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SCANGREEN 2019-2022: Turfgrass species, varieties and seed mixtures for Scandinavian putting greens

Final results from a four-year testing period

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Karin J., Hesselsøe[1], Anne F. Borchert[1], Trygve S. Aamlid[1], Bjarni Hannesson[2], Per Rasmussen[3], Karin Normann[4], Tatsiana Espevig[1], Michelle DaCosta[5], Eric Watkins[6], Andrew Hollman[6], Jørgen Hornslien[1], Trond Pettersen[1] and Pia Heltoft[1]

1) NIBIO; 2) Ness GC; 3) Smørum GC; 4) Turfhouse; 5) University of Massachusetts and 6) University of Minnesota.

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FORFATTER(E)/AUTHOR(S)

Hesselsøe, Karin J., Anne F. Borchert, Trygve S. Aamlid, Bjarni Hannesson, Per Rasmussen, Karin Normann, Tatsiana Espevig, Michelle DaCosta, Eric Watkins, Andrew Hollman, Jørgen Hornslien, Trond Pettersen and Pia Heltoft.

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SAMMENDRAG:

Målet med SCANGREEN 2019-22 var å finne arter, sorter og frøblandinger av *Agrostis*, *Festuca*, *Poa* og *Lolium* egnet for sprøytelfri pleie av greener i Norden og i det nordlige USA. Forsøkene omfattet 30 kandidatsorter, og tre frøblandinger av rødsvingel og eng- og krypkvein, en frøblanding av krypkvein og flerårig raigras. Månedlige vurderinger av helhet, vinterstyrke, sykdom og ugrasdekning ble gjort fra såing i 2019-22. I rangeringen av arter i Norden hadde krypkvein det beste helhetsinntrykket. Blant sorter av *Festuca rubra commutata* i Norden var den nye sorten 'Euro Carina' best, sammen med kontrollsorten 'Barlineus' etterfulgt av de to nye sorter 'Orionette', 'Gima' og kontrollsort 'Musica'. Blant sorter av *Festuca rubra litoralis* i Norden var 'Sybille' best etterfulgt av kontrollen 'Cezanne'. For sorter av *Agrostis capillaris* i Norden var det ingen forskjell mellom sortene i helhet, men 'Jorvik' hadde den laveste totale vinterskade og minst mikrodokiumflekk. Blant sorter av *Agrostis stolonifera* i Norden var de nye sortene 'Matchplay', 'L-93 XD' og '777 Triple Seven' best, tett fulgt av 'Piranha' og 'Valderrama' som var på linje med kontrollsorten 'Luminary'. For *Agrostis canina* er 'Villa' fortsatt den beste sorten i Norden. For sorter av *Poa pratensis* er kontrollsorten 'Limousine' stadig best I Norden. Bare få klare forskjeller ble funnet mellom frøblandingene i Norden. Ved høy gjødsel og lav klipp er blandingen med rødsvingel og krypkvein å foretrekke til fordel for den tradisjonelle blandingen med rødsvingel og engkvein, på grunn av bedre vinteroverlevelse og mindre mikrodochiumflekk, men med fare for at krypkvein utkonkurrerer

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rødsvingel. Blandingen med krypkvein og flerårig raigras etablerte seg betydelig raskere enn noen av de andre, men etter vinteren ble helhetsinntrykk redusert sammenlignet med de andre blandingene.

LAND/COUNTRY:	Norway
FYLKE/COUNTY:	Agder
KOMMUNE/MUNICIPALITY:	Grimstad
STED/LOKALITET:	Landvik

GODKJENT /APPROVED	**PROSJEKTLEDER /PROJECT LEADER**
NAVN/NAME	**NAVN/NAME**

Preface

The SCANGREEN program was initiated in 2003 and involves testing of turfgrass species and varieties on sand-based golf greens at four sites in the Nordic countries. The evaluation is organized in four-year testing cycles and forms the basis for recommended variety lists at www.scanturf.org and www.sterf.org.

The present report gives a detailed account of methods and results obtained during the fifth SCANGREEN test cycle from 2019 to 2022. As the previous cycle SCANGREEN 2015-18, this evaluation also included seed blends and mixtures of special relevance to the golf industry in the Nordic countries. The 2019-22 test cycle also comprised experiments at two trial sites in USA (Massachusetts and Minnesota).

As with the earlier test cycles, SCANGREEN 2019-22 has been funded 10% by fees paid by the seed companies entering varieties into the trials, and 90% by the Scandinavian Turfgrass and Environment Research Foundation (STERF). The trials in USA have been carried out thanks to the USDA-funded project WinterTurf: A holistic approach to understanding the mechanisms and mitigating the effects of winter stress on turfgrasses in northern climates. Thanks are expressed to all parties for funding and excellent collaboration during the projects.

Landvik, 24.04.23

Karin Juul Hesselsøe

Content

Summary

The objective of SCANGREEN 2019-22 was to find species, varieties and seed blends/mixtures of *Agrostis, Festuca, Poa* and *Lolium* that are suited for pesticide-free management of putting greens in the two major climatic zones of the Nordic countries and in the northern USA. The four test sites in the Nordic countries were Reykjavik GC, Iceland and NIBIO Apelsvoll in the the northern zone, and NIBIO Landvik, Norway and Smørum GC, Denmark in the southern zone. The two US test sites were located at Troll Turfgrass Research Facility in Massachusetts and at University of Minnesota.

The trials included 30 candidate varieties representing eight different species and subspecies from 13 different seed companies/representatives, and three seed mixtures of red fescue and colonial and creeping bentgrass, a seed mixture of creeping bentgrass and perennial ryegrass and a seed blend of red fescue. Monthly evaluations of overall impression, tiller density, winter hardiness, disease and weed coverage etc., were done from three weeks after sowing in June-September 2019 until October 2022. The trial at Smørum GC was established in May 2021.

The trials were established according to a split-plot design with three blocks (replicates), species on main plots and varieties on subplots. The experimental greens were mown three times per week – Monday, Wednesday, and Friday and deficit-irrigated to 80% of field capacity three to four times per week in periods without sufficient natural rainfall. Fertilizer (mean N–P–K ratio, 100–22–74) was given as completely balanced compound fertilizers every second week. Each experimental green was divided in different management levels: High and low fertilizer rate and high and low mowing. The two fertilizer rates were 10 and 17 g N m^{-2} yr^{-1} and the two mowing heights were 3 and 5 mm. Mixtures were managed at both regimes. There was no use of pesticides or plant growth regulators in any of the trials.

In the ranking of species across three Nordic countries (Smørum not included because of the shorter testing period) creeping bentgrass and second velvet bentgrass had the best overall impression, both significantly better than slender creeping red fescue, Kentucky bluegrass and Chewing's fescue, which were all equal. The perennial ryegrass was rated at the lowest or second lowest at all sites except at Smørum. Rough bluegrass was rated with the lowest turfgrass quality at all sites and years.

Among varieties of Chewing's fescue (*Festuca rubra commutata*) across all Nordic sites and years the new variety 'Euro Carina' performed best, in line with the control variety 'Barlineus' followed by the two new varieties 'Orionette', 'Gima' and the control variety 'Musica'. In USA 'Lodde' was ranked the highest. Among varieties of slender creeping red fescue (*Festuca rubra litoralis*) across three Nordic sites (except Smørum) 'Sybille' performed the best followed by the control 'Cezanne'. In USA 'Sea Mist' performed best across the two sites.

Among varieties of colonial bentgrass (*Agrostis capillaris*) across the three Nordic sites: Reykjavik, Apelsvoll and Landvik there was no difference between the varieties in overall turfgrass quality, but 'Jorvik' had the lowest overall winter damage and the least microdocium patch across all years. In USA 'Musket' performed best in turfgrass overall impression, with 'Jorvik' at the lowest.

Among varieties of creeping bentgrass (*Agrostis stolonifera*) across the three Nordic test sites Reykjavik, Apelsvoll and Landvik the results showed that the new varieties 'Matchplay', 'L-93 XD' and '777 Triple Seven' performed the best, closely followed by 'Piranha' and 'Valderrama' which were in line with the control variety 'Luminary'. In USA 'Matchplay' was ranked the highest with low coverage of microdochium patch during winter in Minnesota compared to 'Tripleseven' (='777 Triple Seven'). Among varieties of velvet bentgrass (*Agrostis canina*) 'Villa' remains the top variety for the Nordic countries. In the US, 'Villa' also had slightly higher turfgrass quality than 'Legendary' and 'Avalon' in Minnesota, while 'Villa' and 'Avalon' were very equal in Massachusetts.

Among varieties of Kentucky bluegrass (*Poa pratensis*) the control variety 'Limousine' produced higher turfgrass quality, higher tiller density, finer leaves and less in-season disease than the candidate 'Professor' on average for the three Nordic sites Reykjavik, Apelsvoll and Landvik. The candidate 'A99_2679' was ranked intermediate between 'Limousine' and 'Professor' in Minnesota.

Only few clear differences were found between the mixtures and blends. At Landvik and Smørum at high maintenance the mixture with fescue and creeping bentgrass is to prefer in favor of the traditional mixture with fescue and colonial bentgrass, because of better winter survival and less microdochium patch, but with the risk that the creeping bentgrass outcompetes the fescue. Varieties of creeping bentgrass with a lower tiller density should be preferred for the mixture with fescue. The mixture with creeping bentgrass and perennial ryegrass established significantly faster than any of the others, but after winter turfgrass quality decreased compared to the other mixtures.

1 Introduction

In addition to microdochium patch (*Microdochium nivale*), which is the economically most important disease on turfgrass in the Nordic countries, dollar spot (*Clarireedia spp*), has now got a foothold in Denmark and Southern Sweden (Espevig et al., 2017). The recent suggestion by the EU-commission to prohibit all pesticide use on 'sensitive areas' (EU-Commission, 2022) is likely to increase the need for in-depth knowledge about turfgrass species and choice of new and improved varieties for pesticide-free turfgrass management on golf courses.

Golf in the Nordic countries is played at latitudes from 55 to 70°N and altitudes from 0 to 900 m a.s.l. Due to the variation in climatic conditions, STERF has always presented two lists of recommended varieties, one for the northern and mostly continental zone and one for the southern and mostly coastal zone (Aamlid et al., 2015). These two climatic zones may also differ regarding optimal seed blends and mixtures.

Thus, since 2015, the SCANGREEN trials have included selected seed blends and mixtures to evaluate their suitability for use on putting greens managed without pesticides (Aamlid et al., 2019). In Norway and Denmark, only 30 to 40% of the golf courses have greens initially seeded with creeping bentgrass. Most of the remaining golf courses have greens that were initially seeded with a mixture of colonial bentgrass and red fescue. Mixtures of red fescue and creeping bentgrass as well as mixtures of red fescue, creeping bentgrass, and colonial bentgrass are commonly used for putting greens in Germany, but these mixtures had not been evaluated in Scandinavian trials up to 2015. Results from SCANGREEN 2015-18 showed that red fescue plus creeping bentgrass produced greens of equal quality and with less microdochium patch than red fescue plus colonial bentgrass under various management regimes, and tiller counts in the mixed plots showed that red fescue was not outcompeted by bentgrass in any of the mixtures (Hesselsøe et al., 2022). The objective of testing mixtures again in SCANGREEN 2019-22 was to evaluate turfgrass quality and occurrence of microdochium patch on mixed red fescue–bentgrass greens with more competitive varieties of bentgrass and fescue and to explore the potential for a triple mixture with red fescue, colonial and creeping bentgrass. Additionally, a mixture of creeping bentgrass and perennial ryegrass was included to test if the ryegrass can be an alternative as a nurse grass for creeping bentgrass.

2 Materials and methods

2.1 Pure species and varieties

The trials included 30 candidate varieties representing eight different species and subspecies from 13 different seed companies/representatives (Table 1). Several controls (marked with bold in the table) were retested from previous SCANGREEN test rounds. Information on previous years variety testing in SCANGREEN (since 2003) can be found at www.scanturf.org. Rough bluegrass *(Poa trivialis)* and perennial ryegrass (*Lolium perenne*) were included at NIBIO's own initiative to test the species' tolerance to low mowing. Seeding rates were: 7, 30, 15 and 40 g m^{-2} for *Agrostis* sp., *Festuca* sp., *Poa sp*. and *Lolium perenne*, respectively.

Table 1: Candidate varieties and controls (bold) from different seed representatives/companies.

	Creeping bentgrass *(Agrostis stolonifera)*	**Colonial bentgrass *(Agrostis capillaris)***	**Velvet bentgrass *(Agrostis canina)***	**Chewings fescue *(F. rubra commutata)***	**Slender creeping fescue *(F. rubra littoralis)***	**Kentucky bluegrass *(Poa pratensis)***	**Rough bluegrass *(Poa trivialis)***	**Perenniel ryegrass *(Lolium perenne)***
DLF Seeds	Macdonald	**Jorvik**	**Villa**	Firan	Coptic		**Dark Horse**	**Clementine**
	777 Triple Seven			Orionette	Zari			
	Independence			Torona	Yoga			
				Gima	Sybille			
					Absolom			
					DLF FRR-6039			
					Cezanne			
Barenbrug	L-93 XD			Dancing	Barswilcan			
				Musica				
				Barlineus				
DSV			Avalon	EuroCarina	Charlotte	**Limousine**		
					Finesto			
Scandinavian Seeds	Ardent			Kalle		Professor		
Mountain View Seeds		Musket		Compass II	Sea Mist			
				Radar				
Graminor		**Leirin**	Nordlys	**Lykke**				
			Norgreen	**Lystig**				
				Lodde				
Svensk Jordelit	Pure Select							
	Crystal Blue							
	Pure Distinction							
Semillas Fito	Valderrama							
	Tour Pro							
Landmark Seeds	Matchplay							
	Luminary							
ICL/Everris	Piranha	**Heritage**				**Traction**		
	Riptide							
PGM	**007**							
Tempo Verde	**Penncross**							
	Penntrio							
Germinal		**AberRoyal**						

Note: Creeping bentgrass '777 Triple Seven' is the name in Scandinavia/Europe, in USA it is called 'Tripleseven'. Penntrio is a seed blend of Penncross, Penneagle, and. PennLinks II.

All varieties were not tested at all sites. The breeding line A99_2679 was only tested in Minnesota. Detailed information on which varieties that were tested at which sites can be found in the tables of results.

2.2 Seed mixtures and blends

Five mixtures/blends were compared (Table 2): A seed blend of red fescue only – FR. FR + AC – a red fescue seed blend in mixture with colonial bentgrass - which is the traditional mixture for golf greens in Scandinavia with a weight ratio of 85 % red fescue and 15 % colonial bentgrass. An alternative to this mixture: FR + AS – where colonial bentgrass was changed to creeping bentgrass with the same weight ratios, and a triple mixture (FR + AC + AS) including all three species where the 15 % bentgrass was divided equally between colonial and creeping bentgrass. Additionally, a mixture of creeping bentgrass and perennial ryegrass with the weight ratio 20/80 was tested.

The red fescue seed blend comprised three varieties: One slender creeping red fescue 'Cezanne' (47 % by weight) and two Chewing's fescues 'Musica' and 'Barlineus' (each 26.5 %). The varieties of colonial bentgrass, creeping bentgrass and perennial ryegrass were 'Greenspeed', 'Pure Distinction' and 'Clementine', respectively.

Table 2: Seed blends/mixtures, weight ratios and treatment codes.

Treatment code	Seed blends and mixtures	Weight ratios in %
FR	Red fescue seed blend	100
FR + AC	Red fescue seed blend + Colonial bentgrass	85/15
FR + AS	Red fescue seed blend + Creeping bentgrass	85/15
FR + AC + AS	Red fescue seed blend + Colonial bentgrass + Creeping bentgrass	85/7.5/7.5
AS + LP	Creeping bentgrass + perennial ryegrass	20/80

The mixtures were managed as the pure varieties with one section at high fertilizer/low mowing (high maintenance) and another section at low fertilizer/high mowing (low maintenance) (See 2.3), and plots were assessed as the pure varieties according to the SCANGREEN-protocol (Aamlid, 2019). In addition, the botanical composition of the fescue–bentgrass mixtures was determined in October 2020 and again in October 2021 at Landvik only. Five random samples were taken as small cylinders (2.8 cm^{-2}) from each plot and the number of tillers of each species was counted under a magnifying lens.

2.3 Experimental sites and protocol

Within the Nordic countries, the trials were established on USGA-spec. greens at Reykjavik GC, Iceland (64.1°N, 21.9°W, 30 m a.s.l.), NIBIO Apelsvoll (60.7°N, 10.9°E, 250 m a.s.l.) and NIBIO Landvik (58.3°N, 8.5°E, 12 m.a.s.l.), Norway, and Smørum GC, Denmark (55.4°N, 12.2°E, 29 m a.s.l.). The trial at Smørum was established later than the three others (in spring 2021). Reykjavik and Apelsvoll were considered to represent the northern, and Landvik and Smørum the southern climatic zone of the Nordic countries (Figure 1).

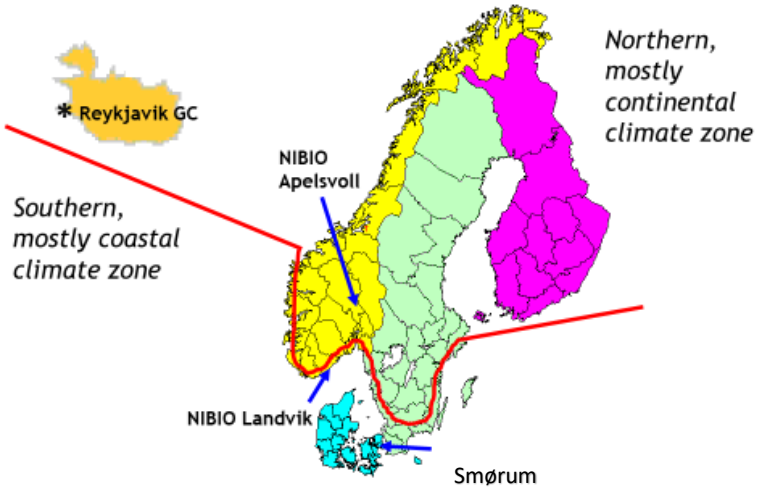


Figure 1: The four trial sites of Scangreen 2019-22 in the Nordic countries. Red line indicates the border between northern and southern zone. Smørum was included from 2021.

In USA the trials were established on a USGA-spec. green at Troll Turfgrass Research Facility, University of Massachusetts, and on a native soil push-up green at University of Minnesota. Mixtures were tested at Smørum, Landvik and Minnesota only.

The trials were established according to a split-plot design with three blocks (replicates), species on main plots and varieties on subplots. This allowed different management of the various species and mixtures. Plot size was 1.0 m x 1.0 m. The experimental greens were mown three times per week – Monday, Wednesday, and Friday and deficit-irrigated to 80% of field capacity three to four times per week in periods without sufficient natural rainfall. Fertilizer (mean N–P–K ratio, 100–22–74) was given as completely balanced compound fertilizers every second week.

Each experimental green was divided in different management levels: High and low fertilizer rate and high and low mowing. The two fertilizer rates were 10 and 17 g N m^{-2} yr^{-1} and the two mowing heights were 3 and 5 mm. Mixtures were managed at both regimes. There were some deviations from these prescriptions, especially in conjunction with establishment and recovery after winter damage (Table 6 to Table 10). Wear was simulated using friction wear drums with golf spikes corresponding to an average of 11,000 rounds of golf per year. There was no use of pesticides or plant growth regulators in any of the trials.

Table 3: Mowing height and annual fertilizer rates to main plots with different species. Mixtures and blends were tested under both management regimes.

	Mowing height low, 3 mm	Mowing height high, 5 mm
Fertilizer rate low ≈ 10 g N m^{-2} yr^{-1}	*Agrostis capillaris* *Agrostis canina*	*Festuca rubra*
Fertilizer rate high ≈ 17 g N m^{-2} yr^{-1}	*Agrostis stolonifera*	*Lolium perenne* *Poa pratensis* *Poa trivialis*

2.4 Weather conditions and management

The mean monthly temperatures were slightly higher than the 30-year reference period (1991-2020) at all sites in the Nordic countries (Table 4). 2021 and especially 2022 were very dry years at Apelsvoll, Smørum and Landvik. From August 2021 to August 2022 at Landvik there was only half as much rainfall as normal.

Photo 1: Covering with tarp at Apelsvoll, 18.06.2019. Photo: Jan Thomsen.

Table 4: Mean monthly temperatures (a) in °C and precipitation (b) in mm from the month of seeding (June 2019) to December 2022 compared with 30 year normal values (1991-2020) at Reykjavik (Korpa weather station) and Apelsvoll in the northern climatic zone and Landvik and Smørum (Ballerup weather station) in the southern climatic zone. The trial at Smørum was established May 2021. Missing values in 2021 and 2022 at Iceland, January 2022 at Apelsvoll.

Mean monthly temperature and 30 yr average																					
	Korpa, Reykjavik						Apelsvoll						Landvik						Ballerup, Smørum				
(a)	2019	2020	2021	2022	30yr		2019	2020	2021	2022	30yr		2019	2020	2021	2022	30yr		2019	2020	2021	2022	30yr
Jan.	0.0	0.1	-0.8	1.0	-0.5		-	1.5	-8.9	-	-4.7		-	4.8	-2.2	2.6	0.1		-	-	0.7	3.7	1.1
Feb.	0.8	0.0	2.6	-1.6	0.4		-	-0.4	-6.5	-1.6	-4.6		-	3.1	-1.9	2.3	0.1		-	-	0.2	3.9	1.0
Mar.	0.9	0.2	2.2	2.5	0.5		-	1.3	1.6	0.0	-0.8		-	3,8	3.9	3.6	2.4		-	-	4.2	4.0	3.5
Apr.	6.4	4.1	3.4	5.4	2.9		-	5.5	3.7	4.3	4.3		-	7.3	6.0	6.3	6.4		-	-	6.1	6.8	8.0
May	7.7	7.1	-	8.2	6.3		-	8.3	9.0	9.5	9.8		-	10.2	10.2	11.4	11.2		-	-	10.8	12.2	12.0
Jun.	10.3	10.3	-	10.2	9.0		14.4	17.4	16.4	15.5	13.8		14.9	17.2	16.3	15.8	14.8		-	-	17.6	16.1	15.2
Jul.	13.3	10.8	-	11.1	10.6		16.5	13.3	17.8	15.5	16.1		17.2	15.1	19.1	17.0	16.9		-	-	19.5	17.5	18.3
Aug.	10.7	11.1	-	10.6	10.3		15.5	16.0	14.3	15.6	14.7		16.6	16.8	15.9	17.0	16.1		-	-	16.1	19.0	17.3
Sep.	9.3	7.3	-	9.3	7.4		9.9	11.3	11.6	10.4	10.5		12.5	13.1	14.2	12.9	12.7		-	-	14.8	13.6	14.0
Oct.	5.0	5.4	5.7	4.8	4.4		4.0	6.4	7.5	6.3	4.8		6.8	9.1	10.1	9.7	8.0		-	-	10.7	12.0	9.8
Nov.	1.5	1.4	1.8	5.3	1.1		-1.6	3.3	1.1	2.8	0.1		3.0	7.2	5.1	7.1	4.2		-	-	6.9	7.7	6.4
Dec.	0.4	1.5	1.5	-	-0.2		-2.2	-0.2	-4.7	-6.8	-3.8		3.4	4.5	-1.1	-2.1	1.2		-	-	2.0	1.5	3.0
Mean	5.5	4.9	-	-	4.4		-	7.0	5.2	-	5.0		-	9.4	8.0	8.6	7.8		-	-	9.2	9.9	9.2

Mean monthly precipitation and 30 yr average																					
	Korpa, Reykjavik						Apelsvoll						Landvik						Ballerup, Smørum				
(b)	2019	2020	2021*	2022*	30yr		2019	2020	2021	2022	30yr		2019	2020	2021	2022	30yr		2019	2020	2021	2022	30yr
Jan.	92	103	50	141	76		-	41	49	-	49		-	189	89	56	142		-	-	64	45	55
Feb.	69	56	53	95	72		-	18	28	33	32		-	272	110	155	94		-	-	25	97	36
Mar.	85	91	59	141	82		-	40	16	1	47		-	135	63	10	90		-	-	39	1	32
Apr.	85	65	51	-	58		-	19	16	11	40		-	12	13	14	67		-	-	22	33	28
May	47	63	-	49	44		-	34	81	28	55		-	44	197	56	80		-	-	79	71	61
Jun.	30	49	-	58	50		104	99	62	80	66		148	144	50	60	88		-	-	13	38	73
Jul.	54	46	-	68	52		38	71	93	58	73		110	169	61	33	90		-	-	73	28	75
Aug.	44	100	-	79	62		63	17	16	77	80		167	68	39	74	126		-	-	111	57	97
Sep.	153	105	-	94	67		103	81	34	51	62		152	100	70	106	137		-	-	54	81	53
Oct.	83	51	-	81	86		78	120	63	66	63		295	143	138	170	176		-	-	76	34	68
Nov.	88	93	-	88	73		108	32	24	68	52		262	197	115	356	169		-	-	44	15	68
Dec.	87	67	91	-	79		50	104	24	28	43		239	410	150	157	146		-	-	77	43	63
Sum	916	889	-	-	801		-	675	507	501	667		-	1883	1093	1247	1409		-	-	676	542	709

*: unverified data, may contain errors

Table 5: Mean monthly temperatures (a) in °C and precipitation (b) in mm from 2019-2022 compared with 30 year normal values (1991-2020) at the experimental sites in Massachusetts and Minnesota.

Mean monthly temperature and 30 yr average										
	Troll Turfgrass Research Facility, Massachusetts						St. Paul Campus Weather station, Minnesota			
(a)	2019	2020	2021	2022	30yr		2019	2020	2021	2022	30yr
Jan.	-3.2	-0.5	-2.2	-5.0	-4.5		-10.4	-7.7	-6.9	-14.3	-9.2
Feb.	-0.9	-0.3	-2.4	-1.1	-3.2		-12.6	-7.7	-12.5	-11.8	-6.7
Mar.	2.7	4.9	4.0	3.4	1.5		-3.3	1.1	3.1	-2.0	0.2
Apr.	9.7	7.2	9.7	8.9	7.9		7.5	5.6	7.1	3.7	7.8
May	13.8	14.4	14.7	16.7	14.2		11.6	13.8	14.1	14.8	15.0
Jun.	19.4	20.8	21.6	19.5	19.2		19.6	21.2	23.1	20.9	20.4
Jul.	23.7	24.1	21.0	23.3	22.1		22.5	23.2	23.1	23.0	22.8
Aug.	21.3	22.0	23.0	23.5	21.1		20.0	21.8	22.4	21.2	21.6
Sep.	17.1	17.5	18.3	17.2	16.8		17.5	15.2	17.5	17.4	17.2
Oct.	11.5	11.1	13.5	10.8	10.1		7.1	5.1	12.2	9.8	9.5
Nov.	2.5	6.3	4.4	9.1	4.1		-2.1	2.8	1.6	0.9	1.1
Dec.	-1.4	0.8	1.8	0.5	-1.1		-6.2	-4.8	-5.6	-9.4	-5.9
Mean	9.7	10.7	10.6	10.6	9.0		5.9	7.4	8.2	6.2	7.8

Mean monthly precipitation and 30 yr average										
	Troll Turfgrass Research Facility, Massachusetts					St. Paul Campus Weather station, Minnesota				
(b)	2019	2020	2021	2022	30yr	2019	2020	2021	2022	30yr
Jan.	--	62	58	29	85	9	21	16	14	17
Feb.	--	83	54	100	74	59	13	10	12	19
Mar.	--	88	56	88	88	53	70	75	81	41
Apr.	180	123	113	102	96	86	42	62	91	77
May	89	58	123	75	94	164	113	85	124	107
Jun.	92	50	57	58	113	72	105	40	20	117
Jul.	105	97	301	49	105	121	56	40	35	116
Aug.	68	88	136	72	105	175	94	167	116	115
Sep.	16	92	132	120	117	124	27	46	7	84
Oct.	63	141	158	84	120	125	57	58	6	73
Nov.	74	161	65	82	86	42	35	25	52	39
Dec.	119	92	97	121	99	61	22	49	46	27
Sum	--	1135	1349	980	1183	1091	655	673	604	831

Photo 2: Snow mold in the bentgrasses in Minnesota, April 2021. Photo: Andrew Hollman.

2.4.1 Establishment of trials in 2019

The trials were seeded 18 June (Apelsvoll), 1-2 July (Landvik), 6-10 July (Reykjavik), 1 September (Minnesota) and 18 September (Massachusetts). The establishment was very uniform at Reykjavik, Apelsvoll, and Landvik except for one variety of Chewings fescue 'Dancing' which had to be reseeded with new seeds at all sites. The American trials were seeded late but established well and fast. Further details from each site and management in the seeding year is shown in Table 6.

Photo 3: Newly established green at Reykjavik, July 2019: Photo: Bjarni Hannesson

Photo 4: Removing the tarp at Landvik, August 2019. Photo: Karin J. Hesselsøe.

Table 6: Green type, soil conditions, seeding dates and management in the seeding year 2019 at three sites in Scandinavia and in USA.

		Reykjavik	Apelsvoll	Landvik	Minnesota	Massachusetts
Type of green		USGA Spec	USGA-Spec.	USGA-spec.	Native soil-push up	USGA spec
Year of construction		2005	2003	2003	2003	2003
Type of organic matter in rootzone			0-30 cm: Composted garden waste (Green Mix), 2.15 % (w/w)	0-30 cm: Composted garden waste (Green Mix), 2.15 % (w/w)	Soil Test: 3.5% OM, pH= 6.5, 30 mg/kg (Bray P), 143 mg/kg K	*Sphagnum* peat
Seeding date (Specify below info about overseeding/ which plots)		6-10 July	18 June	1-2 July (11 Sep: Dancing)	4 September 10th(missing bent mixtures), 14th (low germ FF)	18 September
Preplant fertilizer	Type	ICL Sieraform GT Preseeder	Helgjødsel 12-2-16	Slow release, inorganic	12-24-8	Slow release, inorganic
	N / P / K, g m^{-2}	7/4/2	5 / 1 / 6	7/2/3	2-5-2	7/2/3
Plots covered by tarp after seeding (days)		18	10	13	Futerra Environet by Profile (covers left in place)	10
Ferti-lization after seeding	Fertilizer type(s)	Ammoium Sulphate Yara Arena royal 15-2-8 Kristalon 18-8-15	Greenmaster 14-0-10 Wallco Blomstra 5-1-4	Slow release, inorganic	18-4-18, 1-0-0, 18-0-18, 12-24-8	Slow release, inorganic
	First application after seeding	7 August	11 July	9 October	Sept 20	9 October
	Last application before winter	25 September	28 October	20 November	Oct 11	20 November
	Number of applications	8	13	3	4	3
	Total rate of N, P and K, to *A.stolonifera, Poa* sp.*, L.perenne,* and high input mixtures, g m^{-2}	20/7/8	28/6/20	18/4/11	13/11/11	18/4/11
	Total rate of N, P and K, to *A.capillaris, A.canina,* and low input mixtures g m^{-2}	18/6/6	20/5/14	20/5/12	13/11/11	18/4/11
Mowing	Type of mower	Ransomes Certes Mk8 Push mower/Toro GM1000	Walk behind	Walk behind	Toro Greensmaster 1600 (walking)	Walk behind
	First mowing after seeding, mm	24 July (ryegrass) 1 August	15 July	15 July	20 September	9 October
	Hight of cut at first mowing, mm	9	9	9	12	9
	Lowest height in *Agrostis* sp., Poa *sp.*, mm	5	4	4	8	4
	Lowest height in *Festuca/Lolium/Poa pratensis,* mm	5	5	6	8	6
	Last mowing before winter	8 October	28 October 4/6 mm	12 November: 4/6 mm	19 October	12 November
Top-dressing	Type of sand	Pure black sand	Pure sand, grain size 0.2 – 0.7	Pure sand, grain size 0.2 – 0.7	USGA specified	-
	Number of applications	1	9	8	1	-
	Total quantity (mm)	2	2.25	2.25	4	-

Photo 5: Establishment at the Troll Turfgrass Research Facility, University of Massachusetts. Photo taken on 5 October 2019, approximately 2.5 weeks after sowing. Photo: Michelle DaCosta

2.4.2 Winter 2019-20 and management in 2020

The winter 2019-20 offered some challenges in the northern zone of Scandinavia. In Iceland the snow melted in the beginning of April, but a very cold May resulted in a slow green-up. None of the plots were reseeded except for Chewings fescue 'Dancing'. At Apelsvoll all varieties of creeping bentgrass were dead after the winter and most of the colonial and velvet bents too. The dead plots were reseeded in May but did not recover until after reconstruction of the bentgrass area and reseeding in August. It was suspected that the problems with the bentgrasses were caused by nematodes and therefore it was decided to reconstruct the bentgrass area with new USGA-sand in August 2020 (Photo 7). At Landvik the winter 2019-20 was very mild and none of the plots were reseeded. Details from the three trials in the Nordic countries are shown in Table 7.

Photo 6: Ice-covered trial at Apelsvoll, February 2020. Photo: Pia Heltoft

Photo 7: In August 2020, the research green at Apelsvoll was partly reconstructed with the replacement of the rootzone material and new establishment of all creeping bentgrass plots (left) and some plots of colonial and velvet bentgrass (right). Photo: Pia Heltoft

Table 7: Winter conditions, reseeding and management in 2020.

		Reykjavik	Apelsvoll	Landvik
Snow cover during winter	**Duration of snow or ice cover, days**	66	63	13
	Soil frozen under snow or ice, days	66	120	15
Re-seeding	**Species / varieties that were reseeded**	*Festuca rubra:* Dancing	*Poa trvialis* *Agrostis stolonifera* *Agrostis capillaris:* Jorvik, Heritage, Musket *Agrostis canina* Villa	0
	Reseeding, date	-	19 May and 20 August	-
Fertilization	**Fertilizer type(s)**	Ammonium Sulphate, Kristalon, Potassium Nitrate, Sulphate of Iron	Greenmaster Pro-Lite - Cold Start 11-5-5+8 Fe $MnSO_4$ Sierraform GT All season Greenmaster Pro-Lite Zero Phosphate 14-0-8,3+2,1 Mg Greenmaster Pro-Lite Zero Phosphate 12-0-10	Greenmaster cold start 11-5-5 Wallco liquid Greenmaster zero P 14-0-10
	First application in spring seeding	Week 20	14 May	3 April
	Last application before winter	Week 42	13 October	28 October
	Number of applications	13	15	16
	Total rate of N, P and K, to *A.stolonifera and Poa spp.*, g/ m^2	14/2/11	16/03/12	17/2/12
	Total rate of N, P and K, to *A.capillaris, A.canina and F.rubra,* g/ m^2	8/1/6	10/3/8	11/1/8

Mowing	**Type of mower Single/Triplex**	Walk behind	Walk behind	Walk behind
	First in spring Date / height	8 May: 7 mm	4 May: 6mm/8 mm	6 April Fescue: 7 mm Bent: 5 mm
	Lowest height in *Agrostis*	3 mm	4 mm	3 mm
	Lowest height in *Festuca/Lolium/Poa*	5 mm	6 mm	5 mm
	Last before winter: Date / height	6 mm	8 October 4 and 6 mm	26 October 3 and 6 mm
Irrigation	**Number of times**	23	60	37
	Total quantity, mm	94.5	600	560
Top-dressing	**Type of sand**	Volcanic	Pure sand	Pure sand
	Number of applications	4	10	34
	Total quantity	1 cubic meter	7 mm	8.5 mm
Vertical mowing	**No of times, Agrostis**	2	0	2
	No of times, other species	2	0	0
Slicing, 5 cm depth	**No of times, *Agrostis***	0	0	5
	No of times, other species	0	0	5
Spiking, 6 mm tines	**No of times, *Agrostis***	2	0	1
	No of times, other species	2	0	1
Deep aeration	**Date**	0	-	9 October
	Equipment, depth	0	-	120 mm
Wear machine	**Number of passes**	34	15	53

2.4.3 Winter 2020-21 and management in 2021

At both sites in the northern zone, April and May were cold and dry which resulted in a very slow green-up and winter damages. At Apelsvoll a stabile snow cover was seen from January to April, but there was no ice. Reseeding was done in rough bluegrass and in the bentgrasses (Photo 8). The variety owner Graminor had no seed of 'Nordlys' left so reseeding of that variety was not possible in 2021.

In Iceland the spring drought caused a few big wildfires, one of them very close to the test side, where it burned the irrigation pipe leading to the plot. This slowed down winter recovery, and the test site was dormant well into mid-May (no assessments were done in May). Rough bluegrass and ryegrass had to be reseeded.

At Landvik in the southern zone a period with severe frost and no or very little snow cover in January combined with a very dry April and a cold May caused winter damages and reduced turfgrass quality on some plots in spring. Reseeding was done in rough bluegrass, ryegrass and in the creeping bentgrass/ryegrass mixture.

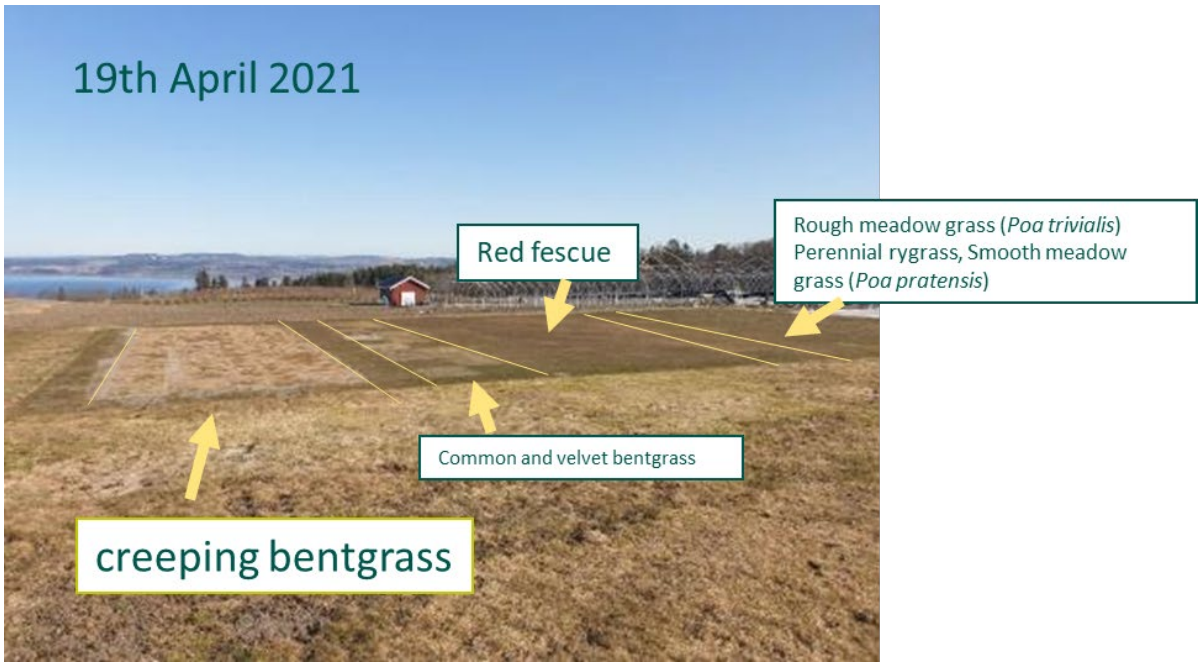


Photo 8: Winter damages at Apelsvoll. April 2021, Photo: Pia Heltoft

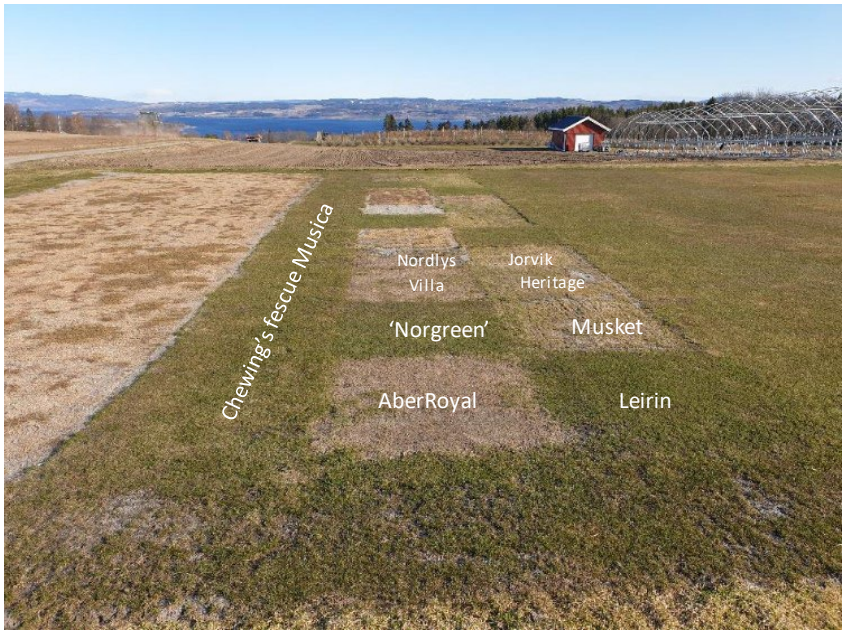


Photo 9: Severe winterkill at Apelsvoll, May 2021. The substate in the dead creeping bentgrass section to the left had been replaced in August 2020 after several unsuccessful attempts to reseed plots after winter kill during the previous 2019-20 winter. It was not until reseeding these plots in 2021 that we managed to reestablish a good cover on these creeping bentgrass plots. The damages in velvet bentgrass and colonial bentgrass in the front was variety dependent. All red fescues to the right had good winter survival. Photo: Pia Heltoft.

On 19 May a new trial was established in the southern zone, at Smørum GC. Cover sheets were removed 3 June and first registration was done on 10 June. Some problems occurred with establishment of the bentgrasses (yellow and dead plants). Pythium was detected on diseased plants, and therefore irrigation was reduced in the trial, and the bentgrasses were reseeded. After that the whole trial looked good, and assessments were done as planned. The southern zone experienced warm weather in September/October. Wetting agent was used at Landvik. Take-all-patch was observed at Landvik, which was treated with $MnSO_4$ in July and August. In September the fescues at Smørum were infected by dollar spot. Details from the four trials in Scandinavia are shown in Table 8.

Photo 10: Establishment of a new experimental green at Smørum GC in May 2021.

Table 8: Winter conditions, reseeding and management in 2021. The trial at Smørum was established in May.

		Reykjavik	Apelsvoll	Landvik	Smørum
Snow cover during winter	**Duration of snow or ice cover, days**	49	90	40	-
	Soil frozen under snow or ice, days	49	90	75	-
Re-seeding (seeding at Smørum)	**Species that were reseeded**	*Lolium perenne* , *Poa trivialis*	*Agrostis* spp. and *Poa trivialis*	*Lolium perenne, Poa trivialis*	-
	Date	-	27 May	20 May	19 May
Fertilization	**Fertilizer type(s)**	Ammonium Sulphate, Pioner Green, Potassium Nitrate, Sulphate of Iron	Greenmaster cold start 11-5-5, Sierraform GT all season, Greenmaster Pro-Lite Zero Phosphate 14-0-8,3 + 2,1 Mg, + Mangansulfat	Greenmaster cold start 11-5-5 Wallco liquid Greenmaster zero 14-0-10	NPK 12-6-9 NK 12-0-9 NH4SO4 FeSO4 MnSO4 MgSO4
	First application in spring seeding	Week 17	27. May	12. April	27 May
	Last application before winter	Week 43	18. October	10. November	17. September
	Number of applications	14	15	15	6 low input 7 high input
	Total rate of N, P and K, to *A.stolonifera, Poa spp.and Lolium perenne* kg/100 m²	14/2/11	17/4/14	17/2/12	17/7/13
	Total rate of N, P and K, to *A.capillaris, A.canina and F.rubra,* kg/100 m²	8/1/6	10/2/8	11/1/8	16/6/7

Mowing	**Type of mower Single/Triplex**	Walk behind	Walk behind	Walk behind	Walk behind and Triplex
	First in spring: Date / height (mm)	3 May 7	Late May	16 April 6/4	20 June
	Lowest height in *Agrostis* (mm)	3	4	3	4
	Lowest height in *Festuca/Lolium/Poa* (mm)	5	6	5	6
	Last before winter: Date/height (mm)	7 October 6	11 October 4 / 6	29 October 4 / 6	17 November 4 / 6
Irrigation	**Number of times**	16	60	34	30
	Total quantity, mm	66	600	630	300
Top-dressing	**Type of sand**	Volcanic	Pure sand	Pure sand	Green Mix
	Number of applications	4	10	26	6
	Total quantity	1 cubic meter	7 mm	5.5 mm	10-12 mm
Vertical mowing	**No of times, Agrostis**	2	0	1	0
	No of times, other species	2	0	0	0
Slicing, 5 cm depth	**No of times, *Agrostis***	0	4	5	0
	No of times, other species	0	4	5	0
Spiking, 6 mm tines	**No of times, *Agrostis***	3	0	1	0
	No of times, other species	3	0	1	0
Deep aeration,	**Date**	-	-	-	-
	Equipment, depth	-	-	-	-
Rolling	**Number of passes**	27	10	53	0

Photo 11: Wear machine in action at Landvik, June 2021. Photo: Karin J. Hesselsøe.

2.4.4 Winter 2021-22 and management in 2022

In winter 2021-22 considerable winter damages were observed on many GCs in Finland, Sweden and eastern Norway, but the SCANGREEN trials at both Apelsvoll and Landvik managed through the winter relatively well. At Apelsvoll rough bluegrass, perennial ryegrass and creeping bentgrass were reseeded.

Photo 12: Colors in February 2022 at Landvik. The fescues have turned purple while creeping bentgrasses are green. Photo: Karin J. Hesselsøe.

In Iceland in summer some of the fescues and creeping bentgrasses did show symptoms that appeared like dollar spot (Photo 13). This was the first time dollar spot was observed at the experimental green in Iceland. In summer dollar spot was observed at Smørum too. At Landvik wetting agent was used in spring and $MnSO_4$ in May to reduce Take-all-patch.

Photo 13: Symptoms of dollar spot in fescue in Iceland. Photo: Bjarni Hannesson.

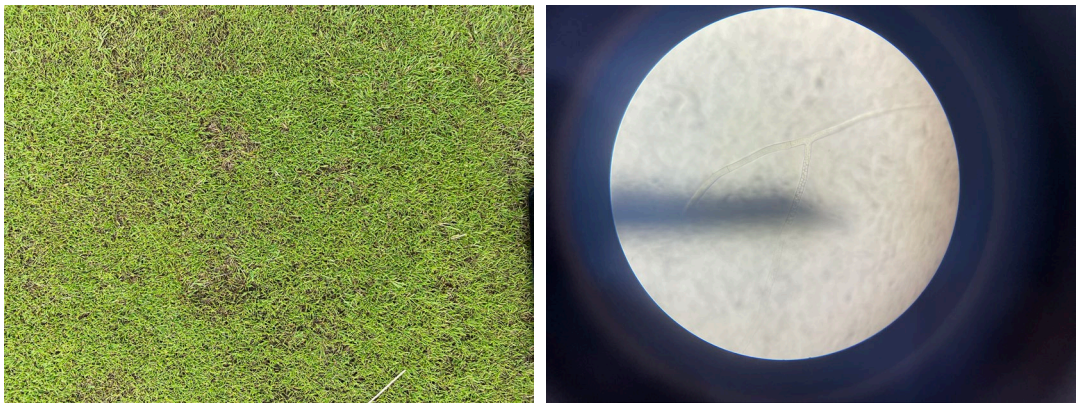


Photo 14: Symptoms and mycelium of dollarspot from Smørum, June 2022. Photo: Karin Normann

Table 9: Winter conditions, reseeding and management in 2022 at four test sites in Scandinavia.

		Korpa	Apelsvoll	Landvik	Smørum
Snow cover during winter	**Duration of snow or ice cover, days**	69	126 (until 26. March)	56	10
	Soil frozen under snow or ice, days	63	126 (until 1. April)	30	15
Re-seeding	**Species that were reseeded**	-	*Poa trivialis, Lolium perenne, Agrostis stolonifera*	-	-
	Reseeding, date	-	9. June	-	-
Fertilization	**Fertilizer type(s)**	Ammonium Sulphate, Pioner Green, Potassium Nitrate, Sulphate of Iron	Greenmaster cold start 11-5-5 Sierraform All season Scotts 12-0-12	Greenmaster cold start 11-5-5 MnSO4 Wallco liquid Greenmaster zero, 14-0-10	NPK 5-1-7 NH4SO4 FeSO4 MgSO4 MnSO4
	First application in spring seeding	Week 16	2. May	6 April	22April
	Last application before winter	Week 42	17 October	26 October	18 August
	Number of applications	14	15	16	9
	Total rate of N, P and K, to *A.stolonifera, Poa spp.and Lolium perenne* g/ m²	19/2/11	17/4/14	17/2/12	15/3/21
	Total rate of N, P and K, to *A.capillaris, A.canina and F.rubra*, g/ m²	8/1/5	10/2/8	11/1/8	11/2/15
Mowing	**Type of mower Single/Triplex**	Single	Single	Single	Single
	First in spring: Date / height (mm)	29 april 7	13. May 8	20. April 7/5	9. March 6
	Lowest height in *Agrostis* (mm)	4	4	3	3
	Lowest height in *Festuca/Lolium/Poa* (mm)	5	6	5	5
	Last before winter: Date/height (mm)	30. September 5	7. October Fescue: 6 Bent: 4	27. October Fescue: 6 Bent: 4	2. November 4 and 6
Irrigation	**Number of times**	10	300	28	?
	Total quantity, mm	41	445 in total incl. 210 mm rain	560	?

Top-dressing	**Type of sand**	Volcanic	Pure sand (0.2-0.5 mm)	Pure sand	Greenmix
	Number of applications	4	13	26	Hi input 5 times Low input 2 times
	Total quantity	1 cubic meter	8 mm	6.5 mm	Hi: 15 mm Low: 6 mm
Vertical mowing	**No of times, *Agrostis***	2	0	0	4
	No of times, other species	2	0	0	0
Slicing, 5 cm depth	**No of times, *Agrostis***	0	0	6	0
	No of times, other species	0	0	6	0
Spiking, 6 mm tines	**No of times, *Agrostis***	3	5	2	0
	No of times, other species	3	5	2	0
Deep aeration,	**Date**	-	25 April	-	-
	Equipment, depth	-	8 cm	-	-
Rolling with wear machine	**Number of passes**	27	51	55	-

2.4.5 Management in 2020-22 at Minnesota and Massachusetts

The two trials in USA made it through the winters very healthy and there was no need for reseeding even though there was a lot of snow mold in the bentgrasses in Minnesota. At both sites they had a very hot and dry season. Rough bluegrass turned off colour (purple) early.

Table 10: Winter conditions and management in Minnesota 2020-22.

Minnesota, USA		**2020**	**2021**	**2022**
Snow cover during winter	**Duration of snow or ice cover**		November 14 first snow but melted, snow cover Dec 20th through March 8th	Dec 20 -Mar 21 again April 8th
	Soil frozen under snow or ice ?	yes	yes	90
Re-seeding	**Species that were reseeded**	-	-	-
	Reseeding, date	-	-	-
Fertilization	**Fertilizer type(s)**	12-24-8 (1 time), 18-0-18 (6 times)	18-0-18	18-0-18
	First application in spring seeding	May 13, 2020	5/18	May 10
	Last application before winter	Sept 30, 2020	9/27	September 30
	Number of applications	7	6	7
	Total rate of N, P and K, to *A.stolonifera and Poa spp.*, kg /100 m²	1.71 kg	1.19kg N 0 P 1.02kg K	1.39kg N 0 P 1.39kg K
	Total rate of N, P and K, to *A.capillaris, A.canina and F.rubra*, kg /100 m²	1.28 kg	0.85kg N 0 P 0.67kg K	0.99kg N 0 P 0.99kg K
Mowing	**Type of mower Single/Triplex**	Single, Toro 800 (5mm), Toro 1000 (3mm)	Single	Single
	First in spring: Date / height	April 17,2020 / 8.45mm	April 6th	May 3

	Lowest height in *Agrostis*	3mm	3mm	3mm
	Lowest height in *Festuca/Lolium/Poa*	5mm	5mm	5mm
	Last before winter: Date / height	Oct 9, 2020 / 4 and 6mm	October 22nd	October 10
Irrigation	**Number of times**	7	6	8
	Total quantity, mm	60mm	50	67
Top-dressing	**Type of sand**	USGA spec	USGA spec	USGA Spec
	Number of applications	6 applications	4	3
	Total quantity	7 mm	4mm	3mm
Vertical mowing	**No of times, Agrostis**	0	0	0
	No of times, other species	0	0	0
Slicing, 5 cm depth	**No of times, *Agrostis***	0	1	0
	No of times, other species	0	1	0
Spiking, 6 mm tines	**No of times, *Agrostis***	0	0	0
	No of times, other species	0	0	0
Deep aeration,	**Date**	8/6/2020	0	0
	Equipment, depth	Procore 648, 5.1mm x 114mm	0	0
Wear machine	**Number of passes**	60	6 passes/week For 10 weeks	6 passes/week

Table 11: Winter conditions and management in Massachusetts in 2020-2022.

Massachusetts, USA		**2020**	**2021**	**2022**
Snow cover during winter	**Duration of snow or ice cover**	-	-	-
	Soil frozen under snow or ice?	yes	yes	yes
Re-seeding	**Species that were reseeded**	-	-	-
	Reseeding, date	-	-	-
Fertilization	**Fertilizer type(s)**	18-0-8	18-0-18	18-0-18
	First application in spring seeding	6-May	4-May	24-May
	Last application before winter	27-Oct-20	31-Oct	28-Oct
	Number of applications	9	8	8
	Total rate of N, P and K, to *A.stolonifera and Poa spp.,* kg /100 m^2	1.8 N	1.3 N/0 P/1.1 K	1.3 N/0 P/1.1 K
	Total rate of N, P and K, to *A.capillaris, A.canina and F.rubra,* kg /100 m^2	1.3 N	0.85 /0 P/0.7 K	0.85 N/0 P/0.7 K
	Type of mower Single/Triplex	Single, Toro Flex 21	Single	Single

Mowing	**First in spring: Date / height**	April 8,2020 / 7 mm	April 27th	15-Apr
	Lowest height in *Agrostis*	3mm	3mm	3mm
	Lowest height in *Festuca/Lolium/Poa*	5mm	5mm	5mm
	Last before winter: Date / height	Nov 15, 2020 / 4 and 6mm	8-Nov	14-Nov
Irrigation	**Number of times**	7	6	8
	Total quantity, mm	57mm	52	61
Top-dressing	**Type of sand**	USGA spec	USGA spec	USGA Spec
	Number of applications	6	6	8
	Total quantity	8 mm	8 mm	10 mm
Vetical mowing	**No of times, Agrostis**	0	0	0
	No of times, other species	0	0	0
Slicing, 5 cm depth	**No of times, *Agrostis***	0	0	0
	No of times, other species	0	0	0
Spiking, 6 mm tines	**No of times, *Agrostis***	0	0	0
	No of times, other species	0	0	0
Deep aeration,	**Date**	0	0	0
	Equipment, depth	0	0	0
Rolling with wear machine	**Number of passes**	6 passes/wk	5 passes/wk	5 passes/wk

2.5 Assessments, statistical analyses, and presentation of results

The trials were rated at monthly intervals for visual turf quality and most other characters. The complete observation program is outlined in the protocol (Aamlid, 2019). Turfgrass height growth was measured at Landvik, Massachusetts and Minnesota only.

At all sites, the assessments were undertaken by experienced researchers/technicians. However, as no attempt was made to harmonize the use of scales at the four locations, values should not be used to compare turfgrass quality between the four sites. The seed blends and mixtures were rated in the same way as the pure varieties and species.

Analyses of variance were performed using the statistical packages R version 3.6.3 (R Core team, 2013) and the procedure PROC ANOVA in SAS. For comparison of species, values for all varieties (subplots) within each main plot (species) were averaged before the analyses. If characters such as tiller density, leaf fineness, diseases etc. for one or more species had not been assessed on a specific date due to slow establishment, winter damage or other reasons, these observations were excluded from the

comparisons of species, but not from the comparison of varieties within the species which had complete observations.

The results for species and varieties within species were analyzed separately for each of the Nordic sites. Analyses and ranking of species and varieties within species were also performed separately for the northern climatic zone including Reykjavik and Apelsvoll, for the southern climatic zone including Landvik and Smørum and in one overall analysis including the three Nordic sites Reykjavik, Apelsvoll and Landvik but not Smørum because that trial was not established until 2021. To obtain balanced data for the southern zone, data from Landvik in 2019 and 2020 were excluded when ranking species and varieties for the southern zone. For the US sites Massachusetts and Minnesota, separate analyses of varieties within species were performed for each site and in a common analysis including both sites. When analysing data across sites varieties that were not present on all sites were always excluded to obtain balanced data sets. Except for the US sites, the main effect of species (varieties) and the interaction site x species (site x variety) were tested against species x block within site (variety x block within site) as the error term. Whenever significant ($P \leq 0.05$) differences occurred, the Least Significant Difference (LSD) was calculated for comparison of species, varieties, or blends/mixtures.

The results are presented in Table 12-Table 19. In these tables, species or varieties have been ranked for decreasing overall turfgrass quality. Two decimal places were used when ranking varieties for overall quality, but only one decimal is shown in the tables. In cases where two or more species (varieties) had the same scores (using two decimals), they were ranked secondly for increasing winter damage and thirdly for increasing infection of in-season diseases. This ranking was done to evaluate which species and varieties were best suited for Pesticide-Free Management of putting greens in the Nordic countries.

3 Results and discussion

3.1 Comparison of pure species and subspecies (Table 12)

Across three Nordic countries (Smørum not included because of the shorter testing period) creeping bentgrass and second velvet bentgrass had the best overall impression, both significantly better than slender creeping red fescue, Kentucky bluegrass and Chewing's fescue, which were all equal. In Iceland the bentgrasses and Kentucky bluegrass were better than the fescues. At Apelsvoll Kentucky bluegrass and the fescues performed significantly better than the bentgrasses, which was obviously due to the problems with reestablishment of the bentgrasses after winter damage. At Landvik creeping bentgrass was significantly better than the other species, while at Smørum, Chewings fescue had the highest overall impression.

3.1.1 Comparison of *Festuca rubra spp.*

In the southern Nordic zone, the Chewings fescues performed better than the slender creeping red fescues. At Landvik the two subspecies were very close, but at Smørum the difference could be explained by more microdochium patch during winter and more dollar spot during summer in slender creeping red fescue. The first dollar spot observation in Iceland was also made in the slender creeping red fescue.

In Iceland red fescue was rated low compared to the bentgrasses, and it could be explained by low density resulting in expanding problems with moss (Photo 15). There was no difference between the two subspecies of fescue in this regard. Despite the short growing season, fertilization with 8 g N/m2 to fescues was probably too low to get an acceptable turfgrass quality in Iceland.

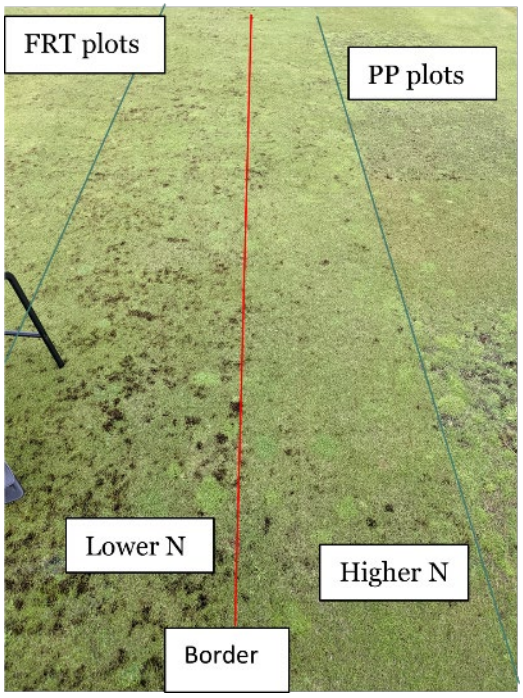


Photo 15: The advantage of higher N rates in the trial at Reykjavik can be seen on the overspray into the border between the high input (ryegrass and Kentucky Bluegrass) plots and the low input (FRT= fescue) plots. A line with less moss invasion in the fescue border where higher N rates from PP=Kentucky bluegrass plots hits the border compared to the lower N rates from the neighboring fescue plots. Photo: Bjarni Hannesson.

3.1.2 *Agrostis spp.*

At one of the first observations of microdochium patch in October 2019 at Landvik (three months after seeding), colonial and velvet bentgrass were more infected than the creeping bentgrasses. In March the following year microdochium patch was seen in all the bentgrasses while the first signs of take-all-patch appeared in creeping bentgrass in August. Though the creeping bentgrasses had the highest ratings across the three Nordic sites, lower ratings were recorded at Apelsvoll which could be explained by the problems with reestablishment in 2020, which were suspected to be caused by nematodes. The dead plots were reseeded in May but did not recover until the next spring, after replacement of the entire rootzone material in August 2020. Hence, no data were collected from creeping bentgrass plots in 2020 at Apelsvoll. Similar problems with unsuccessful establishment of creeping bentgrass were observed in another trial at Landvik in 2019 (Xiao et al., 2021).

Colonial bentgrass was rated as second (at Landvik) and third best (at Reykjavik), while at Apelsvoll and Smørum it was rated at the lowest. The velvet bentgrass was rated on top in Iceland, in the middle at Apelsvoll and Landvik, and at the lowest at Smørum.

3.1.3 *Poa spp.*

Kentucky bluegrass was rated with the highest turfgrass quality in the northern zone. At Smørum it was also highly rated, but only with assessments in two years. At Landvik it was rated at the lowest together with perennial ryegrass. Observations from Iceland (in 2021) indicated that Kentucky bluegrass plots did well through the summer. Rough bluegrass was rated with the lowest turfgrass quality at all sites and years.

3.1.4 *Lolium perenne*

The perennial ryegrass was rated at the lowest or second lowest at all sites except Smørum. It is not a good alternative when seeded in pure stand on greens. At Apelsvoll it had to be reseeded every spring and at Reykjavik and Landvik in the spring of 2021.

Photo 16: Landvik February 2022. Colonial and velvet bentgrass to the left, perennial ryegrass, rough bluegrass (with microdochium) and Kentucky bluegrass to the right. Border with Chewings fescue 'Musica' in the middle. Photo: Karin J. Hesselsøe.

Table 12: Ranking of species after four years testing on putting greens in SCANGREEN trials at a) Reykjavik GC (Korpa, Iceland); b) NIBIO Apelsvoll Research Center (Norway); c) average for Reykjavik and Apelsvoll representing the northern climatic zone of Scandinavia; d) Smørum GC (Denmark), e) NIBIO Landvik Research Center (Norway), f) average for Smørum and Landvik representing the southern climatic zone of Scandinavia; and g) average for three test sites (Smørum not included). Means of varieties within each species.

a) Reykjavik GC, Iceland (northern climatic zone)

No of obser-vations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown species, %	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	18	2	6	5	5	3	12	3	1	7	7	3	4	3	3	16	17	8	2	4	3	11	14	14	11
ACAN	5.7	7.0	4.6	5.1	6.2	4.9	5.5	5.5	73	7.5	5.2	3.5	6.6	6.3	6.3	93	3.5	1.1	0.0	0.0	0.0	1.7	0.4	0.5	0.2
AS	5.6	6.4	3.9	6.1	6.0	4.1	6.0	5.7	64	7.0	5.0	3.4	6.0	2.9	3.1	96	1.6	0.7	0.0	0.7	0.0	1.1	0.1	0.5	0.3
ACAP	5.4	7.1	3.2	5.6	5.6	3.8	5.3	5.7	65	6.5	5.7	3.3	6.0	1.0	1.0	94	1.6	0.0	0.0	1.7	0.0	0.3	0.4	0.8	0.5
PP	5.4	7.1	5.6	5.0	3.8	4.9	4.9	5.2	51	3.5	6.2	5.5	4.7	0.4	0.5	97	0.7	0.2	0.0	0.0	0.0	0.4	1.2	0.3	0.4
FRL	4.8	6.0	4.3	4.7	4.1	4.0	4.6	4.7	57	4.0	4.7	4.1	7.0	0.8	0.9	95	0.4	0.0	0.0	0.0	0.1	0.3	2.8	0.4	0.5
FRC	4.6	5.8	4.4	4.7	3.6	4.0	4.5	4.6	53	3.7	4.4	4.2	7.0	0.2	0.2	93	0.1	0.0	0.0	0.0	0.0	0.2	2.9	0.7	0.4
PT	3.3	7.1	3.6	1.7	1.0	1.7	2.1	3.6	77	1.3	2.9	1.4	5.5	63.1	29.8	86	0.5	0.0	0.0	0.0	0.0	3.4	1.5	1.4	1.0
LP	3.2	7.0	3.0	1.5	1.3	1.2	2.2	3.6	80	1.3	3.3	1.5	4.0	62.3	29.0	84	2.4	0.0	0.0	0.0	0.0	3.3	1.8	3.2	0.7
P%	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	0.1	1	<0.1	0.1	0.6	9
LSD 5%	0.3	0.4	0.5	0.4	0.4	0.2	0.4	0.3	9.6	0.3	0.7	0.3	3.9	4.8	4.8	2.5	1.2	0.3	-	0.6	0.04	0.6	1.2	1.3	0.5

Abbreviations: ACAN: *Agrostis canina* (velvet bentgrass, 'Villa'); ACAP: *Agrostis capillaris* (colonial bentgrass, mean of 3 varieties); AS: *Agrostis stolonifera* (creeping bentgrass, mean of 16 varieties); FRC = *Festuca rubra* ssp. *commutata* (Chewing's fescue, mean of 13 varieties); FRL = *Festuca rubra* ssp. *litoralis* (slender creeping red fescue, mean of 11 varieties); LP: *Lolium perenne* (perennial ryegrass, 'Clementine'); PP= *Poa pratensis* (Kentucky bluegrass, mean of 2 varieties); PT: *Poa trivialis* (rough bluegrass, 'Dark horse').

b) NIBIO Apelsvoll Research Center, Norway (northern climatic zone)

No of obser-vations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown species, %	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	20	1	5	7	7	6	9	5	1	15	6	2	5	3	3	19	6	6	0	0	0	9	6	0	6
PP	5.7	6.2	6.8	5.9	3.7	6.0	5.7	5.1	36	4.0	7.0	2.5	5.0	8.9	5.6	95	0.2	0.2	0.0	0.0	0.0	0.9	0.9	0.0	0.4
FRC	5.5	4.1	6.4	6.5	5.1	5.9	6.2	5.2	65	5.0	5.7	2.8	7.9	15.2	1.2	95	0.4	0.3	0.0	0.0	0.0	0.6	0.5	0.0	0.2
FRL	5.5	4.7	5.8	6.3	5.2	5.6	6.0	5.4	61	5.1	5.2	3.0	7.9	5.8	2.4	96	0.6	0.6	0.0	0.0	0.0	0.9	0.3	0.0	0.1
AS	5.0	5.5	-	4.3	5.1	2.4	5.7	5.0	66	5.4	5.2	2.9	5.6	66.5	10.3	86	3.0	3.0	0.0	0.0	0.0	3.6	0.0	0.0	0.0
ACAN	4.6	4.8	6.7	4.0	4.2	4.0	5.0	4.4	57	6.0	6.1	2.4	5.1	43.5	9.8	89	1.8	1.6	0.0	0.0	0.0	2.3	0.2	0.0	0.1
ACAP	4.2	4.1	6.0	4.0	4.2	3.5	4.7	4.3	46	5.3	6.4	2.4	5.1	40.6	7.2	86	2.2	1.5	0.0	0.0	0.0	2.1	0.2	0.0	0.2
LP	4.0	6.0	3.2	4.4	2.4	2.3	3.5	4.5	82	3.9	6.0	2.3	3.7	52.1	16.2	85	0.0	0.0	0.0	0.0	0.0	3.7	0.8	0.0	0.0
PT	2.3	4.3	2.0	2.0	1.0	1.0	1.4	3.7	72	3.0	1.5	1.0	-	85.4	16.4	58	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0
P%	<0.1	0.9	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	<0.1	<0.1	-	-	-	0.1	0.3	-	<0.1
LSD 5%	0.5	1.2	0.9	0.7	0.8	0.5	0.6	0.5	12.1	0.4	0.1	0.6	0.8	16.7	7.3	6.0	0.7	0.7	-	-	-	1.4	0.4	-	0.1

Abbreviations: ACAN: *Agrostis canina* (velvet bentgrass, mean of 3 varieties); ACAP: *Agrostis capillaris* (colonial bentgrass, mean of 5 varieties); AS: *Agrostis stolonifera* (creeping bentgrass, mean of 16 varieties), in 2020 no data due to unsuccessful reestablishment; FRC = *Festuca rubra* ssp. *commutata* (Chewing's fescue, mean of 13 varieties); FRL = *Festuca rubra* ssp. *littoralis* (slender creeping red fescue, mean of 11 varieties); LP: *Lolium perenne* (perennial ryegrass, 'Clementine'); PP= *Poa pratensis* (Kentucky bluegrass, mean of 2 varieties); PT: *Poa trivialis* (rough bluegrass, 'Dark horse').

c) Mean of two sites, northern climatic zone

No of sites	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown species, %	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	2	2	2	2
PP	5.5	6.6	6.2	5.5	3.8	5.4	5.3	5.2	43	3.8	6.6	4.3	4.8	4.7	3.0	96	0.5	0.2	0.0	0.0	0.0	0.7	1.1	0.2	0.4
ACAN	5.4	6.5	4.6	4.5	5.6	3.9	5.6	5.2	69	7.2	5.4	3.2	6.5	33.6	8.8	90	3.1	1.6	0.0	0.0	0.0	2.2	0.2	0.3	0.1
AS	5.3	6.0	3.9	5.2	5.5	3.4	5.9	5.4	65	6.1	5.1	3.2	5.8	34.7	6.7	92	2.2	1.7	0.0	0.4	0.0	2.2	0.1	0.3	0.2
FRL	5.1	5.4	5.1	5.5	4.6	4.8	5.3	5.0	59	4.7	5.0	3.7	7.4	3.3	1.6	95	0.5	0.3	0.0	0.0	0.0	0.6	1.6	0.2	0.3
FRC	5.1	4.9	5.4	5.6	4.3	5.0	5.3	4.9	59	4.6	5.1	3.6	7.5	7.7	0.7	94	0.2	0.2	0.0	0.0	0.0	0.4	1.7	0.4	0.3
ACAP	4.8	5.6	3.2	4.7	5.0	3.3	5.1	5.1	56	5.7	6.0	3.0	5.8	24.0	4.9	90	2.3	0.9	0.0	1.0	0.0	1.4	0.3	0.5	0.4
LP	3.6	6.5	3.1	2.9	1.9	1.7	2.8	4.1	81	2.7	4.8	1.8	3.8	57.2	22.6	84	1.4	0.0	0.0	0.0	0.0	3.5	1.3	1.7	0.3
PT	2.8	5.7	2.8	1.9	1.0	1.4	1.9	3.6	74	2.2	2.1	1.3	5.5	72.9	23.9	74	0.3	0.0	0.0	0.0	0.0	2.4	0.8	0.7	0.5
P%	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	0.3	<0.1	<0.1	0.1	<0.1
LSD 5%	0.3	0.7	0.7	0.4	0.5	0.3	0.4	0.4	7.9	0.3	0.4	0.3	0.4	8.4	4.2	3.0	0.7	0.4	-	0.3	0.1	0.8	0.6	0.6	0.6
Interact species x site	<0.1	1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.6	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	0.3	<0.1	0.1	0.1	0.1

Abbreviations: ACAN: *Agrostis canina* (velvet bentgrass, 'Villa'); ACAP: *Agrostis capillaris* (colonial bentgrass, mean of 3 varieties); AS: *Agrostis stolonifera* (creeping bentgrass, mean of 16 varieties); FRC = *Festuca rubra* ssp. *commutata* (Chewing's fescue, mean of 13 varieties); FRL = *Festuca rubra* ssp. *littoralis* (slender creeping red fescue, mean of 11 varieties); LP: *Lolium perenne* (perennial ryegrass, 'Clementine'); PP= *Poa pratensis* (Kentucky bluegrass, mean of 2 varieties); PT: *Poa trivialis* (rough bluegrass, 'Dark horse').

d) Smørum GC, Denmark (southern climatic zone)

No of obser-vations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown species, %	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	11	*	*	4	7	2	6	3	1	3	2	1	2	1	1	10	20	7	4	1	8	8	0	0	0
FRC	5.0	-	-	5.6	4.3	4.1	4.9	5.2	56	5.5	5.6	6.0	7.9	1.1	1.1	99	0.3	0.0	0.2	0.0	0.4	0.2	0.0	0.0	0.0
AS	4.8	-	-	5.3	4.3	4.5	4.8	4.6	100	7.2	6.8	5.8	5.7	9.3	9.3	99	0.7	0.8	0.0	0.0	0.0	3.5	0.0	0.0	0.0
PP	4.8	-	-	4.6	5.0	4.9	4.8	4.9	22	5.6	5.9	4.1	4.2	0.0	0.0	98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LP	4.5	-	-	5.5	3.6	3.7	4.5	4.6	88	5.3	5.2	5.3	4.9	0.0	0.0	97	1.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
FRL	4.3	-	-	4.4	4.1	3.7	4.5	4.1	57	4.9	5.9	5.1	7.8	18.5	18.5	97	1.1	0.0	0.1	0.0	3.6	3.8	0.0	0.0	0.0
ACAP	4.0	-	-	4.1	3.9	3.5	4.2	4.0	100	6.1	7.0	5.0	5.9	6.2	6.2	98	0.3	0.4	0.0	0.0	0.0	3.4	0.0	0.0	0.0
ACAN	3.2	-	-	3.6	2.8	3.1	3.1	3.2	100	5.7	6.5	3.2	6.8	5.6	5.6	96	0.5	0.5	0.0	0.0	0.0	2.9	0.0	0.0	0.0
PT	3.0	-	-	3.9	2.0	1.7	2.7	3.7	33	3.8	6.2	3.0	6.5	0.0	0.0	98	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P%	<0.1	-	-	1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	>10	>10	<0.1	0.1	-	<0.1	<0.1	-	>10	-
LSD 5%	0.7	-	-	1.1	0.3	0.8	0.7	0.7	8.4	0.6	0.4	0.8	0.3	5.3	5.3	2	0.9	0.2	0.1	-	1.3	0.8	-	-	-

**No data from 2019 and 2020, SCANGREEN at Smørum established in 2021.*

Abbreviations: ACAN: *Agrostis canina* (velvet bentgrass, mean of 'Villa' and 'Nordlys'); ACAP: *Agrostis capillaris* (colonial bentgrass, mean of 3 varieties); AS: *Agrostis stolonifera* (creeping bentgrass, mean of 15 varieties); FRC = *Festuca rubra* ssp. *commutata* (Chewing's fescue, mean of 14 varieties); FRL = *Festuca rubra* ssp. *littoralis* (slender creeping red fescue, mean of 11 varieties); LP: *Lolium perenne* (perennial ryegrass, 'Clementine'); PP= *Poa pratensis* (Kentucky bluegrass, mean of 3 varieties); PT: *Poa trivialis* (rough bluegrass, 'Dark horse').

e) NIBIO Landvik Research Center, Norway (southern climatic zone)

No of obser-vations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown species, %	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	22	2	7	7	6	6	10	6	1	8	7	3	6	2	3	22	24	12	9	3	0	15	13	13	13
AS	7.2	7.9	6.8	6.7	7.4	5.9	7.9	7.1	34	7.2	7.2	5.2	7.2	6.8	6.3	97	0.4	0.3	0.0	0.1	0.0	1.4	0.0	0.2	0.0
ACAP	6.4	7.4	6.1	5.8	6.1	4.7	7.0	6.6	63	6.4	6.4	3.8	6.4	13.0	12.0	95	1.6	1.2	0.0	0.0	0.0	3.2	0.0	0.5	0.0
FRL	6.3	6.7	6.0	6.1	6.6	5.6	6.7	6.3	29	6.1	6.2	3.7	8.1	1.6	4.0	96	0.3	0.1	0.3	0.0	0.0	0.8	0.1	0.2	0.1
FRC	6.3	6.5	6.1	6.1	6.4	5.8	6.7	5.9	32	6.1	6.3	3.1	8.1	1.2	3.1	95	0.2	0.1	0.2	0.0	0.0	0.6	0.2	0.4	0.1
ACAN	5.8	7.4	5.1	5.7	4.9	4.4	6.5	5.4	66	7.1	6.4	3.5	8.3	6.7	9.3	96	1.6	0.6	0.2	0.0	0.0	1.9	0.0	0.6	0.0
PP	5.7	6.2	5.4	5.8	5.3	5.5	5.8	5.6	18	5.7	6.3	4.4	5.6	0.5	0.7	90	0.1	0.0	0.0	0.0	0.0	0.3	0.1	3.4	0.2
LP	5.5	6.8	6.4	4.5	4.4	3.9	6.0	5.8	70	5.6	6.1	2.9	5.5	54.9	6.3	92	0.3	0.2	0.1	0.0	0.0	1.0	0.0	1.9	0.3
PT	4.9	6.8	4.4	4.0	4.6	3.6	5.2	5.2	58	5.3	5.8	2.5	5.3	26.9	28.0	88	3.1	1.2	0.2	0.0	0.0	5.9	0.0	2.3	0.1
P%	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	4	-	<0.1	2	<0.1	>10
LSD 5%	0.5	0.3	0.4	0.6	1.1	0.7	0.5	0.5	4.9	0.5	0.2	0.6	0.3	8.0	4.8	3.1	0.9	0.4	0.1	0.1	-	1.0	0.1	0.7	0.2

Abbreviations: ACAN: *Agrostis canina* (velvet bentgrass, mean of 'Villa' and 'Nordlys'); ACAP: *Agrostis capillaris* (colonial bentgrass, mean of 3 varieties); AS: *Agrostis stolonifera* (creeping bentgrass, mean of 15 varieties); FRC = *Festuca rubra* ssp. *commutata* (Chewing's fescue, mean of 14 varieties); FRL = *Festuca rubra* ssp. *litoralis* (slender creeping red fescue, mean of 11 varieties); LP: *Lolium perenne* (perennial ryegrass, 'Clementine'); PP= *Poa pratensis* (Kentucky bluegrass, mean of 3 varieties); PT: *Poa trivialis* (rough bluegrass, 'Dark horse').

f) Mean of two sites, southern climatic zone (balanced data from 2021 and 2022 only)

No of sites	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown species, %	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	2	-	-	2	2	2	2	2	-	2	2	2	2	2	2	2	2	2	2	2	1	2	1	1	1
AS	5.9	-	-	6.0	5.8	5.2	6.4	5.9	-	7.2	6.9	5.1	6.7	9.2	8.3	99	0.6	0.7	0.0	0.0	0.0	2.7	0.0	0.2	0.0
FRC	5.6	-	-	5.9	5.4	5.1	5.9	5.6	-	6.0	6.2	3.4	8.1	1.1	3.5	99	0.4	0.1	0.3	0.0	0.2	0.5	0.2	0.4	0.1
FRL	5.3	-	-	5.3	5.4	5.0	5.7	5.2	-	5.8	6.3	3.6	8.0	7.7	10.2	98	0.9	0.1	0.3	0.0	1.8	2.4	0.1	0.3	0.1
PP	5.2	-	-	5.2	5.1	5.6	5.1	5.1	-	5.6	5.9	3.8	5.1	0.4	0.7	95	0.1	0.0	0.0	0.0	0.0	0.1	0.1	3.4	0.2
ACAP	5.0	-	-	5.0	5.0	4.0	5.5	5.3	-	6.0	6.4	3.5	6.2	13.9	13.0	97	1.1	1.2	0.0	0.0	0.0	3.9	0.0	0.5	0.0
LP	4.5	-	-	5.0	4.0	3.0	4.9	5.0	-	5.2	5.6	2.6	5.3	54.8	6.3	92	0.8	0.2	0.1	0.0	0.0	0.8	0.0	1.9	0.3
ACAN	4.2	-	-	4.7	3.8	4.1	4.6	3.9	-	6.6	6.5	2.8	7.8	5.8	9.3	96	0.9	0.8	0.2	0.0	0.0	2.7	0.0	0.6	0.0
PT	3.6	-	-	4.0	3.3	2.6	3.8	4.4	-	4.3	5.6	2.4	5.7	26.9	28.0	93	0.3	0.1	0.2	0.0	0.0	2.9	0.0	2.3	0.1
P%	<0.1	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	-	<0.1	<0.1	0.5	<0.1	2
LSD 5%	0.6	-	-	0.7	0.7	0.7	0.7	0.6	-	0.6	0.3	0.6	0.2	6.7	4.4	2.1	0.5	0.2	0.1	-	0.6	0.6	0.1	0.8	0.2
Interaction species x site	0.8	-	-	0.1	0.2	0.6	0.2	0.2	-	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.1	-	<0.1	<0.1	0.5	<0.1	2

Abbreviations: ACAN: *Agrostis canina* (velvet bentgrass, mean of 'Villa' and 'Nordlys'); ACAP: *Agrostis capillaris* (colonial bentgrass, mean of 3 varieties); AS: *Agrostis stolonifera* (creeping bentgrass, mean of 15 varieties); FRC = *Festuca rubra* ssp. *commutata* (Chewing's fescue, mean of 14 varieties); FRL = *Festuca rubra* ssp. *litoralis* (slender creeping red fescue, mean of 11 varieties); LP: *Lolium perenne* (perennial ryegrass, 'Clementine'); PP= *Poa pratensis* (Kentucky bluegrass, mean of 3 varieties); PT: *Poa trivialis* (rough bluegrass, 'Dark horse').

g) Mean of three sites (Smørum not included), both climatic zone

No of sites	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown species, %	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	3	3	2	3
AS	6.0	6.6	5.4	5.7	6.2	4.4	6.8	6.0	56	6.6	5.9	4.0	6.4	25.3	6.3	94	1.5	1.1	0.0	0.3	0.0	1.8	0.0	0.2	0.1
ACAN	5.8	6.9	5.5	5.1	5.7	4.3	6.4	5.6	69	7.4	5.8	3.6	7.2	24.2	8.7	93	2.3	1.2	0.0	0.0	0.0	2.0	0.1	0.2	0.1
FRL	5.5	5.8	5.4	5.7	5.3	5.1	5.9	5.5	49	5.3	5.4	3.7	7.7	2.7	2.4	95	0.5	0.2	0.1	0.0	0.0	0.7	1.1	0.2	0.2
PP	5.5	6.4	5.9	5.5	4.2	5.4	5.4	5.3	34	4.4	6.5	4.2	5.0	3.3	2.2	94	0.3	0.1	0.0	0.0	0.0	0.5	0.7	1.4	0.3
FRC	5.5	5.4	5.7	5.8	5.0	5.2	5.9	5.3	50	5.2	5.5	3.5	7.7	5.6	1.5	94	0.2	0.1	0.1	0.0	0.0	0.5	1.2	0.4	0.2
ACAP	5.4	6.2	4.7	5.0	5.4	3.9	5.9	5.7	58	6.0	6.1	3.3	6.0	20.3	7.3	92	2.0	1.0	0.0	0.6	0.0	2.1	0.2	0.5	0.2
LP	4.2	6.6	4.2	3.5	2.7	2.5	4.1	4.6	77	4.2	5.4	2.2	4.7	56.4	17.2	87	1.0	0.1	0.0	0.0	0.0	2.7	0.8	1.7	0.3
PT	3.5	6.1	3.3	2.6	2.2	2.2	3.3	4.2	69	4.3	3.8	1.7	5.4	56.3	25.4	79	1.3	0.4	0.1	0.0	0.0	3.6	0.5	1.3	0.4
P%	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	1
LSD 5%	0.3	0.5	0.5	0.4	0.5	0.3	0.3	0.3	5.8	0.3	0.3	0.3	0.3	6.2	3.2	2.5	0.5	0.3	0.03	0.2	0.01	0.6	0.4	0.5	0.2
Interaction species x site	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	2

Abbreviations: ACAN: *Agrostis canina* (velvet bentgrass, 'Villa'); ACAP: *Agrostis capillaris* (colonial bentgrass, mean of 3 varieties); AS: *Agrostis stolonifera* (creeping bentgrass, mean of 14 varieties); FRC = *Festuca rubra* ssp. *commutata* (Chewing's fescue, mean of 13 varieties); FRL = *Festuca rubra* ssp. *litoralis* (slender creeping red fescue, mean of 11 varieties); LP: *Lolium perenne* (perennial ryegrass, 'Clementine'); PP= *Poa pratensis* (Kentucky bluegrass, mean of 2 varieties); PT: *Poa trivialis* (rough bluegrass, 'Dark horse').

3.2 Varieties of *Festuca rubra ssp. commutata* Table 13

In total 14 varieties (8 candidate and 6 controls) of Chewings fescue (*Festuca rubra* ssp. *commutata)* were tested. 'Lodde' ('LøRc0010') was only tested in the northern zone of Scandinavia and in USA. 'Euro Carina' was only tested in the Nordic trials.

All varieties had low incidence of microdochium patch (less than 1 %) and dollar spot (less than 0.5 %) at all Nordic sites except for Smørum, where 'Kalle' had 2.6 % coverage of microdochium and 2.7 % coverage of dollar spot. In Massachusetts coverage of dollar spot was less than 1 % in all varieties.

Across all Nordic sites and years the new variety 'Euro Carina' performed best, in line with the control variety 'Barlineus' followed by the two new varieties 'Orionette', 'Gima' and the control variety 'Musica'. In USA 'Lodde' was ranked the highest. 'Kalle' had the lowest performance at all sites and cannot be recommended for putting greens. In the STRI list (STRI/BSPB, 2022) 'Barlineus' performed second best.

Low germination in the seed lot of 'Dancing' that was provided by the variety owner and seeded in the Nordic trials, explains the low ratings of this variety in the Nordic countries. The plots were overseeded with a new seed lot provided in August 2019, but this could not compensate for the poor start of this variety in the Nordic trials. At the US sites, where the new seed lot was used when seeding the trials in September, 'Dancing' performed second best in Massachusetts, and intermediate in Minnesota. In the STRI list (STRI/BSPB, 2022) 'Dancing' is ranked as nr. 3 on top. 'Dancing' will be retested in the next round of SCANGREEN 2023-26.

Table 13: Ranking of Chewings fescue (Festuca rubra ssp. commutata) varieties after four years testing on putting greens in SCANGREEN trials at a) Reykjavik GC (Iceland); b) NIBIO Apelsvoll Research Center (Norway); c) average for Korpa and Apelsvoll representing the northern climatic zone of Scandinavia; d) Smørum GC (Denmark), e) NIBIO Landvik Research Center (Norway), f) average for Smørum and Landvik representing the southern climatic zone of Scandinavia; and g) average for three test sites in Scandinavia; h) University of Massachusetts; i) University of Minnesota; j) average for Massachusetts and Minnesota.

a) Reykjavik GC, Iceland (northern climatic zone)

No of obser-vations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown species, %	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	18	2	6	5	5	3	12	3	1	7	7	3	4	3	3	16	17	8	2	4	3	11	14	14	11
Gima	5.3	6.6	5.1	5.3	4.1	4.9	4.9	5.2	62	4.1	4.3	4.1	7.0	0.8	0.8	96	0.2	0.0	0.0	0.0	0.0	0.3	1.9	0.6	0.5
Musica	5.3	6.5	5.1	5.4	4.1	4.8	5.1	5.2	58	4.1	4.4	4.1	7.0	0.2	0.2	96	0.1	0.0	0.0	0.0	0.0	0.2	2.1	0.6	0.5
Barlineus	5.2	6.4	5.2	5.6	3.6	4.6	5.0	5.1	60	3.8	4.3	4.2	7.0	0.4	0.4	96	0.1	0.0	0.0	0.0	0.0	0.2	2.0	0.4	0.4
Euro Carina	5.2	6.3	5.1	5.4	3.9	4.6	5.1	5.1	58	4.1	4.5	4.2	7.0	0.2	0.2	96	0.1	0.0	0.0	0.0	0.0	0.2	2.3	0.4	0.4
Firan	4.9	6.2	4.8	4.8	3.7	4.3	4.7	4.8	56	3.7	4.4	4.2	7.0	0.2	0.2	96	0.0	0.0	0.0	0.0	0.0	0.2	2.5	0.5	0.3
Torona	4.9	6.1	4.7	5.0	3.7	4.1	4.8	4.9	62	3.7	4.4	4.2	7.0	0.1	0.1	95	0.1	0.0	0.0	0.0	0.0	0.2	2.5	0.7	0.4
Orionette	4.8	6.1	4.6	4.8	3.6	4.0	4.6	4.9	56	3.9	4.2	4.1	7.0	0.0	0.0	95	0.2	0.0	0.0	0.0	0.0	0.2	3.1	0.3	0.3
Lykke	4.7	6.2	4.5	4.5	3.5	3.9	4.4	4.6	53	3.5	4.4	4.2	7.0	0.0	0.0	94	0.0	0.0	0.0	0.0	0.0	0.2	3.4	0.6	0.6
Compass II	4.7	6.4	4.4	4.4	3.4	4.0	4.3	4.6	53	3.3	4.7	4.3	7.0	0.1	0.1	94	0.0	0.0	0.0	0.0	0.0	0.2	3.5	0.6	0.3
Lystig	4.6	5.8	4.5	4.5	3.8	4.0	4.5	4.6	57	3.6	4.4	4.3	7.0	0.1	0.1	94	0.1	0.0	0.0	0.0	0.0	0.2	2.9	0.8	0.5
Radar	4.6	6.1	4.4	4.4	3.4	3.9	4.2	4.6	55	3.3	4.8	4.3	7.0	0.1	0.1	94	0.0	0.0	0.0	0.0	0.0	0.2	3.7	0.8	0.5
Kalle	4.4	5.9	3.9	4.2	3.5	3.6	4.0	4.4	57	3.5	4.4	4.2	7.0	0.2	0.2	94	0.1	0.0	0.0	0.0	0.0	0.2	3.2	0.7	0.5
Dancing	1.9	1.0	1.2	2.4	2.9	1.8	2.3	2.1	4	3.4	4.3	4.8	7.0	0.1	0.1	62	0.1	0.0	0.0	0.0	0.0	0.0	4.8	2.2	0.4
P%	<0.1	<0.1	<0.1	<0.1	5	<0.1	<0.1	<0.1	<0.1	2	0.1	<0.1	>10	0.4	0.4	<0.1	>10	-	-	-	-	<0.1	3	0.1	>10
LSD 5%	0.5	0.5	0.5	0.9	0.5	0.5	0.7	0.5	5.3	0.6	0.2	0.2	-	0.3	0.3	6.4	-	-	-	-	-	0.1	1.5	0.6	-

b) NIBIO Apelsvoll Research Center, Norway (northern climatic zone)

No of observations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	20	1	5	7	7	6	9	5	1	15	6	2	5	3	3	19	7	6	1	0	0	9	6	0	6
Lykke	6.0	4.7	6.9	6.9	5.4	6.8	6.5	5.6	65	5.1	5.6	2.6	7.8	3.3	0.4	97	0.3	0.3	0.0	0.0	0.0	0.4	0.2	0.0	0.1
Orionette	5.9	4.3	6.9	7.0	5.6	6.4	6.7	5.8	73	5.4	5.6	3.1	8.1	4.1	1.0	96	0.3	0.2	0.0	0.0	0.0	0.5	0.5	0.0	0.2
Euro Carina	5.8	4.0	7.4	6.8	5.2	6.5	6.7	5.5	77	5.1	5.7	2.7	8.1	8.6	1.2	96	0.5	0.5	0.0	0.0	0.0	0.8	0.4	0.0	0.1
Barlineus	5.7	4.0	7.0	6.5	5.4	5.4	6.8	5.6	73	5.1	5.6	2.7	8.2	43.6	0.9	95	0.2	0.2	0.0	0.0	0.0	0.4	0.3	0.0	0.2
Torona	5.6	4.3	6.5	6.7	5.0	6.2	6.2	5.5	75	5.1	5.7	2.7	8.1	4.1	1.3	96	0.4	0.3	0.0	0.0	0.0	0.6	0.5	0.0	0.2
Gima	5.6	4.0	6.2	7.0	5.2	5.2	6.5	5.8	72	5.1	5.8	3.0	7.9	36.9	1.3	95	0.3	0.3	0.0	0.0	0.0	0.5	0.2	0.0	0.1
Musica	5.6	4.0	6.1	6.8	5.6	5.8	6.4	5.5	68	5.3	5.6	2.5	8.2	25.6	0.9	96	0.2	0.2	0.0	0.0	0.0	0.5	0.2	0.0	0.1
Firan	5.5	4.0	6.6	6.6	4.9	6.5	6.3	5.0	67	4.9	5.7	2.8	8.1	6.8	1.6	97	0.3	0.2	0.1	0.0	0.0	0.5	0.3	0.0	0.1
Lystig	5.5	4.3	6.0	6.6	4.9	6.3	6.0	5.0	68	5.1	5.6	2.6	7.9	2.4	0.9	96	0.4	0.4	0.0	0.0	0.0	0.5	0.6	0.0	0.3
Radar	5.4	4.0	6.3	6.5	4.7	5.8	6.2	4.9	72	4.9	6.2	2.6	7.4	35.0	1.4	96	0.4	0.4	0.1	0.0	0.0	0.7	0.5	0.0	0.2
Compass II	5.3	4.0	6.3	6.2	4.7	5.6	6.1	4.8	67	4.8	6.1	2.6	7.9	14.9	1.3	95	0.4	0.3	0.1	0.0	0.0	0.6	0.6	0.0	0.3
Kalle	4.9	3.7	6.0	5.3	4.5	5.5	5.5	4.6	67	4.8	5.5	3.3	7.4	6.9	1.6	94	0.8	0.8	0.0	0.0	0.0	0.9	0.8	0.0	0.2
Dancing	4.7	3.5	4.8	6.0	4.7	5.1	5.3	4.5	5	4.8	5.8	2.8	7.9	5.9	1.3	89	0.5	0.4	0.0	0.0	0.0	0.5	0.8	0.0	0.2
P%	0.7	9	3	0.1	0.5	0.1	0.9	0.1	<0.1	7	0.6	3	0.8	<0.1	>10	<0.1	>1	>10	>10	-	-	>10	>10	-	>10
LSD 5%	0.6	0.6	1.2	0.7	0.6	0.8	0.8	0.7	16	0.4	0.3	0.5	0.4	13.5	-	2	-	-	-	-	-	-	-	-	-

c) Mean of two sites, northern climatic zone

No of sites reporting	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Euro Carina	5.5	5.2	6.2	6.1	4.5	5.6	5.9	5.3	68	4.8	5.1	3.6	7.6	4.4	0.7	96	0.3	0.3	0.0	0.0	0.0	0.5	1.4	0.2	0.2
Barlineus	5.5	5.2	6.1	6.0	4.5	5.0	5.9	5.4	67	4.7	5.0	3.6	7.6	22.0	0.7	96	0.2	0.1	0.0	0.0	0.0	0.3	1.1	0.2	0.3
Gima	5.4	5.3	5.7	6.1	4.7	5.1	5.7	5.5	67	4.7	5.1	3.7	7.5	18.9	1.1	96	0.2	0.2	0.0	0.0	0.0	0.4	1.1	0.3	0.3
Musica	5.4	5.2	5.6	6.1	4.8	5.3	5.8	5.4	63	4.9	5.0	3.5	7.6	12.9	0.6	96	0.2	0.1	0.0	0.0	0.0	0.3	1.2	0.3	0.3
Orionette	5.4	5.2	5.7	5.9	4.6	5.2	5.6	5.4	65	4.9	4.9	3.7	7.5	2.1	0.5	96	0.2	0.1	0.0	0.0	0.0	0.3	1.8	0.2	0.2
Lykke	5.3	5.4	5.7	5.7	4.4	5.4	5.5	5.1	59	4.6	5.0	3.6	7.4	1.7	0.2	96	0.1	0.1	0.0	0.0	0.0	0.3	1.8	0.3	0.3
Torona	5.3	5.2	5.6	5.9	4.4	5.1	5.5	5.2	69	4.6	5.0	3.6	7.6	2.1	0.7	96	0.2	0.2	0.0	0.0	0.0	0.4	1.5	0.3	0.3
Firan	5.2	5.1	5.7	5.7	4.3	5.4	5.5	4.9	61	4.5	5.0	3.6	7.5	3.5	0.9	96	0.2	0.1	0.0	0.0	0.0	0.4	1.4	0.3	0.2
Lystig	5.1	5.1	5.3	5.5	4.4	5.2	5.2	4.8	63	4.6	5.0	3.6	7.4	1.3	0.5	95	0.2	0.2	0.0	0.0	0.0	0.3	1.8	0.4	0.4
Compass II	5.0	5.2	5.4	5.3	4.0	4.8	5.2	4.7	60	4.3	5.4	3.6	7.4	7.5	0.7	95	0.2	0.2	0.0	0.0	0.0	0.4	2.0	0.3	0.3
Radar	5.0	5.0	5.4	5.5	4.0	4.8	5.2	4.7	64	4.3	5.5	3.6	7.2	17.6	0.8	95	0.2	0.2	0.0	0.0	0.0	0.4	2.1	0.4	0.3
Kalle	4.6	4.8	5.0	4.7	4.0	4.5	4.8	4.5	62	4.3	5.0	3.9	7.2	3.6	0.9	94	0.5	0.4	0.0	0.0	0.0	0.6	2.0	0.4	0.3
Dancing	3.3	2.3	3.0	4.2	3.8	3.4	3.8	3.3	4	4.3	5.1	3.8	7.5	3.0	0.7	76	0.3	0.2	0.0	0.0	0.0	0.3	2.8	1.1	0.3
P%	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.2	<0.1	9	<0.1	>10	>10	>10	-	-	>10	2	<0.1	>10
LSD 5%	0.4	0.4	0.7	0.6	0.4	0.5	0.5	0.4	9	0.3	0.2	0.3	0.2	6.5	-	3	-	-	-	-	-	-	0.2	0.3	-
Interact	<0.1	<0.1	5	0.3	<0.1	<0.1	<0.1	<0.1	>10	>10	>10	0.5	0.2	<0.1	>10	<0.1	-	-	-	-	-	-	>10	<0.1	-

d) Smørum GC, Denmark (southern climatic zone)

No of observations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	11	*	*	4	7	2	6	3	1	3	2	1	2	1	1	10	20	7	4	1	8	8	0	0	0
Musica	5.5	-	-	6.1	4.9	4.8	5.3	5.8	67	5.9	5.7	6.0	8.0	0.1	0.1	100	0.1	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0
Gima	5.4	-	-	6.3	4.6	4.3	5.3	5.8	58	5.8	5.8	5.7	8.0	0.1	0.1	100	0.3	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.0
Euro Carina	5.4	-	-	6.1	4.6	5.2	5.2	5.4	58	5.9	5.4	6.7	8.0	0.1	0.1	99	0.4	0.0	0.1	0.0	0.4	0.1	0.0	0.0	0.0
Lodde	5.3	-	-	5.9	4.8	4.3	5.3	5.6	43	5.8	5.7	4.3	8.0	0.2	0.2	99	0.2	0.0	0.0	0.0	0.2	0.1	0.0	0.1	0.0
Lystig	5.2	-	-	5.9	4.5	4.2	5.2	5.3	67	5.7	5.6	6.0	8.0	0.0	0.0	99	0.2	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0
Barlineus	5.1	-	-	5.7	4.5	3.8	5.0	5.5	43	5.5	5.3	7.0	8.0	0.1	0.1	99	0.3	0.0	0.1	0.0	0.3	0.0	0.0	0.0	0.0
Firan	5.0	-	-	5.7	4.2	3.7	5.1	5.1	58	5.4	5.6	6.3	8.0	0.0	0.0	99	0.3	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.0
Lykke	5.0	-	-	5.4	4.5	4.3	4.8	5.4	58	5.3	5.3	5.0	8.0	0.0	0.0	99	0.2	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0
Radar	5.0	-	-	5.7	4.2	4.2	4.9	5.0	68	5.2	6.3	7.3	7.8	0.1	0.1	99	0.5	0.0	0.5	0.0	0.1	0.0	0.0	0.0	0.0
Torona	4.9	-	-	6.0	3.9	4.0	4.7	5.2	45	5.4	5.4	6.0	8.0	0.3	0.3	99	0.5	0.0	0.2	0.0	0.4	0.1	0.0	0.0	0.0
Dancing	4.9	-	-	5.5	4.4	4.2	5.0	4.9	50	5.7	5.6	5.3	8.0	0.3	0.3	99	0.3	0.0	0.1	0.0	0.4	0.2	0.0	0.0	0.0
Orionette	4.6	-	-	5.3	4.0	3.7	4.6	4.8	63	5.5	5.0	5.3	8.0	0.3	0.3	99	0.3	0.0	0.2	0.0	0.2	0.0	0.0	0.0	0.0
Compass II	4.6	-	-	5.4	3.9	3.3	4.5	5.1	47	4.7	6.5	7.0	7.7	0.2	0.2	99	0.4	0.0	0.4	0.0	0.2	0.0	0.0	0.0	0.0
Kalle	4.0	-	-	4.1	3.8	3.7	4.2	3.7	53	4.8	5.8	5.3	7.4	13.7	13.7	98	0.7	0.0	0.1	0.0	2.7	2.6	0.0	0.0	0.0
P%	1	-	-	0.3	4	6	>10	0.1	>10	0.1	0.1	<0.1	<0.1	1	1	>10	>10	-	>10	-	>10	3	-	>10	-
LSD 5%	0.7	-	-	0.8	0.7	-	-	0.7	-	0.5	0.5	0.9	0.2	6.3	6.3	-	-	-	-	-	-	1.3	-	-	-

*No data from 2019 and 2020, Scangreen at Smørum established in 2021.

e) NIBIO Landvik Research Center, Norway (southern climatic zone)

No of observations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %	Daily height growth, mm
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot					
	22	2	7	7	6	6	10	6	1	8	7	3	6	2	3	22	24	12	9	3	0	15	13	13	13	22
Barlineus	6.8	6.8	6.7	6.7	6.9	6.4	7.2	6.4	37	6.3	6.2	3.5	8.1	0.5	1.6	97	0.1	0.0	0.1	0.0	0.0	0.4	0.0	0.3	0.0	1.07
Orionette	6.8	6.8	6.6	6.6	7.1	6.3	7.2	6.5	30	6.7	6.1	3.3	8.2	0.6	1.9	97	0.2	0.0	0.2	0.0	0.0	0.5	0.0	0.2	0.1	1.10
Euro Carina	6.8	6.8	6.5	6.7	7.1	6.5	7.2	6.2	38	6.5	6.4	3.2	8.2	0.7	3.6	97	0.1	0.1	0.1	0.0	0.0	0.7	0.0	0.2	0.1	1.11
Gima	6.6	6.8	6.5	6.1	6.8	5.9	7.1	6.1	52	6.2	6.3	3.3	8.1	0.9	3.2	97	0.2	0.1	0.2	0.0	0.0	0.6	0.0	0.3	0.1	0.99
Torona	6.6	6.6	6.4	6.6	6.7	6.2	6.9	6.2	43	6.2	6.1	3.3	8.2	0.6	2.5	96	0.1	0.0	0.1	0.0	0.0	0.5	0.1	0.4	0.1	1.11
Musica	6.5	6.7	6.5	6.4	6.5	6.2	7.0	6.1	32	6.3	6.1	3.2	8.2	1.2	3.3	97	0.2	0.1	0.2	0.0	0.0	0.7	0.1	0.3	0.1	1.12
Lodde	6.5	6.8	6.1	6.4	6.7	6.1	6.9	6.1	35	6.0	6.2	2.5	8.2	0.5	4.3	96	0.1	0.0	0.1	0.0	0.0	0.7	0.2	0.3	0.0	1.08
Lystig	6.3	6.6	6.2	6.1	6.4	5.9	6.7	6.0	30	6.1	6.2	3.1	8.1	0.2	2.3	96	0.2	0.0	0.2	0.0	0.0	0.5	0.1	0.5	0.0	1.09
Lykke	6.2	6.5	6.2	5.9	6.2	5.7	6.6	5.8	32	6.0	6.2	2.6	8.2	0.4	2.2	96	0.1	0.0	0.2	0.0	0.0	0.5	0.3	0.4	0.1	1.05
Firan	6.0	6.6	6.1	5.8	5.7	5.3	6.5	5.8	28	6.0	6.3	3.2	8.1	0.9	4.0	95	0.3	0.1	0.2	0.0	0.0	0.8	0.4	0.5	0.1	1.15
Compass II	6.0	6.6	5.8	5.6	5.8	5.3	6.5	5.5	27	6.0	6.7	2.9	8.1	1.6	3.5	96	0.4	0.1	0.3	0.0	0.0	0.8	0.1	0.5	0.1	1.10
Kalle	5.9	6.4	5.7	5.9	5.7	5.1	6.4	5.7	30	5.5	5.9	3.4	8.2	0.6	3.7	95	0.4	0.0	0.5	0.0	0.0	0.6	0.1	0.4	0.2	0.96
Radar	5.7	6.6	5.6	5.2	5.3	4.8	6.2	5.2	33	5.9	7.1	3.0	7.8	1.0	3.8	94	0.4	0.2	0.2	0.0	0.0	0.8	0.5	0.5	0.2	1.00
Dancing	5.4	3.9	5.1	6.0	6.5	5.0	6.0	5.3	3	5.5	6.7	3.5	8.1	6.5	3.7	86	0.2	0.1	0.1	0.0	0.0	0.7	0.3	0.3	0.1	1.02
P%	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.4	<0.1	<0.1	<0.1	>10	<0.1	>10	<0.1	<0.1	0.7	<0.1	-	-	>10	>10	8	>10	
LSD 5%	0.4	0.6	0.4	0.4	0.7	0.6	0.3	0.5	17	0.5	0.3	0.3	-	1.6	-	2	0.1	0.1	0.1	-	-	-	-	-	-	

f) Mean of two sites, southern climatic zone (balanced data from 2021 and 2022 only)

No sites reporting	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	2	-	-	2	2	2	2	2	-	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Euro Carina	6.1	-	-	6.4	5.8	6.1	6.3	5.9	-	6.5	6.2	3.7	8.1	0.7	3.6	99	0.3	0.1	0.2	0.0	0.2	0.5	0.0	0.2	0.1
Musica	6.0	-	-	6.2	5.7	5.6	6.2	5.9	-	6.5	6.0	3.5	8.1	1.2	3.3	99	0.3	0.1	0.2	0.0	0.1	0.5	0.1	0.3	0.1
Barlineus	5.9	-	-	6.2	5.7	5.4	6.2	6.0	-	6.1	5.9	4.1	8.1	0.5	1.6	99	0.3	0.0	0.2	0.0	0.1	0.2	0.0	0.3	0.0
Gima	5.9	-	-	6.2	5.7	5.2	6.3	5.9	-	6.1	6.3	3.4	8.1	0.9	3.3	99	0.4	0.1	0.3	0.0	0.1	0.4	0.0	0.3	0.1
Lodde	5.9	-	-	6.1	5.8	5.4	6.3	5.9	-	6.1	6.1	2.4	8.1	0.5	4.3	99	0.1	0.0	0.1	0.0	0.1	0.5	0.2	0.3	0.0
Torona	5.8	-	-	6.3	5.3	5.4	6.0	5.7	-	5.9	6.0	3.4	8.1	0.6	2.6	99	0.3	0.0	0.2	0.0	0.2	0.3	0.1	0.4	0.1
Orionette	5.8	-	-	6.0	5.6	5.4	6.0	5.7	-	6.4	6.0	3.3	8.1	0.6	2.0	99	0.4	0.0	0.3	0.0	0.1	0.3	0.0	0.3	0.1
Lystig	5.7	-	-	6.0	5.5	5.2	6.1	5.6	-	6.1	6.1	3.5	8.1	0.2	2.3	99	0.3	0.0	0.3	0.0	0.0	0.3	0.1	0.5	0.0
Dancing	5.6	-	-	5.7	5.4	5.1	5.9	5.5	-	6.1	6.4	3.5	8.1	1.6	3.8	99	0.3	0.1	0.2	0.0	0.2	0.6	0.3	0.3	0.1
Lykke	5.5	-	-	5.7	5.4	5.0	5.8	5.6	-	5.8	5.9	2.8	8.1	0.3	2.2	99	0.2	0.0	0.2	0.0	0.0	0.3	0.3	0.5	0.1
Firan	5.4	-	-	5.8	5.0	4.4	5.8	5.4	-	5.9	6.3	3.5	8.1	0.7	4.0	98	0.4	0.1	0.2	0.0	0.1	0.5	0.4	0.5	0.1
Compass II	5.2	-	-	5.5	4.8	4.4	5.5	5.3	-	5.5	6.6	3.7	7.9	1.6	3.6	98	0.5	0.1	0.4	0.0	0.1	0.5	0.1	0.5	0.1
Radar	5.1	-	-	5.4	4.8	4.3	5.5	4.9	-	5.7	6.9	3.7	7.8	1.0	3.8	98	0.6	0.2	0.4	0.0	0.1	0.6	0.5	0.5	0.2
Kalle	4.9	-	-	5.0	4.8	4.6	5.3	4.6	-	5.4	5.9	3.4	7.9	4.9	8.2	98	0.7	0.0	0.5	0.0	1.4	1.7	0.1	0.4	0.2
P%	<0.1	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	0.1	1	0.7	0.6	0.6	<0.1	>10	-	>10	3	>10	>10	>10
LSD 5%	0.4	-	-	0.5	0.5	0.7	0.4	0.4	-	0.5	0.3	0.5	0.2	3.2	3.6	1	0.3	0.1	-	-	-	0.7	-	-	-
Interact species x site	0.2	-	-	<0.1	0.8	6	3	<0.1	-	>10	<0.1	<0.1	2	0.4	4	>10	>10	<0.1	>10	-	-	2	-	-	-

g) Mean of three sites (Smørum not included), Nordic countries

No of sites reporting	Turfgrass quality (1-9)																In-season diseases, %								
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest	Winter color (1-9, 9 most freshly	Leaf fineness (1-9)	Overall winter damage, %	Microdochium patch during	In-season coverage of	Total	Microdochium	Red thread	Snow mold	Dollar spot	Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Euro Carina	5.9	5.7	6.3	6.3	5.4	5.9	6.4	5.6	58	5.5	5.5	3.5	7.8	3.2	1.7	96	0.2	0.2	0.0	0.0	0.0	0.6	0.9	0.2	0.2
Barlineus	5.9	5.7	6.3	6.3	5.3	5.5	6.4	5.7	57	5.3	5.4	3.5	7.8	14.8	1.0	96	0.1	0.1	0.0	0.0	0.0	0.4	0.7	0.2	0.2
Orionette	5.8	5.7	6.0	6.2	5.4	5.6	6.2	5.8	53	5.6	5.3	3.6	7.8	1.6	1.0	96	0.2	0.1	0.1	0.0	0.0	0.4	1.2	0.2	0.2
Gima	5.8	5.8	5.9	6.1	5.4	5.4	6.3	5.7	62	5.3	5.5	3.6	7.7	12.9	1.8	96	0.2	0.1	0.1	0.0	0.0	0.5	0.7	0.3	0.2
Musica	5.8	5.7	5.9	6.2	5.4	5.6	6.2	5.6	53	5.5	5.4	3.4	7.8	9.0	1.5	96	0.2	0.1	0.1	0.0	0.0	0.5	0.8	0.3	0.2
Torona	5.7	5.7	5.9	6.1	5.1	5.5	6.1	5.5	60	5.2	5.4	3.5	7.8	1.6	1.3	96	0.2	0.1	0.0	0.0	0.0	0.4	1.0	0.4	0.2
Lykke	5.6	5.8	5.9	5.8	5.0	5.5	5.9	5.4	50	5.1	5.4	3.2	7.7	1.2	0.9	96	0.1	0.1	0.1	0.0	0.0	0.4	1.3	0.3	0.3
Firan	5.5	5.6	5.8	5.7	4.8	5.3	5.9	5.2	50	5.1	5.5	3.5	7.7	2.6	1.9	96	0.2	0.1	0.1	0.0	0.0	0.5	1.1	0.3	0.2
Lystig	5.5	5.6	5.6	5.7	5.0	5.4	5.8	5.2	52	5.2	5.4	3.4	7.7	0.9	1.1	96	0.2	0.1	0.1	0.0	0.0	0.4	1.2	0.4	0.3
Compass II	5.3	5.7	5.5	5.4	4.6	5.0	5.7	5.0	49	5.0	5.8	3.3	7.7	5.5	1.6	95	0.2	0.1	0.1	0.0	0.0	0.5	1.4	0.4	0.2
Radar	5.2	5.6	5.4	5.4	4.4	4.8	5.6	4.9	53	5.0	6.0	3.4	7.4	12.1	1.8	95	0.3	0.2	0.1	0.0	0.0	0.5	1.6	0.4	0.3
Kalle	5.1	5.3	5.2	5.1	4.6	4.7	5.4	4.9	51	4.8	5.3	3.7	7.5	2.6	1.8	94	0.4	0.3	0.2	0.0	0.0	0.6	1.4	0.4	0.3
Dancing	4.0	2.8	3.7	4.8	4.7	4.0	4.7	4.0	4	4.8	5.6	3.7	7.7	4.2	1.7	79	0.2	0.2	0.1	0.0	0.0	0.4	2.0	0.8	0.2
P%	<0.1	<0.1	<0.1	<0.1	<0.1	<0.	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.7	<0.1	0.2	>10	<0.1	-	-	3	<0.1	<0.1	>10
LSD 5%	0.3	0.3	0.5	0.4	0.4	0.4	0.4	0.3	8	0.3	0.2	0.2	0.2	4.2	0.7	2	0.1	0.1	0.1	-	-	0.2	0.5	0.2	-
Interact species x	<0.1	<0.1	0.3	<0.1	0.9	<0.	3	<0.1	>10	>10	0.7	0.1	1	<0.1	>10	<0.1	8	2	<0.1	-	-	>10	2	<0.1	>10

h) University of Massachusetts

	Turfgrass quality (1-9)																In-season diseases, %						Weeds, % of plot area			
No of obser-vations	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown species, %	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss	*Digitaria*	Sagina	Daily height growth, mm
	16	0	7	5	4	5	10	1	0	3	6	0	6	0	0	4	5	0	0	0	5	0	0	6	0	0
Lodde	5.5		5.5	5.4	5.6	6.3	5.0	6.2	-	6.8	6.9	-	7.8	-	-	90	0.5	-	-	-	0.5			3.1	-	-
Dancing	5.4		5.1	5.6	5.8	6.1	5.0	6.3	-	7.1	7.3	-	7.8	-	-	85	0.3	-	-	-	0.3	-	-	6.2	-	-
Radar	5.3		5.2	5.5	5.3	5.7	5.1	5.5	-	6.1	7.8	-	7.7	-	-	83	0.3	-	-	-	0.3	-	-	5.7	-	-
Gima	5.3		4.8	5.6	5.6	6.1	4.9	4.8	-	6.9	7.2	-	7.9	-	-	84	0.3	-	-	-	0.3	-	-	4.8	-	-
Musica	5.1		4.6	5.0	5.9	5.8	4.8	4.4	-	6.6	7.1	-	7.8	-	-	84	0.5	-	-	-	0.5	-	-	6.0	-	-
Orionette	5.1		5.2	4.9	5.2	5.7	4.8	5.3	-	6.2	6.2	-	7.8	-	-	85	0.4	-	-	-	0.4	-	-	5.9	-	-
Firan	5.1		5.5	4.9	4.4	6.1	4.5	5.8	-	6.4	6.4	-	7.7	-	-	85	0.8	-	-	-	0.8	-	-	7.1	-	-
Lystig	5.0		4.9	4.8	5.7	5.5	4.9	4.3	-	6.3	6.3	-	7.6	-	-	87	0.4	-	-	-	0.4	-	-	4.9	-	-
Compass II	5.0		4.5	5.3	5.5	5.0	5.0	5.2	-	6.1	7.5	-	7.7	-	-	78	0.3	-	-	-	0.3	-	-	6.3	-	-
Barlineus	5.0		5.0	4.8	5.4	5.5	4.7	5.5	-	6.3	6.7	-	7.7	-	-	81	0.8	-	-	-	0.8	-	-	7.1	-	-
Torona	4.8		4.1	5.1	5.5	5.4	4.6	3.8	-	6.4	6.9	-	7.8	-	-	80	0.4	-	-	-	0.4	-	-	5.7	-	-
Lykke	4.4		4.4	4.2	4.8	5.2	4.1	3.8	-	5.7	6.6	-	7.8	-	-	79	0.9	-	-	-	0.9	-	-	7.5	-	-
Kalle	4.1		4.3	3.9	3.8	4.4	3.9	3.8	-	5.6	7.1	-	7.3	-	-	70	0.7	-	-	-	0.7	-	-	18.9	-	-
P%	<0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<1	-	<5	<0.1	-	<0.1	-	-	<0.1	<0.1	-	-	-	<0.1	-	-	<0.1	-	-
LSD 5%	0.5		0.5	0.6	0.7	0.7	0.5	1.3	-	0.8	0.2	-	0.1	-	-	5	0.3	-	-	-	0.3	-	-	3	-	-

i) University of Minnesota

	Turfgrass quality (1-9)															In-season diseases, %							
No of obser-vations	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown species, %	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Weeds, % of plot area	Daily height growth, mm
	17	0	5	6	6	6	9	2	0	6	6	0	3	0	3	4	5	0	0	0	5	3	19	14
Musica	5.9		6.2	5.8	5.8	6.0	5.8	5.9		5.7	3.5		8.8		0.0							0.0	1.2	1.44
Lodde	5.8		5.5	5.8	6.2	5.8	5.7	6.2		5.6	2.9		8.9		0.0							0.0	0.5	1.51
Gima	5.8		6.1	5.8	5.5	5.9	5.8	5.7		5.5	3.3		8.9		0.0							0.0	1.0	1.28
Orionette	5.7		5.7	5.4	5.9	5.6	5.7	5.8		5.4	2.9		8.8		0.0							0.0	0.4	1.39
Firan	5.5		5.8	5.6	5.2	5.5	5.5	5.5		5.4	3.3		8.9		0.0							0.0	2.7	1.57
Barlineus	5.4		5.6	5.3	5.4	5.6	5.3	5.3		5.6	2.6		9.0		0.0							0.0	1.2	1.28
Lykke	5.2		5.3	5.2	5.1	5.2	5.1	5.3		5.2	2.7		9.0		0.0							0.0	1.0	1.68
Radar	5.1		5.7	4.8	4.9	5.1	5.1	5.0		5.1	3.9		8.7		0.0							0.0	1.2	1.41
Dancing	5.1		4.5	5.3	5.4	4.9	5.2	5.3		5.2	3.1		8.9		0.0							0.0	1.1	1.36
Lystig	5.0		5.2	4.9	4.9	4.9	5.0	5.0		5.6	3.0		8.7		0.0							0.0	2.0	1.48
Torona	4.7		5.4	4.5	4.4	4.9	4.7	4.2		5.0	3.5		8.8		0.0							0.0	2.2	1.46
Compass II	4.7		5.3	4.7	4.3	4.7	4.7	5.2		5.0	4.3		8.4		0.0							0.0	4.0	1.64
Kalle	4.5		5.1	4.4	4.1	4.8	4.6	3.2		4.9	3.9		8.0		0.0							0.0	1.1	1.37
P%	<5		<5	<1	8	<5	<5	<1		8	<1		<1		>10							>10	>10	<0.1
LSD 5%	0.9		0.9	0.9	-	0.9	0.9	1.2		-	0.8		0.5		-							-	-	0.12

j) Two sites, USA

	Turfgrass quality (1-9)															In-season diseases, %						Weeds, % of plot area			
No of sites reporting	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss	*Poa annua*	Sagina	Daily height growth, mm
	2	0	2	2	2	2	2	2	0	2	2	0	2	0	1	1	0	0	0	0	1	1	0	0	0	
Lodde	5.7	.	5.5	5.6	5.9	6.1	5.4	6.2	.	6.2	4.9	.	8.4	.	0.0	90	.	.	.	.	0.5	0.0	.	.	.	-
Gima	5.5	.	5.5	5.7	5.6	6.0	5.4	5.3	.	6.2	5.3	.	8.4	.	0.0	84	.	.	.	.	0.3	0.0	.	.	.	-
Musica	5.5	.	5.4	5.4	5.9	5.9	5.3	5.2	.	6.2	5.3	.	8.3	.	0.0	84	.	.	.	.	0.5	0.0	.	.	.	-
Orionette	5.4	.	5.5	5.2	5.6	5.7	5.3	5.6	.	5.8	4.6	.	8.3	.	0.0	85	.	.	.	.	0.4	0.0	.	.	.	-
Firan	5.3	.	5.7	5.3	4.8	5.8	5.0	5.7	.	5.9	4.9	.	8.3	.	0.0	85	.	.	.	.	0.8	0.0	.	.	.	-
Dancing	5.3	.	4.8	5.5	5.6	5.5	5.1	5.8	.	6.2	5.2	.	8.4	.	0.0	85	.	.	.	.	0.3	0.0	.	.	.	-
Barlineus	5.2	.	5.3	5.1	5.4	5.6	5.0	5.4	.	6.0	4.7	.	8.4	.	0.0	81	.	.	.	.	0.8	0.0	.	.	.	-
Radar	5.2	.	5.5	5.2	5.1	5.4	5.1	5.3	.	5.6	5.9	.	8.2	.	0.0	83	.	.	.	.	0.3	0.0	.	.	.	-
Lystig	5.0	.	5.1	4.9	5.3	5.2	5.0	4.7	.	6.0	4.7	.	8.2	.	0.0	87	.	.	.	.	0.4	0.0	.	.	.	-
Compass II	4.9	.	4.9	5.0	4.9	4.9	4.9	5.2	.	5.6	5.9	.	8.1	.	0.0	78	.	.	.	.	0.3	0.0	.	.	.	-
Lykke	4.8	.	4.9	4.7	5.0	5.2	4.6	4.6	.	5.5	4.7	.	8.4	.	0.0	79	.	.	.	.	0.9	0.0	.	.	.	-
Torona	4.7	.	4.8	4.8	5.0	5.2	4.7	4.0	.	5.7	5.2	.	8.3	.	0.0	80	.	.	.	.	0.4	0.0	.	.	.	-
Kalle	4.3	.	4.7	4.2	4.0	4.6	4.3	3.5	.	5.3	5.5	.	7.7	.	0.0	70	.	.	.	.	0.7	0.0	.	.	.	-
P%	0.1	-	>10	10	6	<1	11	<5	-	5	<1	-	<1	-	>10	<0.1	-	-	-	-	<0.1	>10	-	-	-	-
LSD 5%	0.6	-	-	-	-	0.7	0.7	1.2	-	0.6	0.6	-	0.3	-	-	5	-	-	-	-	0.3	-	-	-	-	-

3.3 Varieties of *Festuca rubra* ssp. *litoralis* Table 14

In total 11 varieties (8 candidate and 2 controls) of slender creeping red fescue (*Festuca rubra ssp. litoralis)* and one variety of strong creeping red fescue (*Festuca rubra* ssp. *rubra)* were tested. 'Charlotte' was tested in the Nordic trials only.

Microdochium patch in the varieties of slender creeping red fescue was in general higher than for the varieties of Chewings fescue. At Smørum big differences between the varieties of slender creeping red fescue was observed with 20-30 % microdochium patch during winter in several varieties compared to 0.2 % in the new variety 'Sea Mist' and 3 % in the control 'Cezanne'. 'Sea Mist' also had the lowest coverage of dollar spot at Smørum, significantly lower than several of the other varieties. 'Sea Mist' had also low coverage of dollar spot at Massachusetts, but not significantly different from the other varieties.

Across the three Nordic sites (except Smørum) 'Sybille' performed the best followed by the control 'Cezanne'. In the STRI list (STRI/BSPB, 2022) 'Cezanne' and 'Absolom' were ranked the highest of the varieties included in this SCANGREEN round. The variety of strong creeping red fescue 'DLF FRR-6039' was ranked lowest at all sites, which indicates that this subspecies is still not suitable for putting greens.

In USA 'Sea Mist' performed best across the two sites. 'Sybille' was on top in Minnesota, while it was second lowest in Massachusetts with the highest coverage of the weed *Digitaria sp.* (Crabgrass).

Table 14: Ranking of slender creeping red fescue (Festuca rubra ssp. litoralis) varieties after four years testing on putting greens in SCANGREEN trials at a) Korpa GC, (Iceland); b) Apelsvoll Research Center (Norway); c) average for Korpa and Apelsvoll representing the northern climatic zone of Scandinavia; d) Smørum GC (Denmark), e) Landvik Research Center (Norway); f) average for Smørum and Landvik representing the southern climatic zone of Scandinavia; and g) average for three test sites in Scandinavia (Smørum not included); h) University of Massachusetts; i) University of Minnesota; j) average for Massachusetts and Minnesota.

a) Reykjavik GC, Iceland (northern climatic zone)

No of observations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	18	2	6	5	5	3	10	3	1	7	7	3	4	3	3	16	17	8	2	4	3	11	14	14	11
Sybille	5.3	6.0	4.7	5.5	5.1	4.8	5.4	5.3	55	5.0	4.8	4.1	7.0	0.9	1.1	96	0.6	0.0	0.0	0.0	0.1	0.3	1.6	0.4	0.2
Charlotte	5.1	6.4	5.0	4.9	4.2	4.5	5.0	4.9	59	3.9	4.8	4.1	7.0	1.8	2.0	96	0.5	0.0	0.0	0.0	0.1	0.4	2.5	0.2	0.3
Barswilcan	5.0	6.5	4.8	4.9	3.9	4.0	4.8	5.0	58	3.9	4.7	3.9	7.0	1.4	1.5	95	0.6	0.1	0.0	0.0	0.0	0.4	2.9	0.3	0.3
Cezanne	5.0	6.2	4.7	4.8	4.2	4.2	4.9	4.9	52	4.1	4.7	4.2	7.0	0.9	1.0	96	0.4	0.0	0.0	0.0	0.0	0.3	2.3	0.3	0.6
Finesto	4.9	6.1	4.6	4.8	4.1	4.2	4.8	4.9	60	4.0	4.6	4.1	7.0	0.8	0.8	95	0.4	0.1	0.0	0.0	0.1	0.3	2.6	0.2	0.3
Absolom	4.9	6.2	4.5	4.8	4.1	4.2	4.8	4.8	57	4.0	4.6	4.1	7.0	0.5	0.6	95	0.5	0.0	0.0	0.0	0.0	0.3	2.5	0.2	0.7
Coptic	4.8	5.8	4.4	4.8	4.2	4.1	4.7	4.7	58	4.0	4.8	4.0	7.0	0.3	0.3	95	0.2	0.0	0.0	0.0	0.0	0.2	2.8	0.2	0.4
Zari	4.7	6.1	4.2	4.6	4.1	4.0	4.5	4.7	58	4.0	4.7	4.0	7.0	1.8	1.8	94	0.9	0.1	0.0	0.0	0.2	0.4	2.8	0.5	0.7
Sea Mist	4.5	5.8	3.9	4.4	3.8	3.8	4.2	4.4	57	4.0	4.8	4.1	7.0	0.3	0.4	95	0.2	0.0	0.0	0.0	0.0	0.2	2.6	0.6	0.5
Yoga	4.2	5.4	3.5	4.1	3.7	3.3	4.0	4.1	48	3.7	4.9	4.2	7.0	0.1	0.2	92	0.2	0.0	0.0	0.0	0.0	0.2	3.6	0.8	0.9
DLF FRR-6039	4.1	5.9	3.5	3.6	3.4	3.3	3.7	3.9	59	3.5	4.9	4.4	7.0	0.3	0.3	92	0.1	0.0	0.0	0.0	0.0	0.2	4.4	1.0	0.7
P%	<0.1	0.1	<0.1	0.3	2	<0.	0.2	<0.1	0.4	6	>10	<0.1	>10	<0.1	<0.1	1	0.4	>10	>10	-	5	<0.1	>10	<0.1	2
LSD 5%	0.5	0.4	0.4	0.7	0.8	0.5	0.7	0.5	5	-	-	0.1	-	0.6	0.6	2	0.3	-	-	-	0.1	0.1	-	0.3	0.4

b) NIBIO Apelsvoll Research Center (northern climatic zone)

No of observations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	20	1	5	7	7	6	9	5	1	15	6	2	5	3	3	19	6	6	0	0	0	9	6	0	6
Cezanne	5.8	5.3	6.3	6.3	5.2	6.0	6.1	5.6	45	5.1	5.4	3.3	8.0	3.6	2.6	96	0.5	0.5	0.0	0.0	0.0	0.8	0.3	0.0	0.3
Coptic	5.8	5.0	6.1	6.1	5.9	5.5	6.4	5.9	67	5.2	5.3	3.3	7.8	10.1	2.6	95	1.2	1.2	0.0	0.0	0.0	1.4	0.2	0.0	0.0
Sybille	5.8	4.7	5.7	6.7	6.0	5.5	6.4	6.0	52	5.4	5.2	3.5	8.0	4.2	2.8	96	0.2	0.2	0.0	0.0	0.0	0.6	0.2	0.0	0.1
Finesto	5.6	5.0	5.4	6.3	5.7	5.5	6.1	5.7	73	5.2	5.0	3.4	8.1	4.4	1.8	96	0.7	0.7	0.0	0.0	0.0	0.9	0.2	0.0	0.1
Barswilcan	5.6	5.3	6.4	6.0	4.6	5.4	6.0	5.5	53	5.0	5.0	2.9	7.5	6.4	2.7	97	0.6	0.6	0.0	0.0	0.0	0.9	0.3	0.0	0.1
Zari	5.6	4.3	5.5	6.9	5.5	5.4	6.2	5.8	60	5.3	5.1	3.3	8.0	3.8	1.6	96	0.2	0.2	0.0	0.0	0.0	0.5	0.2	0.0	0.0
Absolom	5.5	4.7	5.8	6.8	4.9	5.7	6.1	5.5	72	5.3	4.8	3.2	8.0	2.2	2.8	97	0.4	0.4	0.0	0.0	0.0	0.8	0.2	0.0	0.0
Sea Mist	5.5	4.3	6.3	6.6	4.8	6.5	6.1	4.9	62	5.1	5.5	2.1	8.0	3.7	1.3	97	0.4	0.4	0.0	0.0	0.0	0.6	0.3	0.0	0.1
Charlotte	5.5	4.7	6.3	6.1	4.8	5.3	6.2	5.3	58	4.9	5.5	2.8	8.0	5.0	3.0	96	0.7	0.6	0.1	0.0	0.0	1.0	0.3	0.0	0.1
Yoga	5.0	4.2	5.1	5.7	5.1	5.4	5.6	4.8	63	4.9	5.6	3.2	7.8	4.0	2.2	94	0.7	0.6	0.0	0.0	0.0	0.9	0.4	0.0	0.1
DLF FRR-6039	4.9	4.7	5.3	5.5	4.1	5.2	5.2	4.5	68	4.7	5.1	2.1	7.6	16.7	2.8	92	1.1	1.1	0.0	0.0	0.0	1.4	0.8	0.0	0.2
P%	>10	>1	>10	6	0.4	>10	>10	>10	3	>10	<0.1	<0.1	8	>10	3	>10	>10	>10	>10	-	-	>10	>10	-	>10
LSD 5%	-	-	-	-	0.9	-	-	-	16	-	0.3	0.4	-	-	1.0	-	-	-	-	-	-	-	-	-	-

c) Mean of two sites, northern climatic zone

No of sites reporting	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf fineness (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	2	2	2
Sybille	5.5	5.4	5.2	6.1	5.5	5.1	5.9	5.6	53	5.2	5.0	3.9	7.5	2.6	1.9	96	0.4	0.1	0.0	0.0	0.1	0.5	0.9	0.2	0.2
Cezanne	5.4	5.8	5.5	5.6	4.7	5.1	5.5	5.3	48	4.8	5.0	3.8	7.5	2.3	1.8	96	0.4	0.3	0.0	0.0	0.0	0.5	1.3	0.2	0.4
Charlotte	5.3	5.6	5.6	5.5	4.5	4.9	5.6	5.1	59	4.6	5.1	3.5	7.5	3.4	2.5	96	0.6	0.3	0.0	0.0	0.0	0.7	1.4	0.1	0.2
Barswilcan	5.3	5.9	5.6	5.5	4.2	4.7	5.4	5.3	56	4.7	4.9	3.5	7.3	3.9	2.1	96	0.6	0.3	0.0	0.0	0.0	0.6	1.6	0.1	0.2
Coptic	5.3	5.4	5.3	5.4	5.1	4.8	5.6	5.3	63	4.8	5.0	3.8	7.4	5.2	1.5	95	0.7	0.6	0.0	0.0	0.0	0.8	1.5	0.1	0.2
Finesto	5.3	5.6	5.0	5.6	4.9	4.9	5.4	5.3	67	4.8	4.8	3.8	7.5	2.6	1.3	96	0.6	0.4	0.0	0.0	0.1	0.6	1.4	0.1	0.2
Absolom	5.2	5.4	5.1	5.8	4.5	4.9	5.4	5.1	65	4.8	4.7	3.7	7.5	1.4	1.7	96	0.4	0.2	0.0	0.0	0.0	0.5	1.4	0.1	0.4
Zari	5.1	5.2	4.9	5.7	4.8	4.7	5.3	5.2	59	4.8	4.9	3.7	7.5	2.8	1.7	95	0.6	0.1	0.0	0.0	0.1	0.5	1.5	0.2	0.4
Sea Mist	5.0	5.1	5.1	5.5	4.3	5.1	5.2	4.7	59	4.8	5.1	3.3	7.5	2.0	0.9	96	0.3	0.2	0.0	0.0	0.0	0.4	1.4	0.3	0.3
Yoga	4.6	4.8	4.3	4.9	4.4	4.4	4.8	4.4	56	4.5	5.2	3.8	7.4	2.1	1.2	93	0.4	0.3	0.0	0.0	0.0	0.5	2.0	0.4	0.5
DLF FRR-6039	4.5	5.3	4.4	4.6	3.7	4.2	4.5	4.2	64	4.3	5.0	3.5	7.3	8.5	1.6	92	0.6	0.6	0.0	0.0	0.0	0.8	2.6	0.5	0.5
P%	0.4	>10	0.8	<0.1	<0.1	0.3	0.2	<0.1	0.7	0.7	<0.1	<0.1	0.4	>10	<0.1	1	>10	>10	>10	-	4	>10	>10	<0.1	>10
LSD 5%	0.5	-	0.7	0.6	0.6	0.5	0.6	0.6	9.0	0.4	0.2	0.2	0.2	-	0.6	2	0.4	-	-	-	0.1	-	-	0.1	-
Interact species x site	>10	>10	>10	>10	>10	0.4	>10	>10	>10	>10	0.6	<0.1	0.4	>10	0.2	>10	0.5	>10	5	-	4	4	>10	<0.1	>10

d) Smørum GC, Denmark (southern climatic zone)

No of observations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	11	*	*	4	7	2	6	3	1	3	2	1	2	1	1	10	20	7	4	0	8	8	0	1	0
Sea Mist	5.1	-	-	5.7	4.6	4.2	5.1	5.3	72	5.3	5.9	6.7	7.8	0.2	0.2	100	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
Coptic	4.7	-	-	4.9	4.5	4.2	4.7	5.0	57	5.4	5.8	5.0	8.0	11.5	11.5	99	0.2	0.0	0.0	0.0	1.6	1.3	0.0	0.0	0.0
Cezanne	4.5	-	-	4.6	4.3	4.3	4.3	4.8	35	5.6	6.2	5.0	8.0	3.0	3.0	97	1.1	0.0	0.1	0.0	3.1	1.2	0.0	0.0	0.0
Barswilcan	4.3	-	-	4.3	4.4	4.3	4.7	3.8	50	5.0	5.8	5.0	8.0	21.3	21.3	98	0.9	0.0	0.0	0.0	2.6	4.9	0.0	0.0	0.0
Sybille	4.2	-	-	4.4	4.1	3.5	4.6	4.0	57	4.7	6.0	3.7	7.8	22.0	22.0	97	1.4	0.0	0.0	0.0	6.2	4.7	0.0	0.2	0.0
Zari	4.2	-	-	4.3	4.1	3.8	4.6	3.8	57	5.0	5.4	4.7	7.8	27.0	27.0	95	2.4	0.0	0.0	0.0	6.3	5.5	0.0	0.0	0.0
Absolom	4.2	-	-	4.1	4.3	3.5	4.6	3.9	60	4.8	5.9	4.3	8.0	25.3	25.3	96	1.9	0.0	0.0	0.0	4.8	5.2	0.0	0.0	0.0
Yoga	4.1	-	-	4.1	4.1	3.8	4.3	4.0	57	5.1	6.3	6.3	7.9	16.3	16.3	98	1.1	0.0	0.1	0.0	2.7	2.8	0.0	0.1	0.0
Charlotte	4.0	-	-	4.3	3.7	3.0	4.4	3.8	53	4.4	6.0	4.7	7.7	30.0	30.0	97	0.8	0.0	0.0	0.0	4.3	5.9	0.0	0.0	0.0
Finesto	3.9	-	-	4.0	3.7	3.5	4.0	3.8	62	4.5	5.6	5.0	8.0	19.3	19.3	97	1.3	0.0	0.1	0.0	3.7	5.5	0.0	0.0	0.0
DLF FRR-6039	3.5	-	-	3.7	3.3	2.8	3.8	3.3	67	4.2	6.1	5.7	7.3	28.0	28.0	97	1.3	0.0	0.2	0.0	4.6	5.0	0.0	0.0	0.0
P%	0.3	-	-	1	2	8	<0.1	0.1	3	2	>10	0.2	5	<0.1	<0.1	>10	>10	-	0.9	-	3	<0.1	-	0.2	-
LSD 5%	0.6	-	-	0.9	0.7	-	0.5	0.8	17	0.7	-	1.2	0.4	9.6	9.6	-	-	-	0.1	-	3.3	2.0	-	0.1	-

*No data from 2019 and 2020, Scangreen at Smørum established in 2021.

e) NIBIO Landvik Research Center, Norway (southern climatic zone)

No of observations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %	Daily height growth, mm
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot					
	22	2	7	7	6	6	10	6	1	8	7	3	6	2	3	22	24	12	9	3	0	15	13	13	13	22
Zari	6.7	6.8	6.5	6.5	7.1	6.1	7.1	6.6	27	6.5	6.2	4.1	8.1	1.6	3.8	97	0.3	0.1	0.2	0.0	0.0	0.8	0.0	0.1	0.0	0.98
Cezanne	6.7	6.7	6.2	6.7	7.3	6.3	7.0	6.5	18	6.6	6.3	4.0	8.1	1.2	4.0	95	0.3	0.0	0.4	0.0	0.0	0.7	0.0	0.1	0.0	0.93
Absolom	6.6	7.1	6.3	6.2	6.9	5.9	6.9	6.6	32	6.3	6.2	3.7	8.0	1.5	3.7	97	0.3	0.1	0.2	0.0	0.0	0.9	0.0	0.2	0.0	0.99
Barswilcan	6.6	6.9	6.0	6.5	7.1	6.2	6.9	6.4	27	6.3	6.4	3.8	8.0	2.4	4.4	97	0.3	0.1	0.3	0.0	0.0	1.0	0.0	0.1	0.0	0.86
Sybille	6.5	6.8	6.4	6.2	6.9	5.5	7.0	6.6	28	6.0	6.1	3.8	8.0	0.4	2.3	96	0.1	0.0	0.1	0.0	0.0	0.5	0.1	0.3	0.1	0.91
Coptic	6.5	6.7	6.1	6.5	6.9	5.9	6.9	6.5	37	6.2	6.4	3.8	8.2	0.4	3.1	96	0.2	0.0	0.3	0.0	0.0	0.5	0.1	0.2	0.1	0.92
Finesto	6.4	6.8	6.0	6.2	6.7	5.8	6.8	6.3	38	6.3	6.1	3.8	8.0	2.1	5.0	97	0.3	0.1	0.3	0.0	0.0	0.9	0.1	0.1	0.0	0.96
Charlotte	6.2	6.7	5.8	6.0	6.4	5.3	6.6	6.1	32	6.2	6.3	3.9	8.0	5.1	7.1	96	0.5	0.2	0.4	0.0	0.0	1.3	0.0	0.2	0.0	0.85
Yoga	6.0	6.3	5.6	5.7	6.4	5.1	6.5	5.9	18	5.8	6.4	4.1	8.2	1.6	4.2	93	0.5	0.2	0.4	0.0	0.0	0.8	0.2	0.3	0.1	0.98
Sea Mist	6.0	6.5	5.6	5.8	6.2	5.4	6.3	5.8	32	5.6	6.4	2.6	8.0	0.3	3.0	95	0.3	0.1	0.3	0.0	0.0	0.6	0.3	0.4	0.1	1.14
DLF FRR-6039	5.4	6.1	5.1	5.1	5.2	4.4	5.8	5.4	30	5.4	6.1	3.1	8.1	0.6	3.7	94	0.6	0.0	0.5	0.0	0.0	0.6	0.4	0.5	0.2	1.10
P%	<0.1	<0.1	<0.1	0.2	<0.1	0.3	<0.1	<0.1	0.7	<0.1	>10	<0.1	>10	3	3	<0.1	0.5	>10	0.2	-	-	0.2	>10	0.2	0.1	
LSD 5%	0.4	0.3	0.4	0.6	0.7	0.8	0.4	0.3	10	0.5	-	0.5	-	2.4	2.2	2	0.2	-	0.2	-	-	0.3	-	0.2	0.1	

f) Mean of two sites, southern climatic zone (balanced data from 2021 and 2022 only)

	Turfgrass quality (1-9)																In-season diseases, %								
No of sites	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	2	-	-	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Cezanne	5.7	-	-	5.6	5.8	5.9	5.8	5.7	-	6.5	6.4	3.8	8.1	2.1	5.0	98	0.9	0.0	0.4	0.0	1.6	1.1	0.0	0.1	0.0
Coptic	5.7	-	-	5.7	5.7	5.4	5.9	5.8	-	6.0	6.2	3.7	8.1	4.1	6.9	99	0.3	0.0	0.3	0.0	0.8	1.0	0.1	0.2	0.1
Barswilcan	5.6	-	-	5.4	5.8	5.8	6.0	5.2	-	6.0	6.3	3.8	8.0	9.5	11.4	98	0.8	0.1	0.3	0.0	1.3	3.1	0.0	0.1	0.0
Sea Mist	5.6	-	-	5.7	5.4	4.9	5.9	5.6	-	5.6	6.4	3.2	7.9	0.3	3.1	99	0.3	0.1	0.3	0.0	0.1	0.4	0.3	0.4	0.1
Zari	5.5	-	-	5.4	5.6	5.3	6.0	5.3	-	6.1	6.0	3.8	8.0	10.6	12.8	97	1.5	0.1	0.3	0.0	3.2	3.3	0.0	0.1	0.0
Sybille	5.4	-	-	5.3	5.5	4.8	6.0	5.3		5.5	6.2	3.3	8.0	7.7	9.7	98	0.8	0.0	0.1	0.0	3.1	2.6	0.1	0.4	0.1
Absolom	5.4	-	-	5.1	5.6	5.0	5.8	5.3	-	5.9	6.3	3.4	8.0	9.8	12.1	98	1.3	0.1	0.2	0.0	2.4	3.2	0.0	0.2	0.0
Finesto	5.2	-	-	5.1	5.2	5.0	5.5	5.1	-	5.8	6.0	3.7	8.0	8.4	11.4	98	1.0	0.1	0.4	0.0	1.9	3.4	0.1	0.1	0.0
Yoga	5.1	-	-	4.9	5.3	4.7	5.5	5.1	-	5.8	6.5	4.3	8.1	6.9	9.6	98	1.0	0.2	0.4	0.0	1.4	2.0	0.2	0.4	0.1
Charlotte	5.1	-	-	5.1	5.0	4.5	5.6	4.9	-	5.6	6.3	3.7	7.9	15.0	17.1	98	0.9	0.2	0.4	0.0	2.1	3.9	0.0	0.2	0.0
DLF FRR-6039	4.3	-	-	4.4	4.3	3.8	4.8	4.3	-	5.0	6.3	3.4	7.8	9.8	13.1	97	1.1	0.0	0.6	0.0	2.3	2.9	0.4	0.6	0.2
P%	<0.1	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	-	2	>10	>10	5	<0.1	<0.1	>10	>10	>10	<0.1	-	>10	<0.1	>10	<0.1	0.7
LSD 5%	0.5	-	-	0.5	0.5	0.8	0.5	0.5	-	-	-	-	0.2	5	5	-	-	-	0.2	-	-	1	-	0.2	0.1
Interact species x site	2	-	-	1	>10	>10	5	>10	-	>10	>10	<0.1	>10	<0.1	<0.1	>10	>10	>10	3	-	>10	<0.1	>10	0.3	0.7

g) Mean of three sites (Smørum not included), Nordic countries

	Turfgrass quality (1-9)																In-season diseases, %								
No of sites	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf fineness (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Sybille	5.9	5.8	5.6	6.1	6.0	5.3	6.3	6.0	45	5.5	5.3	3.8	7.7	1.8	2.1	96	0.3	0.1	0.0	0.0	0.0	0.5	0.6	0.2	0.1
Cezanne	5.8	6.1	5.7	5.9	5.6	5.5	6.1	5.7	38	5.5	5.4	3.9	7.7	1.9	2.5	96	0.4	0.2	0.1	0.0	0.0	0.6	0.9	0.1	0.3
Barswilcan	5.7	6.3	5.7	5.8	5.2	5.2	6.0	5.7	46	5.3	5.4	3.6	7.5	3.4	2.9	96	0.5	0.3	0.1	0.0	0.0	0.8	1.1	0.1	0.1
Coptic	5.7	5.8	5.5	5.8	5.7	5.2	6.1	5.7	54	5.3	5.5	3.8	7.7	3.6	2.0	96	0.6	0.4	0.1	0.0	0.0	0.7	1.0	0.1	0.2
Absolom	5.7	6.0	5.5	6.0	5.3	5.3	6.0	5.6	54	5.4	5.2	3.7	7.7	1.4	2.3	96	0.4	0.2	0.1	0.0	0.0	0.7	0.9	0.1	0.3
Zari	5.7	5.8	5.4	6.0	5.5	5.2	6.1	5.7	48	5.5	5.3	3.9	7.7	2.4	2.4	95	0.5	0.1	0.1	0.0	0.1	0.6	1.0	0.2	0.3
Finesto	5.7	6.0	5.3	5.8	5.5	5.2	6.0	5.6	57	5.4	5.2	3.8	7.7	2.4	2.6	96	0.5	0.3	0.1	0.0	0.0	0.7	0.9	0.1	0.1
Charlotte	5.6	5.9	5.7	5.7	5.1	5.0	6.0	5.4	50	5.2	5.5	3.7	7.7	3.9	4.0	96	0.6	0.3	0.2	0.0	0.0	0.9	1.0	0.1	0.1
Sea Mist	5.3	5.5	5.3	5.6	4.9	5.2	5.6	5.1	50	5.1	5.6	3.1	7.7	1.4	1.6	96	0.3	0.2	0.1	0.0	0.0	0.5	1.1	0.3	0.2
Yoga	5.1	5.3	4.7	5.2	5.1	4.6	5.5	4.9	43	5.0	5.6	3.9	7.6	1.9	2.2	93	0.4	0.3	0.1	0.0	0.0	0.6	1.4	0.4	0.4
DLF FRR-6039	4.8	5.5	4.6	4.7	4.2	4.3	5.0	4.6	53	4.7	5.4	3.3	7.6	5.8	2.3	93	0.6	0.4	0.2	0.0	0.0	0.8	1.9	0.5	0.4
P%	<0.1	3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	>10	>10	<0.1	<0.1	>10	>10	<0.1	-	3	3	>10	<0.1	4
LSD 5%	0.4	0.5	0.5	0.4	0.4	0.4	0.4	0.4	7	0.3	0.1	0.2	-	-	0.9	2	-	-	0.1	-	0.05	0.3	-	0.1	0.2
Interact species x site	>10	>10	>10	>10	>10	0.3	>10	>10	>10	>10	1	<0.1	3	>10	2	>10	0.6	>10	<0.1	-	1	2	>10	<0.1	3

h) University of Massachusetts

	Turfgrass quality (1-9)																In-season diseases, %								
No of obser-vations	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss	*Digitaria*	Sagina
	16	0	7	5	4	5	10	1	0	3	6	0	6	0	0	4	5	0	0	0	5	0	0	6	0
Sea Mist	5.5	-	5.0	5.7	6.1	5.7	5.5	5.2	-	6.4	7.4	-	7.8	-	-	79	0.4	-	-	-	0.4	-	-	5.1	-
Absolom	5.3	-	5.0	5.8	5.3	5.9	5.0	5.5	-	6.9	6.9	-	7.7	-	-	76	0.4	-	-	-	0.4	-	-	5.9	-
Finesto	4.8	-	4.7	5.4	4.4	5.2	4.7	4.3	-	6.4	6.6	-	7.6	-	-	68	0.3	-	-	-	0.3	-	-	12.3	-
Coptic	4.7	-	4.9	5.2	3.8	5.2	4.5	4.5	-	6.4	7.6	-	7.8	-	-	68	0.7	-	-	-	0.7	-	-	18.7	-
Zari	4.7	-	4.4	5.1	4.8	5.1	4.6	3.8	-	6.6	6.6	-	7.6	-	-	67	0.4	-	-	-	0.4	-	-	8.7	-
Cezanne	4.3	-	4.2	4.7	4.2	4.8	4.1	3.9	-	6.0	6.9	-	7.6	-	-	71	0.4	-	-	-	0.4	-	-	15.4	-
Barswilcan	4.1	-	3.8	4.5	4.2	5.0	3.7	3.2	-	6.2	6.7	-	7.3	-	-	65	0.5	-	-	-	0.5	-	-	14.0	-
DLF-FRR-6039	3.8	-	3.8	3.9	3.9	4.5	3.6	3.2	-	5.3	6.5	-	7.2	-	-	58	1.1	-	-	-	1.1	-	-	16.9	-
Sybille	3.8	-	3.8	4.0	3.5	4.4	3.6	2.2	-	6.2	7.0	-	7.6	-	-	58	0.4	-	-	-	0.4	-	-	27.3	-
Yoga	3.8	-	3.7	4.1	3.4	4.0	3.7	3.0	-	5.7	7.3	-	7.4	-	-	61	0.4	-	-	-	0.4	-	-	22.5	-
P%	<0.1	-	<0.1	<1	<0.1	<1	<0.1	<0.	-	<1	<0.1	-	<0.	-	-	<0.1	>10	-	-	-	>10	-	-	<0.1	-
LSD 5%	0.6	-	0.6	1.0	0.9	0.8	0.7	1.1	-	0.6	0.3	-	0.3	-	-	8.0	-	-	-	-	-	-	-	7.2	-

i) University of Minnesota

	Turfgrass quality (1-9)																In-season diseases, %							
No of obser-vations	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Weeds, % of plot area	Daily height growth, mm
	17	0	5	6	6	6	9	2	0	6	6	0	3	0	3	4	5	0	0	0	5	3	19	14
Sybille	5.6	-	5.9	5.9	5.2	5.7	5.8	4.7	-	5.8	2.9	-	8.9	-	0.0	-	-	-	-	-	-	0.0	1.1	1.06
Barswilcan	5.5	-	5.8	4.9	5.7	5.6	5.4	5.0	-	5.8	4.0	-	8.9	-	0.0	-	-	-	-	-	-	0.0	1.9	0.93
Zari	5.4	-	6.3	5.1	5.1	5.6	5.5	4.7	-	5.6	3.0	-	8.9	-	0.0	-	-	-	-	-	-	0.0	0.7	1.18
Finesto	5.4	-	6.5	5.2	4.6	5.4	5.6	4.5	-	5.7	3.5	-	9.0	-	0.0	-	-	-	-	-	-	0.0	4.8	1.10
Absolom	5.3	-	6.3	5.2	4.5	5.6	5.3	4.3	-	5.6	2.8	-	8.9	-	0.0	-	-	-	-	-	-	0.0	0.8	1.07
Sea Mist	5.3	-	4.9	5.4	5.5	5.2	5.3	5.7	-	5.3	3.8	-	8.7	-	0.0	-	-	-	-	-	-	0.0	1.2	1.52
Cezanne	4.8	-	5.4	4.7	4.5	4.9	4.9	4.4	-	5.4	3.7	-	8.8	-	0.0	-	-	-	-	-	-	0.0	3.3	1.19
Yoga	4.2	-	5.3	4.1	3.4	4.4	4.3	3.0	-	4.8	3.4	-	8.9	-	0.0	-	-	-	-	-	-	0.0	1.2	1.24
Coptic	4.2	-	5.9	4.2	2.8	4.4	4.3	2.8	-	4.5	3.8	-	8.9	-	0.0	-	-	-	-	-	-	0.0	0.9	1.14
DLF-FRR-6039	3.0	-	4.1	3.0	2.2	3.3	3.2	1.3	-	4.2	3.9	-	8.4	-	0.0	-	-	-	-	-	-	0.0	4.1	1.61
P%	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.	-	<0.1	<1	-	>10	-	>10	-	-	-	-	-	-	>10	>10	<0.1
LSD 5%	0.8	-	0.8	0.8	1.2	0.8	0.8	1.2	-	0.5	0.6	-	-	-	-	-	-	-	-	-	-	-	-	0.14

j) Mean of two sites, USA

No of sites reporting	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	2	0	2	2	2	2	2	2	0	2	2	0	2		1	1					1	1			
Sea Mist	5.4	.	5.0	5.6	5.8	5.5	5.4	5.5	.	5.9	5.6	.	8.3	.	0.0	79	.	.	.	.	0.4	0.0	.	.	.
Absolom	5.3	.	5.7	5.5	4.9	5.8	5.2	4.9	.	6.3	4.9	.	8.3	.	0.0	76	.	.	.	.	0.4	0.0	.	.	.
Finesto	5.1	.	5.6	5.3	4.5	5.3	5.2	4.4	.	6.1	5.1	.	8.3	.	0.0	68	.	.	.	.	0.3	0.0	.	.	.
Zari	5.1	.	5.4	5.1	5.0	5.4	5.1	4.3	.	6.1	4.8	.	8.3	.	0.0	67	.	.	.	.	0.4	0.0	.	.	.
Barswilcan	4.8	.	4.8	4.7	5.0	5.3	4.6	4.1	.	6.0	5.4	.	8.1	.	0.0	65	.	.	.	.	0.5	0.0	.	.	.
Sybille	4.7	.	4.9	5.0	4.4	5.1	4.7	3.5	.	6.0	5.0	.	8.3	.	0.0	58	.	.	.	.	0.4	0.0	.	.	.
Cezanne	4.6	.	4.8	4.7	4.4	4.9	4.5	4.2	.	5.7	5.3	.	8.2	.	0.0	71	.	.	.	.	0.4	0.0	.	.	.
Coptic	4.5	.	5.4	4.7	3.3	4.8	4.4	3.7	.	5.5	5.7	.	8.4	.	0.0	68	.	.	.	.	0.7	0.0	.	.	.
Yoga	4.0	.	4.5	4.1	3.4	4.2	4.0	3.0	.	5.3	5.4	.	8.2	.	0.0	61	.	.	.	.	0.4	0.0	.	.	.
DLF-FRR-6039	3.4	.	4.0	3.5	3.1	3.9	3.4	2.3	.	4.8	5.2	.	7.8	.	0.0	58	.	.	.	.	1.1	0.0	.	.	.
P%	>10	-	>10	9	8	10	>10	>10		<5	>10	-	10	-	>10	<0.1					>10	>10			
LSD 5%	-	-	-		-	-	-	-	-	0.7	-	-	-	-	-	8					-	-			

3.4 Varieties of *Agrostis capillaris* Table 15

In total 5 varieties (One candidate and 4 controls) of colonial bentgrass (*Agrostis capillaris*) were tested. At Apelsvoll all 5 were tested, at the other sites only the new variety 'Musket' and the two controls 'Heritage' and 'Jorvik'. Take-all-patch was observed at Reykjavik (1.5-2.0 % coverage), but with no significant differences between the varieties.

Microdochium patch was observed in the northern zone at Apelsvoll with significantly lower coverage in 'Leirin' compared to 'Jorvik', 'Musket' and 'Heritage'. In the southern zone 'Jorvik' had significantly lower coverage of microdochium patch during winter than the other varieties. Across the three Nordic sites: Reykjavik, Apelsvoll and Landvik there was no difference between the varieties in overall turfgrass quality, but 'Jorvik' had the lowest overall winter damage and the least microdocium patch across all years. In USA 'Musket' performed best in turfgrass overall impression, with 'Jorvik' at the lowest. In the STRI list (STRI/BSPB, 2022) 'Musket' was ranked higher than 'Heritage' and 'Jorvik'.

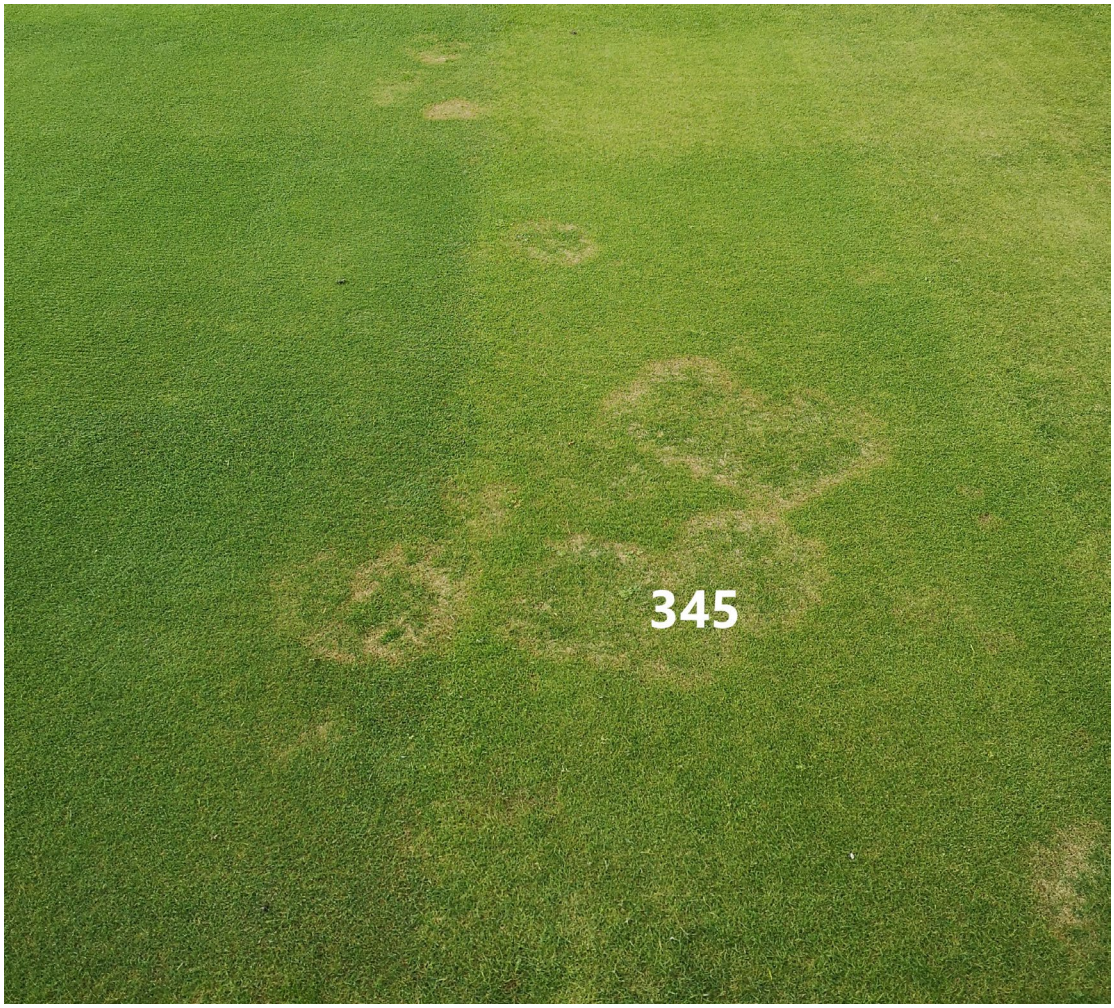


Photo 17: Take-all-patch was observed in the mixtures at Landvik in 2020, but not in the plots with pure varieties of colonial bentgrass. Plot 345 is a mixture of colonial bentgrass 'Greenspeed' and fescues 'Cezanne', 'Musica' and 'Barlineus'. Photo: Karin J. Hesselsøe.

Table 15: Ranking of colonial bentgrass (Agrostis capillaris) varieties after four years testing on putting greens in SCANGREEN trials at a) Korpa GC, (Iceland); b) Apelsvoll Research Center (Norway); c) average for Korpa and Apelsvoll representing the northern climatic zone of Scandinavia; d) Smørum GC (Denmark); e) Landvik Research Center (Norway); f) average for Smørum and Landvik representing the southern climatic zone of Scandinavia; and g) average for three test sites in Scandinavia; h) University of Massachusetts; i) University of Minnesota; j) average for Massachusetts and Minnesota.

a) Reykjavik GC, Iceland (northern climatic zone)

	Turfgrass quality (1-9)																In-season diseases, %								
No of observations	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	18	2	6	5	5	3	10	3	1	7	7	3	4	3	3	16	17	8	0	4	0	11	14	14	11
Heritage	5.6	7.1	3.5	5.9	5.7	4.0	5.5	5.9	63	6.6	5.7	3.3	6.0	0.9	0.9	95	1.4	0.0	0.0	1.8	0.0	0.3	0.4	0.8	0.4
Jorvik	5.4	7.1	3.2	5.6	5.8	3.9	5.3	5.8	66	6.5	5.7	3.3	6.0	1.3	1.3	95	1.4	0.0	0.0	1.5	0.0	0.4	0.3	0.7	0.4
Musket	5.2	7.1	3.0	5.3	5.3	3.4	5.0	5.5	67	6.4	5.7	3.1	6.0	0.7	0.7	92	2.2	0.0	0.0	2.0	0.0	0.3	0.5	0.9	0.6
P%	>10	>1	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	-	>10	>10	>10	>10	-	-	>10	-	>10	>10	>10	2
LSD 5%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1

b) NIBIO Apelsvoll Research Center (northern climatic zone)

No of observations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	20	1	5*	7	7	6	9	5	1	15	6	2	5	3	3	19	6	6	0	0	0	9	6	0	6
Leirin	4.6	4.0	6.0	4.8	3.5	5.7	4.5	4.3	38	5.4	6.3	2.0	4.6	4.4	2.6	91	0.7	0.2	0.0	0.0	0.0	0.8	0.8	0.0	0.5
AberRoyal	4.1	4.0	-	4.0	4.4	2.6	4.9	4.3	52	5.5	6.4	2.4	5.1	57.4	6.7	82	1.7	1.3	0.0	0.0	0.0	1.9	0.0	0.0	0.1
Jorvik	4.1	4.3	-	3.6	4.5	2.9	4.2	4.7	45	5.1	6.5	2.4	5.1	42.8	8.8	86	1.6	0.8	0.0	0.0	0.0	1.5	0.1	0.0	0.2
Musket	4.1	4.0	-	3.9	4.5	3.2	4.9	4.1	48	5.2	6.0	2.8	5.2	47.2	9.1	85	3.9	2.9	0.0	0.0	0.0	3.6	0.0	0.0	0.1
Heritage	4.0	4.0	-	3.7	4.3	2.1	4.8	4.2	47	5.3	6.6	2.4	5.8	51.0	8.7	85	3.9	2.7	0.0	0.0	0.0	3.4	0.1	0.0	0.3
P%	>10	>1	-	>10	>10	<0.1	>10	>10	>10	>10	>10	0.4	>10	<0.1	5	<0.1	<0.1	0.8	-	-	-	1	3	-	>10
LSD 5%	-	-	-	-	-	1.2	-	-	-	-	-	0.3	-	7.2	6	6	1.1	1.4	-	-	-	1.6	0.5	-	-

* Only data for Leirin in 2020 due to unsuccessful reestablishment of the other varieties.

c) Mean of two sites, northern climatic zone

No of sites	Turfgrass quality (1-9)																In-season diseases, %								
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf fineness (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	2	0	2	2	1	2
Heritage	4.9	5.6	3.5	4.8	5.0	3.2	5.2	5.2	55	5.8	6.0	3.0	5.9	25.9	4.8	91	2.5	1.2	0.0	1.0	0.0	1.6	0.3	0.5	0.4
Jorvik	4.9	5.7	3.2	4.6	5.1	3.5	4.9	5.3	55	5.7	6.0	3.0	5.7	22.0	5.0	91	1.5	0.3	0.0	0.8	0.0	0.9	0.2	0.4	0.3
Musket	4.7	5.6	3.0	4.6	4.9	3.3	5.0	4.9	58	5.7	5.8	3.0	5.7	24.0	4.9	89	2.9	1.2	0.0	1.1	0.0	1.7	0.3	0.5	0.4
P%	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	4	>10	>10	>10	>10	>10	4	2	-	>10	-	3	>10	>10
LSD 5%	-	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	0.8	-	-	-	0.8	-	-
Interact species x	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	4	4	>10	>10	>10	>10	1.2	2	-	>10	-	3	>10	>10

d) Smørum GC, Denmark (southern climatic zone)

No of observations	Turfgrass quality (1-9)																In-season diseases, %								
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	11	-	-	4	7	2	6	3	1	3	2	1	2	1	1	10	20	7	4	0	0	8	0	0	0
Heritage	4.3	-	-	4.5	4.0	3.5	4.6	4.0	100	6.3	7.1	4.7	5.8	8.0	8.0	98	0.3	0.3	0.0	0.0	0.0	4.6	0.0	0.0	0.0
Musket	4.1	-	-	4.3	3.9	3.8	4.3	3.8	100	6.1	6.8	5.3	6.0	5.3	5.3	99	0.4	0.4	0.0	0.0	0.0	3.4	0.0	0.0	0.0
Jorvik	3.8	-	-	3.7	3.9	3.2	3.8	4.1	100	5.8	7.2	5.0	5.8	5.3	5.3	98	0.3	0.3	0.0	0.0	0.0	2.2	0.0	0.0	0.0
P%	>10	-	-	7	>10	>10	7	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	-	-	-	>10	-	-	-
LSD 5%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

e) NIBIO Landvik Research Center, Norway (southern climatic zone)

	Turfgrass quality (1-9)																In-season diseases, %									
No of observations	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %	Daily height growth, mm
	22	2	7	7	6	6	10	6	1	8	7	3	6	2	3	22	12	12	0	0	0	15	0	13	0	22
Musket	6.5	7.7	6.4	5.5	6.4	4.8	7.2	6.5	67	6.4	6.3	3.7	6.4	21.6	17.4	95	1.5	1.5	0.0	0.0	0.0	4.4	0.0	0.4	0.0	0.65
Heritage	6.3	7.3	5.9	5.9	6.2	4.8	7.0	6.5	62	6.4	6.3	3.9	6.4	12.4	12.7	95	2.0	1.5	0.0	0.0	0.0	3.6	0.0	0.4	0.0	0.69
Jorvik	6.3	7.3	6.0	6.0	5.9	4.5	6.8	6.8	62	6.3	6.5	3.7	6.4	5.0	5.9	96	1.2	0.6	0.0	0.0	0.0	1.8	0.0	0.6	0.0	0.74
P%	>10	>1	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	-	-	-	>10	-	>10	-	
LSD 5%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

f) Mean of two sites, southern climatic zone (balanced data from 2021 and 2022 only)

	Turfgrass quality (1-9)																In-season diseases, %							
No of sites	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk	Tiller density (1-9)	In-season color (1-9, 9 is	Winter color (1-9, 9 most	Leaf fineness (1-9)	Overall winter	Microdochium patch	In-season coverage of	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss, %	*Poa annua*, %
	2	-	-	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	2	0	1
Heritage	5.1	-	-	5.2	5.1	4.1	5.7	5.4		6.1	6.5	3.5	6.2	13.	14.	97	1.1	1.2	0.0	0.0	0.0	4.5	0.0	0.4
Musket	5.0	-	-	4.9	5.1	4.0	5.6	5.2		6.0	6.4	3.5	6.3	23.	19.	97	1.4	1.7	0.0	0.0	0.0	5.1	0.0	0.4
Jorvik	4.9	-	-	4.9	4.9	4.0	5.2	5.3		5.9	6.5	3.4	6.2	4.9	5.9	98	0.7	0.8	0.0	0.0	0.0	2.1	0.0	0.6
P%	>10	-	-	>10	>10	>10	>10	>10	>1	>1	>1	>1	>1	3	>1	>1	2	1	-	-	-	2	>10	>10
LSD 5%	-	-	-	-	-	-	-	-	-	-	-	-	-	9.4	-	-	0.5	0.5	-	-	-	2	-	-
Interact species x	>10	-	-	>10	>10	>10	>10	>10	>1	>1	>1	>1	>1	2	>1	>1	4	2	-	-	-	>10	>10	>10

g) Mean of three sites (Smørum not included), both climatic zones

	Turfgrass quality (1-9)																In-season diseases, %								
No of sites	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf fineness (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Heritage	5.4	6.1	4.7	5.2	5.4	3.8	6.0	5.6	57	6.1	6.1	3.3	6.1	21.4	7.4	92	2.3	1.3	0.0	0.6	0.0	2.3	0.2	0.4	0.2
Jorvik	5.4	6.3	4.6	5.1	5.4	3.9	5.8	5.8	57	5.9	6.2	3.2	6.0	16.4	5.3	93	1.4	0.5	0.0	0.5	0.0	1.2	0.1	0.5	0.2
Musket	5.4	6.3	4.7	4.9	5.4	3.9	6.0	5.5	61	6.0	6.0	3.2	6.0	23.2	9.1	91	2.4	1.3	0.0	0.7	0.0	2.7	0.2	0.5	0.3
P%	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	1	>10	>10	2	>10	>10	4	0.4	-	>10	-	0.3	>10	>10	>10
LSD 5%	-	-	-	-	-	-	-	-	-	-	0.2	-	-	5	-	-	-	0.6	-	-	-	0.8	-	-	-
Interact species x	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	2	>10	>10	3	>10	>10	0.9	-	-	>10	-	-	>10	>10	>10

h) University of Massachusetts

	Turfgrass quality (1-9)															In-season diseases, %							
No of obser-vations	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss	*Digitaria*
	16	0	7	5	4	5	10	1	0	3	6	0	6	0	0	4	5	0	0	0	5	0	0	6
Heritage	7.1		6.8	7.5	7.3	6.1	7.6	8.0		7.9	7.6		5.5			89	0.1				0.1			0.6
Musket	6.8		6.3	7.2	7.4	5.6	7.4	7.7		8.0	7.0		5.8			89	0.1				0.1			0.6
Jorvik	6.3		6.1	6.5	6.3	5.3	6.7	7.5		7.6	7.2		5.1			85	0.0				0.0			1.3
P%	<5		<5	<5	5	>10	<5	>10		<1	>10		5			<5	>10				>10			<10
LSD 5%	0.6		0.5	0.6	0.9	-	0.8	-		0.2	-		0.5			2					-			-

i) University of Minnesota

	Turfgrass quality (1-9)																In-season diseases, %							
No of obser-vations	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Weeds, % of plot area	Daily height growth, mm
	17	0	5	6	6	6	9	2	0	6	6	0	3	0	3	4	5	0	0	0	5	3	19	14
Musket	4.9		5.2	4.7	4.8	4.8	5.0	5.0		5.2	5.0		7.4		0.0							0.0	2.1	1.25
Heritage	4.7		4.9	5.2	4.2	4.8	4.8	4.3		5.5	4.8		7.8		1.0							1.0	0.6	1.36
Jorvik	4.1		5.3	4.1	3.2	4.2	4.3	3.5		5.0	4.1		7.0		3.3							3.3	0.5	1.28
P%	<5		>10	<1	<1	8	<1	<5		9	<5		<5		>10							>10	>10	>10
LSD 5%	0.4		-	0.4	0.7	-	0.4	0.9		-	0.5		0.5		-							-	-	-

j) Two sites in US

	Turfgrass quality (1-9)															In-season diseases, %							
No of sites	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Weeds, % of plot area	Daily height growth, mm
	2	0	2	2	2	2	2	2	0	2	2	0	2	0	2	0	0	0	0	0	0	2	2	-
Musket	4.9		5.2	4.7	4.8	4.8	5.0	5.0		5.2	5.0		7.4		0.0							0.0	2.1	-
Heritage	4.7		4.9	5.2	4.2	4.8	4.8	4.3		5.5	4.8		7.8		1.0							1.0	0.6	-
Jorvik	4.1		5.3	4.1	3.2	4.2	4.3	3.5		5.0	4.1		7.0		3.3							3.3	0.5	-
P%	<5		>10	<1	<1	8	<1	<5		9	<5		<5		>10							>10	>10	-
LSD 5%	0.4		-	0.4	0.7	-	0.4	0.9		-	0.5		0.5		-							-	-	-

3.5 Varieties of *Agrostis stolonifera* Table 16

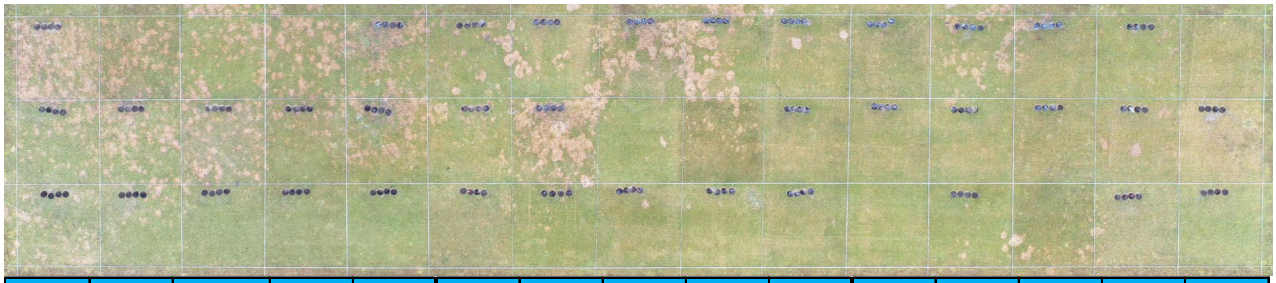
In total 17 varieties (9 candidate and 8 controls) of creeping bentgrass (*Agrostis stolonifera*) were tested. 'Crystal Blue' and 'Penntrio' were only tested in the northern zone of the Nordic countries, 'Pure Distinction' only in Massachusetts and the southern zone of the Nordic countries and 'Pure Select' only in Massachusetts and in both Nordic zones. 'Valderrama' was retested in this SCANGREEN round as it was seeded later than the other varieties in the previous testing (2015-18).

Across the three Nordic test sites Reykjavik, Apelsvoll and Landvik the results showed that the new varieties 'Matchplay', 'L-93 XD' and '777 Triple Seven' performed the best, closely followed by 'Piranha' and 'Valderrama' which were in line with the control variety 'Luminary'. Lowest ranked in the Nordic test zones was 'Pure Select', which had significantly higher winter damage and coverage of microdochium patch during winter than the other varieties of creeping bentgrass. The poor performance of 'Pure Select' was noticeable at Landvik in the southern zone (Photo 19). On the contrary, 'Pure Select' was ranked as third best in Massachusetts, but it was not tested in Minnesota. In Reykjavik 'Ardent', which is darker in color than the other varieties, was ranked with highest turfgrass overall impression. The top varieties from last SCANGREEN (Aamlid et al., 2019) 'Riptide' and 'Luminary' were in the middle on average for Reykjavik, Apelsvoll and Landvik, but 'Riptide' performed poorly at Smørum. 'Pure Distinction' which was tested only in the southern zone was ranked low with high coverage of microdochium patch.

The old and coarse-leaved variety 'Penncross' was ranked the lowest on average for the two American sites and the second lowest on average for Reykjavik, Apelsvoll and Landvik in the Nordic countries. The old seed blend was even worse with winter damage and overall coverage of microdochim on level with 'Pure Select' and significantly more than 'Penncross' in the northern zone of the Nordic countries.

In USA 'Matchplay' was ranked the highest with low coverage of microdochium patch during winter in Minnesota compared to 'Tripleseven' (='777 Triple Seven').

Photo 18: Varieties of creeping bentgrass at Landvik October 2020. Plots with 'Ardent' darker in color. Photo: Karin J. Hesselsøe.



146 Pure Select (27)	147 Ardent (28)	148 Matchplay (31)	149 Valderrama (29)	150 Tour Pro (30)	246 Riptide (35)	247 L-93 XD (32)	248 Independence (34)	249 DLF-PS AP-3018 (25)	250 Pure Distinction (40)	346 007 (37)	347 DC 1 (33)	348 Luminary (36)	349 Tripleseven (26)	350 Valderrama (29)
151 Riptide (35)	152 Tripleseven (26)	153 Penncross (38)	154 007 (37)	155 DLF-PS AP-3018 (25)	251 DC 1 (33)	Pure Select (27)	253 Matchplay (31)	254 Ardent (28)	255 Luminary (36)	351 Tour Pro (30)	352 L-93 XD (32)	Independence (34)	354 Pure Select (27)	355 Pure Distinction (40)
156 Pure Distinction (40)	157 DC 1 (33)	158 Luminary (36)	159 Independence (34)	160 L-93 XD (32)	256 Penncross (38)	257 Tripleseven (26)	258 Valderrama (29)	259 Tour Pro (30)	260 007 (37)	356 Matchplay (31)	357 DLF-PS AP-3018 (25)	358 Ardent (28)	359 Penncross (38)	360 Riptide (35)

Photo 19: Microdochium patch in varieties of creeping bentgrass at Landvik February 2022. Drone photo: Karin J. Hesselsøe.

Table 16: Ranking of creeping bentgrass (Agrostis stolonifera) varieties after four years testing on putting greens in SCANGREEN trials at a) Reykjavik GC (Iceland); b) Apelsvoll Research Center (Norway); c) average for Reykjavik and Apelsvoll representing the northern climatic zone of the Nrdic countries; d) Smørum GC (Denmark); e) Landvik Research Center (Norway); f) average for Smørum and Landvik representing the southern climatic zone of the Nordic countries; g) average for three test sites in Scandinavia (Smørum not included); h) University of Massachusetts; i) University of Minnesota; j) average for Massachusetts and Minnesota.

a) Reykjavik GC, Iceland (northern climatic zone)

	Turfgrass quality (1-9)																In-season diseases, %								
No of observations	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	18	2	6	5	5	3	10	3	1	7	7	3	4	3	3	16	17	8	0	4	0	11	14	14	11
Ardent	5.9	6.7	4.3	6.4	6.1	4.2	6.4	6.0	58	7.1	5.7	3.8	6.0	1.3	1.4	97	0.9	0.3	0.0	0.5	0.0	0.6	0.1	0.5	0.5
Penncross	5.8	6.6	3.9	6.7	6.0	4.4	6.1	5.8	65	6.6	5.0	3.5	5.6	1.8	2.0	98	1.2	0.3	0.0	1.1	0.0	0.6	0.0	0.3	0.2
Matchplay	5.8	6.6	4.1	6.3	6.1	4.3	6.2	5.8	68	7.2	5.0	3.5	6.0	2.4	2.4	97	1.5	1.0	0.0	0.3	0.0	1.3	0.1	0.4	0.1
Valderrama	5.7	6.5	4.0	6.3	5.9	4.0	6.1	5.8	62	7.1	5.0	3.5	6.0	1.5	1.6	97	1.3	0.4	0.0	1.1	0.0	0.7	0.1	0.4	0.5
007	5.7	6.5	3.8	6.3	6.1	4.2	6.1	5.8	64	7.1	5.0	3.5	6.0	1.9	2.0	97	1.3	0.4	0.0	0.7	0.0	0.8	0.2	0.5	0.2
Riptide	5.7	6.4	3.8	6.2	6.3	4.1	6.2	5.7	65	7.1	5.0	3.4	6.0	2.5	2.6	97	1.3	0.6	0.0	0.1	0.0	1.0	0.1	0.4	0.2
Piranha	5.7	6.5	3.9	6.2	6.0	4.1	6.1	5.8	65	7.1	5.0	3.4	6.0	2.5	2.6	97	1.7	0.8	0.0	0.7	0.0	1.1	0.1	0.5	0.3
777 Triple Seven	5.7	6.5	3.9	6.0	6.2	4.0	6.1	5.8	64	7.1	5.0	3.4	6.0	3.8	3.9	96	1.7	0.7	0.0	0.7	0.0	1.3	0.0	0.6	0.2
L-93 XD	5.6	6.3	3.7	6.2	6.4	4.2	6.0	5.8	67	7.2	5.0	3.4	6.0	3.1	3.3	97	1.3	0.5	0.0	0.3	0.0	1.0	0.0	0.5	0.2
Macdonald	5.6	6.4	3.8	6.1	6.0	4.1	6.0	5.7	63	7.2	5.0	3.3	6.0	4.6	4.6	96	1.7	0.8	0.0	0.5	0.0	1.4	0.1	0.4	0.2
Crystal Blue	5.6	6.4	3.9	6.2	5.9	4.2	6.0	5.6	67	7.0	5.0	3.4	6.0	2.2	2.3	97	1.5	0.6	0.0	0.8	0.0	0.9	0.2	0.3	0.2
Luminary	5.5	6.4	4.0	6.0	5.7	3.9	5.9	5.7	64	7.0	5.0	3.6	6.0	2.6	2.7	96	1.9	0.7	0.0	1.5	0.0	1.1	0.2	0.5	0.3
Tour Pro	5.5	6.3	3.8	5.9	5.9	4.0	5.9	5.6	66	7.1	5.0	3.4	6.0	2.9	3.1	95	2.1	1.2	0.0	0.4	0.0	1.6	0.1	0.6	0.3
Independence	5.4	6.2	3.6	6.0	6.0	4.0	5.9	5.5	65	7.0	5.0	3.5	6.0	2.6	2.6	96	1.6	0.4	0.0	1.3	0.0	0.8	0.1	0.5	0.2
Penntrio	5.4	6.5	3.8	6.0	5.5	4.0	5.8	5.4	64	6.8	5.0	3.4	6.0	3.0	3.7	96	1.9	0.5	0.0	1.2	0.0	1.0	0.2	0.6	0.3
Pure Select	5.1	6.3	3.7	4.8	5.6	3.3	5.3	5.4	60	7.0	5.0	3.4	6.0	8.2	8.5	94	2.6	1.6	0.0	0.6	0.0	2.4	0.2	0.7	0.4
P%	0.1	>10	1	<0.1	<0.1	<0.1	1	<0.1	>10	<0.1	<0.1	<0.1	<0.1	0.9	0.7	0.8	2	3	-	>10	-	1	>10	>10	0.2
LSD 5%	0.3	-	0.3	0.6	0.3	0.4	0.4	0.3	-	0.2	0.1	0.2	0.1	3.0	2.9	1.5	0.8	0.7	-	-	-	0.8	-	-	0.2

b) NIBIO Apelsvoll Research Center, Norway (northern climatic zone)

No of observations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	15	1	0	7	7	4	8	3	1	12	6	2	5	3	3	0	6	6	0	0	0	9	0	0	0
777 Triple Seven	5.6	6.0	-	4.4	6.3	2.7	6.3	5.9	79	5.9	5.3	3.7	6.4	64.0	4.8	88	1.8	1.8	0.0	0.0	0.0	1.9	0.0	0.0	0.0
L-93 XD	5.5	5.3	-	4.8	6.5	3.2	6.4	5.8	53	6.1	5.0	4.5	6.6	52.0	7.7	90	1.1	1.1	0.0	0.0	0.0	1.5	0.0	0.0	0.0
Valderrama	5.3	6.3	-	4.3	5.3	2.4	5.8	5.4	82	5.5	5.5	3.0	5.3	64.4	10.8	88	2.4	2.4	0.0	0.0	0.0	2.9	0.0	0.0	0.0
Matchplay	5.3	6.0	-	4.4	5.4	2.5	6.1	5.1	82	5.6	4.8	2.8	6.1	68.2	8.4	87	3.4	3.4	0.0	0.0	0.0	3.6	0.0	0.0	0.0
Luminary	5.2	6.3	-	4.2	5.1	2.4	5.7	5.1	80	5.2	4.9	2.7	5.5	66.9	9.4	87	2.5	2.5	0.0	0.0	0.0	2.7	0.0	0.0	0.0
Tour Pro	5.2	5.7	-	4.3	5.6	2.5	6.2	5.1	78	5.6	4.9	3.2	5.9	68.1	9.9	87	3.0	3.0	0.0	0.0	0.0	3.4	0.0	0.0	0.0
Independence	5.1	5.7	-	4.3	5.3	2.6	5.5	5.3	73	5.5	5.2	3.0	5.6	63.3	7.7	89	1.6	1.6	0.0	0.0	0.0	1.9	0.0	0.0	0.0
Macdonald	5.1	5.7	-	4.1	5.5	2.5	5.9	5.0	80	5.6	5.1	2.9	6.0	70.1	8.9	87	2.8	2.8	0.0	0.0	0.0	3.3	0.0	0.0	0.0
Piranha	5.0	4.7	-	4.4	6.0	2.6	6.3	5.1	48	5.5	5.3	3.5	5.9	73.0	13.6	87	1.8	1.8	0.0	0.0	0.0	3.1	0.0	0.0	0.0
Crystal Blue	5.0	5.3	-	4.5	5.2	2.4	5.7	5.2	47	5.5	5.3	3.0	5.4	63.2	7.4	86	2.8	2.8	0.0	0.0	0.0	3.1	0.0	0.0	0.0
Riptide	4.7	5.0	-	4.4	4.8	2.4	5.5	4.8	62	5.2	5.1	3.0	5.7	65.9	7.7	86	3.1	3.1	0.0	0.0	0.0	3.4	0.0	0.0	0.0
Pure Select	4.7	5.7	-	3.9	4.5	2.1	5.2	4.6	81	5.0	5.2	2.3	5.4	74.4	14.2	84	5.0	5.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0
007	4.6	5.3	-	4.3	4.3	2.2	5.1	4.6	60	5.3	5.4	2.5	5.2	55.1	14.1	85	3.8	3.8	0.0	0.0	0.0	4.1	0.0	0.0	0.0
Penncross	4.6	5.0	-	4.4	4.4	2.4	5.4	4.4	65	5.0	5.0	2.5	4.8	63.3	6.4	87	2.5	2.5	0.0	0.0	0.0	2.8	0.0	0.0	0.0
Ardent	4.6	5.7	-	4.2	3.9	2.1	4.9	4.5	70	5.4	6.4	2.3	5.4	71.3	13.0	85	4.4	4.4	0.0	0.0	0.0	5.2	0.0	0.0	0.0
Penntrio	4.2	5.0	-	4.1	3.7	1.8	5.8	3.8	23	4.7	5.2	1.8	4.2	80.6	21.1	80	6.5	6.5	0.0	0.0	0.0	8.0	0.0	0.0	0.0
P%	2	>10	-	5	0.3	<0.1	>10	<0.1	>10	<0.1	<0.1	<0.1	<0.1	0.3	>10	<0.1	<0.1	<0.1	-	-	-	<0.1	-	-	-
LSD 5%	0.7	-	-	0.4	1.3	0.4	-	0.8	-	0.4	0.4	0.6	0.5	11.2	-	3	1.8	1.8	-	-	-	2.1	-	-	-

c) Mean of two sites, northern climatic zone

No of sites reporting	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf fineness (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown species, %	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2
777 Triple Seven	5.6	6.3	3.9	5.2	6.3	3.5	6.2	5.8	72	6.4	5.1	3.5	6.1	33.9	4.4	93	1.8	1.2	0.0	0.4	0.0	1.5	0.0	0.3	0.1
L-93 XD	5.6	5.8	3.7	5.5	6.4	3.8	6.2	5.8	60	6.5	5.0	3.8	6.2	27.6	5.5	94	1.2	0.8	0.0	0.2	0.0	1.2	0.0	0.3	0.1
Matchplay	5.5	6.3	4.1	5.4	5.7	3.6	6.2	5.5	75	6.2	4.9	3.2	6.0	35.3	5.4	92	2.3	2.0	0.0	0.2	0.0	2.3	0.0	0.2	0.0
Valderrama	5.5	6.4	4.0	5.3	5.6	3.3	6.0	5.6	72	6.1	5.2	3.3	5.7	33.0	6.2	93	1.8	1.3	0.0	0.6	0.0	1.7	0.1	0.2	0.3
Piranha	5.4	5.6	3.9	5.3	6.0	3.5	6.2	5.5	57	6.2	5.1	3.4	6.0	37.8	8.1	92	1.7	1.2	0.0	0.4	0.0	2.0	0.1	0.3	0.2
Luminary	5.4	6.4	4.0	5.1	5.4	3.3	5.9	5.4	72	5.9	5.0	3.2	5.8	34.7	6.1	92	2.1	1.5	0.0	0.8	0.0	1.8	0.1	0.3	0.2
Macdonald	5.4	6.0	3.8	5.1	5.7	3.4	6.0	5.4	71	6.2	5.0	3.2	6.0	37.4	6.8	92	2.2	1.7	0.0	0.3	0.0	2.2	0.1	0.2	0.1
Tour Pro	5.4	6.0	3.8	5.1	5.8	3.4	6.0	5.4	72	6.2	5.0	3.3	6.0	35.5	6.5	92	2.5	2.0	0.0	0.2	0.0	2.4	0.0	0.3	0.2
Crystal Blue	5.3	5.9	3.9	5.3	5.5	3.4	5.9	5.4	57	6.1	5.1	3.3	5.8	32.7	4.9	92	2.0	1.5	0.0	0.5	0.0	1.9	0.1	0.2	0.1
Ardent	5.3	6.2	4.3	5.3	5.0	3.3	5.8	5.3	64	6.1	6.0	3.2	5.8	36.3	7.2	92	2.4	2.1	0.0	0.3	0.0	2.6	0.1	0.3	0.3
Penncross	5.3	5.8	3.9	5.5	5.2	3.6	5.9	5.2	65	5.6	5.0	3.1	5.3	32.6	4.2	93	1.7	1.2	0.0	0.7	0.0	1.5	0.0	0.2	0.1
Independence	5.3	5.9	3.6	5.1	5.6	3.4	5.7	5.4	69	6.1	5.1	3.3	5.9	33.0	5.2	93	1.6	0.9	0.0	0.7	0.0	1.3	0.1	0.3	0.1
Riptide	5.3	5.7	3.8	5.3	5.5	3.4	5.9	5.3	63	6.0	5.0	3.2	5.9	34.2	5.1	92	2.1	1.7	0.0	0.1	0.0	2.0	0.1	0.2	0.1
007	5.2	5.9	3.8	5.3	5.2	3.4	5.7	5.3	62	6.0	5.1	3.1	5.7	28.5	8.1	92	2.4	1.8	0.0	0.4	0.0	2.2	0.1	0.3	0.2
Penntrio	4.9	5.7	3.8	5.0	4.6	3.1	5.8	4.7	44	5.6	5.1	2.7	5.4	41.8	12.4	89	3.9	3.1	0.0	0.7	0.0	4.0	0.1	0.3	0.2
Pure Select	4.9	6.0	3.7	4.4	5.0	2.9	5.3	5.0	71	5.8	5.1	2.9	5.8	41.3	11.4	90	3.6	3.0	0.0	0.3	0.0	4.0	0.1	0.4	0.2
P%	0.8	>10	>10	<0.1	<0.1	<0.1	2	<0.1	>10	<0.1	<0.1	<0.1	<0.1	<0.1	>10	<0.1	<0.1	<0.1	-	>10	-	<0.1	>10	>10	<0.1
LSD 5%	0.4	-	-	0.4	0.7	0.3	0.5	0.4	-	0.3	0.2	0.3	0.3	5.7	-	2	1.0	1.0	-	-	-	1.1	-	-	0.1
Interact species x site	3	>1	>10	>10	0.8	<0.	4	0.2	5	2	0.6	<0.1	<0.1	0.3	>10	0.2	<0.1	<0.1	-	>10	-	<0.1	>10	>10	<0.1

d) Smørum GC, Denmark (southern climatic zone)

	Turfgrass quality (1-9)																In-season diseases, %								
No of observations	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	11	*	*	4	7	2	6	3	1	3	2	1	2	1	1	10	9	7	0	1	1	8	0	0	0
Luminary	5.2	-	-	5.6	4.7	5.5	5.1	4.8	100	7.4	6.7	6.0	5.6	1.0	1.0	99	0.3	0.3	0.0	0.0	0.0	2.3	0.0	0.0	0.0
Tour Pro	5.1	-	-	5.8	4.5	5.2	5.0	4.9	100	7.4	6.6	6.0	5.9	3.3	3.3	99	0.4	0.5	0.0	0.0	0.0	3.0	0.0	0.0	0.0
Matchplay	5.1	-	-	5.5	4.6	4.7	5.2	4.9	100	7.6	6.6	5.3	5.8	9.7	9.7	99	0.4	0.5	0.0	0.1	0.0	2.5	0.0	0.0	0.0
L-93 XD	5.1	-	-	5.9	4.2	4.8	4.8	5.0	100	7.4	6.7	6.0	5.6	3.8	3.8	99	0.6	0.7	0.0	0.0	0.0	3.3	0.0	0.0	0.0
Independence	4.9	-	-	5.4	4.4	5.0	4.9	4.7	100	7.2	7.0	6.0	5.5	2.2	2.2	99	0.3	0.3	0.0	0.0	0.0	2.5	0.0	0.0	0.0
Piranha	4.9	-	-	5.4	4.4	4.5	5.0	4.7	100	7.4	6.8	6.3	5.8	11.4	11.4	99	1.0	1.2	0.0	0.0	0.0	4.9	0.0	0.0	0.0
777 Triple Seven	4.9	-	-	5.7	4.1	4.3	4.8	4.8	100	7.3	6.8	5.3	5.9	9.6	9.6	99	1.0	1.1	0.0	0.0	0.0	4.3	0.0	0.0	0.0
Macdonald	4.8	-	-	5.6	4.0	3.5	5.3	4.4	100	7.4	6.6	5.3	5.9	14.2	14.2	98	1.4	1.6	0.0	0.0	0.0	5.6	0.0	0.0	0.0
Ardent	4.7	-	-	5.0	4.5	5.0	4.5	4.7	100	7.3	8.0	7.0	5.8	4.0	4.0	99	0.3	0.3	0.0	0.1	0.0	1.9	0.0	0.0	0.0
Valderrama	4.6	-	-	5.0	4.2	4.3	4.6	4.6	100	7.0	7.1	6.3	5.8	4.2	4.2	99	0.4	0.4	0.0	0.0	0.0	2.3	0.0	0.0	0.0
007	4.6	-	-	5.0	4.2	4.5	4.8	4.2	100	7.5	6.8	5.7	5.8	6.8	6.8	99	0.5	0.5	0.0	0.0	0.1	3.1	0.0	0.0	0.0
Penncross	4.6	-	-	4.8	4.4	4.5	5.0	4.1	100	6.5	6.7	5.0	5.3	2.8	2.8	100	0.2	0.2	0.0	0.0	0.0	2.0	0.0	0.0	0.0
Pure Distinction	4.6	-	-	5.3	3.9	3.8	4.6	4.5	100	7.0	6.3	5.7	5.9	19.7	19.7	98	1.7	2.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0
Riptide	4.6	-	-	5.3	3.8	4.0	4.6	4.4	100	7.2	6.8	5.7	6.0	6.3	6.3	94	0.3	0.3	0.0	0.0	0.0	1.7	0.0	0.0	0.0
Pure Select	4.3	-	-	4.6	3.9	3.7	4.4	4.2	100	6.8	6.7	4.7	5.8	40.3	40.3	97	2.0	2.3	0.0	0.0	0.0	7.3	0.0	0.0	0.0
P%	>10	-	-	>10	>10	>10	>10	>10	>10	>10	<0.1	>10	>10	>10	>10	>10	>10	>10	-	>10	>10	>10	-	-	-
LSD 5%	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*No data from 2019 and 2020, Scangreen at Smørum established in 2021.

e) NIBIO Landvik Research Center, Norway (southern climatic zone)

No of observations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %	Daily height growth, mm
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot					
	22	2	7	7	6	6	10	6	1	8	7	3	6	2	3	22	14	12	1	1	0	15	0	13	1	22
Matchplay	7.8	8.0	7.5	7.8	8.0	6.7	8.5	7.8	35	7.5	7.1	5.3	7.3	4.5	3.4	98	0.2	0.1	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.71
L-93 XD	7.6	7.9	7.3	7.3	8.0	6.5	8.2	7.7	37	7.3	7.1	5.2	7.6	2.4	2.1	98	0.2	0.2	0.0	0.1	0.0	0.7	0.0	0.1	0.0	0.68
007	7.5	8.0	7.1	7.1	7.7	6.5	8.1	7.3	37	7.3	7.3	5.4	7.0	2.5	1.4	98	0.2	0.1	0.0	0.2	0.0	0.6	0.0	0.2	0.0	0.80
777 Triple Seven	7.4	8.0	7.1	6.9	7.7	6.2	8.1	7.3	38	7.2	7.2	5.3	7.6	5.0	4.2	98	0.3	0.2	0.0	0.0	0.0	1.1	0.0	0.1	0.0	0.71
Piranha	7.4	7.8	6.9	6.9	7.8	6.1	8.1	7.3	33	7.4	7.3	5.1	7.3	5.1	6.4	97	0.4	0.2	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.74
Luminary	7.3	7.8	6.9	6.9	7.8	6.4	7.9	7.1	40	7.3	7.2	5.2	7.0	4.6	2.8	98	0.4	0.3	0.0	0.3	0.0	0.9	0.0	0.1	0.0	0.77
Riptide	7.2	8.0	6.7	6.9	7.3	5.8	7.9	7.3	35	7.1	7.1	5.1	7.3	4.5	4.0	98	0.3	0.2	0.0	0.0	0.0	1.1	0.0	0.1	0.0	0.73
Ardent	7.2	8.0	7.1	6.7	7.1	5.9	8.0	7.0	42	7.3	8.0	6.0	7.4	6.0	5.1	98	0.3	0.2	0.0	0.0	0.0	1.2	0.0	0.2	0.1	0.73
Valderrama	7.1	7.8	6.6	6.8	7.3	5.8	7.8	7.1	23	7.1	7.4	5.4	6.9	5.9	6.6	96	0.4	0.3	0.0	0.1	0.0	1.3	0.0	0.2	0.0	0.83
Macdonald	7.1	8.0	7.1	6.2	7.3	5.8	7.8	7.0	30	7.1	7.0	5.1	7.3	8.0	8.9	97	0.4	0.3	0.0	0.1	0.0	1.7	0.0	0.1	0.0	0.69
Pure Distinction	7.1	7.9	6.8	6.2	7.4	5.6	7.7	7.1	35	7.2	6.8	4.6	7.5	3.3	11.7	97	0.5	0.4	0.0	0.0	0.0	2.2	0.0	0.1	0.0	0.70
Tour Pro	7.1	7.9	6.8	6.2	7.4	5.8	7.7	7.1	33	7.0	7.1	5.2	7.0	6.7	4.7	97	0.6	0.3	0.0	0.3	0.0	1.3	0.0	0.1	0.1	0.76
Independence	7.0	7.8	6.5	6.6	6.9	5.7	7.7	6.7	38	7.2	7.4	5.2	6.8	7.8	7.4	97	0.6	0.3	0.1	0.4	0.0	1.4	0.0	0.2	0.1	0.80
Pure Select	6.7	7.9	6.4	5.7	6.7	4.7	7.5	6.7	30	6.9	7.0	4.6	7.5	31.0	20.4	96	1.2	1.0	0.0	0.0	0.0	3.9	0.0	0.2	0.0	0.72
Penncross	6.4	7.7	6.0	5.8	6.2	5.1	7.1	6.3	27	6.5	7.1	4.9	5.9	5.1	5.3	97	0.5	0.3	0.0	0.0	0.0	1.3	0.0	0.4	0.0	1.01
P%	0.5	>1	0.1	>4	0.8	>1	>2	<0.1	>10	>3	<0.1	<0.1	<0.1	0.5	0.5	>10	<0.1	<0.1	>10	>10	-	<0.1	-	>2	>10	
LSD 5%	0.6	-	0.6	1.1	0.9	1.0	0.6	0.5	-	0.5	0.3	0.4	0.4	11.3	7.7	-	0.3	0.2	-	-	-	1.1	-	0.2	-	

f) Mean of two sites, southern climatic zone (balanced data from 2021 and 2022 only)

	Turfgrass quality (1-9)																In-season diseases, %								
No of sites reporting	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf fineness (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	2	-	-	2	2	2	2	2	-	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Matchplay	6.5	-	-	6.6	6.3	6.0	6.9	6.5	-	7.7	6.8	5.0	6.8	7.2	6.1	99	0.3	0.4	0.0	0.0	0.0	1.7	0.0	0.0	0.0
L-93 XD	6.3	-	-	6.6	6.1	5.7	6.6	6.5	-	7.5	6.8	5.2	6.9	3.1	3.0	99	0.4	0.5	0.0	0.0	0.0	2.0	0.0	0.1	0.0
Luminary	6.3	-	-	6.2	6.3	6.1	6.6	6.1	-	7.4	6.9	5.3	6.5	4.6	2.9	99	0.4	0.4	0.0	0.0	0.0	1.7	0.0	0.1	0.0
Piranha	6.2	-	-	6.2	6.1	5.6	6.7	6.0	-	7.5	6.9	5.2	6.8	7.4	7.7	99	0.7	0.8	0.0	0.0	0.0	3.2	0.0	0.0	0.0
777 Triple Seven	6.1	-	-	6.3	5.9	5.4	6.5	6.0	-	7.3	6.9	5.1	7.1	7.6	6.4	99	0.6	0.7	0.0	0.0	0.0	2.8	0.0	0.1	0.0
007	6.0	-	-	6.1	6.0	5.8	6.5	5.8	-	7.5	7.0	5.3	6.6	4.5	3.5	99	0.3	0.4	0.0	0.0	0.0	1.8	0.0	0.2	0.0
Tour Pro	6.0	-	-	6.0	6.0	5.4	6.2	6.1	-	7.0	6.7	5.3	6.6	7.1	5.4	98	0.5	0.6	0.0	0.1	0.0	2.3	0.0	0.1	0.1
Valderrama	5.9	-	-	5.9	5.8	5.2	6.3	5.9	-	7.1	7.2	5.5	6.5	6.5	5.3	99	0.4	0.5	0.0	0.0	0.0	1.8	0.0	0.2	0.0
Independence	5.8	-	-	6.0	5.7	5.4	6.3	5.7	-	7.3	7.2	5.2	6.3	7.4	6.8	99	0.4	0.4	0.1	0.0	0.0	2.2	0.0	0.2	0.1
Riptide	5.8	-	-	6.1	5.6	5.1	6.3	6.0	-	7.1	6.8	5.0	6.9	6.3	5.3	96	0.3	0.4	0.0	0.0	0.0	1.5	0.0	0.1	0.0
Ardent	5.8	-	-	5.8	5.8	5.4	6.2	5.7	-	7.3	8.0	6.1	6.8	6.9	6.2	99	0.4	0.4	0.0	0.1	0.0	1.8	0.0	0.2	0.1
Macdonald	5.8	-	-	5.9	5.6	4.7	6.5	5.7	-	7.2	6.6	4.9	6.9	12.6	12.9	98	1.0	1.1	0.0	0.0	0.0	4.0	0.0	0.1	0.0
Pure Distinction	5.7	-	-	5.7	5.7	4.6	6.2	6.0	-	7.1	6.5	4.6	6.9	9.5	17.4	98	1.2	1.4	0.0	0.0	0.0	4.7	0.0	0.1	0.0
Penncross	5.3	-	-	5.3	5.3	4.7	5.9	5.0	-	6.5	6.8	4.9	5.7	5.2	4.7	99	0.4	0.4	0.0	0.0	0.0	1.7	0.0	0.4	0.0
Pure Select	5.2	-	-	5.1	5.3	3.8	5.9	5.5	-	6.7	6.8	4.4	6.9	42.8	31.2	97	1.9	2.2	0.0	0.0	0.0	6.7	0.0	0.2	0.0
P%	2	-	-	>10	4	0.5	>10	3	-	0.3	<0.1	0.4	<0.1	<0.1	<0.1	>10	0.3	0.5	>10	>10	>10	<0.1	-	0.5	>10
LSD 5%	0.7	-	-	-	0.6	0.9	-	0.7	-	0.5	0.3	0.7	0.3	14.2	12.4	-	0.7	0.9	-	-	-	2.2	-	0.2	-
Interact species x	>10	-	-	>10	>10	>10	>10	>10	-	>10	>10	>10	0.9	>10	>10	>10	>10	>10	>10	>10	>10	>10	-	0.5	>10

g) Mean of three sites (Smørum not included), both climatic zones

	Turfgrass quality (1-9)																In-season diseases, %								
No of sites reporting	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf fineness (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Matchplay	6.4	6.9	5.8	6.2	6.5	4.7	7.2	6.3	61	6.8	5.7	4.0	6.5	25.1	4.8	94	1.5	1.3	0.0	0.1	0.0	1.8	0.0	0.2	0.0
L-93 XD	6.3	6.5	5.5	6.1	6.9	4.8	7.1	6.5	52	6.9	5.8	4.4	6.8	19.2	4.3	95	0.9	0.6	0.0	0.1	0.0	1.1	0.0	0.2	0.1
777 Triple Seven	6.3	6.8	5.5	5.8	6.7	4.5	7.0	6.3	60	6.8	5.9	4.2	6.7	24.3	4.3	95	1.2	0.8	0.0	0.2	0.0	1.4	0.0	0.2	0.1
Valderrama	6.1	6.9	5.3	5.8	6.2	4.3	6.8	6.2	56	6.6	6.0	4.1	6.2	24.0	6.3	94	1.3	0.9	0.0	0.4	0.0	1.5	0.0	0.2	0.2
Piranha	6.1	6.3	5.4	5.9	6.6	4.5	7.0	6.1	49	6.7	5.9	4.0	6.5	26.9	7.5	94	1.2	0.8	0.0	0.3	0.0	1.7	0.0	0.2	0.1
Luminary	6.1	6.8	5.4	5.7	6.2	4.5	6.8	6.0	62	6.5	5.8	4.0	6.3	24.7	5.0	94	1.5	1.0	0.0	0.6	0.0	1.5	0.1	0.2	0.1
007	6.0	6.6	5.5	5.9	6.0	4.6	6.7	6.0	54	6.6	5.9	3.9	6.3	19.8	5.8	94	1.6	1.2	0.0	0.3	0.0	1.6	0.1	0.2	0.1
Ardent	6.0	6.8	5.7	5.8	5.7	4.3	6.8	5.9	57	6.6	6.7	4.3	6.4	26.2	6.5	94	1.7	1.4	0.0	0.2	0.0	2.1	0.0	0.2	0.2
Macdonald	6.0	6.7	5.5	5.5	6.2	4.3	6.8	6.0	58	6.6	5.8	3.9	6.5	27.6	7.5	94	1.5	1.2	0.0	0.2	0.0	2.0	0.0	0.2	0.1
Tour Pro	6.0	6.6	5.3	5.5	6.3	4.3	6.7	6.0	59	6.5	5.7	4.0	6.4	25.9	5.9	94	1.8	1.4	0.0	0.3	0.0	2.0	0.0	0.3	0.1
Riptide	6.0	6.5	5.3	5.8	6.1	4.3	6.8	6.1	54	6.5	5.8	3.9	6.5	24.3	4.7	94	1.4	1.1	0.0	0.1	0.0	1.7	0.0	0.2	0.1
Independence	5.9	6.6	5.1	5.6	6.1	4.3	6.6	5.9	59	6.6	5.9	4.0	6.2	24.6	5.9	95	1.2	0.7	0.0	0.6	0.0	1.3	0.1	0.3	0.1
Penncross	5.7	6.4	5.0	5.6	5.5	4.2	6.4	5.6	52	6.0	5.8	3.8	5.6	23.4	4.6	95	1.3	0.9	0.0	0.4	0.0	1.4	0.0	0.3	0.1
Pure Select	5.6	6.6	5.0	4.8	5.6	3.5	6.3	5.6	57	6.3	5.8	3.6	6.5	37.9	14.4	92	2.7	2.3	0.0	0.2	0.0	3.9	0.1	0.3	0.1
P%	<0.1	>10	<0.1	<0.1	<0.1	<0.1	<0.	<0.1	>10	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	0.3	<0.1	<0.1	>10	3	-	<0.1	>10	>10	<0.1
LSD 5%	0.3	-	0.3	0.5	0.6	0.4	0.4	0.3	-	0.2	0.2	0.3	0.2	5.5	4.5	1	0.6	0.6	-	0.3	-	0.8	-	-	0.1
Interact species x	2	>10	0.4	>10	4	>10	5	0.2	>10	>10	2	<0.1	<0.1	>10	>10	2	<0.1	<0.1	>10	>10	-	2	>10	>10	<0.1

h) University of Massachusetts

	Turfgrass quality (1-9)															In-season diseases, %						Weeds, % of plot area			
No of obser-vations	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss	*Digitaria*	Sagina	Daily height growth, mm
	16	0	7	5	4	5	10	1	0	3	6	0	6	0	0	4	5	0	0	0	5	0	0	6	0	0
Riptide	6.5		6.6	6.6	6.2	5.8	6.8	7.2		7.2	5.3		5.4			89	0.6				0.6			0.3		
Tripleseven	6.3		6.7	6.7	5.1	5.7	6.5	7.2		7.1	5.2		5.3			85	1.5				1.5			0.0		
Pure Select	6.3		6.4	6.9	5.4	5.7	6.5	7.2		7.5	5.2		6.1			85	1.3				1.3			0.2		
L-93 XD	6.3		6.3	6.9	5.5	5.9	6.4	7.2		7.3	5.2		5.4			85	1.1				1.1			0.1		
Matchplay	6.3		6.5	6.8	5.3	5.7	6.5	7.5		7.3	5.3		5.1			84	0.5				0.5			0.6		
Piranha	6.2		6.0	6.7	6.0	5.3	6.6	7.0		6.6	5.5		5.0			85	0.3				0.3			0.4	-	-
Macdonald	6.1		6.4	6.8	4.6	5.5	6.3	7.5		7.2	5.3		5.7			81	0.8				0.8			0.2	-	-
Tour Pro	6.0		5.7	6.5	6.0	5.3	6.3	6.8		6.0	5.4		5.1			80	0.4				0.4			0.4	-	-
Pure Distincti	5.9		6.2	6.6	4.4	5.1	6.1	7.2		7.2	5.1		5.4			77	1.4				1.4			0.6	-	-
Ardent	5.8		5.8	6.5	4.8	5.1	6.0	7.0		6.6	6.5		4.8			80	1.5				1.5			0.3	-	-
Luminary	5.7		5.6	6.2	5.2	5.0	6.0	6.5		5.7	5.3		4.3			83	1.3				1.3			0.2	-	-
OO7	5.6		5.5	6.5	4.9	5.2	5.8	6.2		6.2	5.3		5.1			80	0.7				0.7			0.7	-	-
Valderrama	5.6		5.3	6.2	5.4	4.7	6.0	6.7		6.4	5.5		4.8			75	0.5				0.5			1.6	-	-
Independence	5.5		5.5	6.3	4.6	4.9	5.7	6.3		5.9	5.3		4.9			74	2.1				2.1			0.4	-	-
Penncross	4.8		4.9	5.5	4.0	4.7	4.9	5.0		5.7	4.9		4.0			77	0.8				0.8			0.9	-	-
P%	<0.1		<1	<0.1	<0.1	<1	<1	<1		<0.1	<0.1		<0.1			>10	<1				<1			>10	-	-
LSD 5%	0.6		0.9	0.4	0.8	0.7	0.7	1.1		0.4	0.2		0.4			-	0.9				0.9			-	-	-

i) University of Minnesota

	Turfgrass quality (1-9)															In-season diseases, %							
No of obser-vations	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown species, %	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Weeds, % of plot area	Daily height growth, mm
	17	0	5	6	6	6	9	2	0	6	6	0	3	0	3	4	5	0	0	0	5	3	19	14
Matchplay	5.6		5.9	5.4	5.6	5.1	5.9	6.2		6.5	7.1		7.6		11.9							11.9	0.8	0.88
L-93 XD	5.5		6.1	5.1	5.5	5.1	5.8	5.7		6.3	7.2		7.4		17.7							17.7	0.5	0.90
Riptide	5.4		5.7	5.1	5.5	4.9	5.6	6.0		5.9	6.6		7.6		17.4							17.4	0.1	0.97
Piranha	5.4		5.9	4.9	5.3	4.7	5.7	5.7		5.8	7.1		7.3		12.1							12.1	1.4	0.91
Luminary	5.2		5.6	5.0	5.1	5.2	5.3	5.0		5.9	7.1		7.0		10.3							10.3	1.7	1.06
TourPro	5.2		5.9	4.8	4.9	4.9	5.3	5.2		6.4	7.3		7.3		10.8							10.8	2.4	0.93
Tripleseven	4.9		6.1	4.2	4.7	4.7	5.1	4.8		6.0	7.0		7.6		21.1							21.1	1.1	0.87
OO7	4.9		5.3	4.4	4.9	4.3	5.1	5.3		5.7	6.9		7.0		21.9							21.9	0.4	1.02
Ardent	4.9		5.5	4.4	4.7	4.2	5.2	5.3		5.7	7.9		7.2		21.7							21.7	0.7	0.97
Independenc	4.7		5.3	4.2	4.7	4.1	5.0	5.0		6.0	7.1		6.8		29.4							29.4	0.5	0.98
Macdonald	4.6		5.7	4.0	4.4	3.9	5.1	4.8		5.2	6.9		7.3		21.0							21.0	1.0	0.86
Valderrama	4.6		5.7	4.0	4.4	4.1	5.0	4.8		5.8	7.5		6.9		28.3							28.3	3.6	1.05
Penncross	4.3		4.5	4.1	4.3	4.0	4.4	4.3		5.5	6.6		6.0		24.8							24.8	2.5	1.30
P%	<0.1		8	<0.1	>10	<0.1	<1	>10		<0.1	<1		<1		<1							<1	>20	<0.1
LSD 5%	0.6		-	0.6	-	0.6	0.6	-		0.5	0.5		0.7		11.2							11.2	-	0.11

j) Mean of two sites, USA

No of sites reporting	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf fineness (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %	Daily height growth, mm
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot					
	2	0	2	2	2	2	2	2	0	2	2	0	2	0	1	1	1	0	0	0	1	1	0	0	0	
Matchplay	6.0	.	6.2	6.1	5.5	5.4	6.2	6.9	.	6.9	6.2	.	6.4	.	11.9	84	0.5	.	.	.	0.5	11.9	.	.	.	
Riptide	6.0	.	6.2	5.9	5.9	5.4	6.2	6.6	.	6.6	6.0	.	6.5	.	17.4	89	0.6	.	.	.	0.6	17.4	.	.	.	
L-93-XD	5.9	.	6.2	6.0	5.5	5.5	6.1	6.5	.	6.8	6.2	.	6.4	.	17.7	85	1.1	.	.	.	1.1	17.7	.	.	.	
Piranha	5.8	.	6.0	5.8	5.7	5.0	6.2	6.4	.	6.2	6.3	.	6.2	.	12.1	85	0.3	.	.	.	0.3	12.1	.	.	.	
Tour Pro	5.6	.	5.8	5.7	5.5	5.1	5.8	6.0	.	6.2	6.4	.	6.2	.	10.8	80	0.4	.	.	.	0.4	10.8	.	.	.	
Tripleseven	5.6	.	6.4	5.5	4.9	5.2	5.8	6.0	.	6.6	6.1	.	6.5	.	21.1	85	1.5	.	.	.	1.5	21.1	.	.	.	
Luminary	5.5	.	5.6	5.6	5.2	5.1	5.7	5.8	.	5.8	6.2	.	5.7	.	10.3	83	1.3	.	.	.	1.3	10.3	.	.	.	
Macdonald	5.4	.	6.1	5.4	4.5	4.7	5.7	6.2	.	6.2	6.1	.	6.5	.	21.0	81	0.8	.	.	.	0.8	21.0	.	.	.	
Ardent	5.4	.	5.7	5.5	4.8	4.7	5.6	6.2	.	6.2	7.2	.	6.0	.	21.7	80	1.5	.	.	.	1.5	21.7	.	.	.	
OO7	5.3	.	5.4	5.5	4.9	4.8	5.5	5.8	.	6.0	6.1	.	6.1	.	21.9	80	0.7	.	.	.	0.7	21.9	.	.	.	
Valderrama	5.1	.	5.5	5.1	4.9	4.4	5.5	5.8	.	6.1	6.5	.	5.9	.	28.3	75	0.5	.	.	.	0.5	28.3	.	.	.	
Independence	5.1	.	5.4	5.3	4.7	4.5	5.4	5.7	.	6.0	6.2	.	5.9	.	29.4	74	2.1	.	.	.	2.1	29.4	.	.	.	
Penncross	4.6	.	4.7	4.8	4.2	4.4	4.7	4.7	.	5.6	5.8	.	5.0	.	24.8	77	0.8	.	.	.	0.8	24.8	.	.	.	
P%	<0.1	-	<1	7	<1	<5	<0.1	<1	-	>10	<0.1	.	<0.1	-	<1	>10	<1	-	-	-	<1	<1	.			
LSD 5%	0.5	-	0.6	-	0.7	0.6	0.4	0.8	-	-	0.3	-	0.4	-	11.2	-	0.9	-	-	-	0.9	11.2				

3.6 Varieties of *Agrostis canina* Table 17

In total 5 varieties (2 candidates and 3 controls) of velvet bentgrass (*Agrostis canina)* were tested. 'Norgreen' was tested only at Apelsvoll, 'Nordlys' only in the Nordic countries, 'Avalon' (US denomination 'SR 7200') only in Minnesota and Massachusetts and 'Legendary' only in Minnesota. 'Villa' was the only variety included at all sites and it was also ranked higher than 'Nordlys' in the southern zone of the Nordic countries. 'Norgreen' performed very well at Apelsvoll with low winter damage and microdochium patch during winter compared to 'Villa' and 'Nordlys' which suffered from severe winter damages. 'Norgreen' is the Agrostis variety that was included in the first SCANGREEN test round as 'Nordlys' creeping bent (Aamlid et al., 2006) or 'Norwegian type' (Aamlid et al., 2010) but which was later deemed to be a mixture of various bengrass species and therefore discarded from further multiplication. After that, the variety owner Graminor did a new selection/purification of 'Norgreen' and had it approved in DUS-test under the name 'Nordlys' velvet bentgrass, but unfortunately, most of its outstanding winterhardiness and resistance to microdochium seems to have been lost during this process. 'Norgreen' is now a dead variety and further use of 'Nordlys' also seems questionable based on the present results. 'Villa' therefore remains the top variety of velvet bentgrass for the Nordic countries. In the US, 'Villa' also had slightly higher turfgrass quality than 'Legendary' and 'Avalon' in Minnesota, while 'Villa' and 'Avalon' were very equal in Massachusetts.

Table 17: Ranking of velvet bentgrass (Agrostis canina) varieties after four years testing on putting greens in SCANGREEN trials at a) Korpa GC (Iceland); b) Apelsvoll Research Center (Norway), c) average for Korpa and Apelsvoll representing the northern climatic zone of Scandinavia; d) Smørum GC (Denmark); e) Landvik Research Center (Norway), f) average for Smørum and Landvik representing the southern climatic zone of Scandinavia; and g) average for three sites, Nordic countries (Smørum not included), h) University of Massachusetts; i) University of Minnesota; j) Average for Massachusetts and Minnesota.

a) Reykjavik GC, Iceland (northern climatic zone)

No of observations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	18	2	6	5	5	3	10	3	1	7	7	3	4	3	3	16	17	8	2	4	3	11	14	14	11
Villa	5.7	7.0	4.6	5.1	6.2	4.9	5.5	5.5	73	7.5	5.2	3.5	6.6	6.3	6.3	93	3.5	1.1	0.0	0.0	0.0	1.7	0.4	0.5	0.2

b) NIBIO Apelsvoll Research Center, Norway (northern climatic zone)

No of observations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	20	1	5	7	7	6	9	5	1	15	6	2	5	3	3	19	6	6	0	0	0	9	6	0	6
Norgreen	5.1	4.0	6.7	5.3	4.2	6.3	5.2	4.7	58	5.6	6.3	2.8	4.6	3.8	2.3	96	0.4	0.1	0.0	0.0	0.0	0.7	0.5	0.0	0.2
Villa	4.9	6.0	-	3.9	5.0	2.4	5.8	4.8	65	7.1	5.5	2.8	6.3	61.0	11.4	86	2.6	2.4	0.0	0.0	0.0	2.8	0.0	0.0	0.0
Nordlys	3.5	4.3	-	2.9	3.3	2.0	3.9	3.4	47	5.4	6.5	1.7	5.1	65.7	15.7	82	3.0	2.8	0.0	0.0	0.0	4.0	0.0	0.0	0.1
P%	1	>4	-	3	>8	<0.1	3	3	2	0.3	1	3	0.8	<0.1	>10	0.5	>10	>5	-	-	-	0.8	0.9	-	>10
LSD 5%	0.8	1.5	-	1.6	-	1.1	1.1	0.9	10	0.6	0.5	0.8	0.8	16.6	-	6	-	-	-	-	-	1.4	0.3	-	-

* Only data for Norgreen in 2020 due to unsuccessful reestablishment of the other varieties.

c) Mean of two sites, northern climatic zone

No of sites	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Villa	5.4	6.5	4.6	4.5	5.6	3.9	5.6	5.2	69	7.2	5.4	3.2	6.5	33.6	8.8	90	3.1	1.6	0.0	0.0	0.0	2.2	0.2	0.3	0.1

d) Smørum GC, Denmark (southern climatic zone)

No of observations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	* 2019	* 2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	11	*	*	4	7	2	6	3	1	3	2	1	2	1	1	10	7	7	0	0	0	8	0	0	0
Villa	3.7	-	-	4.3	3.2	3.8	3.5	3.7	100	6.5	6.2	4.7	7.0	7.7	7.7	98	0.3	0.3	0.0	0.0	0.0	2.8	0.0	0.0	0.0
Nordlys	2.7	-	-	3.0	2.3	2.3	2.6	2.7	100	4.8	6.9	1.7	6.7	3.5	3.5	93	0.6	0.7	0.0	0.0	0.0	3.0	0.0	0.0	0.0
P%	0.3	-	-	>1	0.5	<0.	>5	>2	-	>3	>3	<0.1	>10	>10	>10	>10	0.8	2	-	-	-	>10	-	-	-
LSD 5%	0.3	-	-	0.6	0.3	0.1	-	0.8	-	1.5	0.6	0.1	-	-	-	-	0.1	0.3	-	-	-	-	-	-	-

*No data from 2019 and 2020, Scangreen at Smørum established in 2021.

e) NIBIO Landvik Research Center, Norway (southern climatic zone)

No of observations	Turfgrass quality (1-9)																In-season diseases, %									
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %	Daily height growth, mm
	22	2	7	7	6	6	10	6	1	8	7	3	6	2	3	22	14	12	1	0	0	15	0	13	0	22
Villa	6.6	7.6	6.4	6.5	5.8	5.0	7.4	6.3	68	7.7	6.4	4.3	8.3	5.2	8.5	97	0.8	0.5	0.1	0.0	0.0	1.7	0.0	0.1	0.0	0.48
Nordlys	5.0	7.3	3.9	5.0	4.0	3.8	5.5	4.6	63	6.5	6.4	2.8	8.2	8.2	10.0	94	2.4	0.8	0.2	0.0	0.0	2.1	0.0	1.0	0.0	0.65
P%	>1	>1	0.8	>1	>4	>10	>1	0.9	>10	>3	>10	<0.1	>10	>10	>10	>10	>10	>10	>10	-	-	>10	-	1	-	
LSD 5%	0.9	-	1	0.9	1.8	-	1.1	0.7	-	1.1	-	0.1	-	-	-	-	-	-	-	-	-	-	-	0.4	-	

f) Mean of two sites, southern climatic zone (balanced data from 2021 and 2022 only)

No of sites reporting	Turfgrass quality (1-9)																In-season diseases, %									
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf fineness (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %	
	2	-	-	2	2	2	2	2	-	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Villa	4.9	-	-	5.4	4.5	4.6	5.3	4.7	-	7.4	6.6	3.8	7.9	7.3	10.9	98	0.6	0.7	0.1	0.0	0.0	2.7	0.0	0.1	0.0	
Nordlys	3.6	-	-	4.0	3.2	3.6	3.9	3.0	-	5.9	6.4	1.9	7.7	4.4	7.6	94	1.1	1.0	0.2	0.0	0.0	2.8	0.0	1.0	0.0	
P%	0.3	-	-	2	0.2	0.4	0.4	0.3	-	3	>10	<0.1	0.7	>10	>10	1	>10	>10	>10	-	-	>10	-	<0.1	>10	
LSD 5%	0.7	-	-	1.0	0.6	0.6	0.7	0.8	-	1.2	-	0.6	0.1	-	-	3	-	-	-	-	-	-	-	0.2	-	
Interact species x	>10	-	-	>10	>10	>10	>10	>10	-	>10	>10	2	>10	>10	>10	>10	>10	>10	>10	-	-	>10	-	<0.1	>10	

g) Mean of three sites (Smørum not included), Nordic zone

No of sites	Turfgrass quality (1-9)																In-season diseases, %								
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Villa	5.8	6.9	5.5	5.1	5.7	4.3	6.4	5.6	69	7.4	5.8	3.6	7.2	24.2	8.7	93	2.3	1.2	0.0	0.0	0.0	2.0	0.1	0.2	0.1

h) University of Massachusetts

No of obser-vations	Turfgrass quality (1-9)																In-season diseases, %						Weeds, % of plot area			
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss	*Digitaria*	Sagina	Daily height growth, mm
	16	0	7	5	4	5	10	1	0	3	6	0	6	0	0	4	5	0	0	0	5	0	0	6	0	0
Villa	6.5	-	5.8	7.1	7.1	4.9	7.2	7.8	-	8.1	7.3	-	7.7	-	-	81	0.0	-	-	-	0.0	-	-	1.3	-	-
Avalon	6.5	-	5.7	7.0	7.1	4.9	7.2	7.7	-	8.2	7.6	-	7.7	-	-	81	0.1	-	-	-	0.1	-	-	1.3	-	-
P%	>10	-	>10	>10	>10	>10	>10	>10	-	>10	>10	-	>10	-	-	>10	>10	-	-	-	>10	-	-	>10	-	-

i) University of Minnesota

	Turfgrass quality (1-9)																In-season diseases, %							
No of obser-vations	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Weeds, % of plot area	Daily height growth, mm
	17	0	5	6	6	6	9	2	0	6	6	0	3	0	3	4	5	0	0	0	5	3	19	14
Villa	3.9	-	4.3	3.8	3.6	3.9	3.9	3.3	-	4.3	5.3	-	8.1	-	12.2	-		-	-	-		12.2		0.8
Legendary	3.7	-	4.5	3.4	3.4	3.8	3.8	3.3	-	4.3	5.3	-	7.9	-	13.9	-		-	-	-		13.9		1.2
Avalon	3.5	-	4.3	3.4	2.8	3.7	3.4	2.8	-	4.2	5.1	-	8.0	-	10.6	-						10.6		0.8
P%	>10	-	>10	>10	>10	>10	>10	>10	-	>10	>10	-	>10	-	>10	-						>10		>10

j) Mean of two sites, USA

	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf fineness (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %	Daily height growth, mm
No of sites reporting	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot					
	2	0	2	2	2	2	2	2	0	2	2	0	2	0	1	1	1	0	0	0	1	1	0	0	0	-
Villa	5.2	.	5.1	5.5	5.4	4.4	5.6	5.6	.	6.2	6.3	.	7.9	.	12.2	81	0.0	.	.	.	0.0	12.2	.	.	.	-
Avalon	5.0	.	5.0	5.2	5.0	4.3	5.3	5.3	.	6.2	6.4	.	7.9	.	10.6	81	0.1	.	.	.	0.1	10.6	.	.	.	-
P%	>10	-	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	>10	-

3.7 Varieties of *Poa pratensis* Table 18

In total five varieties (3 candidates and 2 controls) of Kentucky bluegrass (*Poa pratensis*) were tested. 'Traction' was tested only in the southern zone of the Nordic countries and in Minnesota, while A99_2679 was included in Minnesota only. There was no testing of Kentucky bluegrass in Massachusetts.

The control variety 'Limousine' produced higher turfgrass quality, higher tiller density, finer leaves and less in-season disease than the very dark-colored candidate 'Professor' on average for the three Nordic sites Reykjavik, Apelsvoll and Landvik. Compared to 'Professor', 'Limousine' was also more winter-hardy and less infested with moss and *Poa annua*. Mostly because of finer leaves, 'Traction' was ranked higher than 'Limousine' at Landvik and in Minnesota, but not during only two years of testing at Smørum. Higher leaf fineness of 'Traction' than of 'Limousine' is in agreement with previous testing on fairway mowing height in the Nordic countries. The candidate 'A99_2679' was ranked intermediate between 'Limousine' and 'Professor' in Minnesota.

Table 18: Ranking of Kentucky bluegrass (Poa pratensis) varieties after four years testing on putting greens in SCANGREEN trials at a) Korpa GC (Iceland); b) Apelsvoll Research Center (Norway), c) average for Korpa and Apelsvoll representing the northern climatic zone of Scandinavia; d) Smørum GC (Denmark); e) Landvik Research Center (Norway), f) average for Smørum and Landvik representing the southern climatic zone of Scandinavia; and g) average for three test sites in Scandinavia (Smørum not included), h) University of Minnesota.

a) Reykjavik GC, Iceland (northern climatic zone)

No of observations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	18	2	6	5	5	3	10	3	1	7	7	3	4	3	3	16	8	8	0	0	0	11	14	14	11
Limousine	6.0	7.3	6.1	6.0	4.5	5.6	5.6	5.9	54	4.2	5.7	5.2	5.0	0.1	0.1	98	1.0	0.2	0.0	0.0	0.0	0.4	0.8	0.2	0.3
Professor	4.8	6.8	5.2	4.1	3.0	4.1	4.2	4.6	48	2.7	6.7	5.8	4.4	0.7	0.8	96	0.4	0.1	0.0	0.0	0.0	0.4	1.6	0.4	0.5
P%	>0.6	>1	0.3	0.5	0.9	0.8	0.4	0.2	>10	>1	>2	<0.1	<0.1	>10	>10	>10	>3	>10	-	-	-	>10	>10	>10	>10
LSD 5%	0.4	-	0.3	0.6	0.6	0.6	0.4	0.3	-	0.9	0.8	0.1	0.1	-	-	-	0.5	-	-	-	-	-	-	-	-

b) NIBIO Apelsvoll Research Center, Norway (northern climatic zone)

No of observations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	20	**1**	**5**	**7**	**7**	**6**	**9**	**5**	**1**	**15**	**6**	**2**	**5**	**3**	**3**	**19**	**6**	**6**	**0**	**0**	**0**	**9**	**6**	**0**	**6**
Limousine	6.4	6.7	7.8	6.7	4.4	6.9	6.4	5.8	38	4.6	6.2	3.0	5.9	1.1	3.6	98	0.4	0.4	0.0	0.0	0.0	0.9	0.3	0.0	0.3
Professor	4.9	5.7	5.9	5.0	3.1	5.1	5.0	4.4	33	3.3	7.8	2.0	4.0	16.8	7.6	93	0.1	0.1	0.0	0.0	0.0	1.0	1.5	0.0	0.5
P%	>2	>1	>3	2	>4	1	>6	0.6	>10	2	0.9	>10	>1	>10	>10	0.5	>10	>10	-	-	-	>10	>10	-	>10
LSD 5%	1.1	-	1.6	1.0	1.3	0.8	-	0.5	-	0.9	0.6	-	0.9	-	-	1.6	-	-	-	-	-	-	-	-	-

c) Mean of two sites, northern climatic zone

No of sites	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf fineness (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	2	2	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Limousine	6.2	7.0	7.0	6.3	4.5	6.2	6.0	5.9	46	4.5	5.9	4.3	5.4	0.6	1.9	98	0.7	0.3	0.0	0.0	0.0	0.7	0.6	0.1	0.3
Professor	4.8	6.2	5.5	4.6	3.0	4.6	4.6	4.5	41	3.1	7.3	4.3	4.2	8.8	4.2	94	0.2	0.1	0.0	0.0	0.0	0.7	1.6	0.2	0.5
P%	<0.1	3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	>10	<0.1	<0.1	>10	<0.1	>10	0.2	<0.1	0.9	>10	-	-	-	>10	3	>10	>10
LSD 5%	0.3	0.7	0.4	0.3	0.5	0.2	0.4	0.3	-	0.3	0.3	-	0.2	-	1.1	0.9	0.3	-	-	-	-	-	0.9	-	-
Interacti species x	>10	>10	2	>10	>10	>10	>10	>10	>10	>10	>10	>10	<0.1	>10	0.9	0.6	>10	>10	-	-	-	>10	>10	>10	>10

d) Smørum GC (southern climatic zone)

No of observations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	11	*	*	4	7	2	6	3	1	3	2	1	2	1	1	10	7	7	0	0	0	8	0	0	0
Limousine	5.5	-	-	5.3	5.6	6.0	5.5	5.3	25	6.3	5.3	4.0	4.8	0.0	0.0	99	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Traction	4.9	-	-	4.5	5.3	5.2	4.8	5.1	20	6.1	5.3	4.0	4.8	0.0	0.0	97	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Professor	4.0	-	-	3.9	4.0	3.5	4.0	4.3	22	4.5	7.2	4.3	3.0	0.0	0.0	97	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P%	>1	-	-	>2	0.3	0.5	>4	0.3	>10	0.2	0.2	>10	<0.1	>10	-	>10	>10	-	-	-	-	-	-	-	-
LSD 5%	0.7	-	-	0.8	0.5	1.0	1.0	0.4	-	0.6	0.6	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-

*No data from 2019 and 2020, Scangreen at Smørum established in 2021.

e) NIBIO Landvik Research Center, Norway (southern climatic zone)

No of observations	Turfgrass quality (1-9)																In-season diseases, %									
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %	Daily height growth, mm
	22	2	7	7	6	6	10	6	1	8	7	3	6	2	3	22	13	12	1	0	0	15	1	13	1	22
Traction	6.1	6.8	5.8	6.2	5.5	6.0	6.2	5.9	25	6.3	6.2	4.8	6.0	0.3	0.9	92	0.1	0.1	0.1	0.0	0.0	0.4	0.1	2.3	0.1	1.24
Limousine	5.9	6.0	5.5	6.3	5.6	6.1	5.9	5.7	17	5.8	6.0	4.6	5.5	0.5	0.4	90	0.0	0.0	0.0	0.0	0.0	0.3	0.1	2.8	0.2	1.32
Professor	5.1	5.8	4.9	4.9	4.8	4.5	5.2	5.4	13	4.9	6.8	3.7	5.2	0.7	0.8	87	0.0	0.0	0.0	0.0	0.0	0.3	0.1	5.0	0.2	1.18
P%	>1	>1	>1	0.2	>10	0.8	>2	>10	>10	0.4	>9	0.6	4	>10	>10	0.4	>10	>10	>10	-	-	>10	>10	0.9	>10	
LSD 5%	0.5	-	0.5	0.5	-	0.8	0.6	-	-	0.5	-	0.5	0.6	-	-	2	-	-	-	-	-	-	-	1.3	-	

f) Mean of two sites, southern climatic zone (balanced data from 2021 and 2022 only)

No of sites	Turfgrass quality (1-9)																In-season diseases, %									
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest gree11n)	Winter color (1-9, 9 most freshly green)	Leaf fineness (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %	
	2	-	-	2	2	2	2	2	-	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Limousine	5.7	-	-	5.8	5.6	6.5	5.6	5.4	-	6.0	5.5	4.1	5.3	0.4	0.4	96	0.0	0.0	0.1	0.0	0.0	0.0	0.1	2.8	0.2	
Traction	5.4	-	-	5.4	5.4	6.1	5.3	5.2	-	6.2	5.8	4.2	5.6	0.2	0.9	96	0.1	0.1	0.1	0.0	0.0	0.1	0.1	2.3	0.1	
Professor	4.4	-	-	4.4	4.4	4.3	4.5	4.7	-	4.7	6.2	3.2	4.4	0.4	0.8	93	0.0	0.0	0.0	0.0	0.0	0.1	0.1	5.0	0.2	
P%	>10	-	-	3	>10	0.2	>10	>10	-	0.1	0.1	>10	<0.1	>10	>10	2	>10	>10	>10	-	-	>10	>10	0.6	>10	
LSD 5%	-	-	-	1.0	-	1.1	-	-	-	0.7	0.5	-	0.3	-	-	2	-	-	-	-	-	-	-	1.5	-	
Interact species x	>10	-	-	>10	>10	>10	>10	>10	-	>10	0.2	>10	0.1	>10	>10	4	>10	>10	>10	-	-	>10	>10	0.6	>10	

g) Mean of three sites (Smørum not included), (both climatic zones)

No of sites reporting	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf fineness (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Limousine	6.1	6.7	6.5	6.3	4.8	6.2	6.0	5.8	36	5.0	6.0	4.4	5.5	0.6	1.4	95	0.5	0.2	0.0	0.0	0.0	0.5	0.4	1.0	0.3
Professor	4.9	6.1	5.3	4.7	3.6	4.6	4.8	4.8	32	3.9	7.1	4.1	4.5	6.1	3.1	92	0.2	0.1	0.0	0.0	0.0	0.5	1.1	1.8	0.4
P%	<0.1	3	<0.1	<0.1	0.6	<0.1	<0.1	<0.1	>10	<0.1	<0.1	>10	<0.1	>10	0.1	<0.1	0.9	>10	>10	-	-	>10	1.4	0.8	>10
LSD 5%	0.4	0.5	0.3	0.4	0.8	0.4	0.5	0.4	-	0.3	0.3	-	0.2	-	0.8	2	0.2	-	-	-	-	-	0.5	0.6	-
Interact species x	>10	>10	2	>10	>10	>10	>10	>10	>10	>10	>10	>10	<0.1	>10	0.4	>10	>10	>10	>10	-	-	>10	>10	0.7	>10

h) University of Minnesota

No of obser-vations	Turfgrass quality (1-9)																In-season diseases, %								
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Weeds, % of plot area	Daily height growth, mm
	17	0	5	6	6	6	9	2	0	6	6	0	3	0	3	4	5	0	0	0	5	3	19	14
Traction	5.8		5.2	6.3	5.8	5.7	5.9	5.8		6.1	5.4		6.2		0.0							0.0	0.8	1.18
Limousine	5.4		5.0	5.7	5.4	5.2	5.5	5.5		5.7	5.7		5.9		0.0							0.0	2.5	1.14
A99_2679	4.9		4.3	5.2	5.2	4.3	5.2	5.7		5.2	6.9		5.0		0.0							0.0	0.8	1.27
Professor	4.5		4.3	4.7	4.4	3.8	4.8	5.3		5.1	7.2		4.9		0.1							0.1	2.2	1.34
P%	<5		<5	<1	<5	<0.1	<5	>10		<5	<0.1		<1		>10							>10	>10	<5
LSD 5%	0.7		0.5	0.8	0.9	0.6	0.7	-		0.5	0.4		0.7		-							-	-	0.13

3.8 Seed blends and mixtures Table 19

At high maintenance the mixture of fescue and creeping bentgrass (FR + AS) had the highest overall turfgrass quality at Landvik and Smørum, while the mixture of fescue and colonial bentgrass (FR + AC) was ranked the lowest at Smørum (significantly behind FR + AS). Comparing overall winter damage and microdochium patch during the winter, FR + AS was also significantly better than FR + AC at Smørum, with the same trend occurring at Landvik. By contrast, the infection of microdochium patch across years was higher with FR+AS than with FR+AC in Minnesota, but the three mixtures with fescue and bentgrass were nonetheless very close in overall turfgrass quality.

At high maintenance, the fescue blend FR performed second best at Landvik, but the lowest at Smørum and the second lowest in Minnesota. The mixture of creeping bentgrass and perennial ryegrass AS + LP performed at the lowest in Minnesota with a high coverage of microdochium patch and coarse leaves.

At low maintenance FR + AC performed best at Landvik, FR + AC + AS and FR + AS at Smørum and FR + AS in Minnesota.

The mixtures FR + AC and FR + AS were also tested in the previous SCANGREEN round (Aamlid et al., 2019) with the varieties 'Jorvik' (AC) and 'Independence' (AS). Those results showed that disease infections in the mixture between fescue and colonial bentgrass (FR + AC) were slightly higher than in the mixture with fescue and creeping bentgrass (FR + AS).

Photo 20: The blends and mixtures at Landvik in February 2022. Border row in the middle with pure fescue, row to the right with high N/low mow and row to the left with low N/high mow. The mixture of creeping bentgrass and perennial ryegrass (plot no 4 on both sides of the border had the highest coverage of microdochium patch. Photo: Karin J. Hesselsøe.

Photo 21: Dew on the experimental green in September 2022 at Landvik. Pure varieties of creeping bentgrass furthest to the left with heavy dew, mixtures of fescue and bentgrass in the middle including a border row with pure fescue and different varieties of fescue furthest to the right (almost no dew). Photo: Karin J. Hesselsøe

The proportion of fescue vs. bentgrass in the mixed plots was investigated at Landvik in 2020 and 2021 (Figure 2 and Figure 3). In 2020 the proportion between red fescue and bentgrass was in favour of the bentgrasses at high maintenance with the highest proportion of bentgrass in the mixture with fescue and creeping bentgrass followed by FR + AC + AS and then the mixture with fescue and colonial bentgrass (Figure 2). At low maintenance, the proportion between fescue and bentgrass was more balanced though the FR + AC + AS mixture was in favour of the bentgrasses (Figure 2).

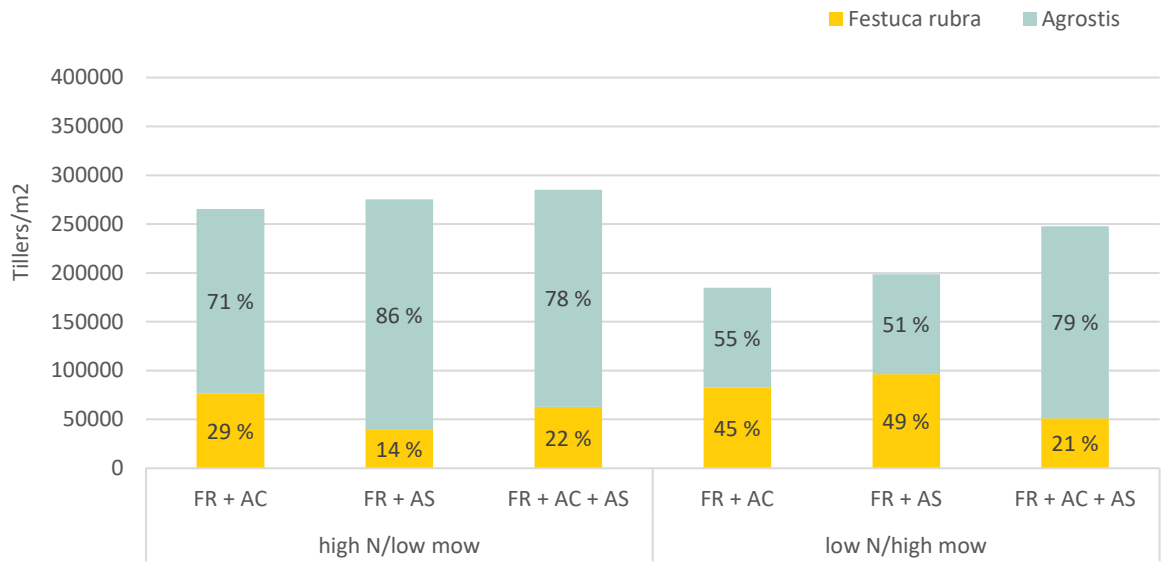


Figure 2: Tiller numbers of red fescue and bentgrass in October 2020 in plots with the following mixtures: red fescue plus colonial bentgrass (FR + AC), red fescue plus creeping bentgrass (FR + AS), and red fescue plus colonial and creeping bentgrass (FR + AC + AS) subjected to high N/low mow maintenance or low N/high mow maintenance at Landvik. Figures in the bars indicate the percentage of red fescue and bentgrass tillers.

In 2021 the dominance of the creeping bentgrass was clear at high maintenance where red fescue was almost outcompeted in the FR + AS mixture (Figure 3). In FR + AC + AS the proportion of bentgrass had also increased from 2020 to 2021, while the proportion of colonial bentgrass had decreased from 2020 to 2021 in the mixture with fescue and colonial bentgrass FR + AC. At low maintenance, the

proportions between fescue and bentgrass in the FR + AC and FR + AS mixtures were very similar to those in the first year, while the proportion of bentgrass had decreased from 2020 to 2021 in the FR + AC + AS mixture.

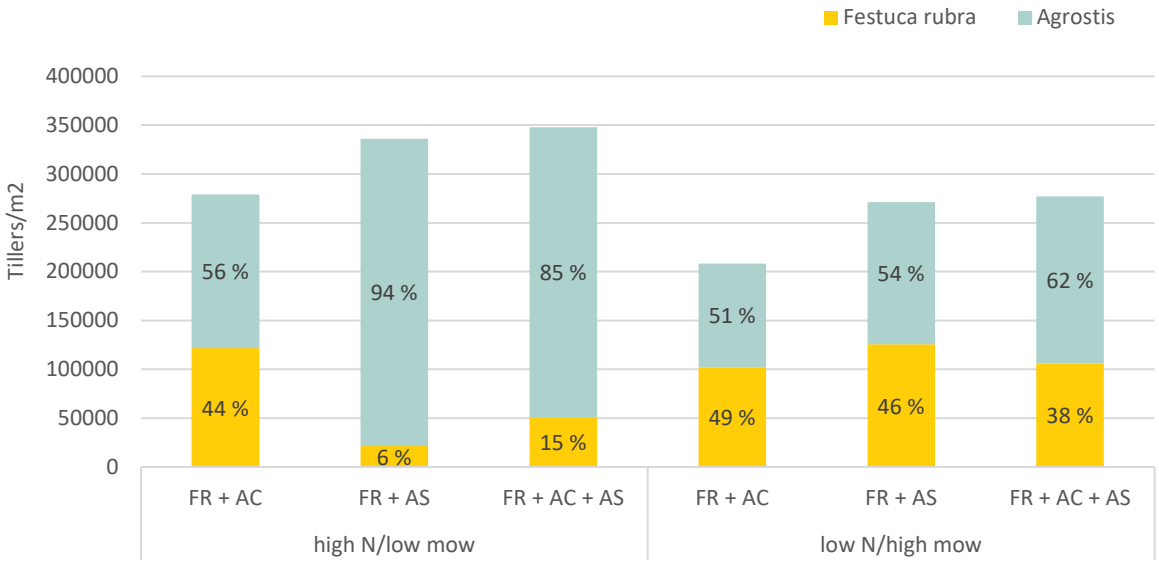


Figure 3: Tiller numbers of red fescue and bentgrass in October 2021 in plots with the following mixtures: red fescue plus colonial bentgrass (FR + AC), red fescue plus creeping bentgrass (FR + AS), and red fescue plus colonial and creeping bentgrass (FR + AC + AS) subjected to the high N/low mow maintenance or the low N/high mow maintenance at Landvik. Figures in the bars indicate the percentage of red fescue and bentgrass tillers.

Only few clear differences were found between the mixtures. But at some sites and management levels the mixture with fescue and creeping bentgrass is to prefer e.g. at Landvik and Smørum at high maintenance, but with the risk that the creeping bentgrass outcompetes the fescue. Varieties of creeping bentgrass with a lower tiller density should be preferred for the mixture with fescue. The mixture with creeping bentgrass and perennial ryegrass established significantly faster than any of the others, but after winter turfgrass quality decreased compared to the other mixtures.

Table 19: Ranking of blends and mixtures: Red fescue seed blend (FR), red fescue and colonial bentgrass mixture (FR + AC), red fescue and creeping bentgrass mixture (FR + AS), red fescue, colonial and creeping bentgrass mixture (FR + AC + AS), creeping bentgrass and perennial ryegrass mixture (AS + LP) after four years testing on putting greens in SCANGREEN trials at: a) Landvik Research Center (Norway); b) Smørum GC (Denmark) (two years only); c) University of Minnesota. All blends and mixtures managed at two levels: Low maintenance (10 g N m^{-2} yr^{-1} and 5 mm mowing height, upper unshaded rows) and high maintenance (17 g N m^{-2} yr^{-1} and 3 mm mowing height, lower shaded rows).

a) NIBIO Landvik Research Center, Norway (southern climatic zone)

	Turfgrass quality (1-9)																In-season diseases, %									
No of observations	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall	Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown ~	Total	Microdochium	Red thread	Take-all	Dollar spot	Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %	Daily height growth, mm
	22	2	7	7	6	6	10	6	1	8	7	3	6	2	3	22	14	12	1	1	0	15	0	13	1	22
FR + AC	6.7	7.1	6.4	6.1	7.1	5.6	7.3	6.4	42	6.3	6.5	3.9	7.2	7.1	5.5	97	0.3	0.2	0.0	0.0	0.0	1.4	0.0	0.3	0.0	0.93
FR + AS	6.6	7.0	5.9	6.4	7.1	5.7	7.1	6.2	38	6.5	6.6	4.0	7.3	8.4	8.4	97	0.7	0.1	0.0	0.1	0.0	1.3	0.0	0.0	0.0	0.94
FR	6.6	6.5	6.3	6.5	7.0	6.1	6.9	6.4	27	6.1	6.5	3.8	7.3	0.3	2.0	95	0.1	0.0	0.0	0.0	0.0	0.5	0.0	0.2	0.0	1.02
FR + AC + AS	6.5	7.1	6.4	6.2	6.4	5.6	7.1	6.3	42	6.4	6.6	4.0	7.0	6.3	3.6	97	0.2	0.1	0.0	0.0	0.0	1.0	0.0	0.3	0.1	0.90
AS + LP	5.7	6.9	5.3	4.9	5.7	3.8	6.4	5.8	65	5.4	6.8	3.5	6.0	38.7	15.3	96	0.9	0.5	0.1	0.0	0.0	2.6	0.0	0.1	0.0	1.05
P%	<0.1	0.1	1	<0.	0.2	<0.	0.2	0.1	<0.1	0.4	3	4	<0.1	<0.1	>10	>10	0.8	>10	>10	>10	-	>10	>10	0.6	>10	
LSD 5%	0.2	0.2	0.6	0.3	0.6	0.2	0.3	0.2	9	0.5	0.2	0.4	0.4	12.8	-	-	0.4	-	-	-	-	-	-	0.1	-	
FR + AS	7.0	7.2	6.9	6.8	7.3	5.9	7.6	6.9	52	7.0	6.7	4.9	6.8	5.7	3.6	98	0.3	0.2	0.0	0.3	0.0	0.9	0.0	0.1	0.0	0.99
FR	6.9	6.3	7.0	6.8	7.8	6.6	7.5	6.5	22	6.6	6.5	4.9	7.4	0.2	0.8	96	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.1	0.0	1.30
AS + LP	6.8	7.4	6.8	6.3	6.7	4.9	7.7	6.7	68	6.5	6.7	4.5	6.4	14.8	9.0	98	0.8	0.8	0.0	0.2	0.0	2.0	0.0	0.1	0.0	1.14
FR + AC + AS	6.8	7.4	6.6	6.3	6.8	5.4	7.5	6.7	47	6.7	6.6	4.6	7.0	9.3	8.0	97	0.4	0.3	0.0	0.3	0.0	1.6	0.0	0.3	0.0	1.11
FR + AC	6.6	7.3	6.3	5.8	6.9	5.3	7.3	6.2	40	6.5	6.7	4.5	6.9	14.6	6.4	96	1.3	0.8	0.0	1.6	0.0	2.1	0.0	0.4	0.0	1.14
P%	>10	<0.1	>10	>10	>10	0.2	>10	>10	<0.1	>10	>10	>10	2	>10	>10	>10	<0.1	4	>10	>10	-	>10	>10	0.1	>10	
LSD 5%	-	0.3	-	-	-	0.6	-	-	13	-	-	-	0.5	-	-	-	0.4	0.6	-	-	-	-	-	0.1	-	

b) Smørum GC (southern climatic zone)

No of observations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot				
	11	-	-	4	7	2	6	3	1	3	2	1	2	1	1	10	9	7	0	1	1	8	0	0	0
FR + AC + AS	5.3	-	-	5.5	5.1	5.8	4.8	5.5	50	7.3	6.2	5.0	6.0	0.0	0.0	99	0.1	0.0	0.0	0.0	0.5	0.5	0.0	0.0	0.0
FR + AS	5.3	-	-	5.5	5.0	5.8	4.7	5.7	48	7.3	6.0	5.0	6.0	0.0	0.0	99	0.2	0.0	0.0	0.0	0.3	0.2	0.0	0.0	0.0
FR + AC	5.1	-	-	5.7	4.5	4.3	4.9	5.4	43	6.1	5.8	4.7	6.9	0.2	0.2	99	0.1	0.0	0.0	0.0	0.1	1.5	0.0	0.0	0.0
FR	4.9	-	-	5.5	4.4	4.7	4.7	5.0	48	5.4	5.3	4.7	8.0	8.2	8.2	98	0.1	0.0	0.0	0.0	0.3	2.6	0.0	0.0	0.0
AS + LP	4.7	-	-	5.3	4.0	4.7	4.3	5.0	88	6.9	6.4	5.7	5.8	0.0	0.0	99	0.6	0.1	0.0	0.0	0.0	0.3	0.0	0.0	0.0
P%	>10			>10	2	0.5	>10	>10	0.2	0.2	>10	>10	<0.1	4	4	>10	<0.	>10	-	-	>10	>10	-	-	-
LSD 5%	-			-	0.6	0.8	-	-	18	0.8	-	-	0.5	6	6	-	0.2	-	-	-	-	-	-	-	-
FR + AS	5.5	-	-	6.1	4.9	5.8	5.2	5.5	57	7.5	5.9	5.7	6.0	1.4	1.4	99	0.2	0.2	0.0	0.0	0.1	1.7	0.0	0.0	0.0
FR + AC + AS	5.3	-	-	5.3	5.3	5.8	5.2	5.2	53	7.3	5.8	5.3	5.8	0.8	0.8	99	0.4	0.1	0.0	0.0	0.6	1.6	0.0	0.0	0.0
AS + LP	4.9	-	-	5.5	4.4	5.0	4.6	5.2	87	7.2	5.9	5.3	5.9	0.0	0.0	100	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
FR + AC	4.5	-	-	4.7	4.4	3.8	4.8	4.4	43	5.5	6.2	4.0	6.7	6.7	6.7	98	0.3	0.1	0.0	0.0	1.4	2.9	0.0	0.0	0.0
FR	4.4	-	-	4.6	4.2	4.0	4.6	4.2	58	5.0	5.7	4.3	7.8	4.0	4.0	98	0.7	0.0	0.0	0.0	1.7	1.5	0.0	0.0	0.0
P%	0.9	-	-	0.2	2	5	>10	>10	2	<0.1	>10	>10	<0.1	1	1	>10	>10	>10	-	-	5	>10	-	-	-
LSD 5%	0.6	-	-	0.6	0.6	1.6	-	-	22	0.6	-	-	0.7	3.5	3.5	-	-	-	-	-	1.3	-	-	-	-

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No of observations	Turfgrass quality (1-9)								Coverage 3 wk after sowing, %	Tiller density (1-9)	In-season color (1-9, 9 is darkest green)	Winter color (1-9, 9 most freshly green)	Leaf finess (1-9)	Overall winter damage, %	Microdochium patch during winter, %	In-season coverage of healthy turf of sown	In-season diseases, %					Microdochium patch, all obs, %	Moss, %	*Poa annua*, %	Pearlworth, %	Daily height growth, mm
	Overall mean	2019	2020	2021	2022	Spring	Summer	Fall									Total	Microdochium	Red thread	Take-all	Dollar spot					
	17		5	6	6	6	9	2		6	6		3									17				
FR + AS	5.8		6.2	5.7	5.4	5.2	6.1	6.2		5.6	5.2		7.6									1.4				
FR	5.5		5.8	5.4	5.2	5.4	5.5	5.2		5.6	3.2		8.8									0.0				
FR + AC	5.4		6.3	5.1	4.8	5.3	5.4	5.3		5.1	3.7		8.6									0.0				
AS + LP	5.3		5.5	5.0	5.5	4.8	5.4	6.3		5.8	5.2		7.6									8.9				
FR + AC + AS	5.2		6.0	4.9	4.8	4.9	5.4	5.3		5.3	5.4		7.7									0.2				
P%	>10	-	>10	>10	>10	>10	>10	>10		>10	<0.1		<0.1									>10				
LSD 5%	-	-	-	-	-	-	-	-		-	0.7		0.5									-				
FR + AC + AS	5.1		4.7	5.3	5.2	5.0	5.1	5.3		6.3	5.8		8.2									2.4				
FR + AS	5.0		5.6	4.7	4.8	4.3	5.5	5.0		6.1	6.4		7.8									10.0				
FR + AC	5.0		4.5	5.4	4.9	5.1	4.8	5.3		5.7	4.8		8.4									0.0				
FR	4.6		4.4	4.7	4.6	5.2	4.4	3.8		5.5	4.3		8.6									0.0				
AS + LP	4.5		4.6	4.3	4.7	4.2	4.6	5.2		5.8	6.3		7.1									20.0				
P%	>10		>10	5	>10	>10	>10	>10		>10	<0.1		<0.1									<0.1				
LSD 5%	-		-	0.8	-	-	-	-		-	0.6		0.4									6				

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