



UV-C Light for Turfgrass Disease Management:

Effectiveness, Applications, and Evidence

 turfcoach



Introduction and Background

Turfgrass managers continually seek innovative, sustainable methods to control fungal diseases on sports fields and golf courses. Traditionally, repeated fungicide applications are used to manage threats like Dollar Spot and Microdochium Patch, but over-reliance on chemicals raises concerns about resistance, cost, and environmental impact (Santin, 2025). Ultraviolet-C (UV-C) light (200–280 nm) has emerged as an alternative approach for reducing disease pressure in turf, inspired by its long-standing use as a surface disinfectant in medicine and food industries (Qianqian Fan, 2024). In viticulture, for example, UV-C treatments have been successfully used to suppress grapevine diseases (downy mildew, powdery mildew, grey mold) and allowed reduced fungicide inputs (Espevig, 2023). Since turf pathogens belong to similar fungal groups, researchers have hypothesized that UV-C could likewise help manage turfgrass diseases.



UV-C Wavelengths and Biological Activity



Ultraviolet-C refers to wavelengths between 200–280 nm, which are highly energetic and strongly germicidal. Unlike UV-A or UV-B, natural UV-C from the sun is completely filtered by the ozone layer, so pathogens and plants on Earth’s surface have little inherent defense against it. UV-C light disrupts cellular functions by directly damaging nucleic acids (Espevig, 2023).

When microorganisms are exposed to UV-C in the ~254 nm range, the radiation penetrates their cell walls and causes lesions in DNA (e.g. thymine base dimerization) that block replication. In essence, UV-C exposure renders fungi (and bacteria or viruses) unable to reproduce, leading to their inactivation or death before they can harm the turf. This mechanism has been exploited for over 40 years in sterilization of water, air, and surfaces (Qianqian Fan, 2024).

Target Turfgrass Pathogens for UV-C Treatment

The primary diseases of interest for UV-C control in turf are those caused by foliar fungal pathogens, especially Dollar Spot and Microdochium Patch. These diseases are among the most destructive and costly for golf courses and sports turf.

Dollar Spot (*Clarireedia jacksonii*) :

This widespread fungus causes straw-colored, sunken spots on nearly all turfgrass species and often requires frequent fungicide use. UV-C has shown strong potential in suppressing Dollar Spot by damaging fungal mycelium and spores. Studies confirm its sensitivity: 5 seconds of daily UV-C significantly reduced colony growth (~36%) and spore germination, with little effect from UV-B (Santin, 2025). In turf trials, daily UV-C exposure (5 s at 5 cm height for 7 days) visibly reduced lesions and eliminated pathogen recovery from treated samples, confirming UV-C's direct antifungal effect (Sinha & Hader, 2002).

Microdochium Patch (Pink Snow Mold)

Caused by *Microdochium nivale*, this disease forms circular brown/pink patches in cool, wet conditions, especially under snow. Though typically managed with preventative fungicides, UV-C is being evaluated as a non-chemical tool. Scandinavian trials (e.g. IPM-Golf) reported reduced patch severity with higher UV-C doses (~80 mJ/cm²), though results were inconsistent. UV-C may help suppress *Microdochium* when used preventatively in high-risk periods (cool, damp autumns) alongside cultural practices and resistant cultivars. Field trials are ongoing to assess its broader efficacy (Espevig, 2023; Escalona et al., 2010).

Optimal UV-C Dosage and Treatment Conditions

Determining the right UV-C dose – the combination of light intensity and exposure time – is crucial for maximizing pathogen kill while minimizing turf damage. Research thus far highlights a few key principles for dose and scheduling

Effective dose range:

Studies in both agriculture and turf suggest that cumulative doses on the order of tens to a few hundred millijoules per square centimeter (mJ/cm^2) per treatment are needed for reliable antifungal effects. In viticulture, field trials found that applying $80\text{--}160 \text{ mW}\cdot\text{s}/\text{cm}^2$ (roughly $80\text{--}160 \text{ mJ}/\text{cm}^2$) of UV-C per treatment struck a good balance: this range achieved up to ~99% pathogen kill in tests without phytotoxicity to the crop.

Turf trials have used similar ranges – for instance, a golf green study in Germany compared multiple UV-C dosages and observed that a higher dose ($\sim 80 \text{ mJ}/\text{cm}^2$) gave the most dollar spot suppression (Salgado-Salazar, et al., 2018). At lower doses, the fungus was less affected. Another field experiment (Scandinavia) applied $\sim 0.35\text{--}0.40 \text{ kJ}/\text{m}^2$ ($35\text{--}40 \text{ mJ}/\text{cm}^2$) of UV-C three times weekly and also saw reduced dollar spot compared to untreated turf. From these data, a practical guideline is emerging that on the order of $50\text{--}100+$ mJ/cm^2 per session may be needed for meaningful disease control in the field. Many commercial machines are calibrated such that traveling at the recommended speed delivers a dose in this target range (Santin, 2025).

Optimal UV-C Dosage and Treatment Conditions

Frequency of treatments:

UV-C has no residual effect – it kills pathogens present at the moment of exposure but does not protect the plant from re-infection the next day. Therefore, frequent applications are necessary, especially under high disease pressure. Researchers have tested schedules ranging from daily light doses to a few times per week (Espevig, 2023). Daily very-low-dose treatments (e.g., 5 seconds of lamp exposure per day) have shown success in experimental settings, suppressing dollar spot without hurting turf.

In most practical scenarios, turf managers treat with UV-C 2–3 times per week during the peak disease period. For example, a turf manager might run the UV unit on greens every Monday, Wednesday, Friday night or early morning when conditions favor dollar spot. In a trial in Norway, thrice-weekly UV-C kept dollar spot in check relative to untreated plots. If disease pressure is extreme or new infection centers are constantly appearing, more frequent (even daily) treatments could be warranted on a temporary basis. The optimal frequency likely depends on pathogen growth rate and environmental conditions – fast-growing fungi or heavy spore influx will require tighter intervals (Escalona, Aguayo, Martínez-Hernández, & Artés, 2010).

Optimal UV-C Dosage and Treatment Conditions

Timing of day and conditions:

UV-C treatments are best done at night or during darkness. This is partly for safety (to avoid human or animal exposure in busy areas), but also for biological efficacy. Many microorganisms have the ability to repair UV-induced DNA damage if visible light is present soon after exposure (a process called photoreactivation, where enzymes use light energy to fix UV lesions).

By applying UV-C in the dark (e.g., predawn or nighttime), turf managers ensure the fungus doesn't immediately get sunlight to activate repair mechanisms, thereby increasing kill rates. For example, UV-C programs in agriculture (like strawberry or grape UV robots) explicitly operate at night for this reason. Additionally, nighttime application avoids UV-C being outshone by sunlight – even though solar UV-B doesn't reach the germicidal UV-C range, intense sun can degrade the effect or cause uneven dosing (and operators cannot work safely in sunlight with UV lamps without heavy shielding) (Qianqian Fan, 2024).

Temperature and moisture conditions might also matter: a dry, clear night is ideal so that the UV-C can directly reach fungal mycelia. If the turf is wet or covered in dew, there is a possibility (though not well-studied yet) that water could shield some spores or reduce penetration. Most current users simply avoid irrigating or having sprinklers on immediately before a scheduled UV pass. In summary, nighttime, dry canopy conditions are preferred for UV-C turf treatments to maximize efficacy and consistency (Santin, 2025).

Optimal UV-C Dosage and Treatment Conditions

Timing of day and conditions:

Applying UV-C effectively without harming turfgrass requires careful dose management. Research shows that excessive exposure, such as 30 minutes per day, can severely damage or kill turf (Qianqian Fan, 2024), while even 6 minutes daily may cause visible injury. In contrast, very low doses (a few seconds per day) have shown no damage and may even enhance turf density.

In practice, UV-C machines move continuously, so each turf area receives only a brief exposure. At recommended operating speeds, commercial units have shown no signs of turf burn or physiological stress. In a week-long trial, daily 5-second treatments caused no change in chlorophyll or carotenoid levels in bentgrass or bermudagrass (Santin, 2025).

To ensure safety, turf managers should follow manufacturer guidelines on lamp output and speed, avoid overlapping passes, and, when uncertain, test the regimen on a small turf area before full application.

Efficacy: Results from Research and Field Use

Laboratory and Growth Chamber Studies

Controlled experiments have confirmed that UV-C can effectively suppress turf pathogens. Santin et al. (2025) showed that UV-C significantly reduced *Clarireedia* (Dollar Spot) growth in petri dishes and on potted turfgrass, with treatments at 5 cm distance far outperforming those at 15 cm—highlighting the importance of intensity. UV-B had minimal effect, confirming that UV-C is the active fungicidal spectrum. After one week of daily treatment, creeping bentgrass had virtually no detectable pathogen, unlike untreated or UV-B treated samples (Salgado-Salazar et al., 2018).

Fan et al. (2024) also examined UV-C's impact on turf itself, finding that seashore paspalum tolerated short daily exposures (seconds to 1 minute), sometimes showing enhanced density, while longer exposures (minutes) caused damage. These dose-response insights help define the safety window: brief, fast passes are safe; prolonged exposure is not.

Efficacy: Results from Research and Field Use

Field Trials on Golf Turf:

Since 2018, field trials across Europe and North America have tested UV-C in real-world turf and disease conditions. The Scandinavian Turfgrass Research Foundation (STERF) led a multi-year study treating greens infected with Dollar Spot and Microdochium Patch. At Osnabrück Golf Club (Germany), UV-C consistently reduced Dollar Spot severity, particularly at higher doses ($\sim 80 \text{ mJ/cm}^2$), though it didn't fully eliminate disease. Researchers concluded that UV-C offers a physical suppression method, though not a full replacement for fungicides at current treatment levels. Turf quality on UV-C plots was equal or slightly better than untreated turf, showing no signs of damage (Espevig, 2023).

Results for Microdochium Patch remain inconclusive. While some STERF sites (Norway, UK) showed disease reduction through cultural practices (e.g., rolling, iron), UV-C was not a primary treatment. However, applying UV-C in autumn may reduce spore loads and mitigate spring outbreaks, ongoing studies aim to validate this.

The table on the next page summarizes some key research studies and field trials on UV-C in turfgrass, illustrating the range of observed outcomes

Efficacy: Results from Research and Field Use

STUDY	PATHOGEN	UV-C REGIMEN	OUTCOMES
Santin et al. (2025) – Italy (lab/greenhouse)	Dollar Spot (Clarireedia)	5 s UV-C per day at 5 cm distance (7 days) on creeping bentgrass; also in vitro on fungus	UV-C reduced mycelium growth by ~36% in vitro (none with UV-B) and suppressed Dollar Spot symptoms in vivo, with no turf damage. Confirms strong antifungal effect.
Espevig et al. (STERF, 2023) – Scandinavia	Dollar Spot (+ Microdochium)	~0.35–0.40 kJ/m ² (35–40 mJ/cm ²) UV-C, applied 3× weekly on research green plots (Agrostis/Poa)	UV-C treated plots showed reduced Dollar Spot without turf damage, confirming it can suppress the disease in field conditions, though not eliminate it entirely.
Hesselsøe et al. (STERF, 2023) – Scandinavia	Dollar Spot (Clarireedia)	Higher UV-C dose ~80 mJ/cm ² , frequency not explicitly stated (likely ~weekly) on golf green; two lower doses also tested	UV-C had a dose-dependent effect: High doses (~80 mJ) reduced Dollar Spot, while lower doses had little impact. Microdochium levels were too low to assess. Conclusion: UV-C can support disease control, but effective dosing is essential, and it doesn't fully prevent Dollar Spot on its own.
Fan et al. (2024) – Georgia, USA (greenhouse)	Turfgrass growth (no disease)	Daily UV-C exposures: 6 s, 1 min, 6 min, 30 min; monitored seashore paspalum growth response	Short UV-C doses (6s–1min) improved turf density and color; high doses (6–30min) caused stress, with 30min/day being lethal. Shows brief exposure is safe and beneficial, but prolonged exposure is harmful

Benefits and Drawbacks of UV-C Turf Treatments

Determining the right UV-C dose – the combination of light intensity and exposure time – is crucial for maximizing pathogen kill while minimizing turf damage. Research thus far highlights a few key principles for dose and scheduling

Benefits:

Reduced Chemical Use:

UV-C can reduce fungicide use, leaving no residues and avoiding resistance buildup, helping lower costs and meet pesticide reduction goals.

Broad-Spectrum Antimicrobial

UV-C targets multiple turf pathogens at once, unlike specialized fungicides—and can achieve up to 99.9% microbe kill with proper dosing

Environmentally Friendly

minimal environmental impact, leaves no residues, and allows immediate turf use—making it ideal for sustainable turf management.

Quick Action and No Resistance

kills pathogens within seconds and acts faster than systemic fungicides, with no risk of resistance due to its physical DNA-damaging action.

Synergy with Other IPM Tactics

UV-C pairs well with cultural practices like rolling and dew removal, enhancing disease control and possibly priming turf defenses through mild stress responses.

Benefits and Drawbacks of UV-C Turf Treatments

Disadvantages (Cons):

Incomplete Control in Isolation

UV-C may not match full fungicide programs; it suppresses rather than eliminates disease, so some chemical use may still be needed in high-pressure conditions.

Frequent Treatments Required

It has no residual effect, requiring frequent treatments to maintain control. This demands consistent scheduling, which can be labor-intensive for busy turf managers

Equipment Cost and Maintenance

High upfront costs limit access to UV-C units, though rental and shared-use models may help offset the investment.

Limited Penetration and Shadowing

UV-C only targets exposed surfaces—shaded pathogens may persist, and it can't treat soil-borne or internal infections in the plant.

Unknown Impacts on Non-target Microbes

UV-C may harm beneficial microbes on turf leaves, disrupting the phyllosphere and creating space for pathogens.

Commercial UV-C Technologies and Adoption

SGL UVC180 – The Leading Commercial Option

Stadium Grow Lighting (SGL), a Dutch company, developed the UVC180: a battery-powered, walk-behind unit emitting UV-C at 253.7 nm. Designed for sports turf disease control, it can treat a full soccer pitch (~11,000 m²) on one charge. Integrated disease forecast software advises on optimal treatment timing based on predicted pressure. Top clubs like Chelsea FC (Stamford Bridge) and Sweden's Friends Arena report positive results, making the UVC180 a catalyst for broader adoption.

Other Emerging Technologies

Beyond SGL, several research groups and startups—especially in the US—are developing alternative UV-C systems. These include mower-mounted units, autonomous robots, and drone- or tripod-based systems. While not yet commercialized, they show the concept is gaining traction. Some handheld wands also exist for spot treatments, though limited in scale and requiring strict safety protocols.

Adoption Trends

Uptake is strongest among golf clubs and stadiums in Europe, where pesticide regulations are tighter and sustainability is prioritized. Trials at clubs like Kristianstads Golfklubb (Sweden) and various professional football teams in the Netherlands, England, and Germany illustrate this shift. Adoption is slower in regions with low-cost fungicides and looser regulations.

Commercial UV-C Technologies and Adoption

What's next?

Future innovations may include:

- Large-scale rigs for fairways
- Small autonomous robots for nightly treatments
- Far-UV-C (207–222 nm), potentially safer for human exposure
- UV-C LEDs, which could enable lighter, more flexible systems (e.g., drone-mounted arrays), though currently less efficient than mercury lamps

As costs drop and research advances, the UV-C technology landscape for turfgrass is likely to expand rapidly.

Conclusion

UV-C light is emerging as a promising non-chemical solution for managing turfgrass diseases, especially on golf courses and sports fields. By disrupting fungal DNA, it offers a sustainable alternative to fungicides. Early adopters using machines like the SGL UVC-180 report healthier turf and lower chemical use. Benefits include broad-spectrum efficacy and reduced fungicide reliance, supporting environmental and regulatory goals. However, challenges remain—UV-C requires frequent application, involves operational costs, and must be integrated into a broader IPM strategy.

Key takeaways for turf managers:

- Start with trials on small areas.
- Time applications using disease prediction models.
- Ensure trained operation and safety protocols.
- Use UV-C as part of an integrated approach.
- Track and document results to evaluate performance.

Looking ahead, UV-C is likely to become a standard IPM tool as research progresses and regulations tighten. Ongoing studies will refine treatment guidelines and help quantify ROI. While not a cure-all, UV-C offers a meaningful step toward more sustainable turf management by blending technology with biology.



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