



**NIBIO**

NORWEGIAN INSTITUTE OF  
BIOECONOMY RESEARCH

# Robotic mowers in research - latest findings from Scandinavia and Italy

Anne F. Borchert, Mattia Fontani, Karin J. Hesselsøe



# We are going to talk about...

- STERF project: Fairways4Future
  - Robotic mowing and soil physical properties
  - Robotic mowing on fairways: N fertilization, mowing height, turf quality, weeds
  - Robotic vs traditional mowing: Turf quality and weeds
  - Golf course demonstration trials: turf quality and (weeds)
- STERF project: H2Mow
  - Project overview
  - Golf course demonstration trials
- University of Pisa
  - Trajectory pattern: turf quality, color, mowing efficiency





# Project: Fairways4Future (2024-2026)

Funding: STERF, Husqvarna, GC in Germany, Finland, Denmark (in-kind)

Collaborators: Daniel Hahn, Golf Agronomy; Daniel Hunt, University of Applied Sciences, Osnabrück

- Aim: Managing high quality fairways and semi-roughs with robotic mowing
- Main focus: weed encroachment
- Field and demonstration trials in Norway, Germany, Denmark, and Finland
- Machine: Husqvarna CEORA

# Demonstration trials on GC

## WP1: Soil physical properties on fairways

- Impact traditional mowing and robotic mowing on soil physical properties
- 2 GC: Genå (Denmark) and Bærheim (Norway)
- Fairways
- Assessments: Soil bulk density and porosity, soil compaction, surface hardness, water content and infiltration
- Results: **limited** due to low spatial coverage but tendency that robotic mowing reduces soil compaction  
➔ more research needed



Comparing soil physical properties on robotic and traditionally mown golf course fairways



Anne F. Borchert, Monica Jayasingha, Michael Bekken, Karin J. Hesselstede  
Norwegian Institute of Bioeconomy Research, Urban Greening and Vegetation Ecology

# Field trial semi-rough

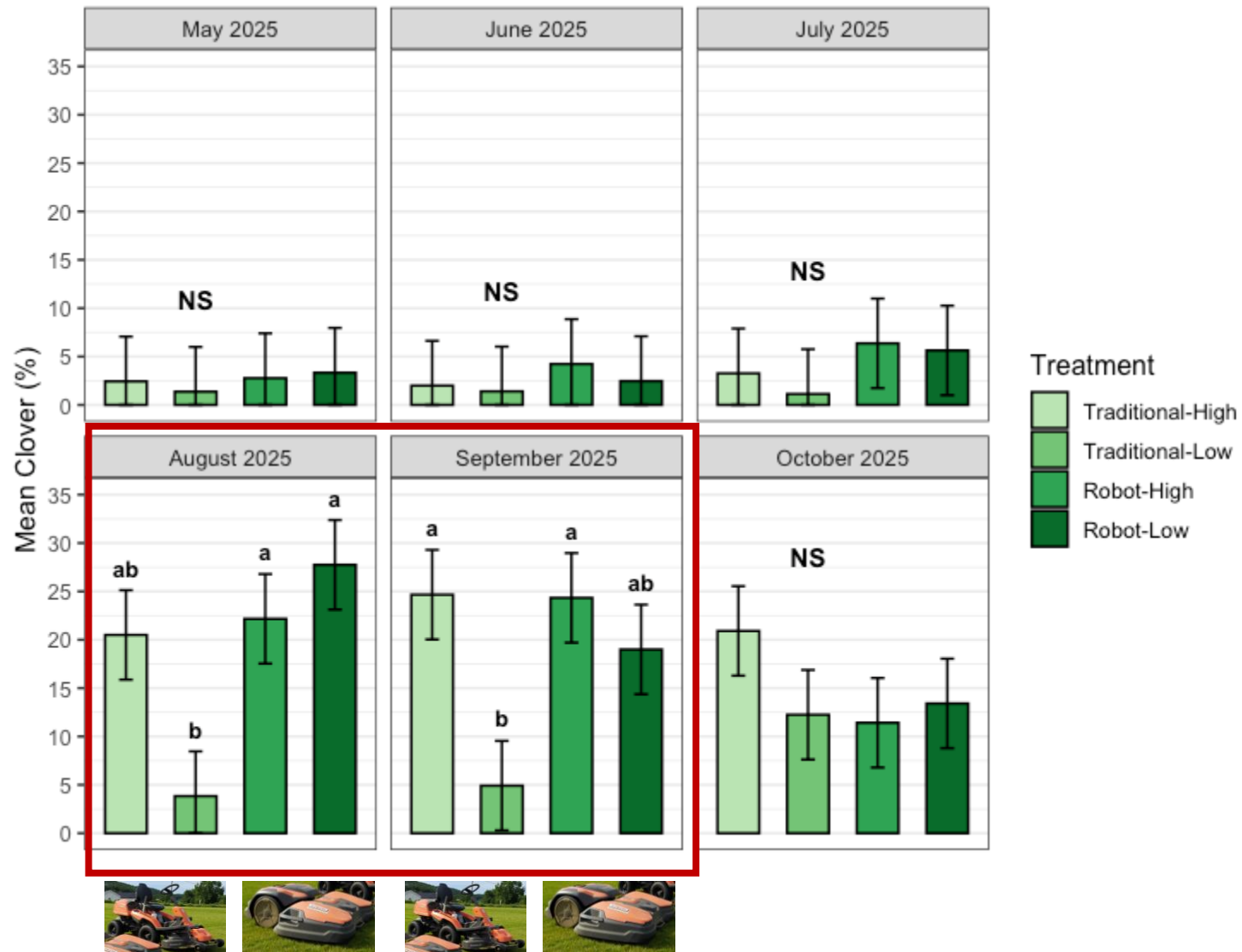
## WP2: Impact of mowing system on turfgrass quality and weed encroachment

- Nibio Landvik (Norway)
- Comparison of
  - Machine
  - Mowing height (35 and 50 mm)
- Transplanted white clover
- 85 kg N/ha/yr
- 45% Kentucky bluegrass,  
55% red fescue



Husqvarna Ceora vs. rotary mower

# Preliminary results White clover 2025



- High variability
- Differences in August and September; highest coverage during vegetation period
- August: TRA\_Low less clover than ROB both heights
- September: TRA\_Low less clover than ROB and TRA higher mowing height

# Field trial fairway

## WP 3: Impact of mowing height and N level on turfgrass quality and weed encroachment

- Nibio Landvik Norway
- Comparison of
  - N rate 50, 85, 120 kg N/ha/yr
  - Mowing height (13 and 18 mm)
- 45% Kentucky bluegrass, 55% red fescue



# Drone images 2025



April 2025



June 2025 (low precipitation)



July 2025

# Transplanted weeds



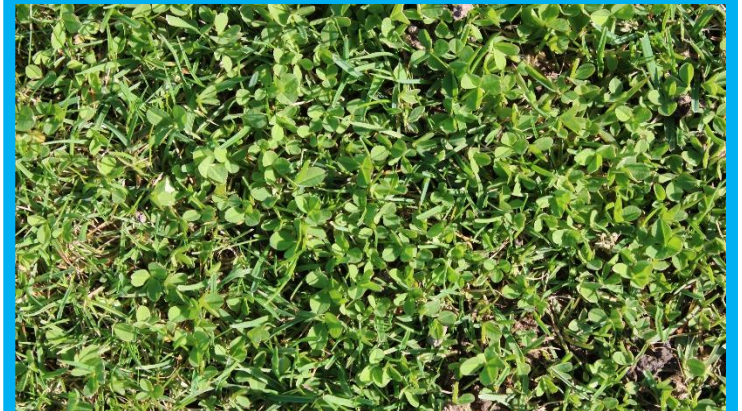
Daisy (Gänseblümchen)



Dandelion

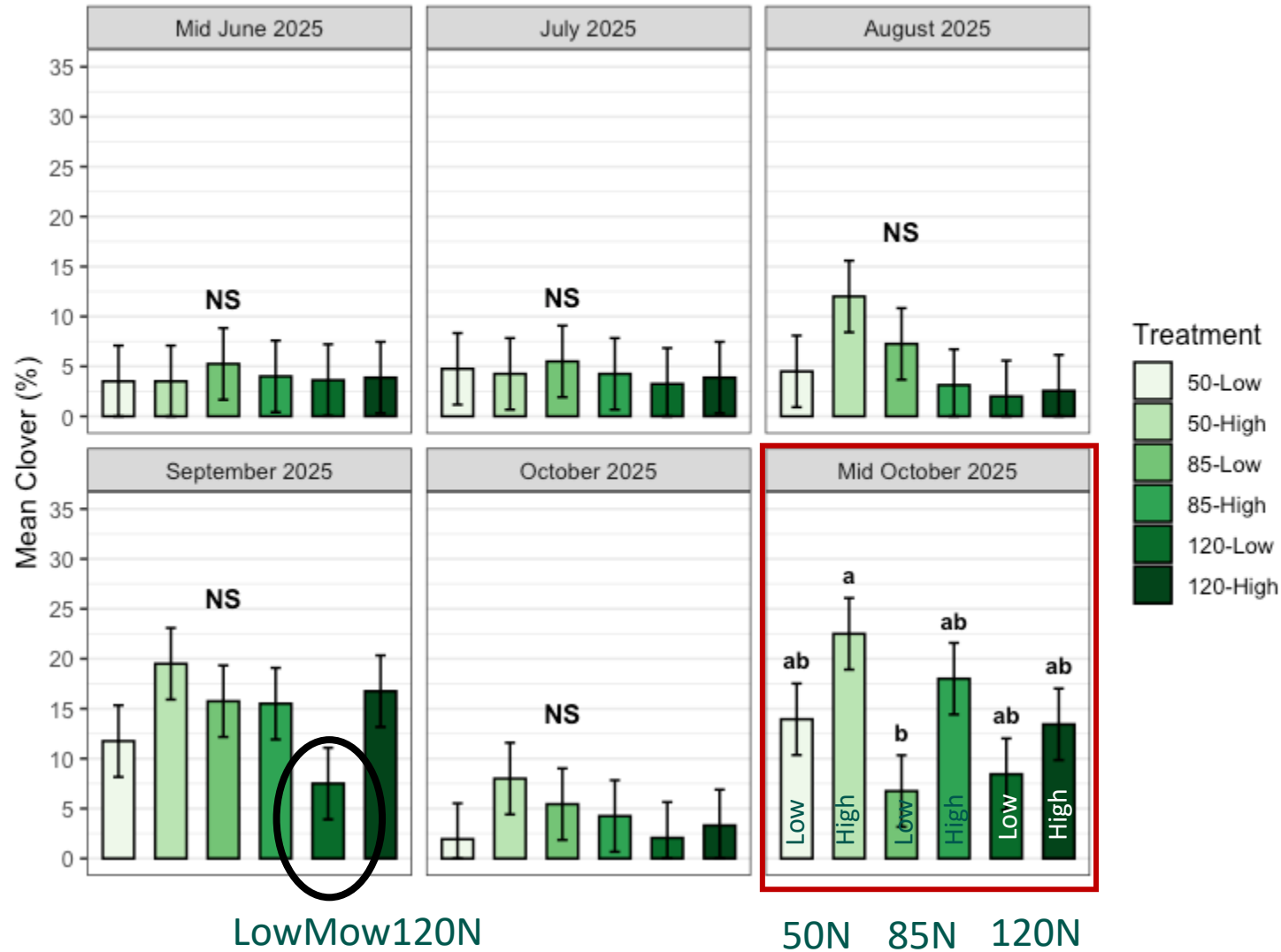


Yarrow (Schafgabe)



White clover

## Fairway: Clover %



## Preliminary results White clover 2025

- High variability
- Mostly no differences
- Mid October: Less N and high mowing height increases clover compared to medium N level and low mowing height

# Demonstration trials on golf courses

## WP4: Impact of mowing system and fertilizer rate on turfgrass quality & weeds

- Golf courses: Haus Bey and St. Eurach in Germany and Hirsala in Finland.
- At each golf course robotic mowing was compared with traditional mowing in fairway and rough
- On the fairways the fertilizer level was split into two doses: 'Common practice' (100%) and reduced (50%).
- Turfgrass visual quality and coverage of individual weed species was recorded monthly in growing season



# F4F WP4 Golf courses



St Eurach, Germany  
Daniel Hahn

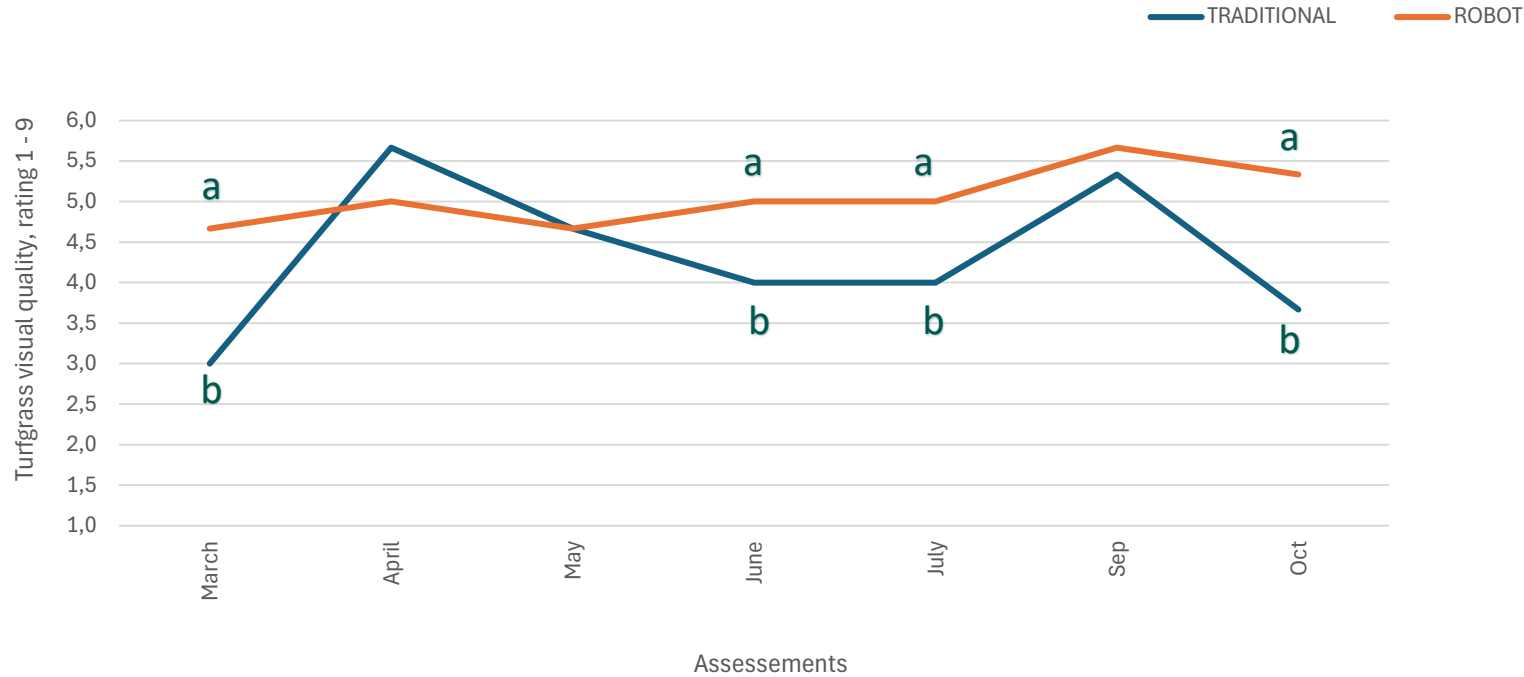


Haus Bey, Germany  
Wolfgang Prämaßing, Daniel Hunt



Hirsala, Finland  
Janne Lehto & Andreas Klang

# Turfgrass quality, fairway high doze (60 kg N ha year)



## St Eurach 2025:

Assessments from March to October, missing in August due to robot break down

Turfgrass quality more consistent with robotic mowing

Significantly better quality with robotic mowing in March, June, July and October

## Comments from Daniel Hahn:

In general, the fairways with the robotic mower looked much better compared to the traditional mown

# Turfgrass quality, fairway low doze (30 kg N ha year)



## St Eurach 2025:

On average lower turfgrass quality in both mowing systems compared to high fertilizer doze due to dry patches and dollar spot from end of April

Significantly better quality with robotic mowing from March to October

The difference in turfgrass quality between the two mowing systems was higher at low fertilizer doze

# What have we learnt so far from Fairways4Future...

- Soil physics: Tendency robotic mowing less soil compaction **BUT more research needed**
- White clover:
  - Semi rough: Only few dates with significant differences traditional and robotic mowing but in those cases traditional and low mowing height best to keep clover at low level
  - Fairway: Only one date in fall significant differences; **medium** N rate and low mowing height best to keep clover at low level

## Demonstration trials:

- **At St. Eurach**: Better and more consistent turfgrass quality with robotic mowing in fairway. The **benefit of robotic mowing** is most profound at **low fertilizer input**.

# H2Mow project (Leader: Anne F. Borchert)

- **Aim:** Develop strategies to optimize robotic mowing on fairways under limited water conditions
- **Field trials:** Germany and Norway
- **Demonstration trials:** Germany and Sweden
- **Project period:** 1. March 2026 – 31. December 2028



## WP2: Drought stress monitoring and mowing height

- a) Compare and advance methods of drought status measurement and
- b) quantify the relationship between turfgrass cutting quality, cutting height, and drought resistance of fairway mixtures (from 2027)



TDR soil moisture



Digital and thermal images



NDVI



Reference plots with irrigation

## WP3a: Demonstration trial Germany





## WP4: Demonstration trial Sweden

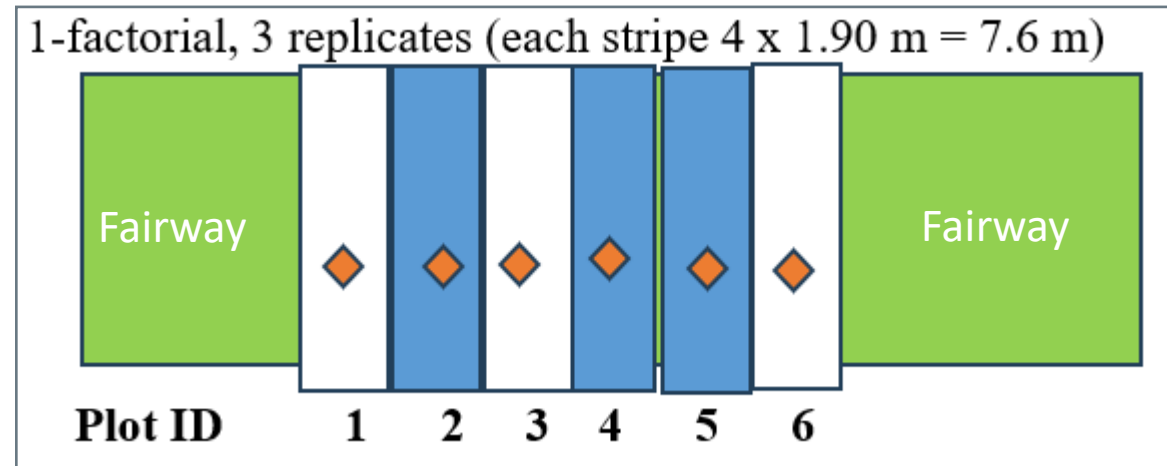
- To compare dollar spot occurrence after drought on a fairway mown...

A) with robotic mower and

B) with a robotic mower and rolling

# Experimental set up at Kalmar GC

- CEORA robotic mower
- Rolling 3x a week in the morning
- Greensroler Salsco HP 11-111
- Start in August: Turf quality 6 – 7, no dollar spot yet



Cleveland Landservices

# Some lessons learnt this summer...



Fertilizer sticking to the wheels



Leaf-burn pattern



Fertilizer granule

These were the findings from Scandinavia  
and Germany. Now we are going to  
ITALY



**NIBIO**

NORWEGIAN INSTITUTE OF  
BIOECONOMY RESEARCH



NIBIO\_no



NIBIO.no



NIBIO\_no

[www.nibio.no/en](http://www.nibio.no/en)



