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3. Winter preparation of golf greens

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From the research project 2014 – 2017:
**Optimal Application of Nitrogen and Suphur in Autumn for Better Winter Survival
of Perennial Grasses – With Emphasis on Turf**



Sterf



Norwegian Greenkeepers Association

Norwegian Golf Course Owners

Tapiola GC, Finland

Kungliga Drottningholm GC, Sverige

Hauger GC, Norway

Keilir GC, Iceland

Roskilde GC, Denmark

1. Effects of autumn fertilization. Results from new, relevant experiments
2. Mechanical autumn treatments
 1. Mowing height
 2. Temporary water control
 3. Aeration
 4. Dressing
 5. Protective covers

Autumn fertilization and environment

- Adaptation to plant uptake?
- Risk for leakage of Nitrogen and other nutrients?

Loss of nitrogen to drain water

Main effects of nitrogen rate on the concentration of $\text{NO}_3\text{-N}$ and total N loss in drainage water.

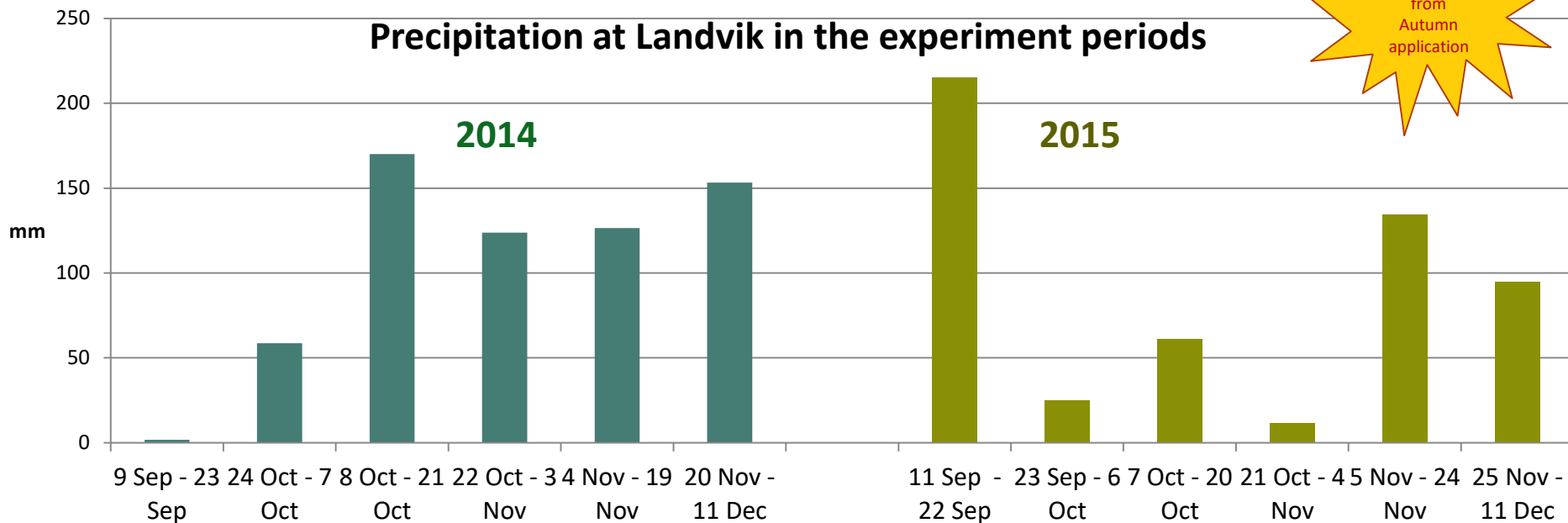
Concentrations are weighed means and losses are total for six two weeks' periods
Medium N was 12 weekly linearly decreasing rates (0.8 to 0.1 g m^{-1}), total 5.5 g m^{-1} .
Low N and high N were $\pm 50\%$ of medium respectively total 8.4 and 2.8 g m^{-1} .



9 Sep - 11 Dec 2014				8 Sept - 11 Dec 2015		
Nitrogen rates	Conc. $\text{NO}_3\text{-N}$, mg L^{-1}	Conc. Total-N, mg L^{-1}	Nitrogen loss in drainage water, g m^{-2}	Conc. $\text{NO}_3\text{-N}$, mg L^{-1}	Conc. Total-N, mg L^{-1}	Nitrogen loss in drainage water, g m^{-2}
No N	0.169 c	0.526 c	0.332 c	1.166 b	1.322 b	0.641 b
Low N	0.341 c	0.661 c	0.418 c	1.560 b	1.690 b	0.805 b
Medium N	2.590 b	3.063 b	1.955 b	2.279 b	2.467 b	1.217 b
High N	7.204 a	8.131 a	5.127 a	6.328 a	6.453 a	3.160 a
P-value	<0.001	<0.001	<0.001	0.0017	0.0019	0.0024
LSD ($P < 0.05$)	0.453	0.555	0.3	1.86	1.885	0.974



Precipitation at Landvik in the experiment periods



No N	0.210	0.463	0.302 c	0.106 c	0.092 c	0.099 c
Low N	0.194	0.32	0.756 c	0.172 c	0.115 c	0.163 c
Med N	0.234	0.376	2.080 b	1.538 b	3.188 b	3.805 b
High N	0.174	0.446	6.063 a	5.192 a	10.950 a	7.500 a
P-value	ns	ns	<0.001	<0.001	<0.001	<0.001
LSD (P<0.05)	-	-	0.847	0.462	0.976	0.709

1.900 b	0.633 b	1.027 b	0.880 b	0.810 b	0.537 b
2.067 b	0.843 b	1.733 b	1.433 b	1.153 b	1.180 b
2.400 b	1.367 b	3.167 b	2.480 b	1.860 b	2.270 ab
3.433 a	3.433 a	14.333 a	10.067 a	8.533 a	5.700 a
0.0064	0.0022	0.0037	0.0014	0.0008	0.0500
0.696	1.051	5.654	3.259	2.509	3.653

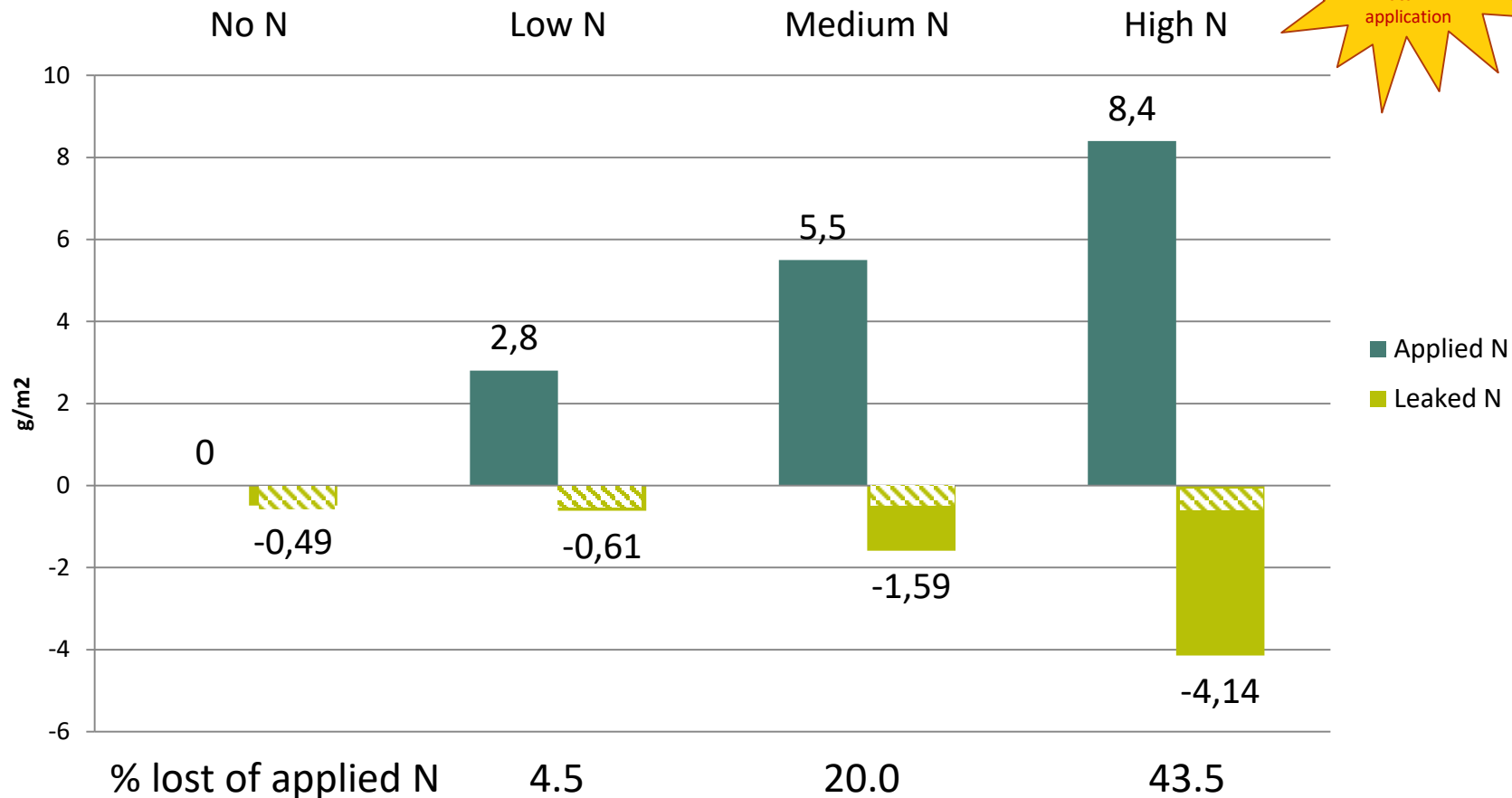
Nitrate N concentration in drainage water

(WHO guideline for drinking water: 50 mg nitrate /l , = 11 mg N / l.)

17 mm rain on the day of fertilization, and more than 40 mm the two following days

Leaked N

Average 2014 and 2015. 9 Sept – 22 Dec



Cost 1 ha 4€/kg 10% N: € 178

€ 800

€ 1741



Colour and early spring growth has been a reason for autumn and winter fertilization.

Picture Syd-Skjælland GK , 5 March 2015.



Often seen more snow mould outside green, most likely due to higher mowing.

General recommendations:

Keep the mowing low until grass stops growing.



Should mowing height be increased in the autumn?


Red fescue		(+)
Creeping bent		
Velvet bent		
Annual meadow-grass		(+)

We recommend deep aeration as the last operation in the autumn. It will normally improve drainage of water .



Installation to prevent surface water .
Conflict with shade?





Temporary ditches can be made
to improve surface water runoff.




Photo: Ole Albert Kjøsnes.

Autumn dressing to protect the turf?
Only recommended if the greens are
open for winter play.

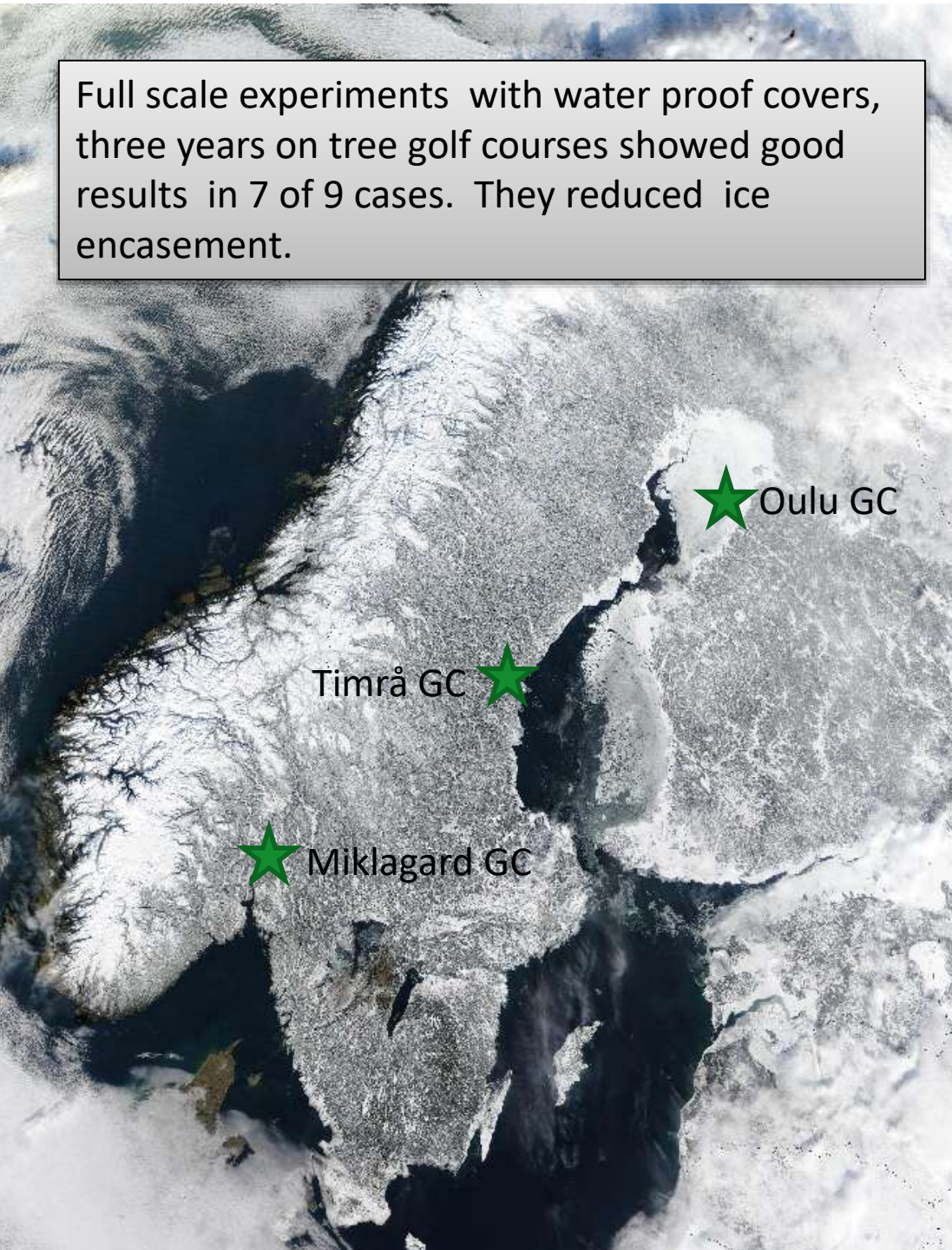




Photo: Jim Ross, Olds College, Canada



Full scale experiments with water proof covers, three years on tree golf courses showed good results in 7 of 9 cases. They reduced ice encasement.



WINTER PROTECTIVE COVERS

Usage of wraps to improve winter survival of golf greens



Introduction

Some greenkeepers regularly cover their greens to prevent winter injuries. They experience good results and find that their effort payback. The arguments for the covering practice differ, though. Some will protect the grass from lethal freezing temperature. Some will prevent desiccation while others claim that covers reduce the risk of water and ice injuries. This fact sheet will discuss what kind of protective covers can be used to address different winter stresses based on research and published reports.

Summary

- Covering golf greens to protect them from winter injuries is expensive but can be very efficient where winter conditions are tough. Annual meadow grass benefits from covers much more than other grass species because it is very vulnerable to all kind of winter stresses.
- The covering materials and techniques should be adapted to the expected stress factor. If low temperature is causing winter kill, insulation materials must be used. If ice encasement or melting water is the problem, an impermeable tarp can keep the soil pores filled with sufficient air to prevent anoxia.
- All covers will increase the risk of winter disease and use of fungicides is a prerequisite for success.

CTRF

CANADIAN TURFGRASS RESEARCH FOUNDATION
LA FONDATION CANADIENNE DE RECHERCHE EN GAZON

Steff

Dominating grass species?

Annual bluegrass (*Poa annua*)

Other species (*Agrostis* / *Festuca*)

Most common winter injury in your district is:

- a. Biotic (snow moulds)
- b. Abiotic (low temperature, water, ice, wind)

No fungicides can be applied

Stable snow cover is the normal

Temp below -12 °C are rare

More than 20 days ice encasement is rare

Temp. below -12 °C is expected on green surface

Temp. fluctuating between -12 and +0 °C

Water proof and additional insulating material recommended

Water proof covers recommended

Only few macro-pores or high content of OM / thatch problem

Semi-permeable tarps, additional air space or mechanical ventilation systems recommended

No cover recommended

Continuously ice encasement for more than 60 days occurs more frequently than every 3-4 years and the dominating grass species is:

- a. Fesue (*Festuca* sp) or cononial bent (*A. capillaris*)
- b. Bent (*Agrostis* sp)

More than 80 days ice encasement is normal and species is creeping bent (*A.stolonifera*)