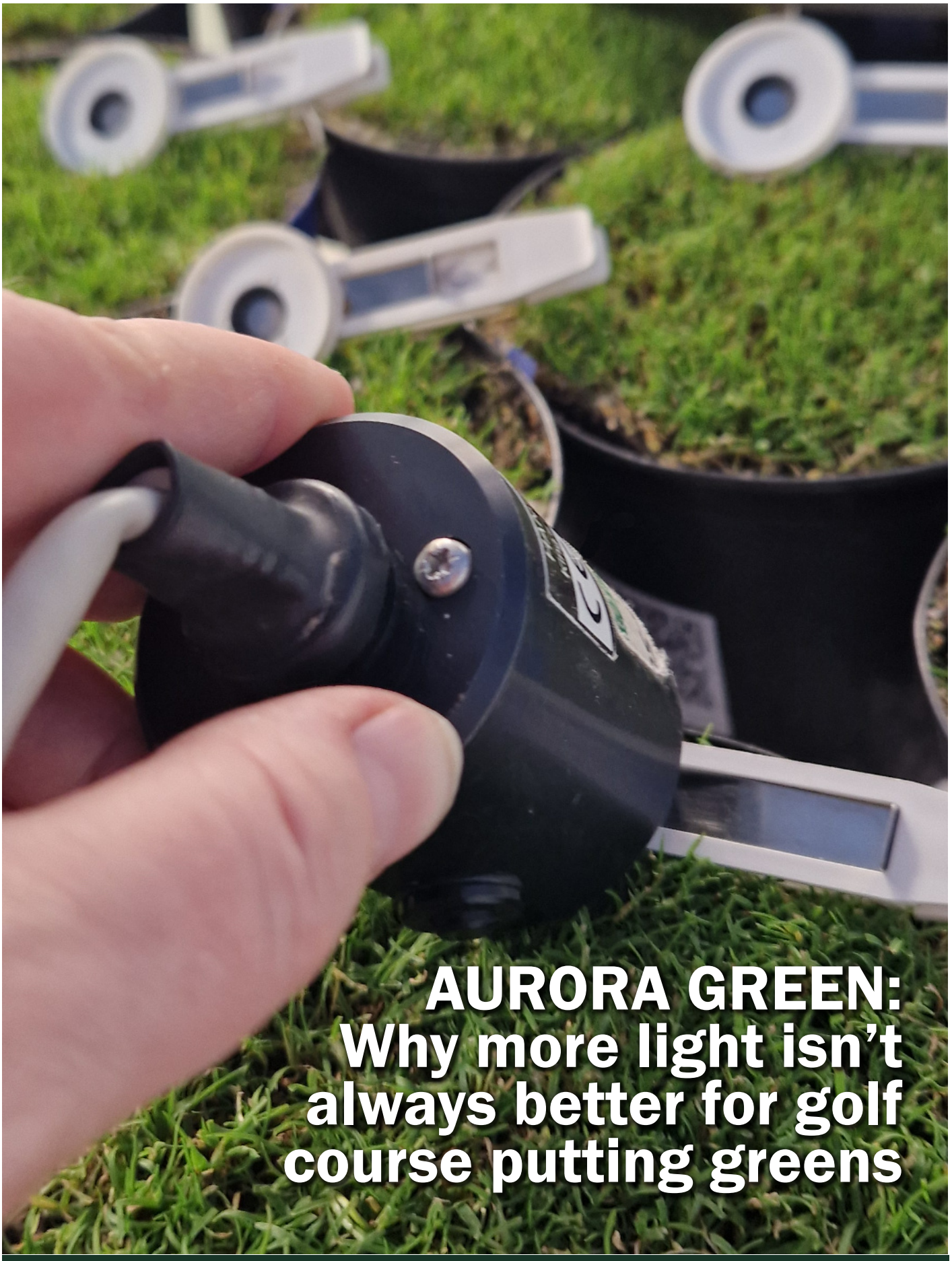


AURORA GREEN: Why more light isn't always better for golf course putting greens

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Understanding Turfgrass Light Stress in Cold Climates

Light is essential for healthy turfgrass, but its effects depend on temperature and the condition of the plants. During autumn, light can influence how grasses prepare for winter. In spring, strong sunshine may stress plants while temperatures are still low and they are still recovering from winter damage. AURORA GREEN brings together researchers in Norway, Sweden and the United States to understand these interactions and investigate practical ways to protect golf greens.

Sunshine is only part of the story

Grass emerging from snow or ice may struggle to utilize the strong sunlight because low temperatures slow photosynthesis. Excess absorbed energy can cause photoinhibition—reduced efficiency of the photosynthetic machinery—and, under severe stress, damage plant cells. Winter-stressed plants and young seedlings may be particularly vulnerable.

Light also influences cold acclimation, the physiological changes that prepare perennial grasses for a multitude of winter stresses. Building on the research projects ICE-BREAKER and WINTER TURF, AURORA GREEN examines when light is beneficial and when it becomes excessive. The research combines experiments under controlled conditions in growth chambers and greenhouses, field trials with covers and pigments to various grass species and large-scale demonstrations on golf course putting greens.

How does autumn light affect winter hardiness?

At NIBIO Tromsø, creeping bentgrass and annual bluegrass from golf course putting greens in northern Swedish are being studied under different light conditions during cold acclimation; natural autumn light, reduced light beneath a cover and supplementary lighting. Temperatures are gradually lowered over six weeks.

Chlorophyll fluorescence measurements track photosynthetic responses (Figure 1), while digital assessments record plant condition. Subsequent freezing tests will establish whether light treatments affect freezing tolerance.

A cold night followed by a bright day

An overnight freeze followed by bright sunshine may challenge seedlings used to restore winter-damaged greens (Figure 2). At the University of Massachusetts, creeping bentgrass, annual bluegrass and slender creeping red fescue seedlings undergo freezing followed by recovery under low or high light intensity. Green cover and photosynthetic efficiency reveal whether strong light adds to freezing stress and whether protective treatments could improve recovery. Measurements include photosynthesis, leaf pigments, antioxidants and other leaf characteristics to understand differences in stress tolerance.

Comparing grasses and the effects of UV light

At the University of Minnesota, experiments compare mature plants of various turfgrass species receiving supplementary ultraviolet (UV) radiation during cold acclimation with plants receiving none.



Figure 1. Turfgrass samples in Tromsø: from is used to investigate how autumn light conditions affect cold acclimation and freezing tolerance.

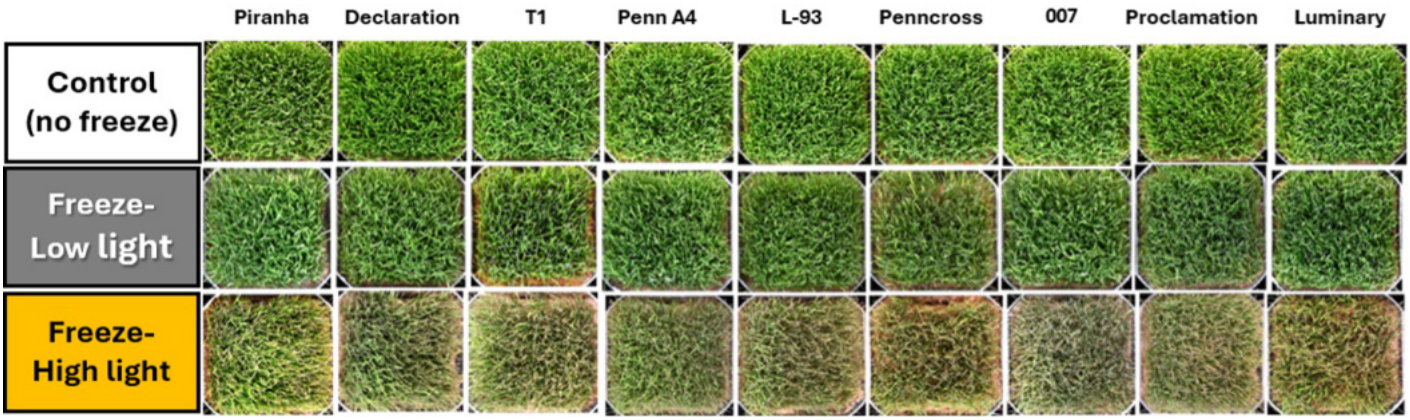


Figure 2. Previous research at University of Massachusetts showed that 3-wk old seedlings of various creeping bentgrass cultivars were sensitive to high light conditions following overnight freezing events.

The aim is to determine whether UV exposure affects acclimation and subsequent freezing tolerance, distinguishing effects of light quality from overall light intensity.

First-season findings: Covers differ more in light reduction than in warming

A screening trial established at NIBIO Landvik on 26 March 2026 compared Agryl, Evergreen Classic, Evergreen Radiant, Norgro, Shade50, Shade70 and Green70 with an uncovered control (Figure 3). Importantly, **the screening contained no turfgrass but was irrigated frequently:** it characterised conditions beneath the materials, not their effects on plants.

Soil-temperature effects were small. Agryl and Evergreen Radiant yielded 12.3 °C as average of 9 weeks, compared with 11.8 °C in the control. Evergreen Classic matched the control, while Shade70 was slightly cooler.

Transmission differed more clearly. Agryl, Evergreen Radiant and Norgro reduced irradiance relatively little; Evergreen Classic gave an intermediate reduction; Shade50, Shade70 and Green70 reduced it more strongly. UV-B reductions were also greater beneath Evergreen Classic and the three stronger-shading materials.

Irradiance varied with measurement position beneath every material except with Green70. UV-B varied with position beneath Evergreen Classic, Evergreen Radiant and Shade50. Covers therefore cannot be treated as interchangeable, but these results do not establish which best protects the grass or improves establishment.



Figure 3. Cover-screening setup at Landvik: Seven covering materials were compared with an uncovered control.The first screening characterised light and temperature conditions without turfgrass.

Can turf pigments provide protection?

Minnesota researchers are also testing synthetic turf pigments/colourants, examining products, application rates, water volumes and nozzle types. Early screening recorded differences in the amount of visible and UV light transmitted through colourant applied to quartz glass (Figure 4). However, filtering radiation is not proof of improved winter survival or spring recovery; benefits must be demonstrated through plant responses.

Taking the findings onto golf greens

Field experiments planned at Landvik in spring 2027 and 2028

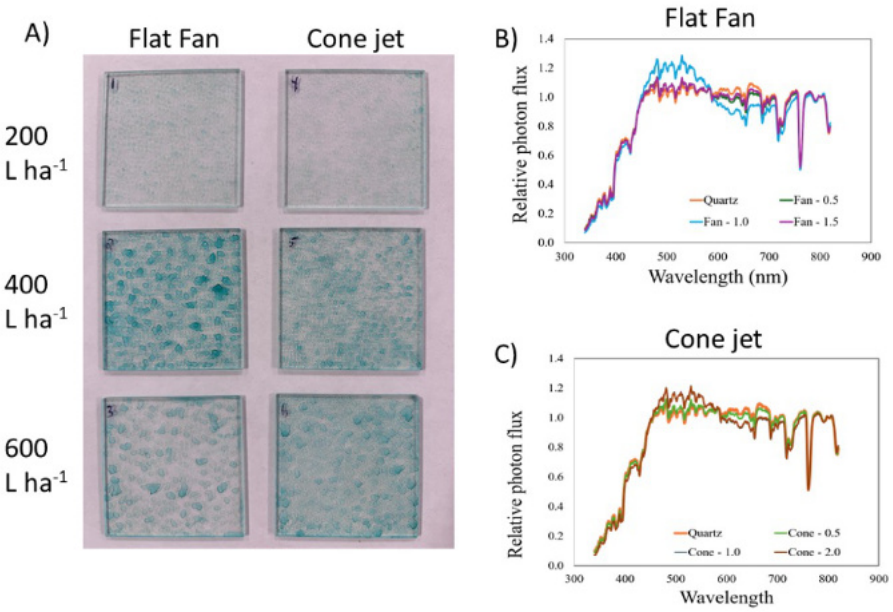


Figure 4. A) Quartz glass slides were treated with TourTurf GTP colourant with either a TeeJet flat fan or cone jet nozzle at 3 different spray volumes (200, 400, 600 L ha-1) to examine how colourant application impacts light transmission. B) For the fan nozzle, light intensity was reduced by 5, 18, and 4% as spray volume increased and UV light by 19, 35, and 22% respectively. C) For the cone jet nozzle, light intensity was reduced by 3, 11, and 11%; UV light was reduced by 16, 31, and 35% respectively.

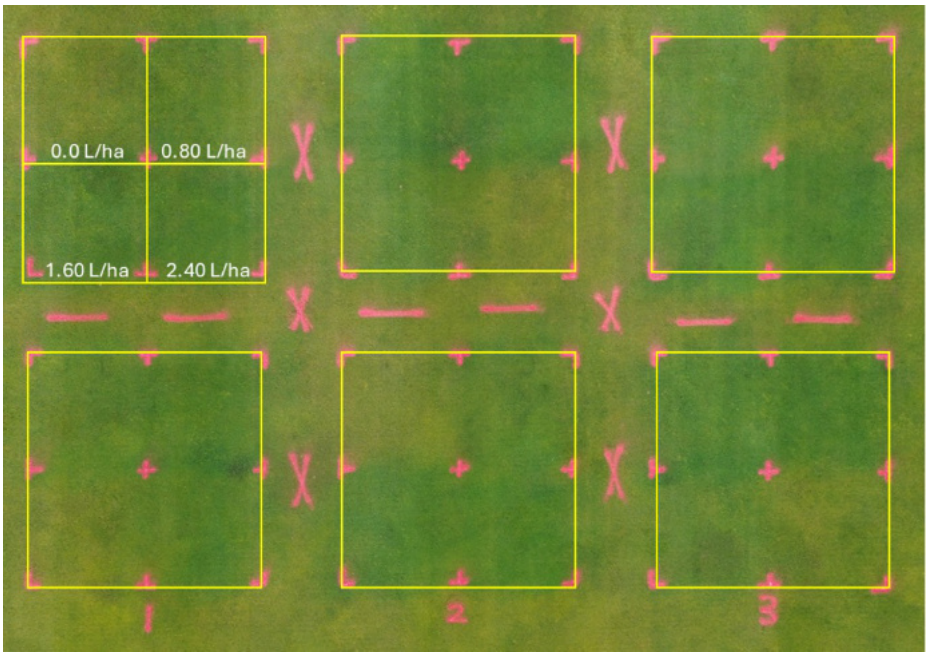


Figure 5. Pigment - ice experiment in Saint Paul Minnesota on a native soil creeping bentgrass putting green. Ryder colourant has been sprayed at 4 rates (0, 0.80, 1.60, and 2.40 L ha-1) and a carrier volume of approximately 400 L ha-1 using TeeJet XR Extended Range 8003 flat fan nozzles. Two applications were made on 24 Oct. and 8 Nov. 2026. All plots outlined in yellow will be encased in ice over the winter and half of these will be covered with a permeable cover in the spring to look at both the impact of the pigments on survival and spring greenup and what benefits the cover adds to spring greenup.

will test selected covers and colourants during early spring establishment of creeping bentgrass, measuring light, soil temperature, turf cover and quality. In Minnesota, we are examining how different rates of colourant (Ryder) impact tolerance to ice encasement and improve spring greenup when combined with a permeable cover in the spring (Figure 5).

What does this mean for greenkeepers?

For greenkeepers, the central message is that light responses depend on temperature, season and plant condition. Current findings do not justify recommending one cover or pigment over another. The goal is to identify when protection helps without unnecessarily restricting light needed for growth.

AURORA GREEN

Managing turfgrass photoinhibition in the northern light

Approaches:
Controlled-environment experiments, screening of covers and pigments, field trials and golf-course demonstrations

Project lead:
Sigridur Dalmannsdottir, NIBIO Tromsø

Partners:
NIBIO, University of Massachusetts, University of Minnesota and the Swedish Golf Federation

Funding:
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