

# Fairways4Future and H2Mow – Robotic Mowing and Resource Conservation

*By Anne F. Borchert, NIBIO, Maximilian Karle, HS Osnabrück, and Klaus Müller-Beck, Honorary Member German Turfgrass Society*

**Popular Scientific Articles - STERF, October 2026**

# New STERF project: H2Mow – Robotic Mowing and resource conservation

**The STERF project H2Mow was initiated in spring 2026 and has finished the first year with data collection. As part of this and the Fairways4Future project the Field Days Osnabrück were held in August at University of Applied Sciences Osnabrück and the KORA Turfgrass Competence Center. Robotic mowing and resource conservation on golf courses were the main topics. Combining field demonstrations and presentations, the event brought more than 75 superintendents, researchers, and turf professionals together in Osnabrück, Germany.**

## What will H2Mow investigate?

Even in Scandinavia, where water was once assumed to be plentiful, water resources are becoming increasingly scarce and as a result many greenkeepers struggle to keep healthy turf stands during summer months. Thus, golf courses will need to be managed using less water than they do today because of the pressure that climate change will put on water resources, but also because of persistent public opinion that golf courses are inefficient or unworthy users of water.

At the same time, the rapid adoption of robotic mowers is changing fairway management on many golf courses. Those mowers are lighter, mow more frequently, and use small razor-like blades instead of reels compared to the traditional fairway mowers. The H2Mow project will examine how robotically mowed fairways perform under drought stress and will investigate:

- practical methods for early detection of drought stress using digital images, vegetation indices, and thermal measurements (NIBIO Landvik, Norway),
- how cutting quality influences drought stress and turfgrass recovery on pure species and mixtures (University of Applied Sciences Osnabrück, Germany),
- the effect of mowing height and cutting quality on drought resistance of fairway mixtures (NIBIO Landvik and University of Applied Sciences Osnabrück),
- the differences in drought response between robotically mown and traditionally mown fairways, as well as the impact of precision irrigation on turfgrass quality (Golf Club Großensee e.V., Germany), and
- the interaction between drought stress, robotic mowing, rolling, and dollar spot incidence (Kalmar GC, Sweden).

The aim of the project is to give greenkeepers practical advice on how to enhance turfgrass drought resistance on robotically mown fairways. This will allow golfers to experience high-quality play over an extended period during summer.





*Photos 1 and 2: Mattia Fontani taking digital images (left) and measures NDVI (right) on the fairway trial at Landvik as two different methods to detect drought stress as part of one of the work packages in the H2Mow project.*

## First season: Research trials underway

The first season is almost over and has generated the first data and useful observations. In Norway, at NIBIO Landvik, various non-destructive soil and plant measurements were done from April to October on the Fairways4Future fairway trial to detect drought stress. Measurements were carried out once a week and included volumetric soil moisture, chlorophyll content measured with the FieldScout CM 1000 Chlorophyll Meter, spectral measurements using the Trimble GreenSeeker (NDVI), turfgrass coverage estimated through digital image analysis using TurfAnalyzer software, and thermal imaging. In addition, four reference plots were established and irrigated twice a week with 80% of evapotranspiration. The prolonged dry period in July resulted in clear differences in plant water status among the treatments. The data will now be evaluated to determine which measurement method was most effective in detecting these differences.

In Germany, at the KORA research facility of the University of Applied Sciences Osnabrück, a field trial investigating the effect of cutting quality on drought resistance was established on 13 August 2026 and continued until 31 October 2026. The experimental setup consisted of three Husqvarna robotic lawn mowers equipped with blades representing different levels of sharpness and wear. Three blade-quality categories were defined: sharp, moderately sharp, dull. Several preliminary tests were conducted to establish these categories as objectively as possible. Blade wear was assessed based on blade width and weight, while blade sharpness was determined using the BESS (Blade Edge Sharpness Scale) with a PT50A sharpness tester. Four turfgrass species/cultivars were included in the field trial: *Lolium perenne* 'Coletta', *Poa pratensis* 'Miracle', *Festuca rubra* 'Barchip', and *Agrostis stolonifera* 'L-93'. Each combination of blade quality and grass species/cultivar was tested with four replicates. Throughout the experimental period, several parameters were recorded to evaluate the effects of blade quality on turfgrass performance and mowing quality. These included volumetric soil moisture, visual turf quality, spectral measurements using the Trimble GreenSeeker (NDVI), turfgrass coverage estimated through digital image analysis using TurfAnalyzer software, and cutting-edge quality documented using RGB images.



*Photo 3: Heiko Tock, superintendent on the Golf Club Großensee e.V. in Germany, compares traditional with robotic mowing during drought stress on one of his fairways.*

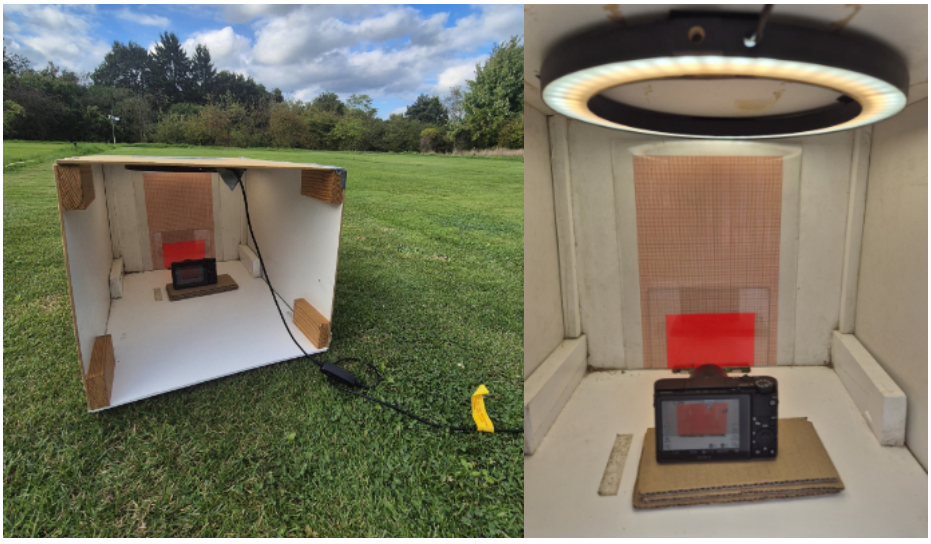


*Photo 4 a and b: With the help of a custom-made light box special close-up images of turfgrass cutting edges are taken to evaluate cutting quality affected by different blade qualities in the field trial in Osnabrück.*



*Photo 5: Maximilian Karle from University of Applied Sciences Osnabrück on his cutting quality trial.*

At Golf Club Großensee e.V. in Germany and Kalmar GC in Sweden, demonstration trials were established in April and July, respectively. The superintendents regularly assessed turfgrass quality and dollar spot incidence.

### From research to practice

Practical recommendations based on the project results will follow and be communicated throughout the project period through the STERF website, Nordic and German greenkeeper journals, scientific publications, and field days. The first field day was held in Germany in August 2026 (see text below), and another is planned at Kalmar Golf Club in Sweden in 2028. The experiments at NIBIO Landvik will also be presented during the International Turfgrass Field Day in 2027.

# Field Days Osnabrück 2026

Robotic mowing and resource conservation on golf courses were the main topics at the Field Days Osnabrück 2026, held on August 18 and 19 at University of Applied Sciences Osnabrück and the KORA Turfgrass Competence Center, as part of the STERF projects Fairways4Future and H2Mow. Combining field demonstrations and presentations, the event brought more than 75 superintendents, researchers, and turf professionals together in Osnabrück, Germany.



*Photo 6: At Osnabrück Golf Club, much of the discussion focused on how well the putting greens had coped with the heat. Photo: Anne F. Borchert*

### Visit of a golf course, football stadium, and KORA trial site

The first day took participants into the field, beginning at Osnabrück Golf Club. One focus was the management of dollar spot and the potential for reducing reliance on conventional plant protection strategies. As part of the 2026–2028 ITRI project 'Integrating alternative strategies to improve the sustainable management of dollar spot', researchers at University of Applied Sciences Osnabrück are studying UV-C treatment in combination with biological products. Earlier trials had already indicated that UV-C treatment of turf surfaces can work in principle. The



*Photo 7: VfL Osnabrück's football stadium, home to a team in the second tier of German men's football, is set to receive a new pitch in the coming weeks due to severe water infiltration problems associated with bomb damage dating back to the Second World War. Photo: Anne F. Borchert*



*Photo 8: KORA trial site with three field trials. In front, testing of climate adapted seed mixtures for urban greens (NNuRKlima project), in the middle testing of seed mixtures and surfactants on drought resistance (FAIRWATER project), and in the back investigation of the effect of cutting quality on drought stress (ReMoCut and H2Mow projects). Photo: Anne F. Borchert*

new project takes this approach further by investigating how it can be integrated with other management strategies.

After a stop at VfL Osnabrück's stadium at Bremer Brücke, discussing turfgrass management strategies, the excursion continued to KORA trial site in Wallenhorst, where several projects demonstrated the range of challenges currently facing turf managers.

Water management was particularly prominent. The STERF project FAIRWATER is investigating whether wetting agents combined with drought-tolerant seed mixtures can improve golf fairway performance on sandy sites. During the dry conditions experienced this summer, differences between irrigation treatments were clearly visible, making the plots a useful basis for discussion about future approaches to water-efficient fairway management.

Climate adaptation was also addressed in the NNuRKlima project, which includes research on warm-season bermudagrass and other vegetation alternatives for urban turfgrass areas.

## Does cutting quality affect drought tolerance?

The ReMoCut project investigates reel mower cutting quality with the goal of developing improved cutting technology, optimizing cut quality, and reducing susceptibility to disease. Closely related is the STERF project H2Mow, which examines the relationship between robotic mowing, cutting quality and drought resistance on fairways. In a field trial it compares sharp, moderately sharp and dull robotic mower blades to evaluate how blade conditions influence turgrass response to drought stress. This trial had just started, so no results could be presented.

Further research presented by Maximilian Karle demonstrated how cutting quality can be evaluated using both visual cutting quality assessments and an Artificial Intelligence (AI)-supported high-throughput method. His work documented relationships between different cutting qualities, plant vitality and drought stress, with characteristic cutting patterns repeatedly appearing according to mowing method.

## Robotic mowing and AI

Robotic mowing was also prominent during the lecture program. Anne Friederike Borchert of NIBIO presented results from the STERF project Fairways4Future,

which is investigating the development of high-quality fairways and semi-roughs using robotic mowing. Individual studies examine parameters including mowing height, clover cover under different nitrogen fertilization regimes. One particularly interesting observation was the rapid adaptation of clover to robotic mowing and its consistently maintained cutting height.

Mattia Fontani from the Universities of Florence and Pisa added results from Italian trials using both cool-season and warm-season turfgrasses. Changing mowing direction between mowing cycles had a positive effect on turf color and turf quality.

Marius Schulze from the turf maintenance company Sommerfeld brought the discussion back to daily golf course operations. His experience showed that successful robotic mowing depends on site-specific factors, such as GPS availability, shading by trees and surface evenness. He also pointed out that robotic mowers also continue to require cleaning, blade changes and troubleshooting, while conventional mowing equipment may still be needed for certain operations.

Heiko Tock (superintendent GC Großensee) and Thomas Fischer (CEO Greenkeeper North) presented their observations from Golf Club Großensee, where conventional and robotic mowing are being compared with special focus on drought periods in a demonstration trial on a fairway within the H2Mow project. In 2026, measurements included turfgrass quality and colour, soil moisture, and dollar spot incidence. Until the Field Days no dollar spot had occurred, and turfgrass quality ratings did not differ between the two mowing systems. However, it was interesting to hear that several golfers mentioned that they preferred the robotic mown fairway.



*Photo 9: Maximilian Karle (University of Applied Sciences Osnabrück) demonstrating his cutting quality trials in different turfgrass species. Photo: Anne F. Borchert*



*Photo 10: Mattia Fontani (internship from Florence and Pisa university at NIBIO), Carl-Johan Lönnberg (Swedish Golf Federation), and Anne F. Borchert (NIBIO; project leader Fairways4Future and H2Mow) (from left to right) visited the Field Days and presented preliminary results from their robotic mowing projects. Photo: Thomas Fischer*

AI completed the program of the field days. Prof. Dr. Thomas Rath from University of Applied Sciences Osnabrück demonstrated how AI approaches are entering turfgrass research, including work on the phenotyping of turfgrass areas. While registering coverage, weeds, or color work very well, turfgrass quality parameter is more challenging.

The Field Days Osnabrück provided a successful combination of research and daily practical turfgrass management on golf courses and soccer pitches. For superintendents, it offered both practical observations for today and a glimpse of how fairway management may develop in the years ahead under a changing climate.

# H2Mow

## Next steps to drought-resistant fairways with robotic mowing

**Project period:**

March 2026 – March 2029

**Project leader:**

Anne Friederike Borchert, NIBIO, Norway

**Co-applicants:**

Michael Bekken, NIBIO, Norway (until March 2026)
Martin Thieme-Hack and Maximilian Karle, University of Applied Sciences Osnabrück, Germany

**Project team:**

Andrew Lees, Husqvarna International, United Kingdom; Esmat Dieter Pieck, Husqvarna Germany, Germany; Marc Biber, German Golf Association, Germany; Carl-Johan Lønnberg, Swedish Golf Association, Sweden; Karin Juul Hesselsøe, Sandmoseskolen AMU-Nordjylland, Danmark; Thomas Fischer, iNovaGreen and CEO Greenkeeper North, Germany; Heiko Tock, Golf Club Großensee e.V., Germany; Patrik Tagesson, Kalmar GC, Sweden

**Funding:**

Scandinavian Turfgrass and Environment Research Foundation (STERF; 1.5 mill. SEK), Husqvarna International and Germany, German Golf Association

# FAIRWAYS4FUTURE

## Managing high-quality golf course fairways and semi-roughs without herbicides and with lower emissions of greenhouse gases

**Project period:**

March 2023 – December 2026

**Project leader:**

Anne Friederike Borchert, NIBIO, Norway
Michael Bekken, NIBIO, Norway (until March 2026)
Karin Juul Hesselsøe, NIBIO, Norway (from the start until July 2025)

**Co-applicants:**

Anne Friederike Borchert and Trygve S. Aamlid, NIBIO Landvik, Norway
Daniel Hahn, Hahn Turf Agronomy, Germany
Wolfgang Prämaßing†, University of Applied Sciences Osnabrück, Germany

**Project team:**

Andrew Lees, Husqvarna International, United Kingdom; Thomas Fischer, iNovaGreen and CEO Greenkeeper North, Germany; Pål Melby, NGF, Norway; Torben Kastrup, DGU, Denmark; Jari Koivusalo, FGU, Finland; GC St. Eurach and Haus Bey, Germany; Brøndby GC (Gediminas Rudokas) and Grenå GC (Lasse Nielsen), Denmark; Hirsala GC (Janne Lehto), Finland; Hills GC (Christofer Andersson), Sweden; Bærheim GC (Atle R. Hansen), Norway.

**Funding:**

Scandinavian Turfgrass and Environment Research Foundation (STERF; 1.085 mill. SEK),
In kind: Husqvarna International, all golf courses