RE-ESTABLISHMENT AFTER WINTER DAMAGE

Updated 2025

Rättviks GC, spring 2022. Photo: Carl-Johan Lönnberg.

Introduction

Winter damages may occur on all parts of the playing surface on a golf course, but generally greens are the most vulnerable. This fact sheet describes methods for faster spring recovery after re-seeding of partly or completely winter damaged greens, but the information can be adapted to other parts of the golf course as well.

While severe winter-kill is common on annual bluegrass-dominated greens in Finland, Northern Sweden and Norway, this situation typically occurs at 5 to 10 years intervals on golf courses in the high populated regions of Helsinki, Stockholm and Oslo. Efforts to improve survival by using sand-based green constructions, winterhardy grass species and varieties, preparations before winter and use of protective covers, have decreased the severity of winter-kill, but when it happens, it is a very stressful reality for course managers and greenkeepers.

The ICE-BREAKER-project 2020-2024 investigated both prevention and repair of winter damages caused by ice and melting water. One of the key objectives was to find out why reestablishment after damage from ice encasement and recurring freeze/thaw cycles may be more challenging than reestablishment after other types of winter damage. The influence of temperature, light, sowing method (machinery), spring covers, creeping bentgrass varieties and seed priming was also investigated, and some of this research continued in the WINTER-TURF-project 2021-2025. Key findings from ICE-BREAKER, WINTER-TURF, SCANGREEN and other related projects on re-establishment after winter damages will be summarized in this fact sheet.

Summary

Turfgrass winter damages are difficult to repair, especially if only parts of the greens are dead. Several projects for the last 5-10 years have investigated repair of winter damages, and one of the conclusions is that the risk of growth inhibition caused by toxic substances after ice encasement is overestimated. Therefore, the challenges with re-establishment of new seedlings is more likely a question about soil temperature, adequate water and fertilizer supply and good seed-soil contact.

Different machinery and methods have been tested where slit seeding resulted in the highest coverage of creeping bentgras. The use of permeable spring covers to improve temperature and protect the new seedlings from strong sunlight have shown promising results. As low soil temperature is one of the main reasons for slow re-establishment in spring, higher applications of phosphorus (P) on sandy greens cannot be justified, and a balanced NPK-fertilizer is recommended.

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To investigate growth inhibition after ice-encasement red fescue and creeping bentgrass greens with a 2-3 cm thatch layer (photo to the left) were encased in ice for 3 months in the winter of 2021 and 4 months in the winter of 2022 (photo to the right). Photos: Trygve Aamlid and Pia Heltoft.

The risk of growth inhibition after ice-encasement is overestimated

Compared to other winter damages re-establishment after prolonged ice cover can be very difficult, and research from hay-fields suggests that this problem could be explained by growth inhibiting toxic substances formed under anaerobic (without oxygen) conditions beneath the ice layer. This topic was investigated by NIBIO from 2021-2022 in field and lab experiments at Apelsvoll, Landvik and Ås.

Butyric and acetic acid and other substances formed by anaerobic metabolism were identified in the thatch layer right after ice melt of ice-encased greens of both red fescue and creeping bentgrass, but these toxic substances were rapidly lost or broken down by microorganisms when the ice thawed, and no inhibition of germination was found.

Lab experiments also confirmed that concentrations of acetic or butyric acid that can inhibit seed germination were approx. 10x higher than found in soil water samples from the thatch of ice-encased greens.

The conclusion of these experiments suggests that growth inhibition from toxic substances formed under ice-encased greens have been overrated in the past.

Soil cores from ice-encased greens were sampled right after ice melt in early April (photo to the left) and analyzed for toxic substances in the thatch (photo to the right). Photos: Pia Heltoft and Karin J. Hesselsøe.

Re-seeding and recovery of various grass species after winter damages

Fast re-establishment of winter-killed greens from seed in spring is primarily a question about soil temperature, adequate water supply, good seed-soil contact, sufficient supply of P and ample supply of N.

Annual bluegrass

Annual bluegrass (*Poa annua*) is most common on putting greens in the Northern hemisphere. It usually has a huge seed bank geminating in the thatch layer to form a new sward within 4-7 weeks depending on temperature. If this is the wanted scenario, we can speed up the natural revegetation process by regular fertilization, irrigation and use of permeable spring covers.

Creeping bentgrass

Creeping bentgrass varieties have different ability to re-establish at low soil temperatures, but these differences also depend on the seed lot used and are altogether less important than the varieties' overall turfgrass quality over several years. Re-seeding trials at Sollefteå GC in Northern Sweden 2021-2023 showed that 'Pure Select' was the fastest, followed by 'Luminary' (intermediate) and 'Independence' as the slowest in emergence , but in mid-June 'Luminary' had the best coverage. Varieties with an overall high ranking for turfgrass quality and at the same time reasonably fast emergence at low soil temperatures are 'Tripleseven (777)', 'Luminary' and '007'. The most slowly germinating varieties such as 'Independence' or 'Memorial' should be avoided. All in all reestablishment rate of creeping bentgrass is more affected by fertilizer type, N rate and the use of spring covers than by variety.

Other grass species

Some Nordic golf courses use either perennial ryegrass *(Lolium perenne*) or rough bluegrass (*Poa trivialis*) as 'nurse grasses' to speed up the re-establishment rate on creeping bentgrass greens or on annual bluegrass-dominated greens with insufficient dormant seed. These species are temporary solutions because they are expected to die the following winter.

When 'nurse-grasses' were seeded together with creeping bentgrass in SCANGREEN 2015-2018, perennial ryegrass was fastest, but rough bluegrass resulted in better turfgrass quality and less disease. In the southern parts of the Nordic countries it is not recommended to use these 'nurse grasses' because they tend to survive the winters.

Effect of re-seeding a winter-killed annual bluegrass green with creeping bentgrass varieties 'Pure Select', 'Luminary' and 'Independence' at Sollefteå GC in Northern Sweden 2021-2023. Left photo: Before re-seeding in spring 2021. Right photo: Same plots in September 2022 after two yeas of reseeding. Row 0 is unseeded control of annual bluegrass, rows 1-4 are the re-seeded creeping bentgrass varieties. Photos: Carl-Johan Lönnberg.

Machinery and methods for good re-establishment

Machines for testing re-seeding in Northern Sweden. Surahammars GK spring 2017.

Good contact between seed and soil and the right seeding depth can be provided by using machines that make slits or small holes into the surface. Drop seeding, spike seeding and slit seeding winter-killed annual bluegrass greens were tested in Central Sweden in 2017-2018 showing that slit seeding resulted in the highest coverage of creeping bentgrass or rough bluegrass. Reseeding should always be followed by a topdressing with a medium-grade sand containing peat, mature compost or some other material that gives it a dark color.

If the goal is to get rid of the seed bank of annual bluegrass, an earlier experiment (2008-09) at Vestfold GC, Norway showed that removing 2 cm of the top layer with a Koro Field Topmaker and reseeding red fescue and bentgrass with a slit-seeder resulted in a slower re-establishment compared to direct slit-seeding into the dead green. But looking at the grass composition, 50% of the seedlings with direct seeding were annual bluegrass compared to 2% where the toplayer had been removed.

As part of the ICEBREAKER-project three years of slit-seeding creeping bentgrass directly into partly or fully winter-killed annual bluegrass greens in Northern Sweden suggested that it is important to reseed golfgreens after winter damages with new seeds, and that there is a long-term effect of re-seeding with creeping bentgrass. Even in autumn 2024 one and a half year after the last re-seedings creeping bentgrass had survived and was expanding at the expence of annual bluegrass.

To the left: Checking seedlings after slit-seeding a winter-killed annual bluegrass green at Rättviks GC in Northern Sweden. To the right: In autumn 2024 creeping bentgrass is expanding at the expence of annual bluegrass. Photo: Carl-Johan Lönnberg.

Seeding or sodding?

Sod of green quality is not easy to find. Some golf courses that regularly experience winter injuries have nursery greens, or they have a standing order of sod as a yearly delivery from a sod farm further south. Their staffs have excellent skills at sodding greens and the greens can be opened for play some weeks earlier. They have found that this practice pays back.

But sodding does bring some extra challenges. Rooting is not always easy, especially if the original green root zone material holds less water than the sod. Root zone layering may cause future problems, and we often see more localized dry spots on sodded parts of the greens. You should include some of these experiences when you calculate the costs of sodding. Sod always has to be properly installed and then removed again by hollow-coring or scarification during the next two years.

Permeable spring covers

Spring covers are important to accelerate germination and seedling growth after re-seeding in spring. Their effect is primarily due to higher soil temperature, but they are also protectants against hard rains, desiccation and high light intensities that can damage the grass. Challenges caused by the combination of strong sunlight and low temperature in early spring are described in detail in STERF's fact sheet 'Spring stress – the difficult transition into a new growing season'.

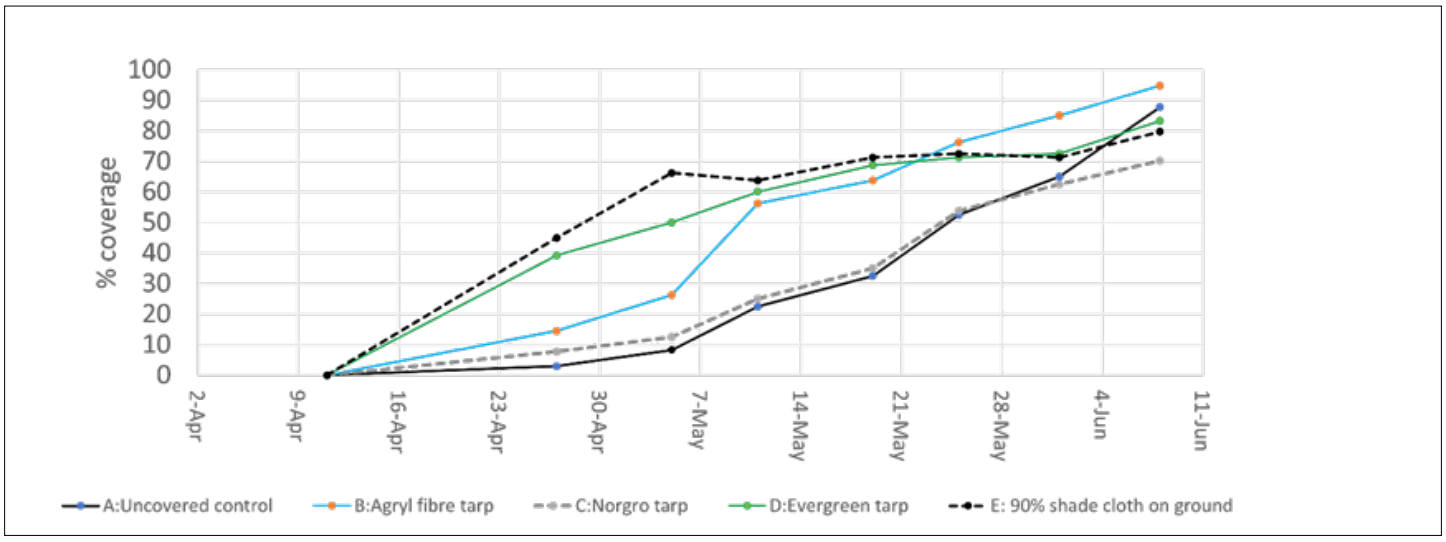
In spring 2021 three types of spring covers were tested for their effect to increase reestablishment of creeping bentgrass at NIBIO-Landvik. They were: 'Evergreen' (Hinsperges Poly Industries, Mississauga, Canada), 'Norgro' (Arrigoni Agrotextiles, Uggiate Trevano, Italy) and 'Agryl' (Berry Agriculture, Biesheim, France). 'Evergreen' resulted in the highest increase in soil temperature and the fastest coverage in early spring, but the two others caught up from 4 weeks after seeding.

In spring 2022 the experiment was repeated adding a 90% shade cloth to test which covers combine temperature and light effects in the best way. The shade cloth had a surprisingly good effect on turfgrass coverage during the first three weeks after seeding despite no temperature increase. Conclusions after two years was that Evergreen was most efficient in increasing soil temperature and turfgrass coverage during the first three weeks after seeding.

Checking re-establishment under the covers. Photo: Lily Watkins.

Permeable spring covers tested at NIBIO-Landvik in 2021 and 2022: (from left to right) 'Evergreen', 'Norgro', 'Agryl and 90% shade cloth. Photos: Trygve Aamlid and Trond Pettersen.

The effect of permeable spring covers to protect the grass from light stress (photoinhibition): Uncovered seedlings to the left and seedlings covered with a spring tarp (Evergreen) to the right. Photos: Ove Hetland.



The effect of four different spring covers on turfgrass coverage from seeding until two months after seeding with creeping bentgrass 'Luminary' in 2022 at NIBIO-Landvik, Norway on a USGA-green.

Seed priming, biostimulants and growth regulators

Weekly application of different biostimulants and growth regulators after emergence of creeping bentgrass seedlings was tested in the ICE-BREAKER project in 2021-22. Also the use of gibberellic acid (GA3, a plant hormone) as a seed primer before seeding was tested. Results with GA3 from Norway, Sweden and University of Massachusetts are conflicting, but the biostimuants tested showed no effect on the establishment rate of creeping bentgrass 'Luminary'.

Fertilization and irrigation

Recommended fertilization rates for re-establishing greens are much higher than the rates used for maintaining turf. This causes a dilemma on partly dead greens because the old turf will respond with excessive growth if fertilization is adjusted to the new seedlings. If we, on the other hand, adapt the fertilitation to the old turf, re-establishment will take time. A small sprayer with a nutrient suspension is very useful for frequent (at least weekly) spot treatments to the small seedlings.

The corresponding situation arise for irrigation strategy as frequent sprinkler irrigation is not only necessary for seedling growth in the dead spots, but it will also lead to more growth and competition from the surrounding turf. Irrigation systems are often not as uniform as they should be, and the best solution to this problem is to irrigate the reseeded spots manually until the new seedlings are well rooted.

As reseeding usuall takes place at low soil temperatures it is often recommended to apply 'start fertilizers' with an equal or even higher concentration of P than of N prior to reseeding. One of the major findings in the SUSPHOS-project 2017-2020 was that low temperatures did not justify higher P applications, and that a fertilizer containing P as 6-12% of the N-ratio (i.e. a normal balanced NP-fertilizer) was sufficient for turfgrass establishment on a sandy soil low in P.

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Read more

Aamlid, T.S. et al. 2017: 'Kärrgröe eller engelskt rajgräs som «hjälpgräs» vid hjälpsådd efter vinterskador', STERF website https://sterf.org/wp-content/uploads/2024/09/Artikel-Hjalpgras-svensk-k.pdf

Hesselsøe, K.J. et al. 2021: 'Extra phosphorus-fertilization in spring not needed'. STERF website https://sterf.org/wp-content/uploads/2024/09/Extra-phosphorus-fertilization-in-spring-not-needed.pdf

Kvalbein, A. 2009: 'Re-etablering av død green etter vinteren'. NGA-rapport.

Melbye, P. et al. 2024: ICE-BREAKER: Reducing the agronomic and economic impact of ice damage on golf courses and other grasslands. Final report on STERF website https://sterf.org/wp-content/uploads/2024/12/ICE-BREAKER-final-report-to-STERF-FINAL.pdf

Lönnberg, C.J. and Aamlid, T.S. 2021: 'Practical reestablishment of golf greens following winter damages – A field study', Int. Turfgrass Soc. Res. Journal. https://doi.org/10.1002/its2.69

Lönnberg, C.J. et al. 2024: Slutrapport ICE-BREAKER delprojekt 6. STERF website https://sterf.org/wp-content/uploads/2024/09/ICE-BREAKER-Slutapport-2024-delprojekt-6.pdf

Øgaard, A.F. and T.S. Aamlid 2020: 'Temperature effects on phosphorus requirements for creeping bentgrass establishment and spring growth. Agronomy Journal 112:3478–3490. https://doi.org/10.1002/agj2.20288

STERF (Scandinavian Turfgrass and Environment Research Foundation) is the Nordic golf federations' joint research body. STERF supplies new knowledge that is essential for modern golf course management, knowledge that is of practical benefit and ready for use, for example directly on golf courses or in dialogue with the authorities and the public and in a credible environ-mental protection work. STERF is currently regarded as one of Europe's most important centres for research on the construction and upkeep of golf courses. STERF has decided to prioritise R&D within the following thematic platforms: Integrated pest management, Multifunctional golf facilities, Sustainable water management and Winter stress management. **More information can be found at www.sterf.org**

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