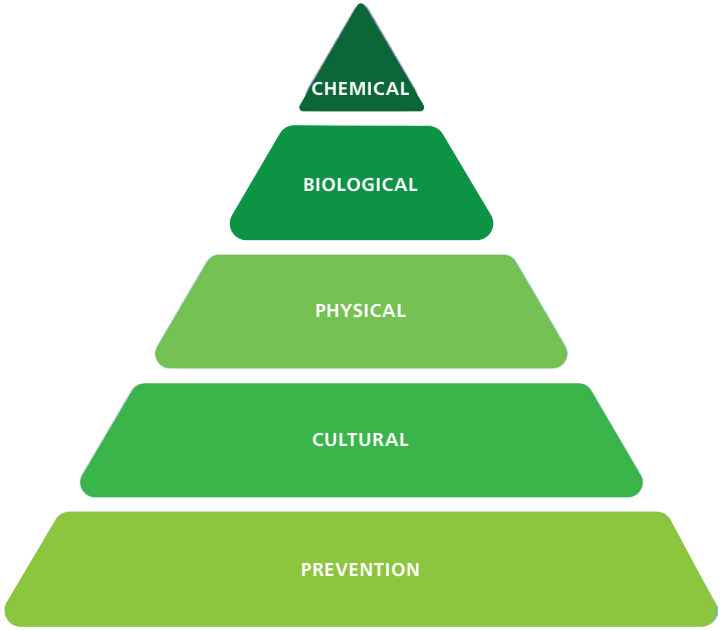


Figure 3. Decision hierarchy for ITM control of pest, weed or disease issues

3.15 The challenges to be considered when thinking about Integrated Turf Management on football pitches.

When following and developing an ITM based programme for football pitch management, it is essential that groundskeepers keep in mind that the issues faced in pitch management are not in isolation of other regional or global challenges that need to be considered. This section aims to outline some of the other challenges that need to be considered along with ITM best practise turf maintenance procedures.

3.16 Legislation and regulation

Integrated turf management has been enshrined in EU law for many years as part of the Sustainable Use Directive (SUD). The SUD has pushed European member states toward further use of ITM to reduce the need to apply plant protection products. However, regulations and legislation continues to evolve, putting further pressure on the available plant protection products in a groundskeeper's management programme. An example of this over recent years has been the proposal for a regulation on the sustainable use of plant protection products (SUR) to replace the SUD. If this legislation had been successful in the European Parliament, it would have resulted in significant further restrictions on the use of PPPs for football pitch management. Whilst this regulation did not make it through into active EU legislation, it is only a matter of time before new regulations and legislation come out, which will result in further restrictions in PPP availability. This means it is important that turf management programmes in stadia and on all football pitches continue moving toward maximum ITM adoption.

The widest possible adoption of ITM will help to keep effective PPP tools available for managing disease and other issues associated with managing turf in the challenging microclimate of stadia. However, it is vital that football pitch turf management can demonstrate that it is fully adopting ITM and that it is following best practice. This will also mean that, when further restrictions come into force in the future, natural turf football pitches will be optimally placed to cope with these changes and pitches will already be more resilient and robust as a result of following ITM based programmes. Put simply, change is coming and football pitch management must be ready and lead the way in what can be achieved by following ITM.

Whilst legislative pressure has focused on EU member states, the impacts would not just be restricted to facilities located in the EU. The impacts of restrictions in the EU would also be felt in non-EU member states, as Europe still operates as a large commercial market. If that market changes (such as shrinks in size) then market forces mean that it is highly likely that the availability of plant protection products would be impacted in non-EU countries. Ultimately, the only sustainable and long term low risk solution is to adopt integrated turf management approaches as fully as possible when managing natural grass football pictures. If ITM is adopted to its fullest possible extent, this means natural turf football pitches will be as robust and resilient as possible to future legislative changes, which will benefit turf, groundskeepers, stadia, players, spectators, society and most importantly the wider environment.

3.1.3 Climate change

One of the biggest challenges facing planet earth is climate change. The effects of global warming are not restricted to elevated average global air temperatures. Major planetary systems such as climate and ocean currents will be affected. Why is climate change a major challenge for turf management and how can ITM help with mitigation? Climate and its effect on weather has a direct impact on grass growth and health. If the growing environment changes then this has both direct and indirect impacts on turf, how it grows and how susceptible it is to play and other stresses.

A key driver of climate change is global warming, but this has local and regional impacts which can and will vary across the globe and around Europe. Typically, climate change will mean for many that weather will be less predictable and more prone to extremes. What this means for a particular stadium requires an understanding of how climate will change in that country and region. Many governments and non-governmental organisations produce predictions as to the outcomes of climate change modelling and what citizens in that country can expect. It is critical that stadia review these predictions and assess the risk on how they prepare and grow their turf.

One example would be if weather became less predictable with greater extremes of wet and dry. This means that turf management needs to be able to cope with very wet weather and even flooding, whilst also being able to deal with extended periods without rainfall. All of which needs careful planning to ensure a stadium will be resilient to these threats. ITM would look to mitigate these impacts by changing turf maintenance processes to prevent turf issues from arising by focussing on drainage and water retention strategies and technologies.

Another example is how climate change may directly affect the length and seasonality of the natural growing season. For many countries, this may mean a longer growing season, which some may argue will help with recovering from wear. However, this will also likely mean that pest, weed and disease activity will also be extended, and if this translates to milder and wetter autumn and winter conditions then disease pressure will extend for longer and with greater severity through the football season.

Understanding what climate change means for your country and region is essential for long-term turf management planning. It allows ITM programmes, pitch design and operational models to adjust to help mitigate any negative impacts of climate change. Planning now to meet these future challenges is vital as leaving it too late will result in less sustainable turf management and greater risk. ITM plays a key role as it promotes preventative approaches to be implemented to mitigate increased risk of pest, weed and disease activity.

3.1.5 Water availability and excess

Many governments across Europe have already identified that water availability is going to be a major challenge with less water resources being available to many. This means that identifying the risks to a stadium of lack or reduced water availability is critical for long-term business and football sustainability. From a turf point of view, if there is not sufficient water available for irrigation it will be hard to produce and sustain high-quality playing surfaces.

What can be done about water scarcity and how can ITM help? There is a need for all football facilities to assess their operations and look to improve their water resilience plans. There are a range of strategies that are or could be adopted to help relieve pressures on water supplies:

- Water harvesting and recycling – capturing alternative sources of water such as through rainwater harvesting and trapping air conditioning condensate can help provide alternative sources of irrigation water. Likewise, recycling water that has already been applied to a pitch and using it for reapplication can significantly improve water savings.

- Alternative sources of water – using wastewater of various levels of treatment such as grey water or TSE water can provide alternative sources of water for pitch irrigation that mean there is less competition for potable quality water.

- Alternative ways of providing water to a pitch – traditional irrigation is applied at the surface, but there are a growing range of solutions that look to provide water sub-surface direct to the grass roots. This minimises evaporation and wind losses increasing water use efficiency.

- More water efficient varieties – plant breeders are actively working on grass varieties that are more drought resistant and require less water or can tolerate lower quality water. This will help reduce demand and allow a more varied supply of water to be used.

- Grass species with lower water demands – As climate change occurs, the areas that can use and sustain warm-season grasses will increase. These grasses are much better adapted to growing in restricted water environments and their increased use, where possible, will help further reduce water demands.

However, it is not just dealing with lack of or sporadic water supplies, dealing with excess water at key stages of the year can be just as problematic. Dealing with heavy and prolonged rainfall or operating in an urban area prone to flooding can be a major challenge. Football pitches are often engineered to have enhanced drainage which is good for moving water out of the pitch but can contribute to local flooding. Additionally, if a surface is engineered for drainage, it needs to also be able to cope with restricted water availability by allowing more water to be held in the pitch profile.

Water is essential for all life and producing and maintaining high quality football pitches is no different. Water security and integrated water management (IWM) are becoming ever more important topics and need to be considered when looking at short-term, medium-term and long-term ITM planning for football pitches at all levels of the game.

The wider growing environment in the stadium bowl is also a critical factor in ITM management as it creates a microclimate that affects all aspects of grass growth. Many of the maintenance approaches outlined in these UEFA Pitch Guidelines focus on mitigating those effects. However, if it was possible to reduce or remove the need for the mitigations, whilst still fulfilling the function of the stadium that has to be the best outcome. When designing a stadium the following turf factors should be considered:

- **Level of shade and natural light** – turf photosynthesises to produce carbohydrates and generate energy. If there is insufficient light turf will become stressed and therefore more prone to pest, weed and disease attack. The design of a stadium is the key determining factor in how much shade and natural light the pitch receives. The best practice ITM approach would be design stands that minimise shade, whether that is by architectural design increasing the size and dimension of the oculus in the roof or for example by including light transmitting panels in the building structure to allow more light to reach the pitch. One thing is for certain, the more shaded the pitch the more challenging the growing environment for turf and the more stressed the grass is, the more prone to damage and pest, weed and disease attack it will be.

- **Airflow** – putting stands up around the full perimeter of a pitch reduces airflow over the pitch surface. This has significant impacts on leaf wetness and disease risk. More and more stadia are looking at including architectural features that assist with increasing airflow over turf. This is an essential strategy for helping to minimise disease outbreaks and the need to use fungicides.

- **Rainfall** – just as ever more enclosed stadia create shade and reduce airflow; they can also limit rainfall on the pitch. Whilst this can be a beneficial effect in very wet weather, the variable wetting of the pitch across its area can result in agronomic differences in the turf. This may make it more difficult to irrigate the pitch, as there needs to be independent head control for pop-up irrigation to even out the water content of the pitch profile, as well as careful monitoring of spatial pitch water contents. Designing stadia with greater control over rain inputs to the pitch can help with long-term ITM planning.

- **Temperature** – reduced airflow and differential shade can result in variable temperatures around the stadium bowl. For transitional grass pitches, this can have a large impact during late Spring/early Summer and in Autumn, when grass species are being transitioned. Sunnier areas in the middle of the pitch may be easier to transition than the cooler and more shady areas, resulting in turf with a variable composition, which makes programming turf maintenance inputs much more difficult. Strategies that create more open and lighter stadia bowls with better airflow will help with ITM programmes.

3.1.6 Key messages

Integrated turf management has been vital over recent decades for meeting the challenges of increasing playing quality standards expected of natural turf pitches, in some of the most difficult environments to grow turf, i.e. the modern stadium. ITM will be even more critical over the coming years as there are legislative and environmental challenges to contend with.

ITM has always been an important part of football pitch maintenance. However, its importance has grown over the past few decades and it is essential for football that ITM based approaches are widely adopted at all levels of pitch management.

Central to ITM is the need to understand the issues that can occur on football pitches, especially concerning pests, weeds and diseases, and use this knowledge and the turf management tools available to prevent these problems from manifesting on the pitch. In essence, it is far better (economically, environmentally and quality wise) to prevent turf problems rather than having to tackle the issue once it is affecting the pitch and causing turf damage.

ITM requires the implementation and understanding of the full range of turf management tools available to groundskeepers. It means using these tools to their best efficacy to produce high quality surfaces that can be sustained with minimal resource input. A core component of ITM is the desire and need to minimise the use of plant protection products.

As legislation moves toward significant restrictions on the use of plant protection products, there has never been a greater need for groundskeepers to ensure they have fully adopted ITM. This is not only to produce the best possible playing surfaces for the minimum input of resources, but also to demonstrate that best practice and sustainable approaches are being followed. It is vital that football can demonstrate how it has adopted ITM and it is at the heart of modern pitch management programmes.

There is a wealth of ITM information and advice available. This can be found from talking to other groundskeepers, agronomists, scientists and pitch consultants, as well as reading the ever growing sources of technical and non-technical information available on the internet, in books, magazines and other varied media.

APPENDIX 4

APPENDIX 4 – CEREMONIES

Ceremonies are an integral part of many UEFA matches and are designed to enhance the fan experience.

In order to deliver a successful ceremony with as little disruption to the playing surface as possible, early discussions between the key stakeholders are required to plan the event and develop a risk mitigation strategy for the pitch. An initial meeting should be held between the ceremony organisers/suppliers, the local organising committee or structure (LOC/LOS), UEFA/the UEFA turf consultant, the venue management team and the head groundskeeper to discuss the proposed concept, programme and timings.

The following information should be shared at the initial meeting in order for everyone involved to understand the possible implications of the ceremony, including rehearsals on the pitch, and to allow the ceremony organisers to deliver a successful ceremony with minimal risk and disruption:

- Overall ceremony concept, including proposed timings
- Number of dancers and other ceremony participants
- Props and equipment to be used, including details of any pyrotechnics and the weight and design of any stage structures
- Proposed turf protection system
- Ground pressure measurements and design of any wheeled trollies
- Proposed assembling and dismantling programme
- Proposed pitch entry and exit points
- Number and length of rehearsals required (this must be as accurate as possible, with 20-minute buffers to allow for possible delays)
- Proposed rehearsal days (e.g. MD-3 and MD-2)
- Anticipated weather and solutions in case of adverse conditions

This initial meeting should coincide with a pitch assessment by UEFA/the UEFA turf consultant. A further brief meeting should be conducted approximately one week before the match, when the ceremony organisers arrive at the stadium to prepare.

In order for ceremonies to run smoothly, rehearsals have to take place on the pitch. However, these need to be carefully scheduled and communicated to the head groundskeeper, to ascertain and minimise their impact on pitch preparations. UEFA and the LOC or LOS will manage and communicate the scheduling and organisation of rehearsals accordingly.

The principle requirements are to:

1. safeguard the field of play and ensure it remains in optimum condition;
2. respect the countdown to kick-off;
3. comply with the UEFA regulations.

4.1 Field of play

The key to the success of UEFA matches, and club competition finals in particular, is to have fields of play that are that of a high enough quality to guarantee the highest possible sporting and player safety standards. In other words, the condition of the field of play (including any divots, unevenness, holes, variation in levels of compaction, etc.) should in no way compromise the quality of the match, the sporting result or the safety of the players, and it should leave no room for criticism from players, coaches, officials, spectators or partners, including sponsors, suppliers, broadcasters and the media.

Although ceremonies are an integral, important part of many UEFA matches, all pre-match activities on the field of play are subject to the prevailing pitch and weather conditions. They may be cancelled at any time if there is a risk that they could cause the match to be played in anything other than the best possible conditions.

Any decision to cancel a ceremony ahead of a UEFA match will be taken by UEFA, in consultation with the UEFA turf consultant (if any), the LOC/LOS and the head groundskeeper.

Furthermore, it must be acknowledged that rehearsals may need to be postponed, relocated or cancelled if they constitute a risk for the field of play. Such decisions are taken by UEFA and are communicated to all the key stakeholders at least 24 hours in advance so that they can make the necessary alternative arrangements.

If a stadium has a retractable roof, that should be used to control pitch conditions, subject to the approval of UEFA, the UEFA turf consultant (if any), the LOC/LOS and the head groundskeeper.

All the information needed to take the above decisions is collected by the event project leader.

4.1.1 General principles and precautions

The following principles and precautions are intended to minimise the risk for the field of play, which remains the top priority at all times:

1. The design, construction and assembly of any ceremony structures and turf protection system, including sizes, weights, types of material and how materials will be manoeuvred and installed, must be carefully planned and implemented.
2. Intensive rehearsals involving repetitive movements should where possible be carried out on at an alternative location.
3. Any heavy-duty structure (more than 90kg per point load) should be lifted onto the pitch rather than wheeled. If the structure cannot be lifted, the weight needs to be distributed on numerous wide wheels (specifics to be shared with the UEFA/the UEFA turf consultant and the head groundskeeper for approval in advance). Clearly, rolling five or six tonnes of staging onto a pitch always poses a risk, even if the weight is distributed over sufficient, suitable wheels. However, in the right conditions, with the right methodology, using skilled operators and limiting the number of strike-in/strike-out movements, it may be possible to reduce the risk to an acceptable level.
4. Any material used to cover the pitch must be air-permeable and its installation must be discussed with all stakeholders, taking into account pitch maintenance activities such as mowing, irrigation and line marking. The cover itself or part of it must be removed for the line-ups: the clear area must be big enough for 27 people to line up approximately 10m from the touchline facing the main camera. The positions and movements of other stakeholders such as photographers and TV cameras must also be taken into account.
5. The number of ceremony participants must be limited, i.e. the minimum required for the agreed choreography, bearing in mind the following golden rules:

- Goal areas and other sensitive areas of the field of play should be avoided.
- No continuous running in circles.
- Other repetitive movements, on the spot or back and forth along the same area, should be avoided.
- Performers must be carefully selected and given a strict code of conduct to follow while on the pitch (e.g. no mobile phones).
- The ceremonies team must have stage managers on-site to manage communication with the stagehands and put chaperones on the pitch to ensure the code of conduct is respected, especially in relation to mobile phones and selfies as the players line up.

4.1.2 Rehearsals

Opening ceremonies

No more than two full dress rehearsals should be held on the field of play. An additional technical rehearsal (stage, props and protective system only) may be permitted if necessary, while sound and lighting rehearsals need not be restricted, provided the field of play and pitch maintenance activities are unaffected.

Ideally, rehearsals should be held on MD-3 and MD-2, with none on MD-1 (when teams' and referees' training sessions are held on the field of play). If three rehearsals are needed (two full and one technical), an additional slot shall be made available on MD-5. It is important to avoid having three rehearsals on the field of play on consecutive days.

Sample rehearsals schedule

- MD-5: Technical rehearsal (stage, props and protective system only)
- MD-4: Pitch maintenance only (no activities on the field of play)
- MD-3: Full rehearsal with TV
- MD-2: Full rehearsal with TV
- MD-1: Dry tech (sound check and special effects installations with no performers, stage, props or pitch protective system)

If either of the full rehearsals on MD-3 or MD-2 has to be cancelled, UEFA will decide whether it is possible to, exceptionally, hold a full rehearsal on MD-1.

Rehearsals should ideally be scheduled for the evening when the actual ceremony will be held and the pitch is shaded. They should not be scheduled for the middle of the day, when the sun could be shining directly on the pitch.

Rehearsals should last no more than three hours, not including the installation of turf protection system and the stage assembly (which together should take no more than an additional 30 minutes).

The UEFA ceremonies team should inform the UEFA turf consultant (if any), the LOC/LOS and the head groundskeeper of the details of each rehearsal (including the duration, use of a turf protection system, number of performers, stage construction and props) four weeks in advance, so that they can evaluate the impact on the pitch and approve the plans. Any late modifications should be communicated at least 24 hours in advance.

Performers should position themselves along the perimeter of the pitch and keep off the grass as much as possible until the rehearsal starts. When on the pitch, they should avoid standing online markings unless explicitly instructed to do so.

An alternative venue should be organised as a backup in case rehearsals on the field of play have to be cancelled, and for any additional rehearsals that may be required.

Cup presentation ceremonies

Only one rehearsal should be held on the field of play, directly before or after one of the opening ceremony rehearsals, in principle on MD-2 and in any case not on MD-1 (when the teams and referees train on the pitch). The rehearsal should last no more than one hour, including the installation of staging, props and the turf protection system.

4.2 Countdown to kick-off

Having a precise countdown to kick-off and ensuring everyone respects it is vital for the smooth running of any UEFA match, especially opening matches and finals. Any changes must be discussed and agreed by UEFA. Unexpected deviations can have serious impacts, especially on the teams and broadcasters.

Sample countdown to kick-off (club competition final with opening ceremony, no turf protection system)

Start Before KO	Duration	Activity
KO - 50 minutes	30 minutes	Team and referee warm up
KO - 20 minutes	5 minutes	Pitch watering (if needed)
KO - 15 minutes	11 minutes	Opening ceremony (including set up)
KO - 4 minutes	1 minute	Referees and players exit the tunnel
KO - 3 minutes	40 seconds	Referees and players lined up & competition anthem plays
KO – 2 minutes 20 seconds	40 seconds	Referees and players shake hands as ceremony is cleared away
KO – 1 minutes 40 seconds	20 seconds	Team Photos
KO – 1 minutes 20 seconds	30 seconds	Coin Toss
KO – 14 seconds	-	Field of Play and its surroundings are fully clear
KO	-	Referee starts the match

Ceremony set-up

The pre-positioning of any turf protection system or other material at the edge of the field of play should be discussed by all stakeholders, taking into account any pitch protection policy or guidelines given to the teams and referees for their pre-match warm-ups (e.g. fast-feet exercises outside the field of play).

The actual set-up on the field of play cannot start until any last-minute pitch watering has been completed. If the irrigation cycle takes less than five minutes, the remaining time will be allotted to the ceremony set-up, and if no pitch watering takes place, the set-up can start as soon as the teams' and referees' warm-ups have finished.

Referees and players line up for the anthem(s)

At UEFA competition matches, the competition anthem starts the moment the referees and players have lined up on the field of play and it normally lasts 40 seconds, during which time the host broadcaster films the line-ups. Alternatively, an extended version of the anthem may be played from the time the teams appear in the stadium bowl up until they have lined up facing the main camera.

The exact time the referees and players gather in and exit the tunnel is venue-specific – it depends how long it takes them to walk from the tunnel to the centre of the field of play. There may be a 10-second countdown and walk-on music to accompany them.

Dismantling of the ceremony

All countdown to kick-off foresee three minutes between the teams having lined up on the field of play and the referee starting the match. This time is vital for the broadcasters, who may run graphics or need to transition from studio to commentator, for example.

The ceremony performers' exit from the field of play and removal of all ceremony materials, including any turf protection system used, needs to start as soon as possible after the anthem(s) and filming of the line-ups. It should start in the area closest to the referees and players, to allow teams space to disperse after the handshakes and team photos. Dismantling should ideally be done equally, and at an equal pace, on both ends of the pitch. All performers and materials must have cleared the field of play and its surroundings by 15 seconds before kick-off at the latest, to ensure the match can start on time.

If a turf protection system is used for the ceremony, more time will be needed to dismantle the panelling and clear the field of play. Generally speaking, the referees and teams exit the tunnel 30 seconds earlier and an additional activity such as an award presentation may be introduced between the end of the anthem(s) and kick-off, with the dual objective of reducing the waiting time on the field of play and distracting the spectators and TV audience from the ceremony dismantling.

The full set-up and dismantling process should be tested as part of the ceremony approval process, ideally on the match pitch, to ensure it can be done within the precise times available.

4.3 UEFA regulations

All ceremony activities, including any special effects, must obviously comply with the UEFA regulations. Of particular relevance are the rules on delays to kick-off and the use of pyrotechnics.

Delays to kick-off

Under Article 11(2)(h) of the UEFA Disciplinary Regulations, clubs can be sanctioned for deliberately delaying the kick-off of a match. Logically, UEFA, as the organiser, must therefore also do its utmost to ensure the countdown to kick-off and actual kick-off time are respected.

Use of pyrotechnics

The use of pyrotechnics by spectators at UEFA matches is prohibited by Article 16 of the UEFA Disciplinary Regulations and a UEFA Stadium and Security Committee working group has been set up to look into minimising the use of pyrotechnics at football matches more broadly, to protect the health and safety of everyone in the stadium and minimise the risk of damaging the pitch. The use of pyrotechnics often results in a delay to the game as a result of excessive smoke or the need for authorities to safely remove any items that have been thrown onto the pitch. Pyrotechnics are common in ceremonies attached to sports events, and their use by the organisers remains possible also at UEFA matches for the time being, either from the stadium roof or pitch side, subject to the agreement of all stakeholders. The final decision rests with UEFA.

4.4 Photos of common ceremony issues

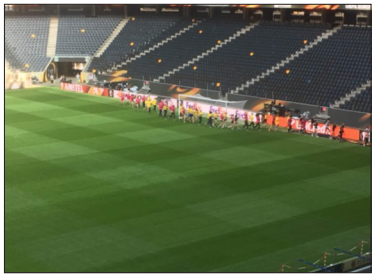


Fig 68. Flag carriers walking in front of the goal. Where possible, they should walk behind the goal. This may not be possible on matchday as there will be several cameras behind the goals, but during rehearsals there is no reason to put extra strain on the goalmouth, which is a particularly vulnerable part of any field of play.

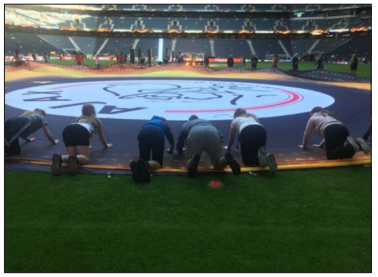


Fig 69. Flag folding on the pitch Flags should be folded away outside the field of play.

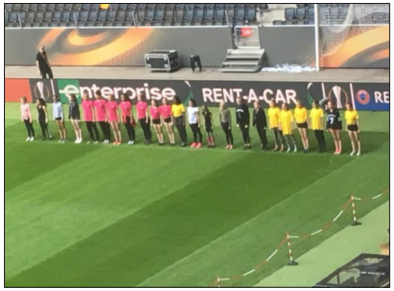


Fig 70. Dancers standing on white lines, reducing line marking accuracy and causing unnecessary wear to the line markings. Choreographers must tell all performers before the rehearsals not to dance or stand on the white

Figure 71. Faded lines caused by too much wear during multiple rehearsals.

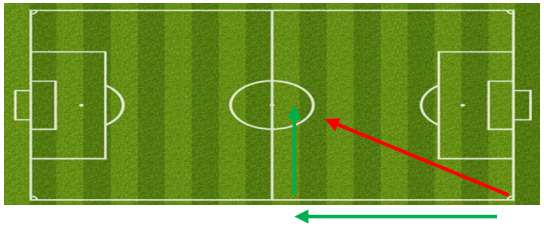
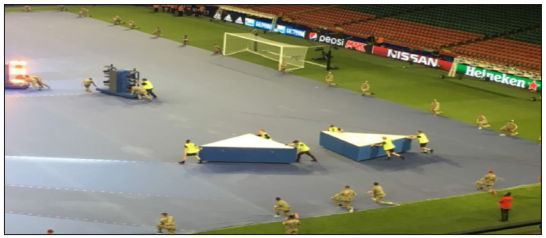


Fig 72 & Fig 73. Materials entering and exiting the field of play. Stage and pyrotechnics crews should enter the pitch at the point closest to their intended position (green arrows), to reduce the distance they must cover on the field of play and the time it takes them to manoeuvre into position.



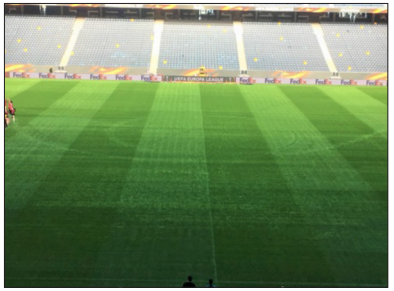


Fig 74. Repetitive movements.
Rehearsals typically involve repetitive movements that can leave visible marks on the field of play.Reducing the number of rehearsals and types of movement practised on the field of play limits the damage and enables ground staff to groom out any marks left behind.

Fig 75. Use of mobile phones.
Allowing ceremony performers and crew to take selfies on or around the field of play can on occasion lead to inappropriate behaviour when on the pitch with the teams and TV cameras.

Fig 76. Having one or two members of staff on the pitch is not a problem in itself, but it sets a dangerous precedent and will soon become problematic if other staff, family members, etc. think it is acceptable to stand around on the field of play.

Fig 77. Unnecessary pitch damage caused by careless manoeuvring of ceremony infrastructure under poor supervision**.**

APPENDIX 5

APPENDIX 5 – CONCERTS AND OTHER NON-FOOTBALL EVENTS

Before going into specific pitch management considerations, it is important to understand the implications of holding any concert or other non-sports event, or indeed non-football event, on a football pitch, especially natural turf.

- Any non-sports event held on a turf pitch (natural or artificial) has the potential to cause irreparable damage.
- Some form of turf protection system will be required for most non-sports events, unless the event happens to coincide with major pitch renovations or upgrades.
- It is essential to have a detailed understanding of any non-sports event that is proposed before planning gets under way (i.e. length and timing of event, stage location and footprint, vehicle access requirements, vehicle weights, etc.) in order to be able to offer a bespoke pitch protection solution.
- Every non-sports event requires a detailed management plan, specialist input from suppliers, and close supervision. The head groundskeeper and their suppliers must be involved in the planning and implementation process.
- Some pitch systems require special consideration. Stitched turf reinforcement systems, for example, are extremely difficult to repair because returfing is not possible on this type of surface. Similarly, pitches with shallow irrigation, drainage or undersoil heating systems are vulnerable to damage if pegs are used to secure temporary structures such as marquees in the middle of the pitch.
- Even other sports events require consideration. Rugby league, rugby union and American football, for example, all allow logos to be applied to the playing surface, which would need to be removed for subsequent football matches. This may be easier said than done. Sports such as boxing on the other hand, for which a ring is usually located in the centre of the pitch, require an approach similar to that required for concerts.

Fig. 78. Logos and line markings for a non-football event

5.1.Event classification

When considering hosting non-football events, it is important to understand the different types of event and their different implications. This not only enables the events and pitch to be better managed; it also allows for better understanding by all stakeholders of the consequences and costs and encourages better contractual arrangements.

The following four event categories are suggested:

- Category 1: Any staging is located off the pitch, with the pitch itself requiring only a light-duty translucent turf protection system for the audience, implying minimal damage to the pitch (Fig. 79).
- Category 2: A stage is required in the centre of the pitch, with the audience on all sides (aka 'in the round', Fig. 80. If scaffolding is used to support the stage and pitch protection is managed correctly, pitch damage should be minimal.
- Category 3: The stage extends onto the pitch, with a walkway and a small, secondary stage ('B stage') on the playing surface (Fig. 81. Heavy-duty access is required, meaning the pitch will need to be covered with a combination of materials, possibly including a steel trackway and a translucent turf protection system, and considerable pitch damage is possible.
- Category 4: A significant structure or structures are required on the pitch in addition to the actual stage, as could be expected for an Olympic opening ceremony or a major rock concert, and a high level of pitch damage can be expected (Fig. 82).

Fig. 79. Category 1 event, with the stage in the stands.

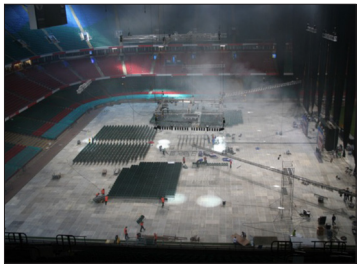


Fig. 80. Category 2 event, with a 'B stage' extending onto the pitch.

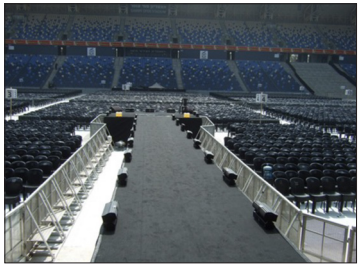


Fig. 81. Category 3 event, in this case a boxing match, with the stage/ring being assembled 'in the round' in the centre of the pitch.

Fig. 82. Category 4 event, with the stage and a major additional structure on the pitch.

5.2 Turf protection systems

Turf protection systems can also be classified, according to the grade of material used, i.e. from light to heavy-duty. When considering the different products available, it is important to fully understand the manufacturer's specific guidelines in order to select the right product for the event in question. The amount of time available for pitch recovery after the event will also be a key factor in the decision-making process. One of the best options is to try to arrange for the event to coincide with a major pitch renovation or upgrading.

Light-duty systems generally comprise white or translucent panels with ventilation holes for drainage and aeration, which can be quickly installed and removed by hand. These types of panel can usually take the weight of golf buggies and loaded trailers but should not be used for forklift or truck access. They can also support delay towers (Fig. 83) and lightweight staging, and depending on the conditions (time of year, weather, etc.) they can typically be left on cool-season grass for five to seven days with no significant detrimental effects. Products of this type include the Terraplas range, Ultradeck 1, ArmorDeck 1 and Matrax 4x4 LD composite mats.

Once light-duty turf protection has been removed, cool-season grasses generally take approximately seven to ten days to recover (Fig. 84), under optimum growing conditions and subject to strict adherence to very specific turf protection guidelines before and after the event (see section 6.3 below).

Warm-season grasses require a different approach, as significant damage from shading typically starts to occur after three days and recovery is much harder, as warm-season grasses suffer a far greater level of 'shade stress' (Fig. 85).

At the other end of the turf protection spectrum, heavy-duty systems allow for heavy vehicles and cranes to be positioned on the edge of the pitch (Fig. 86). These types of heavier plastic panelling may also be translucent or opaque and can be quickly installed and removed by hand. Products such as I-Trac, Terratrak Plus, ArmorDeck 3 and Matrax 4x4 HD composite mats claim to be able to support 150-tonne cranes, forklifts and trucks on a stadium pitch with no significant damage caused.

Aluminium trackway panels may also be useful, especially those that can be installed and removed by hand, but this type of product can severely damage the turf if left in situ for any length of time. They can also burn the pitch in hot, sunny conditions, so in some cases the turf is removed before the panels are laid (Fig. 88).

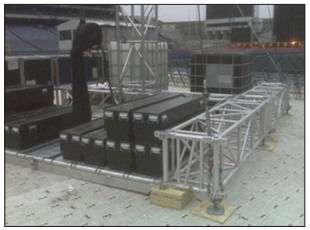


Fig. 83. Delay tower built on light-duty turf protection panels.
Self-erecting delay towers are often used for concerts as they can be quickly put up and taken down, and the various components can be manoeuvred onto the pitch using hand-operated pedestrian forklifts.

Fig. 84. Cool-season turf that has suffered minimal damage from light-duty protective panels left in place for six days.

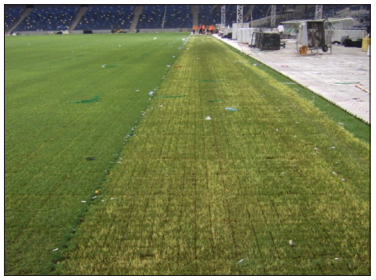


Fig. 85. Warm-season turf on which panels (see Fig. 86) were left in place for three days (left) and five days (right).

Fig. 86. Three types of turf protection system: light-duty on the right under the seating on the field of play; a heavier-duty product in the middle intended to cope with an increased concentration of spectators standing in front of the aluminium crowd control barrier; and a heavy-duty product to the left of the red and white tape, on the artificial turf perimeter, where the stage has been built and on which vehicles and cranes can travel (see Fig. 87).

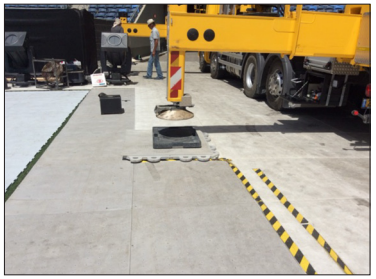


Fig. 87. Heavy-duty panelling to support large vehicles and cranes.

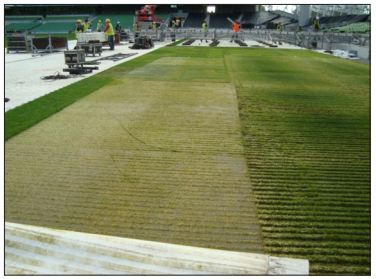


Fig. 88. Aluminium trackway panels used to allow heavy vehicle access onto the pitch, with and without removing the turf first. On the left, significant damage was done to cool-season turf after 11 days of panelling; on the right, the turf was removed prior to installation and the panelling laid on a geotextile surface.

The operation of multi-use stadiums and the use of football stadiums for non-sports events rely heavily on operational efficiency: almost all turf protection systems used for all types of event require double handling and are transported onto the field of play using trailers, buggies and hand-operated forklifts (Fig. 89).

Any obstructions such as ramps slow down operations and can have a significant impact on the overall time needed for both installation and dismantling. Smooth transitions should be ensured between (1) any perimeter track/artificial turf protection, (2) the main light-duty system on the field of play, and (3) any additional heavy-duty panelling or aluminium trackway panels used to provide heavy vehicle access (Fig. 90). Any significant changes in elevation around a pitch form an obstruction and will need addressing in order to get hand-operated forklifts and heavier trucks and equipment onto the field of play.

Fig. 89. Panelling is brought onto the pitch in untied loads, by small buggies that go back and forth hundreds of times.

Fig. 90. Overlaying light-duty turf protection panels to provide a smooth transition onto the heavy-duty aluminium trackway panels on the left of the photo.

5.3 Turf protection guidelines

5.3.1 Planning and communication

Guidelines are needed to ensure all parties – the event organiser, stadium management, ground staff and any turf consultant appointed – understand and formally acknowledge the project plan, expectations, division of responsibilities, communication policy, etc. and to ensure everyone is working to the same programme of works.

The event organiser should supply all parties with a detailed proposal for the stage structure(s), the turf protection system(s) and a programme of works that includes dates and times for each part of the construction, installation and dismantling process, vehicle movements, staffing, materials and equipment. Details of all activities that could have an impact on the pitch and its surrounds should be highlighted and detailed method statements supplied (on the use of cranes, for example). These proposals should be made available with enough time for review, comments, adjustments and approval before any works commence. If the event organiser wishes to make a change to the programme of works, this should also be communicated to all parties, giving them enough time to review and comment.

A specific dismantling programme should be produced (as for construction/installation), with exact timings for each part of the process, method statements and a final deadline for removal of all protective panelling.

Communication between the parties should identify and address any items of pitch infrastructure that are considered liable to damage (stitched turf reinforcement system, dynamic stone base under the pitch perimeter, solenoid valve boxes, irrigation heads etc.).

5.3.2 Installation

The event organiser should ensure that all protective panelling has been washed and dried prior to delivery and installation.

The installation of all turf protection should start at the edge of the pitch and work inwards, with buggies and any other vehicles used to transport panels always working off a section of previously installed panels, employing similar methodology in reverse for removal. It is important that any vehicles travelling on the turf protection system are driven sensibly, with no sharp turns and no overloading. In addition, their entry points onto the pitch should be varied along the length of the pitch and all available pitch tunnels should be used equally to distribute the load and prevent an increase in damage to any one end or corner of the pitch (Fig. 103).

When covering the pitch surrounds, where possible allowance should be made for the ground staff to be able to access hose points so that localised irrigation can be carried out (Fig. 91).

Where possible, surplus equipment such as additional scaffolding poles, large coils of cable, and sound or lighting transport boxes should be stored away and not left on top of the turf protection system (e.g. under the stage) as they may reduce the amount of light and air getting to the grass through the ventilation holes. Where large quantities of cables or coils of cables are necessary, they should be tied up or suspended from the underside of the stage.

5.3.3 Staffing and conduct

The event organiser should ensure that there are enough people to facilitate the laying and removal of turf protection panels according to the agreed schedules. All foot traffic should be carefully organised and supervised to prevent any all unnecessary walking directly on the field of play. Any such foot traffic must be approved in advance by the ground staff.

As a precaution, all staff involved in the set-up or dismantling should ensure their footwear is clean and free from any contamination that could damage the turf (soil, grease, hydraulic fluids, concrete dust, etc.).

Heavy vehicles should not be allowed to enter the stadium bowl unless this and the appropriate level of turf protection is explicitly foreseen in the programme of works. Ideally, vehicle access to the stadium bowl should be limited to forklifts, cherry pickers, golf buggies and trolleys, with the movements of each type of vehicle restricted to the minimum necessary and always on the appropriate level of turf protection. No vehicles should travel directly on the turf.

The event organiser should ensure that all staff involved in the set-up or dismantling are fully briefed on the above requirements and made aware that under no circumstances should they be on the pitch unless previously agreed with the stadium management, ground staff and turf consultant as appropriate. Strict supervision and enforcement are recommended to prevent any unnecessary activity on the pitch.

No materials should be deposited, even temporarily, on the turf directly, including food, pegs, nuts and bolts, hydraulic fluids or fuel. It is also important to strictly control what substances are taken onto the pitch even after the protective panelling has been laid, i.e. during installation, dismantling and the intervening period, including the event itself wherever possible. Alcohol, soft drinks, coffee, tea and cigarettes should not be allowed due to the damage they may do the turf, which in the case of alcohol, for example, takes some days to appear (Fig. 94).

Cleaners should be employed to remove all rubbish from the surface of the turf protection system before it is removed. This takes priority over cleaning the stands and should enable timely dismantling and minimal debris ending up directly on the pitch (Fig. 96). It is also recommended that a towable magnet is kept on-site and used to sweep the pitch, both before and after removal of the turf protection equipment after any event (Fig. 95).

5.3.4 Turf consultants

If a turf consultant is appointed to manage the protection of the pitch and its surrounds, their role should be to:

- liaise with the event organiser to assess the potential impacts of the event on the pitch, conduct a full risk assessment and determine how identified risks can be managed and mitigated;
- prepare a bespoke turf management plan for the run-up to the event and recovery after the event, taking into account the risk assessment and the time available before the next scheduled event.
- decide whether returfing will be required;
- if returfing is necessary, a turf farm or farms should be visited four to six months before the event to identify fields that would be suitable and would provide the closest match to the existing pitch, working with the turf producer to ensure the new turf is in optimum condition for harvest and transport to the stadium, testing the turf during visits and preparing a logistics plan for harvest, delivery and laying, and supervising the process when the time comes to ensure the correct turf is harvested and delivered to the stadium;
- provide agronomic advice to the stadium to optimise the health of its turf ahead of the event and minimise the potential for damage to the turf;
- be present on-site during the event set-up and dismantling phases to ensure that all risks are managed and mitigated as intended and the agreed logistics plan is adhered to, while also being available to discuss and respond to any sudden changes in the programme of works and agree on solutions to avoid damaging the pitch;
- assist the ground staff with recovery measures and ongoing maintenance of the recovering or ngew turf after the event.

Photos to illustrate turf protection guidelines

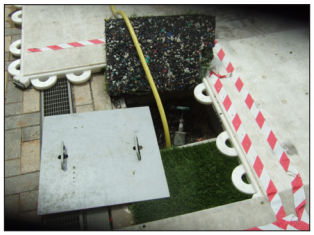


Fig. 91. Quick coupler valve access points, allowing ground staff to irrigate areas that need it (turf exposed to sun or wind).

Fig. 92. Fans can used to maintain air circulation under a stage.

Fig. 93. Artificial lighting used to help grass survive under a stage.

Fig. 94. Turf death caused by alcohol, evident only three to four days after the event.

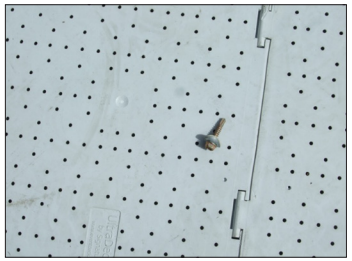


Fig. 95 Abandoned nails, screws and other metallic objects can cause serious injury to players if left on the pitch. Purchasing a towable magnet to sweep the pitch after non-sports events is a sound investment.

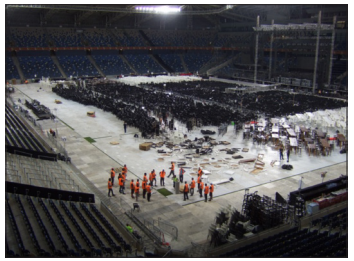


Fig. 96. Pitch protection contractors waiting for seating and cleaning contractors to remove chairs, tables and litter before they can remove the turf protection system. A coordinated programme of works is essential.

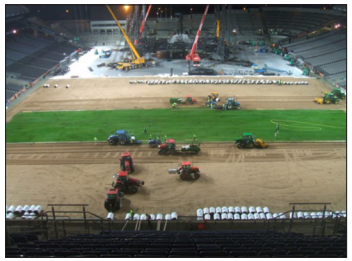


Fig. 97. No time to waste – returfing is carried out while the stage is being dismantled.

Fig. 98. Cables placed along protective panels to prevent potentially significant turf burn, while also creating a pathway for foot traffic across the pitch.

Fig. 99. Emergency turf products such as fungicides and turf colourant – important to have in stock.

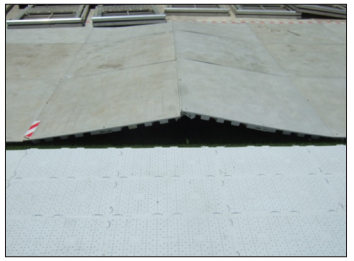


Fig. 100. Expansion of protective panels in a hot climate. Expansion joints are needed where this is a risk.

Fig. 101. Small teams working under close supervision – the key to well-coordinated installation and removal of turf protection systems.

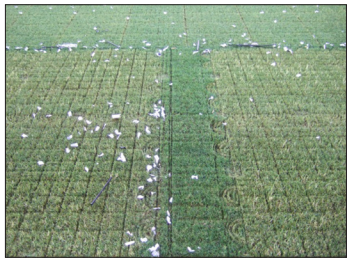


Fig. 102. Litter and other debris left on a pitch after an event.

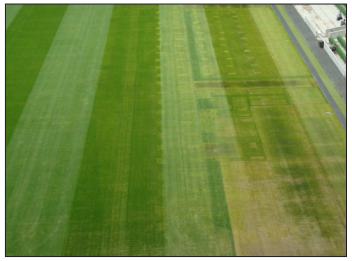


Fig. 103. Variable, localised turf damage following a non-sports event.

Fig. 104. Using a leaf blower as part of final pitch clean-up.

Fig. 105. An irrigation system with individual head control, used to water parts of the pitch while the turf protection system is still being removed.

5.4 Logos and alternative line markings

Logos and alternative field line markings applied to a pitch for non-football events can be problematic in terms of turf management and from a branding and sponsorship perspective, if they are not properly removed in time for the next football event. This section limits itself to the main issues from a turf management perspective.

Communication and cooperation

When a logo is expected to be applied to the pitch, the logo applicator should supply all parties with a detailed proposal for the logo and its positioning, the method of application and removal, and a programme of works that includes dates and times of application.

If the logo applicator is contracted by the event organiser, as is often the case, the ground staff and stadium managers may have no direct contact with them. This need anticipating and addressing because it can hinder the necessary cooperation and coordination between logo applicator and ground staff, and it can make it harder to recoup the cost of repairing any damage caused by the logo application.

Location of logos

Camera positions often mean logos must be applied to high-wear areas such as the centre of the pitch. Since turf in these areas is likely to already be weakened, it will be more difficult to repair. It is far preferable, where possible, to position logos in low-wear areas.

Type and colour of paints used

All logos and line markings should be applied using proprietary sports turf paints that do not seal the surface or smother the turf. Although some such paints are marketed as 'removable' or 'erasable', this just means it can be washed off the blades of grass on the surface; the paint solution also works its way into the profile, where it cannot be removed and may lessen the infiltration capacity of the root-zone beneath the logo. If logos are repeatedly applied in the same location, even with so-called erasable paint, that area may eventually need returfing.

Dark pigments such as blues and blacks absorb heat and have a greater adverse effect on turf condition in the summer months compared with lighter coloured pigments such as yellows and whites. Conversely, in winter, turf can grow faster over darker coloured paints because of their greater heat absorption properties.

ANNEX 1

FIFA Natural-pitch Rating system

FIFA Natural-pitch Rating system

As a result of the need to consistently and accurately measure the quality, performance and playing characteristics of natural grass pitches a standard has been developed by FIFA in conjunction with UEFA and a working group of industry leading consultants and grounds keepers. The detailed test methods can be found in the Natural paying surfaces test manual:

https://www.fifa.com/technical/football-technology/standards/natural-playing-surfaces

This rating system allows competition organisers, clubs and National Associations to track pitch quality progression and deterioration over time leading to a more efficient decision making process and the easier identification of potential issues.

The test method can be used by grounds keepers as part of their day to day activities as well as by independent consultants working in the industry so that accurate comparisons can be made no matter who is carrying out the pitch assessment.

The test methods will apply to all types of Natural Playing surfaces which are classified by FIFA into the following categories:

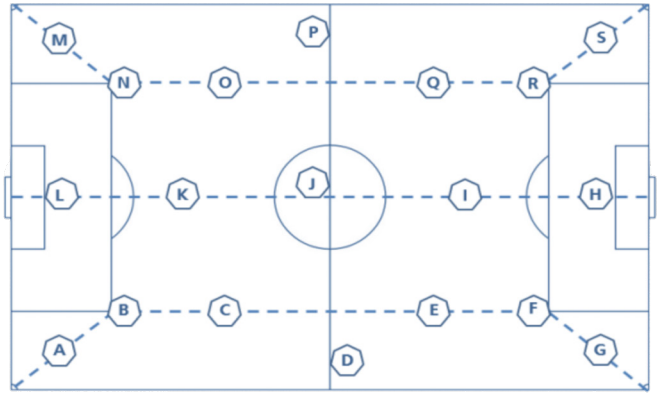
Natural Playing surfaces			
Fully Natural	Natural reinforced root zone	Natural in-situ stitched fibres	Natural synthetic carpet based
Traditional construction for natural turf using only natural materials, including sand.	Synthetic elements added to the root-zone profile of the natural turf to provide reinforcement.	Synthetic fibres stitched into the natural surface with natural turf growing within the fibres.	Synthetic carpet laid in the surface with natural turf growing within the carpet.

Two types of on-site assessment have been developed, the full and the reduced assessment.

The full assessment is designed to be performed by a FIFA-accredited test institute to assess the performance of a new or existing pitch or the performance of a surface prior to a tournament. This test requires specialist equipment with the test institutes taking part in round robin assessment events to ensure accuracy of the equipment and technicians/agronomists.

The reduced assessment is designed to be regularly performed by the grounds staff in charge of monitoring the preparation of a pitch for a tournament of as part of a regular quality control process. The reduced assessment requires less tools and grounds keepers can easily be trained to carry out these assessments as part of their day to day activities.

Characteristic	Test method	Test apparatus	Full assessment test positions	Reduced assesment test
Performance	Vertical ball rebound	Vertical ball rebound	A, L K, J, Q, H	Optional testing
	Ball roll	Ball roll ramp	A, L K, J, Q, H	Optional testing
	Sock absorption	Advanced Artificial athlete	All locations	Optional testing
	Vertical deformation	Advanced Artificial Athlete	All locations	Optional testing
	Rotational resistance	Lightweight rotational resistance apparatus	A, L K, J, Q, H	Optional testing
Agronomy	Evenness	Three-metre straightedge	All locations	All playing surfaces
	Surface hardness	Impact tester	All locations	A, L K, J, Q, H
	Compaction severity	Penetrometer	A, L K, J, Q, H	Optional testing
	Infiltration rate	Two concentric cylinders	A, L K, J, Q, H	Optional testing
	Normalised difference vegetation index (NDVI)	NDVI handheld device	All locations	Optional testing
	Sward height	Prism	A, L K, J, Q, H	A, L K, J, Q, H
	Root depth	Steel ruler	A, L K, J, Q, H	A, L K, J, Q, H
	Thatch depth	Steel ruler	A, L K, J, Q, H	A, L K, J, Q, H
	Sward colour	Visual assessment	A, L K, J, Q, H	A, L K, J, Q, H
	Ground coverage %	Square frame	A, L K, J, Q, H	A, L K, J, Q, H
	Weed content %	Square frame	A, L K, J, Q, H	A, L K, J, Q, H
	Insect pests	Square frame	A, L K, J, Q, H	A, L K, J, Q, H
	Diseases	Square frame	A, L K, J, Q, H	A, L K, J, Q, H
	Volumetric soil moisture content	Moisture probe	A, L K, J, Q, H	A, L K, J, Q, H



Field test positions

Official FIFA Reports

Official FIFA Reports can only be generated using the test results uploaded to the FIFA Quality programme database by FIFA-Accredited test institutes. FIFA Accredits specialised test institutes whose methodologies are certified through a quality control process involving inter-laboratory testing each year. Only FIFA accredited test institutes can request an official FIFA report.

Rating system for pitches mainly intended for professional football

Rating system

Each quantifiable characteristic rating is measured from "unacceptable" to "excellent" the lowest rating is awarded 1 point and the highest is awarded 10 points. Ratings can be specifically designed for warm or cool season grass (all/warm/cool).

The rating system uses the following points system:

Unacceptable Quality	Poor Quality	Satisfactory Quality	Good Quality	Excellent Quality

- Unacceptable quality – 1 point
- Poor quality – 3 points
- Satisfactory quality – 5 points
- Good quality – 7 points
- Excellent quality – 10 points

When the characteristics can be evaluated for consistency, the following is used:

There are only three categories in the subjective assessment:

Major concerns with the pitch under consideration	Minor concerns with the pitch under consideration	No concerns with the pitch under consideration

- *Major concerns with the pitch under consideration – 1 point*
- *Minor concerns with the pitch under consideration – 5 points*
- *No concerns with the pitch under consideration – 10 points*
- *Weighting and pitch rating score*

Each parameter (characteristic, consistency and subjective assessment) is weighted based on its overall importance to the performance of the pitch.

The pitch rating score is expressed as a percentage (%) representing the sum of each characteristic score multiplied by its characteristic weighting divided by the maximum score possible.

The calculation of the overall score is:

$$\textit{The overall score (\%)} = \frac{\sum \textit{Characteristic score (1 to 10)} \times \textit{Characteristic weighting}}{\sum \textit{Characteristic maximun score (10)} \times \textit{Characteristic weighting}}$$

Characteristic	All/ warm/ Cool Season grasses	Unacceptable quality (1 point)	Poor quality (3points)	Satisfactory quality (5 points)	Good quality (7 points)	Excellent quality (10 points)	Weight
Vertical ball rebound	All	<0.45 or >1.15m	0.45 – 0.49m or 1.11 – 1.15m	0.50 – 0.59m or 1.01 – 1.10m		0.60 – 1.00m	4
Vertical ball rebound – consistency	All	>±25%	±25%	±20%	±15%	±10%	0.5
Ball roll	All	<3.0m or >15.0m	3.0 – 3.9m or 12.1 – 15.0m	10.1 – 12.0m		4.0 – 10.0m	4
Ball roll - consistency	All	>±25%	±25%	±20%	±15%	±10%	0.5
Shock absorption	All	<40.00%FR or >80.0%FR	40.0 – 44.9%FR or 75.1- 80.0%FR	45.0 – 49.9% FR or 70.1 – 75.0% FR	50.0 – 54.9% FR	55.0 – 70.0%FR	9
Shock absorption – consistency	All	>±25%	±25%	±20%	±15%	±10%	0.5
Vertical deformation	All	<3.0mm or >14.0mm	12.1 – 14.0mm	3.0 – 4.0mm or 11.1 – 12.0mm		4.0 – 11.0mm	4
Vertical deformation – consistency	All	>±25%	±25%	±20%	±15%	±10%	0.5
Rotational resistance	All	<15.0Nm or >60.0Nm	15.0 – 19.9Nm or 55.1 – 60.0Nm	20.0 – 24.9Nm or 49.9 – 55.0Nm		25.0 – 50.0Nm	6
Rotational resistance – consistency	All	>±25%	±25%	±20%	±15%	±10%	0.5

Characteristic	All/warm/ Cool Season grasses	Major concerns with the pitch under construction (1 point)	Minor concerns with the pitch under consideration (5 points)	No concerns with the pitch under consideration (10 points)	Weighting
Evenness (10mm)	All	No deformation >30mm	No deformation >20mm	No deformation >10mm	5

Characteristic	All/warm/Cool Season grasses	Unacceptable quality (1 point)	Poor quality (3 points)	Satisfactory quality (5 points)	Good quality (7 points)	Excellent quality (10 points)	Weight
Surface hardness	All	<40.0CIV or >100.0CIV	40.0 49.9CIV or 95.1 – 100.0CIV	50.0 – 59.9CIV Or 90.1 – 95.0CIV	60.0 – 69.9CIV or 85.1 – 90.0CIV	70.0 – 85.0CIV	10
Compaction severity	Cool	<1.50MPa or >7.00MPa	6.01-7.00MPa	4.01-6.00 MPa	2.51-4.00MPa	1.50-2.50MPa	3
	Warm	<1.50MPa or >7.00MPa	6.01-7.00MPa	4.01-6.00 MPa	3.01-4.00MPa	1.50-3.00MPa	3
Compaction severity – Consistency	All	>±50%	±50%	±40%	±20%	±15%	0.5
Infiltration rate	Cool	<40mm/h	40-50mm/h	51-100mm/h	101-150mm/h	>150mm/h	8
	Warm	<40mm/h	40-50mm/h	51-100mm/h	101-150mm/h	>150mm/h	8
Infiltration rate – consistency	All	>±50%	>±50%	±40%	±20%	±15% (or ≥200mm/h)	0.5
Normalized difference vegetation Index (NDVI)	Cool	<0.60NDVI	0.60-0.69 NDVI	0.70-0.74NDVI	0.75-0.79NDVI	≥ 0.80NDVI	6
	Warm	<0.30NDVI	0.30-0.59 NDVI	0.60-0.64NDVI	0.65-0.69NDVI	≥ 0.70NDVI	6
Normalized difference vegetation Index (NDVI) – Consistency	All	>±25%	±25%	±20%	±15%	±10%	0.5
Visual inspection (divots, footmarks, etc.)	All	Extensive	Widespread	localised	Occasional	Very Occasional	3
Visual inspection (divots, footmarks, etc.) - Size	All	Very large	Large	Medium	Small	Very Small	3

Characteristic	All/warm/Cool Season grasses	Unacceptable quality (1 point)	Poor quality (3 points)	Satisfactory quality (5 points)	Good quality (7 points)	Excellent quality (10 points)	Excellent quality (10 points)
Sward Height	Cool	<15.0mm or >55.0mm	15.0-17.9mm	(5 points)	20.0-21.9mm	22.0-28.0mm	22.0-28.0mm
	Warm	<15.0mm or >45.0mm	or 45.1-55.0mm	18.0-19.9mm	or 28.1-35.0mm	20.0-25.0mm	20.0-25.0mm
Sward height – consistency	All	>±30%	15.0-17.9mm	or 35.1-45.0mm	18.0-19.9mm	±10%	±10%
Root depth	Cool	<50.0mm	or 35.1-45.0mm	28.1-35.0mm	or 25.1-28.0mm	≥100.0mm	≥100.0mm
	Warm	<50.0mm	±30%	±20%	±15%	≥100.0mm	≥100.0mm
	Hybrid carpet/ Stitched	<30.0mm	50.0-69.9mm	70.0-84.9mm	85.0-99.9mm	>50.0mm	>50.0mm
Thatch depth (or mat)	Cool	>7.0mm	50.0-69.9mm	70.0-84.9mm	85.0-99.9mm	≤1.0mm	≤1.0mm
	Warm	>25.0mm	30.0-39.9mm	40.0-44.9mm	45.0-49.9mm	≤6mm	≤6mm
Uniformity of sward – colour	All	Highly variable	7.0-5.1mm	5.0-3.1mm	3.0-1.1mm	Very consistent	Very consistent
Ground coverage	Cool	<75.0%	25.00-15.1mm	15.0-10.1mm	10.0-6.1mm	95.0-100.0%	95.0-100.0%
	Warm	<75.0%	Variable	Normal variability	Consistent	95.0-100.0%	95.0-100.0%
Ground coverage – consistenc	All	>±50%	75.0-84.9%	85.0-89.9%	90.0-94.9%	±15%	±15%
Weed content	All	>2.5%	75.0-84.9%	85.0-89.9%	90.0-94.9%	0.10-0.00%	0.10-0.00%
Insect pests	All	>10.00%	±50%	±40%	±20%	0.10-0.00%	0.10-0.00%
Diseases	All	>10.00%	2.50-1.01%	1.00-0.51%	0.50-0.11%	0.10-0.00%	0.10-0.00%
Volumeric soil moisture content	Cool	<10.0%	10.00-1.01%	1.00-0.51%	0.50-0.11%	25.0-30.0%	25.0-30.0%
	Warm	<5.0% or >35.0%	10.00-1.01%	1.00-0.51%	0.50-0.11%	15.0-20.0%	15.0-20.0%
Volumeric soil moisture content – Consistency	All	>±40%	10.0-14.9%	15.0-19.9%	20.0-24.9%	±15%	±15%
pH (site testing)	All	<4.5 or >8.5	5.0-9.9% or 30.1-	10.0-11.9%	12.0-14.9%	6.5-7.0	6.5-7.0
pH (lab testing)	All	<4.5 or >8.5	35.0%	or 25.1-30.0%	or 20.1-25.0%	6.5-7.0	6.5-7.0
Soil health analysis	All	<4.5 or >8.5	±40%	±30%	±20%	6.5-7.0	6.5-7.0
pH (lab testing)	All	<4.5 or >8.5	4.5-4.9 or 8.1-8.5	5.0-5.9 or 7.6-8.0	6.0-6.4 or 7.1-7.5	6.5-7.0	For info
Soil health analysis	All	Unacceptable quality	Poor quality	Satisfactory quality	Good quality	Excellent quality	For info

ANNEX 2

EU Microplastics Restriction: Guidance for UEFA member associations

INTRODUCTION

This document is intended to provide useful information for UEFA member associations who are seeking to understand the implications of the EU's restriction on intentionally added microplastics, which includes polymeric infills for artificial turf.

The restriction came into force in October 2023. For synthetic turf surfaces, there will be an eight-year transition period to attempt to avoid serious negative sporting, social and economic impacts. Artificial pitches are crucial for local communities and grassroots football across Europe, so it is imperative that the transition is carried out in a way that supports important European environmental objectives whilst safeguarding social, public health and sports access for all at national and local level.

Throughout its preparation, adoption entry into force, the resolution and its implications have been discussed by UEFA, national associations, various other football stakeholders, industry partners and EU and national government officials. These discussions have enabled us to share important concerns about the potential impacts of the restriction and the transition period for football across Europe.

UEFA and its member associations are committed to implementing the EU restriction and introducing alternative artificial pitch technology. However, alternatives to microplastics are currently limited in availability, are low in scalability, generally have poorer durability and life expectancies than polymeric infills, and are much higher in cost. In addition, some alternatives are not yet sufficiently tested or suitable, particularly in relation to differing environmental conditions across Europe.

It is vital to manage this period of complex and costly transition in line with football development and social objectives, while supporting environmental protection objectives and pitch technology innovation. UEFA has been asked to provide its member associations with this guidance on various key topics relating to the restriction and the transition period. It is to be emphasised that this document is not a procurement reference document or tool for national associations or other stakeholders to assess potential pitch systems or infill products.

Further information on the artificial turf industry can be found on the website of the European Synthetic Turf Council (ESTC). The ESTC Knowledge Centre (see here) contains valuable information and resources that cover most areas within the synthetic turf industry, from choosing a synthetic surface right through to care and maintenance, as well as advice and information from some of the leading manufacturers in the industry.

The European Commission also has a webpage with FAQs about the restriction, along with links to further information.

Legal scope and application

What is the EU restriction and when does it apply?

- The EU restriction on intentionally added microplastics came into force on 17 October 2023.
- The adoption of the restriction had previously been announced by the European Commission on 25 September 2023.
- The restriction was adopted under the EU's regulation on the registration, evaluation, authorisation and restriction of chemicals (REACH). REACH restrictions are "regulatory measures to protect human health and the environment from unacceptable risks posed by chemicals. Restrictions may limit or ban the manufacture, placing on the market or use of a substance."
- The restriction uses a broad definition of microplastics: it covers all synthetic polymer particles 5mm in length or less that are non-organic and insoluble and resist degradation.
- The restriction specifically includes the granular rubber (polymeric) infill material used in artificial sports surfaces. According to the EU (see, for example, the European Commission press release here), this infill is the largest source of intentionally added microplastics in the environment.
- The restriction will ban the sale ("placing on the market") of polymeric infill materials after the transition period, but it does not prevent their use. More details on the transition period can be found below, under What is the transition period?.

Who is affected by the restriction?

- The restriction is directly applicable in all countries where the EU REACH regulation is in force.
- This means all EU member states, plus EEA states Iceland, Liechtenstein and Norway.
- Notable areas that are not covered by the restriction are:
  - Switzerland
  - the Faroe Islands
  - England, Scotland and Wales, as the UK is no longer in the EU
  - Gibraltar: the restriction does not formally apply, but it will be important to consider EU-UK negotiations on a proposed agreement on Gibraltar's relationship with the EU, which might affect the situation in the future

https://single-market-economy.ec.europa.eu/sectors/chemicals/reach/restrictions_en

- The terms of the Northern Ireland Protocol (part of the Brexit arrangements) state that Northern Ireland remains subject to EU REACH regulations, so Northern Ireland is affected.
- While this restriction is an EU measure, it is also relevant to non-EU national associations, because it is anticipated that it will have knock-on effects on the potential development of national and local regulations and the development of the artificial turf market throughout Europe.
- The information above is subject to change as new regulations or market dynamics are introduced in different countries and regions. As a result, it is advisable to keep track of relevant existing and potential regulatory and market rules in your jurisdiction.

What if my country is not part of the EU?

- While the restriction is part of an EU regulation, it will affect all UEFA member associations, for two main reasons:
  - The artificial turf industry as a whole will likely move away from producing polymeric infills, therefore sourcing such materials will likely become significantly more challenging and expensive.
  - Non-EU countries (e.g. including EU candidate and accession countries) may decide to introduce legislation that replicates the EU's environmental protection standards. It is therefore important to monitor policy developments in your region and country.

How can I check if my organisation is affected?

- If you have questions about the applicability and impact of the restriction in your region or country or would like to understand the potential for future regional or national government regulation, it is recommended that you contact your relevant national ministry or environmental protection agency.

What is the transition period?

- The restriction provides a transition period of eight years for polymeric infill for artificial turf. This means the ban on selling polymeric infill will only fully come into force in October 2031.
- The EU had previously considered an immediate ban and much shorter transition period. However, European and national policy makers saw the need for a longer transition period to reduce the negative consequences on football development and social objectives across Europe.
- The transition period has been granted to allow time for the industry to adapt and bring to market suitable alternatives at the required scale, and to enable as many existing pitches as possible to be correctly maintained so they reach their anticipated end of life (10 to 12 years).

- Despite this transition period, measures have already been introduced in some areas that ban or restrict the sale and even the use of polymeric infill materials. It is therefore important to monitor policy developments in your region and country.

How will the restriction be enforced and what are the penalties for non-compliance?

- The regulation itself does not lay down any penalties: the EU's member states are responsible for enforcing the regulation and penalising any breaches. Penalties therefore depend on national laws, they may vary with the severity and frequency of the breach, and they may take the form of fines, product withdrawals, sales bans or even prison sentences.
- The European Commission will monitor the implementation and effectiveness of the restriction and report on it regularly.
- Further information on the national inspectorates for EU countries can be found on the European Chemicals Agency (ECHA) website.

Technical scope and application

What is the impact on existing pitches with polymeric infill?

- There is no immediate impact on existing pitches. Under the terms of the EU restriction (and unless other rules applicable to your jurisdiction say otherwise), polymeric infill can still be bought and sold, and existing pitches with polymeric infill can still be maintained, until October 2031.
- Maintenance is a key issue for existing pitches. With proper maintenance, most pitches should have a lifespan of 10 to 12 years. Without proper maintenance, the performance of the field will deteriorate, its lifespan will shorten (meaning less return on investment) and players will be less safe. This poses a particular concern for fields that are used for competitive matches that require certification as part of the FIFA Quality Programme for Football Turf or national associations' own certification programmes.
- As the restriction only applies to the "placing on the market" of polymeric infills, owners of pitches that will still be in operation after the transition period may purchase and stockpile the infill material required to allow adequate maintenance until the turf reaches the end of its life (see below, under Is stockpiling of polymeric infill permitted?).
- Competition organisers and pitch operators should therefore monitor potential operational and commercial impacts, such as changes in the cost and supply levels of polymeric infill that could make pitch maintenance more difficult or costly.
- For UEFA Competitions, the UEFA Stadium Infrastructure Guidelines and various club and national team competition regulations will continue to apply the FIFA Quality standards as a condition for use of artificial turf pitches when announcing venues. Existing pitches may fail the FIFA testing process as a result of a lack of available infill for maintenance, so even a pitch that has previously been used in a UEFA competition may not be accepted for future competitions.

Can new pitches with polymeric infill be built during the transition period?

- Under the terms of the EU restriction (and unless other rules applicable to your jurisdiction say otherwise), new pitches can still be built using polymeric infill until October 2031.
- However, the restriction will make it harder to make a case for investment in new pitches that use polymeric infill in markets that will be affected by the restriction.
- The key point to note will be the planned lifespan of any such pitches (i.e. if the availability of enough polymeric infill for maintenance can be guaranteed throughout the lifespan) and how that fits into the business model of the national association or club. The points above under What is the impact on existing pitches with polymeric infill? regarding the maintenance and lifespan of existing pitches should also be taken into account for any new pitches.
- The transition period is not intended by the European Commission to encourage ongoing and further investment in pitches using polymeric infill, nor the building of new pitches of this type, as it will no longer be possible to buy the banned infill when the transition period ends, making pitch maintenance difficult if not impossible.
- Municipalities and public procurement bodies may also seek to move away from funding or co-funding the use of polymeric infill.

Is stockpiling of polymeric infill permitted?

- Stockpiling of infill material to extend the lifespan of a field is permitted under the restriction. The European Commission considers it likely that owners of artificial sports surfaces will stockpile to ensure their pitches can be maintained after the transition period.
- However, the European Commission does not and will not encourage stockpiling, nor will they provide guidance on stockpiling, as this practice is not regulated in the restriction.
- Should pitch owners decide to stockpile, the European Commission encourages the safe and environmentally conscious storage of any stockpiled infill material, i.e. storage conditions that do not result in emissions of infill material into the environment
- Stockpiling large quantities of infill material would require the correct planning to be put in place, particularly with regards to safe storage to avoid theft, damage or accidental leakage.
- The challenges and risks that stockpiling would present are a particular concern at the lower end of the football pyramid, where local clubs might not have the finances or facilities to stockpile properly and safely.
- In all cases, it is advisable to thoroughly check the applicable rules on stockpiling. For example, based on current understanding, and subject to change, stockpiling can be carried out off-site (e.g. by a maintenance contractor), providing the infill is purchased by and clearly identified as belonging to the pitch owner.
- While the industry evolves during the transition period, the cost and availability of polymeric infill to stockpile is difficult to predict and therefore factor into long-term planning. For example, companies may reduce or cease production of the polymeric infill completely as the European market comprises the bulk of the demand.

What alternatives to polymeric infill exist in the market?

- To help to inform this guidance document, UEFA asked the European Commission whether, as part of the scientific, research or legislative processes to develop the restriction, the Commission or its agencies conducted any research overview and/or performed any comparative review of alternative infills or pitch systems.
- The Commission answered that the ECHA had collected information on infill alternatives when drafting the restriction dossier and during opinion making. Information on alternatives was also provided by stakeholders (including UEFA) during the call for evidence and the two public consultations.
- The annexes to the background documents to the ECHA Risk Assessment Committee (RAC) and Committee for Socio-Economic Analysis (SEAC) opinion include a section on infill material, including the assessment of available alternatives (see Annex D.13). This information was assessed by RAC and SEAC and informed their final opinion (see, for example, page 134 of the opinion). The European Commission says that, when drafting the decision, it also took into account the information UEFA had provided, including an assessment of the existing alternatives and their technical performance.
- Feedback from across European football remains that alternatives to polymeric infill are currently limited in availability, are low in scalability, generally have poorer durability and life expectancies than polymeric infills and are much higher in cost. Many of the alternatives are not yet sufficiently tested to prove their long-term suitability, particularly in relation to differing environmental conditions across Europe.

- **FIFA's definitions of the different types of infill materials are:**
  - **Polymeric infill:** Systems with non-biodegradable polymeric infill (polymer as per the ECHA definition).
  - **Biodegradable infill:** Systems with biodegradable polymeric infills (polymer as per the ECHA definition) without non-biodegradable polymeric infill.
  - **Natural infill:** Systems containing non-chemically modified natural organic material infill without polymeric infill or biodegradable infill.
  - **Mineral infill:** Systems filled with only solid, non-organic infill without any polymer added.
- The list of natural infills made up of modified natural vegetal material is constantly evolving as the industry looks to produce alternative systems to fill the void created by the restriction, therefore the list below is non-exhaustive but represents the current landscape:
  - **Granulated cork:** Cork infill is produced from a by-product of the cork industry. The properties of the cork granules depend on the quality of the raw material, as well as the crushing, sieving and processing to which it is subjected. Due to this treatment, cork infill may have different densities, particle sizes and properties, and this must be taken into account when selecting infill. Cork infill has low density, meaning it can float. Therefore, if a field with cork infill is subjected to heavy or persistent rain, significant movement of the infill can occur, resulting in substantial additional maintenance or topping of the infill, or indeed both.
  - **Crushed olive stones:** Olive stones are a by-product of the olive oil industry and have various uses, one of which is now infill for artificial turf surfaces. Olive stone particles have a higher density than water and can improve resistance to compaction. The properties of the particles come from the crushing, sieving and processing to which they have been subjected. Olive stone infill has good durability compared to some other vegetal infills, but this means players may find it more abrasive.
  - **Corncobs:** Corncobs are the woody interior of the maize ear to which the corn grains are attached. After harvesting, the grains are separated from the cob. The cobs are then shredded, ground up, sifted and separated to obtain the desired quality and different sizes of granules. The use of corncob infill is relatively new, so long-term experience is not yet available, but feedback to date is generally positive.
  - **Wood particles:** The wood particles used as infill for artificial turf come from waste from the timber industry. Only certain types of timber are suitable, and the infill is produced using a specific set of processes, one of whose aims is to reduce the abrasiveness of the wood by eliminating long fibres that could become splinters. As the infill absorbs moisture, it becomes denser than water when it rains, meaning it does not float.
  - **Pine-cone particles:** These are produced from pinecones, a secondary raw material, that have been carefully selected and have undergone specific processing.
  - **Combined organic materials:** Various combinations of the options above and others are not only the sum of the individual properties of each component material, but can even offer better performance. For example, cork might be combined with coconut fibres to improve stability. Some of these mixes need to be kept moist to prevent them drying out and dispersing through wind erosion.

- **Non-filled systems** have also been on the market for a number of years and provide a system with no infill material, with the exception, in some cases, of sand to help to stabilise the system. Non-filled systems often use a shockpad to meet the performance requirements and mitigate the loss of the shock absorption that infill materials provide. Currently the FIFA Quality Programme states: "*Mineral-infill stabilised, mineral-infill filled and non-filled systems are currently under development for football and are not yet approved by FIFA. As a result, fields that feature these systems cannot be awarded FIFA Quality or FIFA Quality Pro certification.*" This means that such fields would currently be unsuitable for installation in venues looking to stage matches that require FIFA certification as part of the competition regulations.

- **When evaluating alternative infill materials, consider the following questions:**

  - Does the infill have sufficient durability to sustain the anticipated levels of use for at least ten years, without the need for significant replacement due to breakdown or deterioration, etc.?
  - Will the infill's particle size distribution impede the turf's drainage properties?
  - Will the infill float if the field is subjected to heavy or persistent rain?
  - Will the infill need irrigating in dry conditions?

Can a different infill be used on a pitch with polymeric infill?

- The difficulties involved in the practical transition from existing pitches with polymeric infill (such as crumb rubber, also known as SBR) to alternative infill materials should not be underestimated.
- Artificial pitches are constructed using a complex system of components that are engineered to work together from the stone base up. These will often include shockpad underlayers, stabilising infill (sand) and performance infill (e.g. crumb rubber), plus various turf pile heights and tuft densities, which are selected to provide the requisite playability and safety standards.
- It is therefore not possible to simply remove the existing infill material and replace it with an alternative, as this would alter the entire performance of the surface. It would also invalidate any FIFA field certification and manufacturer's warranties.

What has the EU said about risk management measures?

- While the restriction does not contain specific provisions in relation to risk management measures, such measures were the subject of extensive discussions between EU and national policymakers and ECHA experts, also with input from UEFA and member associations. It became clear in these discussions that the European Commission preferred an outright ban with a transition period rather than no ban and mandatory risk management measures.
- UEFA has previously asked the European Commission whether it has a position on the use of risk management measures. The Commission answered that "the restriction lays down a ban on the placing on the market of microplastic infills after an eight-year transitional period, as we consider this is the most effective measure to curb microplastics emissions in the long term. This means that Member States cannot impose other RMMs [risk management measures] for pitches (e.g. barriers, brushes, etc). However, those RMMs can be placed on a voluntary basis. It is also possible for UEFA (who is not a Member State) to include such measures in its guidelines."
- The European Committee for Standardization (CEN) Technical Report on surfaces for sports areas (TR 17519) offers guidance on how to minimise infill dispersion into the environment. Detailed information on these methods, which studies have shown to be effective, can be found in FIFA Test Manual I – Test Methods (October 2025 edition).

What is the impact when pitches with polymeric infill reach the end of their life?

- An added challenge that has been flagged and needs further consideration is the facilities and capacity across Europe for managing the end of life of existing pitch systems and their components (infill, yarn, shockpads, etc). At present, experts suggest that the recycling capacities in Europe are not fit to meet the demand that the restriction will lead to over the next decade.
- In recent years there has been a significant increase in the number of companies offering recycling services for artificial pitches at the end of their life. Nonetheless, given the impending impact of the EU restriction, the volume of surfaces that will require removal and disposal or repurposing will be significant.
- Recycling of an artificial pitch is currently a complex process that involves the separation of the individual elements such as the carpet backing, the stabilising and performance infill and the fibres themselves.
- An overview of the companies currently providing recycling services in Europe and an overview of the topic in general can be found on the EMEA Synthetic Turf Council website.

Are any UEFA regulations or policies affected?

- The UEFA Stadium Infrastructure Regulations and the various regulations governing club and national team competitions will continue to apply the standards of the FIFA Quality Programme as the benchmark for artificial pitches used in UEFA competitions.
- At the time of writing, this would mean that pitches with non-filled systems would not be able to host UEFA matches, as currently no such systems meet FIFA standards.
- However, if pitches that include intentionally added microplastics such as crumb rubber (SBR) or EPDM granules, pass the required FIFA testing process during the transition period, then such venues would be eligible for use in the relevant competition.
- For the impact on the UEFA HatTrick VI Regulations, see below under How does this affect UEFA funding for pitches?.

What impact will the restriction have on the FIFA Quality Programme?

- FIFA operates a Turf Advisory Group (TAG) that comprises stakeholders from across the artificial turf industry, including a number of UEFA member associations, FIFA Preferred Producers of turf surfaces and shockpads, and continental governing bodies such as UEFA.
- The Quality Programme standards, manuals and test methods are regularly reviewed by FIFA with input from the TAG. As a result of new products coming to market, there may be changes to their criteria in the future that would allow new products such as non-filled systems to achieve FIFA certification, but at the time of writing there are no agreed plans to significantly alter these parameters.

Are there any developments in official European standards to be aware of?

- The European Committee for Standardization (CEN) is currently preparing a new standard on infill materials for artificial turf. It is hoped that this standard, EN 15330-5, will be published in early 2025. Once published, it will automatically become a national standard in all countries whose national standards committees are a member of CEN.
- The new standard will:
  - specify minimum performance and durability requirements for performance infill materials used in artificial turf;
  - describe how the performance of an infill should be measured, and the results classified;
  - specify the physical and chemical properties of an infill that are to be declared in a manufacturer's product declaration;
  - specify the minimum production control tolerance to ensure consistency of infill materials between production batches;
  - describe how reclaimed infill should be tested to assess its suitability for use.
- Once this standard is published it is recommended that only infills that have been tested and shown to comply with the criteria and appropriate classifications for the intended use be used.
- In addition to the quality and performance of all types of infill material, their environmental impact should be considered. This includes how their production, use and end-of-life impact may adversely affect the environment. Working with the European Commission, the EMEA Synthetic Turf Council has developed recommendations on how the product environmental footprint (PEF) of sports that use artificial turf should be calculated. PEF is a method of life cycle assessment developed by the Commission, which looks at 16 key environmental impact categories.
- The PEF procedures developed by the EMEA Synthetic Turf Council can be applied to a full artificial pitch, but also the main components from which it is made, including the infill material. The European artificial turf industry is now undertaking PEF analysis on its products, allowing consumers to compare the environmental impact of products and make informed decisions when selecting a sports surface. Further details can be found here.

Financial considerations

What are the cost implications?

- According to the European Commission, the restriction's biggest financial impact will be on football. Indeed, the Commission has previously estimated the cost to football of the transition to be €9.6bn. The methodology for this estimation can be found on pages 119 to 121 of the RAC and SEAC opinion. Additional information can be found in Annex D.13 of the annexes to the background document to the opinion. For a summary, see Table 39 in the background document.
- It has been consistently communicated to EU and national policymakers that this restriction could also have negative effects on access to sports facilities and corresponding healthy lifestyles and sports participation levels, especially for young people, with related public health costs.
- Any stakeholder looking to manage existing facilities or planning to construct new artificial pitches should make a cost analysis factoring the restriction and its effects into any decisions they make.
- A significant increase in the cost of constructing a new field using either vegetal infill materials or non-filled systems is expected based on feedback received from the industry at the time of writing, and as witnessed in some UEFA territories where national and regional associations have already begun to install these types of pitch.
- The reduced lifespan of any new fields using polymeric infills should also be considered when planning to construct new pitches during the transition period, as such fields will likely need to be replaced sooner than in the past, as it will sooner be the case that they can no longer be adequately maintained. Alternatively, stockpiling of infill before the end of the transition period must be budgeted for.

How does this affect UEFA funding for pitches?

- Through its HatTrick programme, UEFA redistributes revenue from the men's EURO to each of its 55 member associations for reinvestment in football development projects. These include building football infrastructure such as national stadiums, training centres and pitches, and implementing a range of UEFA standards and initiatives (for elite youth player development, grassroots or women's football, etc.).
- At its meeting of 4 October 2023, the UEFA HatTrick Committee decided as follows:
  - Approve the ongoing use of HatTrick VI investment funding for artificial turf projects with polymeric (microplastic) infills.
  - The UEFA administration will make applicants aware of the limited use of any newly installed artificial pitches with microplastics.
  - The written agreement for artificial pitch construction projects will include a recommendation for risk management measures.
  - The UEFA administration will closely monitor the development of the artificial turf industry.
  - If necessary, the decision above can be reviewed based on future developments in the industry

What support for R&D and innovation is there?

- The strong geographical and climate-specific issues relating to alternative infills and pitch systems, as well as the different national infrastructure and sport development contexts across the UEFA member associations, mean that it is advisable for national associations to consider cooperating in R&D and innovation on a regional basis.

- Indeed, many national associations and stakeholders are already running impressive pitch testing projects and R&D initiatives.

    - The Nordic national associations are cooperating and targeting different areas of focus. For example, Denmark, Norway and Sweden have run different testing projects until now, but are now looking to create closer links between all projects.

        - Norway is running a test project with a birch infill.
        - Denmark is monitoring 15 pitches with different infills.
        - Sweden was the first NA in the North of Europe to construct test beds in that specific climate and has extensive knowledge in how to approach test beds in future.

- It is important to be aware of European programmes, projects and funding opportunities relating to R&D and innovation. UEFA provides a dedicated service to raise national associations' awareness of such opportunities and to support their funding applications. Is any EU funding available to facilitate the transition? outlines relevant European-level considerations and opportunities.

- It is also clear that national associations can be effective in leveraging public support and unlocking funding for R&D and innovation projects at national level.

    - The Football Association of Norway (NFF) raised awareness at national level about the complexities of the EU restriction, its effects on grassroots football in Norway and the lack of knowledge about suitable alternatives to crumb rubber infill. These advocacy efforts have propelled the NFF to be, in effect, the leader of a structured collaboration between several stakeholders at national and local level (from government to municipalities and football clubs) who are aiming to develop and test new sustainable technologies in Norway. With the approval of the government (the ministries of culture and equality, and climate and environment), the NFF developed an application for public funding for a period of six years from 2024 to 2030. The budget unlocked was NOK 5.5m (approximately €470,000) per year. In 2024 the project funded an assessment of the expected remaining lifespan of pitches with rubber infill and returfing-related costs. In 2025, the budget will fund research activities into the performance of various alternatives to rubber infill, However, the public resources unlocked remain too low to cover further infrastructure development, which emphasises the need for complementary support, such as EU funding.

    - In England, The Football Association has also carried out work relating to testing alternatives to crumb rubber in the UK. A three-year research programme of a total value of £3m started in 2023, with contributions from The FA, the Premier League and the Football Foundation (a joint charity of The FA, the Premier League and the UK government). The programme aims to test the performance of vegetal or mineral infills in seven small-sided artificial pitches. The research will enable The FA to better inform and advise pitch owners regarding future considerations when deciding on the design and specification of a new pitch. This funding does not relate to a government strategy, but generally aims to develop football facilities, with the added aim of eliminating crumb rubber infills, in line with the EU restriction.

- UEFA also encourages national associations to consider the UEFA Research Grant Programme (UEFA RGP) as a possible means for achieving support for R&D and innovation on the transition away from polymeric infill.

    - The UEFA RGP is a prestigious grant programme designed for academics working in partnership with national associations to support visionary research on European football.

    - It is for anyone with or working towards a PhD who is analysing European football from a variety of academic disciplines. Once completed, the research is shared with the 55 UEFA member associations and is used for growth and development purposes.

    - Grant applicants must submit a letter of recommendation written by a president, general secretary or CEO of a UEFA member association, thereby ensuring that their project is relevant to contemporary issues and has the highest practical value possible.

    - In order to foster cooperation between its member associations and European universities, UEFA allows up to three researchers based in the territories of three different national associations to submit joint applications.

    - Each individual project selected by the UEFA Research Grant Jury is eligible for a grant of up to €15,000 and each joint project for a grant of up to €20,000 for a nine-month research period.

- The artificial turf industry also pays an important role in R&D and innovation. Responding to growing environmental awareness and the future polymeric infill restriction, the EMEA Synthetic Turf Council and its members are navigating a route through the conflicting market needs for surfaces that provide good sports performance while being able to sustain prolonged high levels of use and which are still cost-effective and environmentally friendly.

Is any EU funding available to facilitate the transition?

- Current EU funding programmes do not directly address the sport or football sector, nor the transition. However, they are structured to respond to several relevant overarching policy areas that affect a variety of economic sectors.

- As such, the relevant EU funding streams are those supporting research, development and upscaling solutions in the wider context of the transition to a greener, low-carbon economy.

- There are two types of such EU funding streams:

    1. **Centrally managed EU programmes:** Transnational partnerships with a specific EU added value develop a project proposal in response to specific EU-wide calls for applications and submit it to the European Commission for a centralised evaluation across the EU (and beyond in certain cases). Such programmes are very competitive, and the funding that an application can receive depends on the yearly budget allocated by the Commission to the topic in question.

        Relevant programmes: Horizon Europe (a research and innovation funding programme) and LIFE (a funding instrument for the environment and climate action).

Opportunities for 2025 to 2027 and beyond: Horizon Europe's strategic plan for 2025 to 2027 foresees support for the development of EU-wide partnerships (including with non-EU countries) on, among other things, the development of innovative materials that are safe, sustainable, circular and traceable, contributing to the reduction of dependencies on certain raw materials. The development of alternatives to plastic infills for artificial pitches is highly relevant for the objectives of this partnership, as it contributes to the implementation of resilient material value chains across sectors that will help Europe to reach its targets for environmental protection and also boost industrial competitiveness. UEFA expects calls for applications on this topic to be published by Horizon Europe starting from mid-2025.

2. ***Nationally or regionally managed EU programmes:*** Such programmes address specific local socio-economic issues identified by the member state or region who manages them. National associations can directly influence the policy agendas that underpin these funding programmes, as they can argue that the transition period must be facilitated to support the wider development of football in the relevant geographical area. These programmes are less competitive than centrally managed EU programmes, as they are specific to a certain area.

   Relevant programmes: Cohesion Policy funds (specifically, the European Regional Development Fund) and Interreg programmes (for cross-border and interregional collaboration). Usually, calls for applications are not specific, but rather touch on wider policy areas, with increased flexibility on the topic or sector to be tackled.

   Opportunities for 2025 to 2027 and beyond: The midterm review of the EU Cohesion Policy implementation (due by mid-2025) will shed light on the unallocated budgets in each EU member state and on specific challenges still to be addressed by member states at national and regional level. This creates the opportunity for national associations to frame the transition period as a priority for national governments who could leverage remaining Cohesion Policy funding to cater for increased R&D activity at national level. Furthermore, increased synergies with other EU funding programmes will be sought after, including with Horizon Europe.

- UEFA will continue to monitor relevant calls for applications within the above-mentioned programmes and inform its member associations accordingly.

UEFA
Route De Genève 46
CH-1260 Nyon 2
Switzerland
Telephone: +41 848 00 27 27
Telefax: +41 848 00 27 27
UEFA.com

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