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Evaluation of turfgrass varieties for use on Scandinavian golf greens, 2007-2010

Final results from the four year testing period

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Dette er sluttrapport fra et prosjekt i åra 20007-2010 med testing av ulike grasarter og -sorter for golfgreener i Norden.

Summary:

This report gives results from the entire evaluation period 2007-2010 for a project evaluating turfgrass species and varieties for use on Scandinavian golf greens.

Godkjent / Approved, 25 Jan. 2011

Trygve S. Aamlid

Prosjektleder og leder for fagseksjon 'Frøavl og Gras til grøntanlegg' /
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Contents

1. Abstract

Due to fungicide restrictions, harsh winters and special light/temperature combinations at high latitudes, turfgrass variety testing in USA, UK and central Europe has limited relevance for Scandinavia. Thus, trials comparing 41 varieties of seven turfgrass species/subspecies on USGA-greens at two sites in the northern and two sites in the southern climatic zone of Scandinavia were conducted from 2007 to 2010. Once established, the trials were mowed at 3 mm for bentgrasses (*Agrostis stolonifera*, *Agrostis canina,* and *Agrostis capillaris*) and 5 mm for chewings fescue (*Festuca rubra* ssp. *commutata*), slender creeping red fescue (*Festuca rubra* ssp. *litoralis*), perennial ryegrass (*Lolium perenne*), and rough bluegrass (*Poa trivialis*). Mean fertilizers rates in the evaluation years were 1.7 kg N/100 m^2 to creeping bentgrass and rough bluegrass and 1.0 kg N/100 m^2 to the other species. No pesticides were used in the trials. As the trial at Östra Ljungby, Southern Sweden, had to be closed in 2009, species and varieties were ranked based on overall performance (visual merit), winter damage, in-season diseases, and tiller density at Landvik (58°11'N, 12 m a.s.l.) in the southern climatic zone and at Apelsvoll (61°42'N, 250 m a.s.l.) and Reykjavik (64°09'N, 30 m a.s.l.) in the northern climatic zone.

On average for varieties within species, red fescue, especially chewings fescue, had significantly less winter damage (both biotic and abiotic damage) than perennial ryegrass and the bentgrasses in both climatic zones. The red fescues also had significantly less in-season diseases (mainly *Microdochium* patch and *Pythium*) compared with colonial bnetgrass and velvet bentgrass in the southern climatic zone and in comparison with all bentgrass species in the northerm climatic zone. On average for all sites, velvet bentgrass had higher tiller density, better dormancy color and less height growth, but it also accumulated more thatch than the other species. On average for varieties, the ranking of species based on overall performance was velvet bentgrass > creeping bentgrass > chewings fescue > slender creeping fescue > colonial bentgrass > perennial ryegrass > rough bluegrass in the southern climatic zone and chewings fescue > slender creeping fescue > velvet bentgrass > creeping bentgrass > colonial bentgrass > perennial ryegrass > rough bluegrass > perennial ryegrass in the northern climatic zone.

Variety differences within each species at each test site were usually significant, but significant interactions also suggested that different varieties should be preferred in the two climatic zones. In the following table, presented in alphabetical order, varieties indicated in **bold** have been added to our previously published list of recommended varieties for putting greens in the Nordic countries:

	Northern climatic zone: Finland, central and northern parts of Sweden, continental and northern parts of Norway	Southern climatic zone: Denmark, coastal regions of southern Sweden and southern Norway
Agrostis canina	Villa	Greenwich, Villa
Agrostis capillaris	Bardot, Jorvik, Leirin, Nor	**AberRoyal**, Bardot, Barking, Denso, **Greenspeed**, Jorvik
Agrostis stolonifera	**CY-2,** Independence, Nordlys, Penn A-1, Penn G-1, Penn G-2	Bueno, **Declaration**, Independence Nordlys, Penncross, Penn G-1, **Runner**
F.rubra ssp. *commutata*	Bargreen, Center, **Greensleeves**, Kiruna, **Musica**, Soberana	**Barswing**, Blenheim, Calliope, Center, **Greensleeves**, Kiruna, **Musica**
F.rubra ssp. *litoralis*	Baroyal, Cezanne, **Viktorka**	Barcrown, Cezanne, **Finesto**, **Viktorka**
Lolium perenne	**Chardin**	**Chardin**
Poa trivialis	**Qasar, Race Horse**	**Qasar, Race Horse**

2. Introduction

Plant breeding is a long-term and continuous process where new varieties are released every year. Therefore, evaluation of new turfgrass varieties for golf greens must also be a continuous process. Variety trials on USGA greens are expensive and the seed consumption small compared to other markets. Therefore, the seed industry has signaled that variety testing for greens must, at least for the most part, be funded by the golf sector itself. The Scandinavian Turfgrass and Environment Research Foundation (STERF), which is a foundation set up by the gold federations in the five Nordic countries, has taken this responsibility.

The first project with variety evaluation for golf greens in the Nordic countries was conducted from 2003 to 2006 and reported by Aamlid et al. (2006). This report is the final report from the second project, also funded by STERF and entrance fees paid by breeding- and seed companies, and running for the period 2007-2010.

The objectives of the project were:

- To clarify which varieties of *Agrostis, Festuca, Poa and Lolium* are best suited for golf greens at four experimental sites representing the two major climatic zones in the Nordic countries

- To create meeting places for discussions between plant breeders, seed companies and greenkeepers in order to encourage variety awareness and continued efforts into turfgrass breeding for northern environments

Preliminary results from the project have earlier been presented in annual progress reports (Molteberg et al. 2007, 2008, 2010). This report gives results from the third evaluation year (2010) and recommendations for species and varieties based on the whole testing period.

Photo 1. The experimental green at Korpa GC, Iceland, 20 March 2010. Photo: Gudni Thorvaldsson.

3. Methods

3.1 Plant material

A total of 41 varieties, including controls, were entered into the project (Table 1). The distribution between species was as follows:

- Creeping bentgrass (*Agrostis stolonifera*): 9 varieties
- Velvet bentgrass (*Agrostis canina*): 3 varieties
- Colonial bentgrass (*Agrostis capillaris*): 5 varieties
- Chewings fescue (*Festuca rubra* var. *commutata*): 11 varieties
- Slender creeping red fescue (*Festuca rubra* var. *litoralis*): 6 varieties
- Perennial ryegrass *(Lolium perenne)*: 5 varieties
- Rough-stalked meadow grass (*Poa trivialis*): 2 varieties

Table 1. List of varieties included in green trials in Scandinavia, 2007-2010.

Variety	Breeder / Representative
Festuca rubra* var. *commutata	
Center (C)	Innoseeds
Margret	DLF-Trifolium
Greensleeves	DLF-Trifolium
Charme (Frc 04210)	Euro Grass
Excellence	Euro Grass
LøRc 0215	Graminor
LøRc 0021 (Linda)	Graminor
SW RSC6101	Svalöf Weibull
SW RSC6028	Svalöf Weibull
Barswing	Barenbrug
Musica	RAGT Genetique
Festuca rubra* var. *trichophylla	
Cezanne (C)	Innoseeds
Amarone	DLF-Trifolium
Corrida	DLF-Trifolium
Niola	Euro Grass
Finesto (Frt 04213)	Euro Grass
Viktorka	Barenbrug
Poa trivialis	
Qasar	Weibull Trädgård/Pickseed
Race Horse	Scandinav. Seed/Pickseed
Lolium perenne	
Mascot (INLP 634)	DLF-Trifolium
Cardin (DP 17-2147)	DLF-Trifolium
Madrid	DLF-Trifolium
DP 17-9974 (Monroe)	DLF-Trifolium
Ligala	Euro Grass
Agrostis stolonifera	
Independence(C)	Innoseeds
Runner (IS AP 14)	DLF-Trifolium
CY-2	DLF-Trifolium
Sandhill	Weibull Trädgård/Pickseed
Bengal	Barenbrug
Alpha	RAGT Genetique
Declaration	RAGT Genetique
L93	RAGT Genetique
MacKenzie	Scandinavian Seed/Pickseed
Agrostis capillaris	
Jorvik (C)	DLF-Trifolium
Leirin (C)	Graminor
Greenspeed (TAT 720)	DLF-Trifolium
LøEk 0015	Graminor
AberRoyal	Scandinavian Seed/BSH
Agrostis canina	
Villa (C)	Innoseeds
Legendary	DLF-Trifolium
Vesper	Scandinavian Seed/Pickseed

C = Control variety (reference)

In the progress reports from this project we also listed a tenth variety of creeping bentgrass, **'Nordlys'.** Molteberg et al. (2010) referred to this variety as **'Norwegian type'**, as it was discovered that the seed submitted to this project was a mixture of colonial bentgrass and creeping bentgrass. In the present report we have chosen to exclude this entry from the final presentation of results.

3.2 Experimental sites

Trials were established on USGA-spec. greens at the experimental sites Östra Ljungby Naturgymnasium, Sweden, Bioforsk Landvik and Bioforsk Apelsvoll, Norway, and Korpa Golf Course, Reykjavik, Iceland (in earlier reports referred to as Keldnaholt). The four locations were considered to represent the two main climatic zones in Scandinavia (Fig 1).

Unfortunately, the trial at Östra Ljungby had to be discontinued in spring 2009 because of moving of the activity of the naturgymnasium to another city. For this reason, we have no complete data set from Östra Ljungby and results will not be presented here.

Thirty year normal temperatures and precipitation (reference period 1961-1990) at Apelsvoll, Korpa and Landvik are given in Table 2. Although Apelsvoll and Korpa were both considered to represent Scandinavia's northern climatic zone, Apelsvoll has a typical continental climate whereas Korpa has a typical maritime climate.

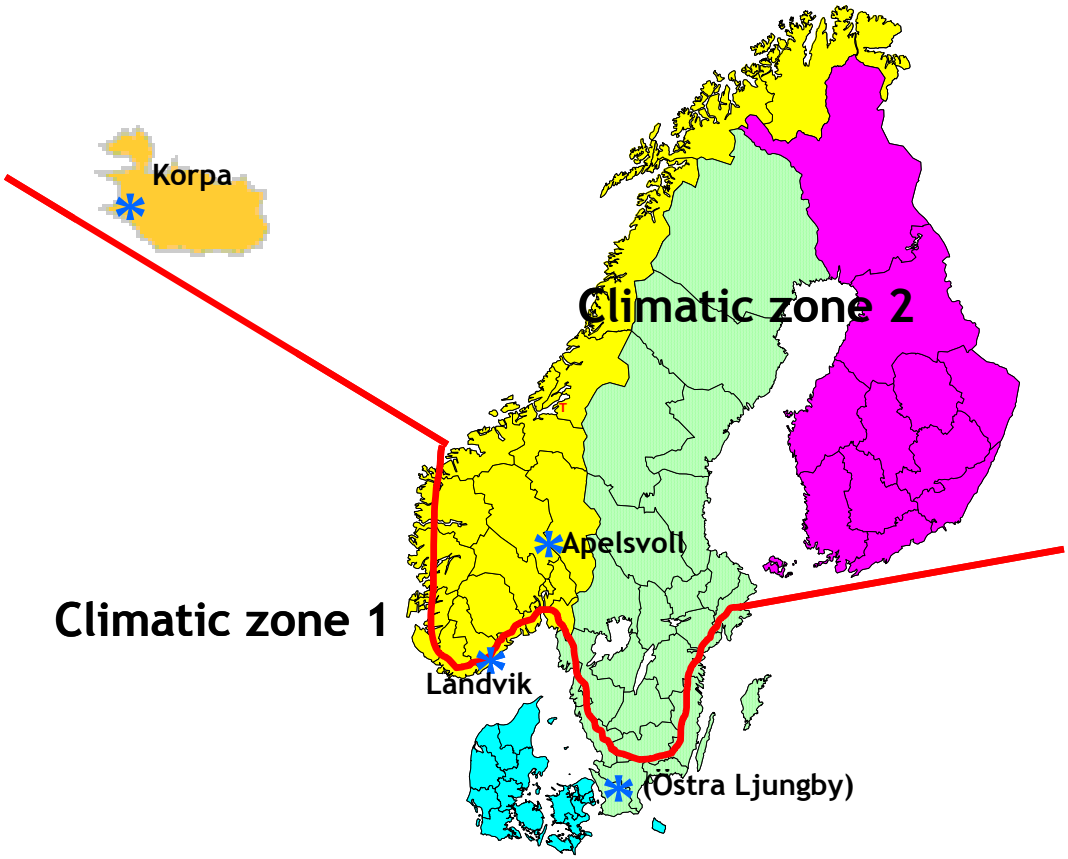

Fig. 1. Division of Scandinavia in two climatic zones. Trial sites are indicated.

Table 2. Monthly temperature and precipitation during the last experimental year Oct. 2009 – Sep. 2010 as compared with thirty year normal values at Apelsvoll, Korpa and Landvik.

	Apelsvoll, northern zone				Korpa, northern zone				Landvik, southern zone			
	Temp. °C		Precip. mm		Temp. °C		Precip. mm		Temp. °C		Precip. mm	
	2009/ 2010	30yr norm.	2009/ 2010	30yr norm.	2009/ 2010	30yr norm.	2009/ 2010	30yr norm.	2009/ 2010	30yr norm.	2009/ 2010	30yr norm.
Oct.	2.5	4.6	44	64	4.5	4.4	95	86	6.1	7.9	252	162
Nov.	1.5	-1.3	116	53	2.4	1.1	49	73	5.3	3.2	295	143
Dec.	-6.4	-5.3	110	40	-0.5	-0.2	58	79	-1.7	0.2	217	102
Jan.	-11.3	-7.4	85	37	1.0	-0.5	124	76	-5.4	-1.6	43	113
Feb.	-10.2	-7.0	37	26	-0.6	0.4	37	72	-6.0	-1.9	82	73
Mar.	-2.0	-2.5	41	29	2.8	0.5	83	82	1.3	1.0	56	85
Apr.	3.5	2.3	29	32	2.5	2.9	42	58	6.2	5.1	32	58
May	8.8	9.0	37	44	8.1	6.3	32	44	10.5	10.4	18	82
June	13.6	13.7	82	60	11.8	9.0	30	50	15.1	14.7	30	71
July	16.3	14.8	114	77	13.3	10.6	43	52	17.0	16.2	68	92
Aug.	14.3	13.5	108	72	12	10.3	74	62	16.0	15.4	131	113
Sep.	9.2	9.1	80	66	9.9	7.4	121	67	11.7	11.8	122	136
Mean / sum	3.3	3.6	881	600	5.6	4.4	788	801	6.3	6.9	1344	1230

3.3 Experimental design and establishment in 2007

The trials were established according to split-plot designs with three block (replicates), species on main plots and varieties on subplots. This allowed different management of the various species. Plot size was 1.0 m x 1.0 m. Seeding dates in 2007 were 26 June at Apelsvoll, 11 July at Landvik and 17 August at Korpa. Seeding rates of bentgrasses, rough bluegrass, red fescues and perennial ryegrass were 0.5, 1.5, 3.0 and 4.0 kg per 100 m^2, respectively.The trials at Apelsvoll and Landvik had a good establishment and a complete cover before the winter. Because of late seeding and low soil temperature, turfgrass plants at Korpa were generally small and exposed to freezing and erosion, especially from wind, during the first winter (Photo 2).

Photo 2. The experimental green at Korpa, Iceland, on 17 Sept. 2007, one month after seeding. Bentgrass plots to the right were poorly established before the first winter. Photo: Gudni Thorvaldsson.

3.4 Winter conditions and the need for reseeding

3.4.1 2007-2008

The newly established green at Apelsvoll was covered with snow, mostly with an ice layer between the green surface and the snow, for almost four months during the first winter. These conditions caused a lot of damage, especially in creeping bentgrass, perennial ryegrass, and rough bluegrass, but also in colonial bentgrass (Photo 3). For this reason all plots with these species were reseeded in spring 2008.

Even at Korpa, all plots with bentgrasses and rough bluegrass had to be reseeded in spring 2008, although there were some variety differences. Plots with perennial ryegrass and red fescues also needed some repair but generally had much better winter survival due to better establishment in the previous autumn. The spring of 2008 was very dry and the seed took a long time to germinate and grow even though the plots were irrigated regularly. Therefore, the growing season 2008 was considered as a second establishment year for this trial. The green was not mowed lower than 20 mm, *i.e.* more like a fairway or lawn.

At Landvik, the winter 2007-08 implied occasional snow falls and frequent fluctuations between frost and thaw periods. There were periods with ice, but never for more than a couple of weeks. Green-up started in the first part of March already, but in late March the green was covered with snow for around three weeks. This caused great infection with snow mold (*Microdochium nivale)*, mostly in the bentgrasses. However, the turf recovered quickly and no reseeding was necessary.

Photo 3. The first winter 2007-2008 discriminated strongly between species and varieties at Apelsvoll. Except for the red fescues, all plots had to be reseeded in spring. The three central columns belong to a related project with evaluation of winter-hardy Norwegian breeding lines. Photo taken 16 May 2008 by Bjørn Molteberg.

3.4.2 2008-2009

The trial at Apelsvoll was covered with ice and snow for an even longer period than the previous winter. The snow melted around 20 April, but during the last weeks until snow melt there was plenty of wet snow and water while still frost in the ground. This caused death of all turfgrass species and varieties including red fescues. The severe damage can probably be explained by drowning and absence of air during the melting period. Just a few plants survived, and as there was no statistical difference among species or varieties, all plots had to be reseeded in spring 2009.

At Kopra, the green was only covered with snow for a few days during the winter 2008-2009. At Landvik, winter damages were also small, and no reseeding was necessary.

3.4.3 2009-2010

At both Norwegian sites the winter 2009-10 was colder and more stable than the previous ones. Mean temperatures for December-February were 2.7 and 3.3 °C below the thirty year normal values at Apelsvoll and Landvik, respectively (Table 2). The soil was frozen underneath a continuous snow cover from 30 Nov. till 15 April at Apelsvoll and from 18 Dec. till 1 April at Landvik. Even at Landvik, snow depths were up to 70 cm. Due to some milder spells, a thin layer of ice developed between the snow and the green surface in February and March (Photo 4), but the ice was porous and winter damages small at both sites.

As usual, the experimental green at Korpa had no continuous snow cover during the winter 2009-2010. The mean temperature for December-February was very close to the thirty year normal values (-0.1 vs. 0.0 °C; Table 2), but fluctuations with severe frost following mild spells were nevertheless stressful to the turfgrass plants.

Photo 4. During the winter 2009-10, even the experiment at Landvik was covered with snow for more than three months. The photo to the left was taken on 22 January and shows no ice between the frozen turf and the snow. Ice started to develop in February, but was quite porous and caused no damage. The photo to the right was taken on 23 March, about one week before snow melt. Photos: Trygve S. Aamlid.

3.4.4 Mowing

Throughout the experimental period, the trials at Apelsvoll and Landvik were mowed three times per week (Monday, Wednesday, Friday) to a height of 5 mm for perennial ryegrass, red fescue and rough bluegrass and 3 mm for the bentgrasses. Higher mowing (up to 6 mm in bentgrasses and 8 mm in the others) were practiced after establishment in 2007, after reseeding at Apelsvoll and at the beginning and end of the growing season at both sites. Mowing was carried out with "John Deere" walk-behind mowers and clippings collected.

As already mentioned, the trial at Korpa was mowed at 20 mm, i.e. more like a fairway in 2007 and 2008. In 2009, mowing height was gradually reduced from 12 mm in early spring to 5.5 mm by the middle of August, the same height for all species. In 2010, mowing started at 5 mm in all species in spring but was gradually reduced to 3 mm in the bentgrasses.

3.4.5 Fertilizer applications

All trials received inorganic fertilizers at two week intervals at Apelsvoll and Landvik and at two to four week intervals at Korpa. Fertilizer types at Landvik and Apelsvoll were mostly Arena products, sometimes supplemented with granular Scott products (not slow release), granular Andersson 13-2-13 and granular ammoniumsulfate, the latter to adjust the initially high pH values of the compost-amended rootzones at both sites. In 2009, the liquid fertilizer Wallco partly replaced granular products at Landvik. Fertilizers at Korpa were mostly granular Angus products. Except at Korpa in 2007 and 2008, higher rates were always given to creeping bentgrass and rough bluegrass than to red fescues, perennial ryegrass and velvet bentgrass. While only nitrogen rates are shown in Table 3, the fertilizers also contained phosphorus, potassium, other macronutrients and micronutrients at balanced rates.

Seasonal fertilizer distributions typically followed an asymmetric curve with the highest inputs in late May and early June.

Table 3. Seasonal nitrogen rates (kg N/100m^2) applied to various turfgrass species at Apelsvoll, Korpa and Landvik in 2007-2010

	2007 (seeding year)		2008		2009		2010	
	Red fesc., per. ryegr. and velvet bentgr.	Creeping bentgr. and rough bluegrass	Red fesc., per. ryegr. and velvet bentgr.	Creeping bentgr. and rough bluegrass	Red fesc., per. ryegr. and velvet bentgr.	Creeping bentgr. and rough bluegrass	Red fesc., per. ryegr. and velvet bentgr.	Creeping bentgr. and rough bluegrass
Apelsvoll	1.3	1.9	0.9	1.8	0.9	1.8	0.8	1.5
Korpa	0.5	0.5	1.6	1.6	0.9	1.8	1.3	2.4
Landvik	1.3	1.9	0.9	1.8	0.7	1.4	0.8	1.5

3.4.6 Vertical cutting and aeration treatments

No mechanical treatments were conducted in the seeding year at any site.

In 2008 and 2010, vertical cutting at Apelsvoll was performed twice in perennial ryegrass, red fescues and rough bluegrass and three times in the bentgrasses. In 2009 all plots at Apelsvoll were verticut only once. Except for a deep aeration with vertidrain (solid tines) in October 2009, leaving the holes open before winter, the experiment at Apelsvoll was not aerated during the course of the experiment.

At Kopra, there were no aeration treatments, but the green was verticut twice in 2009 and three times in 2010.

At Landvik the total number of verticutting to bentgrasses/other species was 3/2 in 2008, 4/0 in 2009 and 3/1 in 2010. In Nov. 2008, the trial was aerated with 12 mm cores and the holes left open until heavy topdressing in spring 2009. Furthermore, the trial was deep-aerated with 8 mm tines on 5 May 2009 and 25 May 2010 and surface aerated with 6 mm tines on 24 Sep. 2009.

3.4.7 Topdressing with sand

All plots at Apelsvoll were top-dressed heavily in conjunction with reseeding in spring 2008 and 2009 and otherwise twice per year in 2008 and 2009 and six times per year in 2010. Apart from reseeding, the total amount for sand corresponded to approximately 6 mm.

At Kopra, there was no topdressing in 2008, but three dressings in both 2009 and 2010.

At Landvik, all plots received one heavy topdressing in October 2007 and one light topdressing (dusting) almost every Friday from mid May until mid September in 2008, 2009 and 2010. With an average application of about 30 kg of pure sand per 100 m^2 per week plus heavier topdressing after verticutting or aeration treatments, the trial received a total of about 18 mm sand during the experimental period. The topdressing sand contained no organic matter and had a grain size of 0.2-0.8 mm.

3.4.8 Artifical wear

In 2008, 2009 and 2010, the green at Landvik was exposed to artificial wear from a friction drum with golf spikes two to three times per week. The total wear load corresponded to approximately 20.000 rounds of golf per year. The trial at Korpa was never exposed to wear, while the trial at Apelsvoll was exposed to wear two times in 2008, never in 2009 and once or twice per week in 2010.

3.4.9 Irrigation, pesticides, growth regulators and soil surfactants

All trials were irrigated after reseeding, fertilization, topdressing and otherwise at 10-15 mm soil water deficit. No pesticides or growth regulators were used in any of the trials, but the whole trial at Landvik was treated with the soil surfactant Revolution (Aquatrols Inc., Paulsboro, NJ) at 20 L/ha on 3 June 2010.

3.5 Registrations, statistical calculations, and presentation of results

The trials were rated at monthly intervals for visual merit (overall turfgrass quality) and most other characters.

The characters presented in tables 4-9 were calculated as follows:

- **Visual merit**: Overall turf quality (1-9, 9 is best quality). At Landvik, the overall mean was weighed with 1/7 on the seeding year and 2/7 on each of the three green years. Due to reseeding of all plots in spring 2009, the overall mean for Apelsvoll was weighed with 1/6 on the seeding year, 2/6 on the first green year 2008, 1/6 on the second year 2009, and 2/6 on the third green year 2010. Due to late seeding with no registration of visual merit in the seeding year and high mowing in the first green year at Korpa, the overall mean for this site was weighed with 1/5 on the first green year 2008, 2/5 on the second green year 2009, and

2/5 on the third green year 2010.

In 2007, ratings of visual merit at Landvik and Apelsvoll started once plant coverage was complete six to seven weeks after seeding. In the green years at Landvik, the first rating was usually performed in April and the last rating in early November. In the green years at Apelsvoll, ratings for visual merit started in late May and went on to early October except in 2009 when they did not start until 26 June. Spring, summer and autumn values at Landvik and Apelsvoll are means of all ratings during the periods 15 March-10 June (three observation years at Landvik, two observation years at Apelsvoll), 11 June-10 September (three observation years at both sites,) and 11 September – 10 November (four observation years at both sites), respectively. Since visual merit at Korpa was never rated before 7 June and never after than 7 Sep., spring, summer and autumn values were not calculated for this site.

- **Tiller density** (1-9, 9 is highest tiller number per m^2): Values for Apelsvoll and Landvik were weighed between years in the same way as visual merit. After reseeding in spring 2008 and 2009 at Apelsvoll, observations of tiller density were suspended until plant coverage was complete in August. Because of the high mowing in 2008, values for Korpa were weighed with 1/2 on 2009 and 1/2 on 2010.

- **Leaf fineness** (texture,1-9, 9 is finest leaves): This character was not evaluated in the seeding year 2007 and not at Korpa in 2008. At Apelsvoll and Landvik, observations were weighed with 1/3 on each of the green years 2008, 2009 and 2010, and at Korpa with ½ on 2009 and ½ on 2010. As differences in leaf fineness among varieties of chewings fescue and slender creeping fescue are usually small, only common values was given to all fescue varieties at Apelsvoll and Korpa.

- **Color** (1-9, 9 is darkest green): At all three sites, in-season color was weighed with 1/3 on each of 2008, 2009 and 2010.

- **Dormancy color** (1-9, 1 is very pale or brown and 9 is most intensely green): Intensity of green color outside the growing season. Mean of registration before green-up and after growth cessation in late autumn. Ratings were weighed with 1/3 on each of the three green years at all sites.

- **Plant cover:** Per cent of plot area covered with healthy turf of the sown species. At Apelsvoll and Landvik, values were weighed with 1/7 on the seeding year (starting when grow-in was compted about two months after seeding) and 2/7 each of the three green years. At Korpa, values were weighed with 1/3 on 2008, 1/3 on 2009 and 1/3 on 2010.

- **In-season disease** (per cent of plot area): In-season diseases mostly occurred during warm and rainy periods in late summer and autumn. Major pathogens were *Microdochium nivale* (mainly in bentgrasses), *Pythium* (mainly in bentgrasses) and *Laetisaria fuciformis* (red tread; mainly in red fescues) Values were weighed as per cent plant cover.

- **Winter damage** (per cent of plot area): Values include both biotic and abiotic winter damages and are means of assessments in the spring of the three green years at all sites.

- **Date for green-up in spring** (=earliness): Recorded as day no after 28 February at Apelsvoll in 2010, Korpa in 2009 and 2010 and Landvik in 2008, 2009 and 2010.

- **Plant cover at the first assessement after seeding in 2007:** This character indicates establishment rate. The first assessment of plant coverage was undertaken 20, 19 and approximately 40 days after seeding at Apelsvoll, Landvik and Korpa, respectively.

- **Daily height increment, mm**: Calculated from height measurements with a prism on the first Monday in each month at Apelsvoll in 2009 and 2010 and at Landvik in 2008, 2009 and 2010. The green had been left uncut since Friday. Not assessed at Korpa.

- **Thatch/mat thickness, mm**: Measured by the end of the experimental period in October 2010 at Apelsvoll and Landvik (Photo 5). Thatch/mat build-up was negligible and not measured systematically at Korpa.

- **Moss** (per cent of plot area): Assessed by the end of the experimental period in October 2010 at Landvik only (Photo 6).

Photo 5. Measurement of thatch/mat thickness at Landvik, October 2010. Photo: Trygve S. Aamlid.

Photo 6. Moss infestation in colonial bentgrass plots at Landvik, October 2010. Photo: Trygve S. Aamlid.

At all sites, the recordings were undertaken by the same group of experiences researchers / technicians. However, as no attempt was made to harmonize the use of scales at the three locations, values should not be used to compare turfgrass quality at the three sites.

The experimental data were analyzed using the procedure PROC ANOVA (SAS Institute 2002). For comparison of species, values for all varieties (subplots) within each main plot (species) were averaged before the analyses. Both the comparison of species and the comparisons of varieties within each species were accomplished separately for each of the three sites, for the northern climatic zone including Apelsvoll and Korpa, and for the Nordic countries as whole including all three sites. When analysing data across 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 differences occurred, least significant differences (LSD) at the 5% probability level were calculated for direct comparisons between varieties. *P*-values between 5% and 15% were reported as 'tendencies'.

The results were presented in Tables 4-11. In these tables, species or varieties were ranked for visual merit scores. In cases where two or more species (varieties) had the same scores, they were further ranked for winter damage, in season diseases and tiller density.

Photo 7. Experiment at Landvik , 4 Sept. 2009. Photo: Trygve S. Aamlid.

4. Results and discussion

4.1 Comparison of species (Table 4)

As shown in Table 4e, the interaction among species and experimental sites was significant for all characters recorded in the project. On average for the two sites in the northern zone, red fescues and velvet bentgrass were ranked significantly before velvet bentgrass, creeping bentgrass, colonial bentgrass, rough bluegrass and perennial ryegrass (Table 4c). The major reason for this difference was better winter survival, especially of the red fescues which relatively to the bentgrasses performed better in the present than in our previous variety testing project (Aamlid et al. 2006). Part of the explanation for this may be that the Icelandic climate favored fescues (Table 4b).

Although it was less superior than in our previous project (Aamlid et al. 2006), velvet bentgrass performed significantly better than any other species at Landvik (table 4d). Velvet bentgrass had higher tiller density, finer leaves, better winter color (Photo 8) and less height growth than the other bentgrass species, but on the negative side, it also accumulated more thatch and was rather susceptible to both in-season diseases and winter diseases. In comparison with red fescues, the performance of velvet bentgrass, as well as the other bentgrasses, would probably have been better had fungicides been allowed in the project.

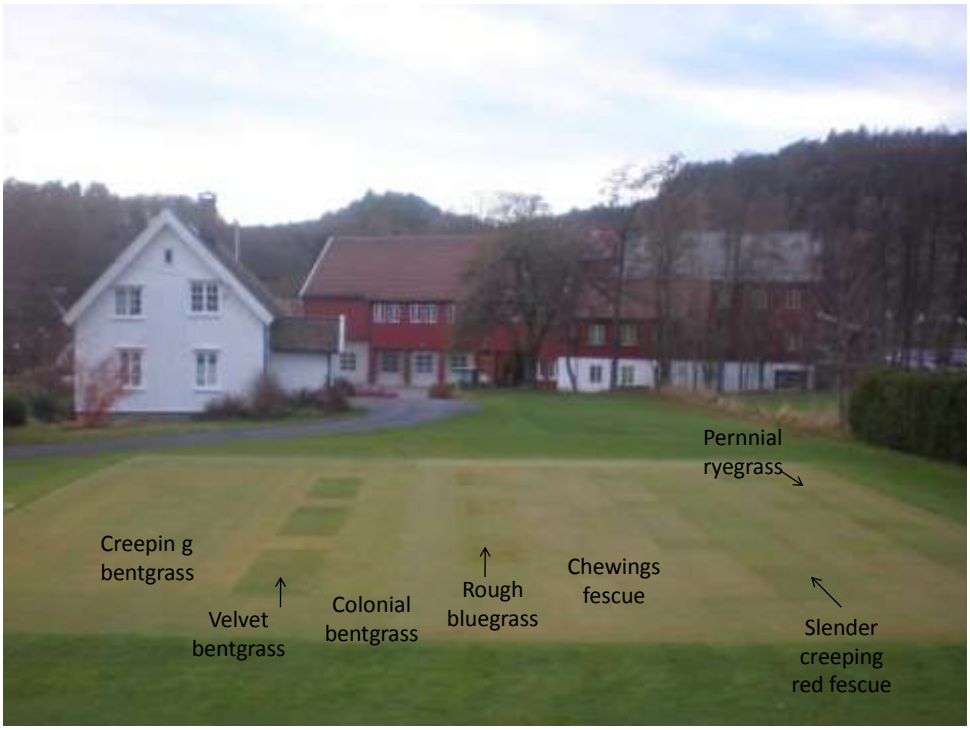

Photo 8. Winter appearance of different species at Landvik, 17 Nov. 2008. Photo: Trygve S. Aamlid.

The differences between the two subspecies of red fescue were mostly as expected: On average for varieties, chewings fescue had less attractive dormancy (winter) color (Photo 8) but better winter survival, better performance in spring, and darker color than slender creeping red fescue. Combination of the two subspecies in seed mixtures for golf greens can still be recommended.

Despite less disease, red fescues were ranked significantly behind creeping bentgrass at Landvik. In this trial, which was located in an area with a long growing season and high rainfall (Table 2) and which was

exposed to more wear than the other trials, it appears that an annual input of 0.7-0.8 kg N/100 m^2 to the fescue was too low, thus allowing infestation of mosses into the green surface (Table 1d). This was even more the case in perennial ryegrass, which is usually considered to have a high nutrient requirement. It is noteworthy that red fescue performed very well under the high fertilizer input at Korpa (Table 4b).

The performance of colonial bentgrass was rather disappointing and clearly behind the performance in our previous project (Aamlid et al. 2006). Among the disadvantages of this species was susceptibility to in-season diseases at both Apelsvoll and Landvik (Photo 9). Compared to the other species, colonial bentgrass showed, however, stronger and more contrasting variation among varieties at the various experimental sites. Therefore, inclusion of colonial bentgrass varieties adapted to the climatic zone can still be justified.

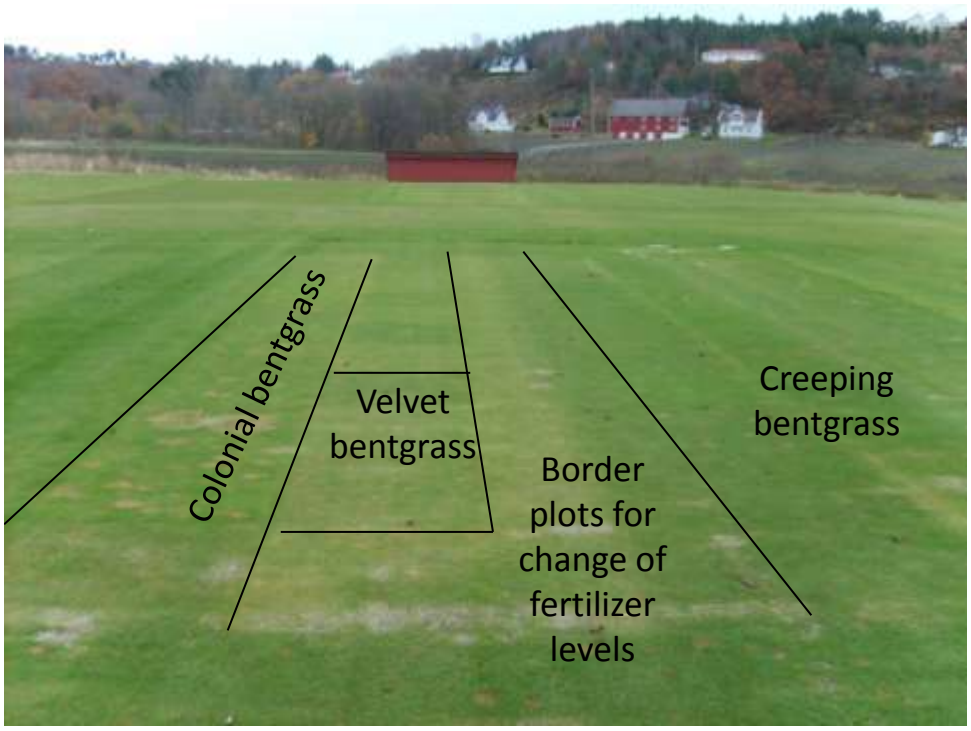

Photo 9. Especially in the first year of the project, colonial bentgrass was more susceptible to in-season diseases than the other bentgrass species at Landvik. Photo taken in September 2008 by Trygve S. Aamlid.

Perennial ryegrass and rough bluegrass were included in this project mainly because some greenkeepers use them to quickly reestablish turf on dead greens in spring. If such use is at all justified, our mean results suggest that rough bluegrass may be even faster in establishment than perennial ryegrass (Table 4e). Rough bluegrass also had less height growth, higher tiller density and darker color than perennial ryegrass. However, with an almost abnormally green appearance in the autumn of the seeding / reseeding year, rough bluegrass was clearly not adapted to the length of growing season at high latitudes (Photo10). Later it was more persistent at Apelsvoll than at Korpa where it was faded (Photo 11) and at Landvik where it was almost outcompeted by other grasses by the end of the trial (Photo 12). Such a low persistency may perhaps be considered an advantage for a species primarily intended as a nurse crop for other turfgrass species. By contrast, perennial ryegrass showed surprisingly high persistence at 5 mm mowing height.

Photo 10. By the end of the reseeding year 2008, rough bluegrass plots stood out as 'green islands' among red fescue plots on the western side of the green at Apelsvoll. Plots on the eastern side of the green are bentgrasses. Photo: Bjørn Molteberg.

Photo 11. Gudni Thorvaldsson standing on rough bluegrass plots in the trial at Korpa, 19 Aug. 2010. Photo: Trygve S. Aamlid.

Photo 12. Rough bluegrass plots at Landvik, October 2009. The is brown and faded rough bluegrass has mostly been out-competed by other grasses invading from neighbor plots. Photo: Trygve S. Aamlid.

4.2 Velvet bentgrass varieties (Table 5)

Differences in overall visual merit among the three velvet bentgrass varieties were not significant at any of the three locations. However, at Apelsvoll there was a strong tendency (P%=6)for 'Villa' to be ranked before 'Legendary' with 'Vesper' in the intermediate position (Table 5a). The higher ranking of 'Villa' was due to in better winter survival, more complete plant cover and less in-season diseases than the other varieties. More in-season diseases in 'Vesper' was confirmed even at Korpa (Table 5b) and on average for the three sites (Table 5e). Although differences in disease occurrence at Landvik were not significant, Photo 13 shows that 'Vesper' developed more patches, especially due to white rot fungi, in the last year of the study. On the other hand 'Vesper' had darker in-season color and better dormancy color than 'Villa' and 'Legendary'. While the latter is in agreement with British trials (STRI 2010), our results do not support STRI findings that 'Vesper had higher density and finer leaves than other bentgrass varieties. STRI (2010) ranked velvet bentgrass cultivars in the order 'Vesper' = (9.3) > 'Villa' (8.7), but our results are in better agreement with the American National Turfgrass Evaluation Program which presented the following order: 'Villa' (5.3) > Legendary (5.2) = 'Greenwich' (5.2) = 'Venus' (5.2) > 'Vesper' (5.0) > 'Avalon' (4.9) (NTEP 2008). For an already extremely dense species such as velvet bentgrass, further increases in tiller density will only result in more problems with thatch accumulation. In conclusion, there is no reason to extend the list of velvet bentgrass already recommended either for the northern or the southern climatic zone.

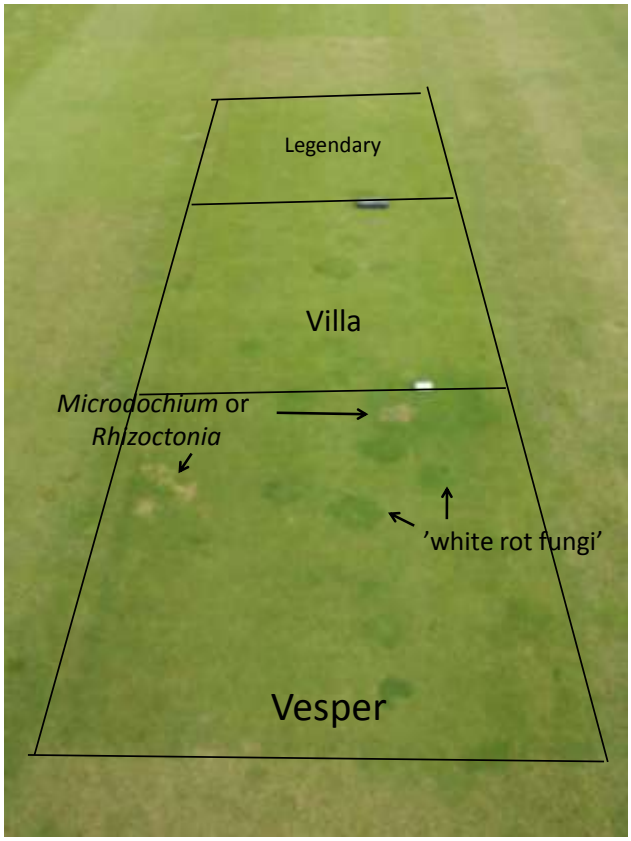

Photo 13. In the last year of the study, 'Vesper' had more patches caused by various fungi than the other velvet bentgrass varieties in the trial at Landvik. Photo taken on 14 October 2010 by Trygve S. Aamlid.

4.3 Colonial bentgrass varieties (Table 6)

Colonial bentgrass varieties could roughly be separated into one group of winter hardy varieties performing well at Apelsvoll and another group of less winter-hardy, but denser varieties performing well at Landvik. Representatives for the former group were the Norwegian variety 'Leirin' and, to a lesser extent, the Norwegian breeding line 'LøEk 0015' which has been selected for darker color, higher tiller density, finer leaves and less height growth. Representatives for the second, less winter-hardy group were the British variety 'AberRoyal' and the Danish variety 'Greenspeed' which, on average for sites, were not significantly different in overall impression although 'Greenspeed' had lighter color and better color retention during the dormancy period than 'AberRoyal' (Table 6e). Although not significantly, the generally better performance of 'AberRoyal' than of 'Greenspeed' at Iceland (Table 6b) may perhaps reflect that the former is better adapted to an oceanic climate, which is also in agreement with the ranking of the two cultivars by STRI (2010). As in our former project (Aamlid et al. 2006), the control variety 'Jorvik' represented a good compromise between northern and southern adaptation and gave the highest visual merit score on average for Apelsvoll and Korpa.

We conclude that **'Greenspeed'** and **'AberRoyal'** should be added to the list of recommended colonial bentgrass varieties for the southern zone, and that breeding line **'LøEk0015'** should be added to the list for the northern zone if registered as a variety and if seed becomes available.

Photo 14. 'Greenspeed' (='TAT 720') had higher visual merit scores than 'Jorvik' at Landvik. Photo taken in September 2009 by Trygve S. Aamlid.

4.4 Creeping bentgrass varieties (Table 7)

On average for the two sites, the control variety 'Independence' was only surpassed by 'CY-2' in the northern zone (Table 7c). 'CY-2' showed particularly good performance at Korpa and was also among the highest ranked cultivars at 'Apelsvoll'. The quality of 'CY-2' on putting greens is in good agreement with NTEP (2008) giving this variety the highest rank on average for 11 trials in North America.

In the southern climatic zone, 'Declaration' was ranked before the control variety 'Independence' because it tended to have less winter damage (Table 7d). Other differences between these varies were that 'Declaration had higher tiller density, lighter in-season color, and more freshly green dormancy color than 'Independence'. On the next place behind 'Independence', but with more winter damage, was 'Runner' ('IS AP 14'), which also obtained the second highest rank next to 'Independence' in the STRI trials (STRI 2010).

We conclude that the lists of recommended creeping bentgrass varieties should be extended with **'CY-2'** for the northern zone and **'Declaration'** and **'Runner'** for the southern zone. Although differences were not statistically significant, no other varieties showed the same quality as the control variety **'Independence'**(Photos 15 and 16).

Photo 15. Three new creeping bentgrass varieties on the recommended lists for putting greens in the Nordic countries: 'Runner'(= 'IS AP 14'), 'CY-2' and 'Declaration'. 'L-93' is relatively winter-hardy, but it is not on the recommended lists due to lower tiller density, broader leaves and more faded winter color than the best varieties. Photo taken at Landvik on 4 September 2009 by Trygve S. Aamlid

Photo 16. Quality difference between one of the best and one of the poorest creeping bentgrass varieties at Landvik. Photo taken on 4 September 2009 by Trygve S. Aamlid

4.5 Chewings fescue varieties (Table 8)

At Landvik and on average for three sites, 'Musica' obtained significantly higher scores for overall visual merit and tiller density than any other variety of chewings fescue (Table 8d and e; Photo 17). This is in good agreement with STRI (2010) which also ranked 'Musica' before other varieties at 4-7 mm mowing height. On the second place in our trials was 'Greensleeves' which also had very good dormancy color and early green-up in spring, but lower tiller density than 'Musica. In the northern zone, the Norwegian breeding line 'LøRc0215' was ranked before 'Greensleeves' due to better performance at Korpa (Table 8c), while in the southern zone,'Barswing' was ranked before 'Greensleeves because of better better performance in summer and autumn at Landvik (Table 8d). On average for Apelsvoll and Korpa, 'Greensleeves' established turf cover more slowly than any other variety (Table 8c), but this was not consistent at Landvik and the effect can perhaps be ascribed to seed quality rather than the genetic make-up of the variety. No other variety met the criteria to enter the recommended lists in any of the climatic zones. Next to 'Musica', 'LøRc0215' and 'Greensleeves', 'Charme' also high the highest visual merit score in the northern zone, but it was not significantly better than the control variety 'Center'. 'Excellence' was significantly darker color than the other varieties, but was otherwise ranked far down the list in both zones. According to personal communication with variety owner DLF Trifolium, 'Center' will now be withdrawn as it has been on the marked for more than 20 years. Likewise, the Swedish breeder Svalöf Weibull has announced that 'SWRSC6028' and 'SWRSC6101' will not enter the market.

We conclude that **'Musica'** and **'Greensleeves'** should be added to the list of recommended chewings fescue varieties for both climatic zones. The recommendation lists may be further extended with **'Barswing'** for the southern zone and – if the variety is registered and seed becomes available – with **'LøRc0015'** for the southern zone.

Photo 17. Quality differences between the new variety 'Musica' and the old variety 'Center' of chewings fescue. Landvik, 4 September 2009. Photo: Trygve S. Aamlid

4.6 Slender creeping red fescue varieties (Table 9)

For slender creeping red fescue there were significant differences in visual merit, tiller density, leaf fineness and dormancy color between the two varieties at the top ('Finesto' and 'Viktorka') and the three varieties at the bottom ('Cezanne', 'Niola', and 'Corrida') of the ranking list from Landvik (Table 9d). 'Amarone' was in an intermediate position. Our ranking for the southern climatic zone is mostly consistent with STRI (2010) which had Viktorka on the very top, almost on a class of its own, followed by 'Cezanne', 'Finesto' and 'Amarone'.

Possibly due to poor seed quality, the control variety 'Cezanne', which was the highest ranked variety in our previous project (Aamlid et al. 2006), obtained low scores turf establishment at all sites. Despite this, it was ranked significantly before any of the other varieties at Apelsvoll (Table 9a). 'Viktorka' had higher tiller density than any other variety at Korpa (Table 9b) and was ranked second for overall visual merit on average for the two sites in the northern zone (Table 9c).

We conclude that **'Viktorka'** should be added to the recommendation list for slender creeping red fescue regardless of climatic zone. For the southern zone, the list should also be include **'Finesto'** (Photo 18).

Photo 18. Both 'Finesto' ('=Frt 04213'and 'Viktorka' produced excellent turf quality, but 'Viktorka' was darker than 'Finesto'. Landvik, 4 Sep. 2009. Photo: Trygve S. Aamlid

4.7 Perennial ryegrass varieties (Table 10)

Within perennial ryegrass 'Chardin' was ranked significantly before the other varieties in both climatic zones (Tables 10c and d) (Photo 18).The variety was significantly denser than all other varieties and had significantly finer leaves than all other varieties except 'Ligala. At Landvik 'Chardin' also greened up earlier in spring and tended to be less invaded by moss than the other varieties. All ryegrass varieties had similar winter survival except for 'Madrid' which was significantly more susceptible to snow mould at both Landvik and Apelsvoll.

As all perennial ryegrass varieties tended to be quite persistent at 5 mm mowing height, it is important to choose a variety with acceptable tiller density. From these trials, there is no reason to recommend any other variety than **'Chardin'** for both climatic zones.

Photo 19. 'Chardin' (='DP 17-2147') was produce significantly better turfgrass quality than any other variety in both climatic zones. Landvik, 4 Sep. 2009. Photo: Trygve S. Aamlid

4.8 Rough bluegrass varieties (Table 11)

Although **'Qasar'** was ranked significantly before **'Race Horse'** at Landvik, differences between these two varieties of rough bluegrass were generally small in both climatic zones. Both varieties can be recommended to the extent that this species should be used for quick repair of winter-damaged greens.

5. References

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6. Appendix (tables)

Table 4. Comparison of species

	Visual merit (1-9)																			
	Over-all mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Sp-ring	Sum-mer	Au-tumn	Tiller den-sity (1-9)	Leaf fine-ness (1-9)	Color (dark-ness) (1-9)	Dor-mancy color (1-9)	Turf cover mean %	In-season disea-ses %	Win-ter dam-age, %	Green-up, days after 28 Feb.	Cover-age 2-3 wk after seeding %	Daily height incre-ment, mm	Thick-ness of thatch/ mat, mm	Moss after 3 years %
a) Apelsvoll, Norway (northern zone)																				
F. rubra com.	5.3	4.6	5.0	5.1	6.0	5.3	5.6	5.1	5.0	7.8	5.1	3.5	97	0	38	65	88	0.7	2	-
A. canina	5.3	6.0	4.2	5.5	5.8	3.6	5.5	5.7	7.5	5.8	5.1	5.2	90	11	48	70	91	0.3	7	-
F. rubra litoralis	4.9	4.2	4.4	4.6	5.9	4.5	5.2	4.9	4.8	7.8	5.1	4.1	95	0	42	67	83	0.6	2	-
A. stolonifera	4.7	6.1	3.1	5.6	5.1	2.3	4.9	5.6	6.1	4.1	5.0	4.5	84	6	64	70	89	0.3	4	-
A. capillaris	4.3	4.8	3.3	4.7	4.7	3.4	4.5	4.3	5.6	4.4	5.3	3.7	85	9	56	67	89	0.4	2	-
P. trivialis	4.3	5.1	2.5	5.6	5.1	3.4	4.5	4.9	4.3	3.9	5.0	3.2	89	0	67	60	94	0.7	1	-
L. perenne	3.5	3.7	2.0	4.2	4.4	2.8	3.8	3.5	3.1	2.9	5.3	4.3	84	1	79	63	100	1.0	1	-
P%	<0.1	<0.1	<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	<0.1	<0.1	<0.1	<0.1	-
LSD 5%	0.3	0.3	0.4	0.5	0.6	0.4	0.2	0.4	0.2	0.2	0.1	0.3	2	1	5	1	4	0.1	1	-
b) Korpa, Iceland (northern zone)																				
F. rubra litoralis	6.5	-	7.0	6.4	6.3	-	-	-	5.7	8.5	4.9	4.9	91	1	18	80	86	-	-	-
F. rubra com.	6.4	-	7.5	6.2	6.1	-	-	-	5.7	8.5	5.2	4.1	93	1	12	79	89	-	-	-
A. canina	5.7	-	1.0	6.8	6.9	-	-	-	7.8	5.9	3.9	5.9	71	3	44	81	90	-	-	-
L. perenne	5.1	-	8.3	5.6	3.0	-	-	-	5.3	5.2	4.8	5.6	76	0	30	82	88	-	-	-
A. stolonifera	4.7	-	1.0	6.5	4.8	-	-	-	7.1	6.5	4.5	5.3	71	2	49	82	79	-	-	-
A. capillaris	4.6	-	1.0	5.7	5.4	-	-	-	7.2	5.6	5.0	5.4	62	0	49	81	85	-	-	-
P. trivialis	4.4	-	6.0	6.7	1.5	-	-	-	6.2	5.3	6.0	5.1	72	0	38	81	93	-	-	-
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	<5	-	-	-
LSD 5%	0.3	-	0.6	0.3	0.5	-	-	-	0.2	0.1	0.1	0.2	4	1	4	1	7	-	-	-

Table 4. Comparison of species (contd.)

	Visual merit (1-9)																			
	Over-all mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Sp-ring	Sum-mer	Au-tumn	Tiller den-sity (1-9)	Leaf fine-ness (1-9)	Color (dark-ness) (1-9)	Dor-mancy color (1-9)	Turf cover mean %	In-season disea-ses %	Win-ter dam-age, %	Green-up, days after 28 Feb.	Cover-age 2-3 wk after sowing %	Daily height incre-ment, mm	Thick-ness of thatch/ mat, mm	Moss after 3 years %
c) Mean of two sites, northern zone																				
F. rubra com.	5.9	4.6	6.3	5.7	6.1	5.3	5.6	5.1	5.4	8.2	5.2	3.8	95	1	25	72	89	0.7	2	-
F. rubra litoralis	5.7	4.2	5.7	5.5	6.1	4.5	5.2	4.9	5.3	8.2	5.0	4.5	93	1	30	74	85	0.6	2	-
A. canina	5.5	6.0	2.6	6.2	6.4	3.6	5.5	5.7	7.7	5.9	4.5	5.6	81	7	46	76	91	0.3	7	-
A. stolonifera	4.7	6.1	2.1	6.1	5.0	2.3	4.9	5.6	6.6	5.3	4.8	4.9	78	4	57	76	83	0.3	4	-
A. capillaris	4.5	4.8	2.2	5.2	5.1	3.4	4.5	4.3	6.4	5.0	5.2	4.6	74	5	53	74	87	0.4	2	-
P. trivialis	4.4	5.1	4.3	6.2	3.3	3.4	4.5	4.9	5.3	4.6	5.5	4.2	81	0	53	71	93	0.7	1	-
L. perenne	4.3	3.7	5.2	4.9	3.7	2.8	3.8	3.5	4.2	4.1	5.1	5.0	80	1	55	73	94	1.0	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	-
LSD 5%	0.2	0.3	0.4	0.3	0.3	0.4	0.2	0.4	0.1	0.1	0.1	0.2	2	1	3	1	4	0.1	1	-
P%, site x species	<0.1	-	<0.1	20	<0.1	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	-	-	-
d) Landvik, Norway (southern zone)																				
A. canina	5.9	5.3	5.0	6.1	6.8	4.9	7.1	5.6	7.4	7.6	5.8	5.8	94	3	15	30	87	0.5	25	0
A. stolonifera	5.5	4.4	5.1	6.0	6.1	5.3	6.1	5.3	6.3	5.1	6.2	4.6	95	1	17	29	79	0.8	21	0
F. rubra com.	5.1	4.9	5.6	4.8	4.9	5.6	5.4	4.6	5.3	7.9	5.4	2.8	97	0	2	31	95	1.3	21	3
F. rubra litoralis	5.0	3.6	5.4	5.4	4.9	4.7	5.7	4.8	5.4	7.8	4.9	4.3	96	1	5	30	71	1.1	20	2
A. capillaris	4.3	3.7	4.0	4.3	4.8	4.4	4.6	4.1	5.3	4.7	5.9	3.3	93	4	7	32	91	1.0	18	3
L. perenne	3.4	4.6	3.9	2.3	3.5	3.4	3.4	3.5	3.6	4.5	5.6	4.2	92	2	7	30	88	1.7	16	6
P. trivialis	3.0	6.3	4.1	2.2	1.1	3.1	2.7	3.0	4.2	5.4	6.2	2.1	61	2	1	32	99	1.0	19	0
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	<5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
LSD 5%	0.4	0.3	0.5	0.5	0.7	0.5	0.5	0.4	0.2	0.1	0.2	0.5	2	2	2	1	10	0.1	2	2

Table 4. Comparison of species (contd.)

	Visual merit (1-9)																			
	Over-all mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Sp-ring	Sum-mer	Au-tumn	Tiller den-sity (1-9)	Leaf fine-ness (1-9)	Color (dark-ness) (1-9)	Dor-mancy color (1-9)	Turf cover mean %	In-season disea-ses %	Win-ter dam-age, %	Green-up, days after 28 Feb.	Cover-age 2-3 wk after seeding %	Daily height incre-ment, mm	Thick-ness of thatch/ mat, mm	Moss after 3 years %
e) Mean of three sites																				
A. canina	5.6	5.7	3.4	6.1	6.5	4.3	6.3	5.7	7.6	6.4	4.9	5.6	85	6	36	60	89	0.4	16	0
F. rubra com.	5.6	4.8	6.0	5.4	5.7	5.5	5.5	4.9	5.3	8.1	5.2	3.5	96	0	17	58	91	1.0	12	2
F. rubra litoralis	5.5	3.9	5.6	5.5	5.7	4.6	5.5	4.9	5.3	8.0	5.0	4.4	94	1	22	59	80	0.9	11	3
A. stolonifera	5.0	5.3	3.1	6.0	5.3	3.8	5.5	5.5	6.5	5.2	5.2	4.8	83	3	43	60	82	0.6	13	3
A. capillaris	4.4	4.3	2.8	4.9	5.0	3.9	4.6	4.2	6.0	4.9	5.4	4.1	80	4	37	60	89	0.7	10	0
L. perenne	4.0	4.2	4.7	4.0	3.6	3.1	3.6	3.5	4.0	4.2	5.2	4.7	84	1	39	58	92	1.4	9	6
P. trivialis	3.9	5.7	4.2	4.8	2.6	3.3	3.6	4.0	4.9	4.9	5.7	3.5	74	1	35	58	95	0.9	10	0
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
LSD 5%	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.2	2	1	2	1	4	0.1	1	2
P%, site x species	<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	-

Table 5. Velvet bentgrass (*Agrostis canina*) varieties

	Visual merit (1-9)																			
	Over-all mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Sp-ring	Sum-mer	Au-tumn	Tiller den-sity (1-9)	Leaf fine-ness (1-9)	Color (dark-ness) (1-9)	Dor-mancy color (1-9)	Turf cover mean %	In-season disea-ses %	Win-ter dam-age, %	Green-up, days after 28 Feb.	Cover-age 2-3 wk after seeding %	Daily height incre-ment, mm	Thick-ness of thatch/ mat, mm	Moss after 3 years %
a) Apelsvoll, Norway (northern zone)																				
Villa	5.6	6.1	4.8	5.6	6.0	3.9	5.8	6.0	7.5	5.8	5.0	5.2	92	9	43	70	90	0.2	7	-
Vesper	5.3	6.0	4.2	5.6	5.9	3.8	5.5	5.7	7.5	5.8	5.2	5.4	90	12	48	70	92	0.3	6	-
Legendary	4.9	5.8	3.8	5.5	5.4	3.2	5.2	5.4	7.5	5.8	5.1	5.1	87	12	52	70	92	0.3	7	-
P%	6	>20	<5	>20	9	8	<5	6	>20	>20	<5	6.0	<0.1	<5	9	>20	>20	<5	>20	-
LSD 5%	-	-	0.5	-	-	-	0.4	-	-	-	0.2	-	1	2	-	-	-	0.1	-	-
b) Korpa, Iceland (northern zone)																				
Vesper	5.7	-	1.0	7.0	6.7	-	-	-	7.7	5.8	3.9	5.9	73	4	42	81	90	-	-	-
Legendary	5.7	-	1.0	6.9	6.9	-	-	-	7.9	5.9	3.9	6.1	72	2	43	81	90	-	-	-
Villa	5.6	-	1.0	6.5	6.9	-	-	-	7.8	5.8	3.9	5.8	69	2	46	82	90	-	-	-
P%	>20	-	>20	17	>20	-	-	-	>20	>20	>20	>20	>20	7	19	>20	>20	-	-	-
LSD 5%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
c) Mean of two sites, northern zone																				
Villa	5.6	6.1	2.9	6.1	6.5	3.9	5.8	6.0	7.7	5.8	4.5	5.5	81	6	45	76	90	0.2	7	-
Vesper	5.5	6.0	2.6	6.3	6.3	3.8	5.5	5.7	7.6	5.8	4.6	5.7	82	8	45	76	91	0.3	6	-
Legendary	5.3	5.8	2.4	6.2	6.2	3.2	5.2	5.4	7.7	5.9	4.5	5.6	80	7	48	76	91	0.3	7	-
P%	>20	>20	<1	>20	>20	8	<5	6	>20	>20	<1	>20	>20	<1	>20	>20	>20	<5	>20	-
LSD 5%	-	-	0.2	-	-	-	0.4	-	-	-	0.1	-	-	1	-	-	-	0.1	-	-
P%, site x variety	11	-	<1	10	>20	-	-	-	>20	>20	<5	10	10	<5	<5	>20	>20	-	-	-

Table 5. Velvet bentgrass (*Agrostis canina*) varieties (contd.)

	Visual merit (1-9)								Tiller density (1-9)	Leaf fineness (1-9)	Color (darkness) (1-9)	Dormancy color (1-9)	Turf cover mean %	In-season diseases %	Winter damage, %	Green-up, days after 28 Feb.	Coverage 2-3 wk after seeding %	Daily height increment, mm	Thickness of thatch/mat, mm	Moss after 3 years %
	Overall mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Spring	Summer	Autumn												
d) Landvik, Norway (southern zone)																				
Villa	6.2	5.2	5.1	6.6	7.3	5.3	7.5	5.8	7.4	7.6	5.4	5.4	95	2	19	31	80	0.5	25	0
Legendary	5.9	5.4	5.1	6	6.8	4.8	7.1	5.6	7.4	7.7	5.4	5.4	94	3	12	31	87	0.5	23	0
Vesper	5.6	5.4	5	5.6	6.4	4.7	6.8	5.4	7.5	7.6	6.7	6.7	92	4	15	28	93	0.5	26	1
P%	>20	>20	>20	>20	>20	>20	>20	>20	>20	>20	<0.1	<1	>20	>20	>20	<0.1	>20	>20	>20	>20
LSD 5%	-	-	-	-	-	-	-	-	-	-	0.4	0.5	-	-	-	1	-	-	-	-
e) Mean of three sites																				
Villa	5.8	5.7	3.6	6.2	6.7	4.6	6.7	5.9	7.6	6.4	4.8	5.5	85	4	36	61	87	0.4	16	0
Vesper	5.5	5.7	3.4	6.1	6.3	4.3	6.2	5.6	7.6	6.4	5.3	6.0	85	7	35	60	92	0.4	16	1
Legendary	5.5	5.6	3.3	6.1	6.4	4.0	6.2	5.5	7.6	6.5	4.8	5.5	84	6	36	61	89	0.4	15	0
P%	>20	>20	<5	>20	>20	>20	>20	>20	>20	>20	<0.1	<0.1	>20	<1	>20	<0.1	17	>20	>20	>20
LSD 5%	-	-	0.2	-	-	-	-	-	-	-	0.1	0.2	-	1	-	1	-	-	-	-
P%, site x variety	>20	-	<1	<5	>20	>20	>20	>20	>20	>20	<0.1	<0.1	15	>20	<5	<0.1	>20	-	-	-

Table 6. Colonial bentgrass (*Agrostis capillaris*) varieties

	Visual merit (1-9)																			
	Over-all mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Sp-ring	Sum-mer	Au-tumn	Tiller den-sity (1-9)	Leaf fine-ness (1-9)	Color (dark-ness) (1-9)	Dor-mancy color (1-9)	Turf cover mean %	In-season disea-ses %	Win-ter dam-age, %	Green-up, days after 28 Feb.	Cover-age 2-3 wk after seeding %	Daily height incre-ment, mm	Thick-ness of thatch/ mat, mm	Moss after 3 years %
a) Apelsvoll, Norway (northern zone)																				
LøEk0015	4.6	4.3	4.4	4.6	4.9	4.3	5.0	4.4	5.7	4.4	5.6	3.2	91	7	50	66	87	0.4	2	-
Leirin	4.5	4.9	4.3	4.4	4.6	4.6	4.6	4.2	5.3	4.1	5.3	2.9	89	10	44	66	90	0.4	3	-
Jorvik	4.5	5.2	3.2	4.9	5.3	3.4	4.7	4.9	6.0	4.4	5.4	4.1	85	8	56	68	90	0.5	2	-
Greenspeed	4.0	4.8	2.4	5.6	4.3	2.2	4.5	4.2	5.9	4.6	5.0	4.4	81	12	66	69	90	0.4	2	-
AberRoyal	3.7	4.8	2.2	4.1	4.4	2.4	3.8	4.0	5.3	4.4	5.3	4.2	79	8	65	67	90	0.5	3	-
P%	<5	<5	<0.1	16	>20	<0.1	8	11	6	>20	7	<0.1	<1	>20	<1	10	>20	>20	>20	-
LSD 5%	0.5	0.5	0.8	-	-	0.5	-	-	-	-	-	0.4	5	-	12	-	-	-	-	-
b) Korpa, Iceland (northern zone)																				
Jorvik	5.0	-	1.0	5.8	6.2	-	-	-	7.5	5.7	5.2	6.2	64	0	46	83	82	-	-	-
AberRoyal	4.9	-	1.0	5.7	6.0	-	-	-	7.2	5.7	5.0	6.2	63	0	51	83	83	-	-	-
Leirin	4.6	-	1.0	6.2	4.8	-	-	-	7.2	5.3	5.0	3.9	67	0	41	79	87	-	-	-
LøEk0015	4.6	-	1.0	5.8	5.2	-	-	-	7.2	5.6	5.0	4.6	63	0	44	79	88	-	-	-
Greenspeed	4.1	-	1.0	5.2	4.6	-	-	-	6.9	5.7	5.0	5.9	52	0	62	83	85	-	-	-
P%	>20	-	>20	19	9	-	-	-	<5	<1	<1	<0.1	15	>20	<1	<0.1	16	-	-	-
LSD 5%	-	-	-	-	-	-	-	-	0.4	0.2	0.1	0.5	-	-	8	1	-	-	-	-

Table 6. Colonial bentgrass (*Agrostis capillaris*) varieties (contd.)

	Visual merit (1-9)								Tiller density (1-9)	Leaf fineness (1-9)	Color (darkness) (1-9)	Dormancy color (1-9)	Turf cover mean %	In-season diseases %	Winter damage, %	Green-up, days after 28 Feb.	Coverage 2-3 wk after seeding %	Daily height increment, mm	Thickness of thatch/mat, mm	Moss after 3 years %
	Overall mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Spring	Summer	Autumn												
c) Mean of two sites, northern zone																				
Jorvik	4.8	5.2	2.1	5.4	5.8	3.4	4.7	4.9	6.8	5.1	5.3	5.2	75	4	51	76	86	0.5	2.0	-
Leirin	4.6	4.9	2.7	5.3	4.7	4.6	4.6	4.2	6.3	4.7	5.2	3.4	78	5	43	73	88	0.4	3.0	-
LøEk0015	4.6	4.3	2.7	5.2	5.1	4.3	5.0	4.4	6.5	5.0	5.3	3.9	77	4	47	73	88	0.4	2.0	-
AberRoyal	4.3	4.8	1.6	4.9	5.2	2.4	3.8	4.0	6.3	5.1	5.2	5.2	71	4	58	75	87	0.5	3.0	-
Greenspeed	4.1	4.8	1.7	5.4	4.5	2.2	4.5	4.2	6.4	5.2	5.0	5.2	67	6	64	76	88	0.4	2.0	-
P%	<5	<5	<0.1	>20	<5	<0.1	8	11	<5	<5	<1	<0.1	<1	>20	<0.1	<0.1	>20	>20	>20	-
LSD 5%	0.4	0.5	0.4	-	0.8	0.5	-	-	0.3	0.3	0.2	0.3	6	-	6	1	-	-	-	-
P%, site x variety	8	-	<0.1	<5	>20	-	-	-	<5	>20	8	<1	19	>20	>20	16	7	-	-	-
d) Landvik, Norway (southern zone)																				
Greenspeed	5.0	4.1	4.2	5.3	6.0	4.6	5.6	5.1	6.0	5.3	5.2	5.0	94	4	10	29	95	0.9	20	1
AberRoyal	4.9	4.0	4.4	4.9	5.7	4.7	5.3	4.8	5.8	4.9	5.8	4.2	95	3	12	30	90	1.0	18	1
Jorvik	4.2	3.2	3.6	4.3	5.2	4.2	4.7	4.0	5.7	5.1	6.3	3.6	91	8	10	32	91	0.9	18	3
LøEk0015	3.8	3.6	3.8	3.5	4.1	4.3	4.0	3.3	4.6	4.6	6.9	2.1	92	5	2	36	95	0.9	17	4
Leirin	3.5	3.8	3.9	3.4	3.0	4.0	3.5	3.2	4.1	3.8	5.4	1.8	93	3	3	34	86	1.3	18	5
P%	<5	>20	>20	<5	<1	>20	<5	<5	<0.1	<1	<0.1	<0.1	>20	12	<1	<0.1	11	<0.1	>20	>20
LSD 5%	1.1	-	-	1.3	1.3	-	1.3	1.1	0.6	0.6	0.4	0.4	-	-	6	2	-	0.1	-	-

Table 6. Colonial bentgrass (*Agrostis capillaris*) varieties (contd.)

	Visual merit (1-9)																			
	Over-all mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Sp-ring	Sum-mer	Au-tumn	Tiller den-sity (1-9)	Leaf fine-ness (1-9)	Color (dark-ness) (1-9)	Dor-mancy color (1-9)	Turf cover mean %	In-season disea-ses %	Win-ter dam-age, %	Green-up, days after 28 Feb.	Cover-age 2-3 wk after seeding %	Daily height incre-ment, mm	Thick-ness of thatch/ mat, mm	Moss after 3 years %
e) Mean of three sites																				
Jorvik	4.6	4.2	2.6	5.0	5.5	3.8	4.7	4.4	6.4	5.1	5.6	4.6	80	5	38	61	88	0.7	10	3
AberRoyal	4.5	4.4	2.5	4.9	5.4	3.6	4.5	4.4	6.1	5.0	5.4	4.8	79	3	42	60	88	0.7	10	1
Greenspeed	4.4	4.5	2.5	5.4	5.0	3.4	5.1	4.7	6.3	5.2	5.1	5.1	76	5	46	60	90	0.6	11	1
LøEk0015	4.3	4.0	3.1	4.6	4.7	4.3	4.5	3.8	5.8	4.9	5.8	3.3	82	4	32	60	90	0.6	10	4
Leirin	4.2	4.4	3.1	4.7	4.1	4.3	4.1	3.7	5.5	4.4	5.2	2.9	83	4	29	60	88	0.9	11	5
P%	>20	>20	<1	11	<0.1	<5	9	<5	<0.1	<0.1	<0.1	<0.1	<5	>20	<0.1	18	>20	<1	>20	>20
LSD 5%	-	-	0.4	-	0.6	0.6	-	0.6	0.3	0.3	0.2	0.3	4	-	5	-	-	0.1	-	-
P%, site x variety	<1	7	<0.1	<1	<1	<0.1	<1	<1	<0.1	6.0	<0.1	<0.1	<5	5	7	<1	<5	<1	>20	-

Table 7. Creeping bentgrass (*Agrostis stolonifera*) varieties

	Visual merit (1-9)								Tiller density (1-9)	Leaf fineness (1-9)	Color (darkness) (1-9)	Dormancy color (1-9)	Turf cover mean %	In-season diseases %	Winter damage, %	Green-up, days after 28 Feb.	Coverage 2-3 wk after seeding %	Daily height increment, mm	Thickness of thatch/mat, mm	Moss after 3 years %
	Overall mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Spring	Summer	Autumn												
a) Apelsvoll, Norway (northern zone)																				
L-93	4.8	6.3	3.2	5.5	5.2	2.5	5.0	5.6	6.0	4.1	4.9	4.4	86	5	62	69	92	0.4	3	-
Independence	4.8	6.1	3.2	5.5	5.3	2.4	5.0	5.7	6.3	4.2	5.0	4.8	84	7	64	70	92	0.3	4	-
CY-2	4.8	6.6	3.2	5.8	5.1	2.3	5.0	5.8	6.3	4.1	4.9	4.3	83	7	64	70	88	0.3	5	-
Sandhill	4.8	6.1	3.4	5.9	5.2	2.2	5.3	5.6	6.1	4.1	5.2	4.7	84	5	65	70	90	0.3	4	-
MacKenzie	4.8	6.0	3.2	6.2	5.2	2.3	5.2	5.9	6.4	4.2	5.0	4.6	84	6	65	69	92	0.4	3	-
Runner	4.7	5.8	3.1	5.8	5.2	2.4	5.0	5.7	6.3	4.3	5.0	4.4	83	7	64	69	90	0.3	4	-
Bengal	4.6	6.0	3.0	5.3	5.2	2.3	4.8	5.5	6.0	4.2	4.9	4.5	83	9	66	70	88	0.3	4	-
Alpha	4.5	6.1	3.1	5.4	4.6	2.3	4.7	5.3	6.0	4.1	5.0	4.2	83	6	64	69	92	0.3	3	-
Declaration	4.3	6.0	3.0	4.5	4.6	2.3	4.3	5.2	5.9	4.0	5.0	4.5	82	5	63	70	77	0.3	3	-
P%	16	>20	>20	<5	14	>20	<5	>20	<5	<5	<1	<5	16	<1	>20	20	>20	>20	>20	-
LSD 5%	-	-	-	0.9	-	-	0.5	-	0.3	0.2	0.1	0.3	-	2	-	-	-	-	-	-
b) Korpa, Iceland (northern zone)																				
CY-2	5.6	-	1.0	7.2	6.2	-	-	-	7.6	6.5	4.6	6.1	74	0	48	82	68	-	-	-
Independence	5.1	-	1.0	6.9	5.3	-	-	-	7.4	6.4	4.4	5.1	77	2	42	82	82	-	-	-
Declaration	4.7	-	1.0	6.3	5.1	-	-	-	7.1	6.3	4.5	5.4	72	3	53	82	75	-	-	-
Bengal	4.6	-	1.0	6.5	4.6	-	-	-	7.2	6.6	4.5	5.2	72	3	49	83	83	-	-	-
Alpha	4.6	-	1.0	6.5	4.4	-	-	-	6.9	6.4	4.5	5.4	70	3	50	82	82	-	-	-
Runner	4.6	-	1.0	6.5	4.6	-	-	-	7.1	6.4	4.4	5.1	71	3	51	82	78	-	-	-
L-93	4.5	-	1.0	6.4	4.4	-	-	-	7.0	6.5	4.4	4.9	71	3	44	83	83	-	-	-
Sandhill	4.5	-	1.0	6.4	4.3	-	-	-	7.0	6.4	4.7	5.3	69	2	52	82	82	-	-	-
MacKenzie	4.5	-	1.0	6.2	4.5	-	-	-	7.0	6.6	4.4	5.4	67	2	53	83	77	-	-	-
P%	12	-	>20	>20	7	-	-	-	5	7	>20	10	>20	17	9	>20	>20	-	-	-
LSD 5%	-	-	-	-	-	-	-	-	0.4	-	-	-	-	-	-	-	-	-	-	-

Table 7. Creeping bentgrass (*Agrostis stolonifera*) varieties (contd.)

	Visual merit (1-9)																			
	Over-all mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Spring	Summer	Autumn	Tiller density (1-9)	Leaf fineness (1-9)	Color (darkness) (1-9)	Dormancy color (1-9)	Turf cover mean %	In-season diseases %	Winter damage, %	Green-up, days after 28 Feb.	Coverage 2-3 wk after seeding %	Daily height increment, mm	Thickness of thatch/ mat, mm	Moss after 3 years %
c) Mean of two sites, northern zone																				
CY-2	5.2	6.6	2.1	6.5	5.7	2.3	5.0	5.8	7.0	5.3	4.8	5.2	79	4	56	76	78	0.3	5.0	-
Independence	5.0	6.1	2.1	6.2	5.3	2.4	5.0	5.7	6.9	5.3	4.7	5.0	81	5	53	76	87	0.3	4.0	-
L-93	4.7	6.3	2.1	6.0	4.8	2.5	5.0	5.6	6.5	5.3	4.7	4.7	79	4	53	76	88	0.4	3.0	-
Runner	4.7	5.8	2.1	6.2	4.9	2.4	5.0	5.7	6.7	5.4	4.7	4.8	77	5	58	76	84	0.3	4.0	-
MacKenzie	4.7	6.0	2.1	6.2	4.9	2.3	5.2	5.9	6.7	5.4	4.7	5.0	76	4	59	76	84	0.4	3.0	-
Sandhill	4.7	6.1	2.2	6.2	4.8	2.2	5.3	5.6	6.6	5.3	5.0	5.0	77	4	59	76	86	0.3	4.0	-
Alpha	4.6	6.1	2.1	6.0	4.5	2.3	4.7	5.3	6.5	5.3	4.8	4.8	77	5	57	76	87	0.3	3.0	-
Bengal	4.6	6.0	2.0	5.9	4.9	2.3	4.8	5.5	6.6	5.4	4.7	4.9	78	6	58	77	86	0.3	4.0	-
Declaration	4.5	6.0	2.0	5.4	4.9	2.3	4.3	5.2	6.5	5.2	4.8	5.0	77	4	58	76	76	0.3	3.0	-
P%	6	>20	>20	6	<5	>20	<5	>20	<1	<1	<1	>20	>20	<1	10	>20	>20	>20	>20	-
LSD 5%	-	-	-	-	0.6	-	0.5	-	0.2	0.2	0.1	-	-	1	-	-	-	-	-	-
P%, site x variety	14	-	>20	14	<5	-	-	-	15	16	>20	<1	>20	<5	>20	7	>20	-	-	-
d) Landvik, Norway (southern zone)																				
Declaration	6.0	4.2	5.7	6.6	6.5	5.7	6.7	5.8	6.8	5.8	5.9	5.6	96	1	11	28	72	0.7	22	0
Independence	6.0	4.9	5.4	6.4	6.9	6.0	6.9	5.6	6.9	5.4	6.6	4.9	95	1	18	29	86	0.7	22	0
Runner	5.9	4.5	5.4	6.7	6.2	5.6	6.8	5.5	6.9	5.6	6.0	4.8	94	1	26	28	84	0.7	22	0
MacKenzie	5.5	4.5	5.0	6.0	6.2	5.4	6.3	5.1	6.3	5.5	5.9	4.1	95	1	16	30	80	0.7	20	0
CY-2	5.5	5.1	5.4	5.6	5.8	4.9	5.9	5.8	6.0	5.0	5.6	5.0	95	2	21	29	75	0.7	21	0
Bengal	5.4	4.2	4.6	5.8	6.2	5.0	5.9	5.3	6.1	5.1	6.3	4.8	95	2	16	29	73	0.8	22	0
Sandhill	5.2	4.2	5.0	5.5	5.8	5.0	5.7	5.1	6.0	4.7	6.7	4.5	95	2	16	29	77	0.8	22	0
Alpha	5.1	4.1	4.4	5.6	5.8	5.2	5.5	4.8	5.7	4.3	6.3	4.1	95	2	13	29	86	0.8	22	1
L-93	5.0	4.2	4.7	5.4	5.2	5.2	5.4	4.6	5.6	4.3	6.2	3.5	96	1	14	30	80	0.8	21	1
P%	>20	>20	>20	>20	>20	>20	>20	>20	9	<0.1	<0.1	>20	>20	>20	9	>20	>20	>20	>20	13
LSD 5%	-	-	-	-	-	-	-	-	-	0.4	0.4	-	-	-	-	-	-	-	-	-

Table 7. Creeping bentgrass (*Agrostis stolonifera*) varieties (contd.)

	Visual merit (1-9)								Tiller density (1-9)	Leaf fineness (1-9)	Color (darkness) (1-9)	Dormancy color (1-9)	Turf cover mean %	In-season diseases %	Winter damage, %	Green-up, days after 28 Feb.	Coverage 2-3 wk after seeding %	Daily height increment, mm	Thickness of thatch/mat, mm	Moss after 3 years %
	Overall mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Spring	Summer	Autumn												
e) Mean of three sites																				
Independence	5.3	5.5	3.2	6.3	5.8	4.2	6.0	5.6	6.8	5.3	5.3	4.9	85	3	41	60	87	0.5	13	0
CY-2	5.3	5.9	3.2	6.2	5.7	3.6	5.4	5.8	6.6	5.2	5.0	5.1	84	3	44	60	77	0.5	13	0
Runner	5.1	5.2	3.2	6.4	5.3	4.0	5.9	5.6	6.8	5.4	5.1	4.8	83	4	47	60	84	0.5	13	0
Declaration	5.0	5.1	3.2	5.8	5.4	4.0	5.5	5.5	6.6	5.4	5.1	5.2	83	3	42	60	74	0.5	13	0
MacKenzie	5.0	5.3	3.0	6.2	5.3	3.9	5.7	5.5	6.6	5.4	5.1	4.7	82	3	45	61	83	0.5	12	0
Bengal	4.9	5.1	2.9	5.9	5.3	3.6	5.4	5.4	6.4	5.3	5.2	4.8	84	5	44	60	82	0.5	13	0
L-93	4.8	5.2	3.0	5.7	4.9	3.8	5.2	5.1	6.2	5.0	5.2	4.3	84	3	40	60	85	0.6	12	1
Sandhill	4.8	5.1	3.1	5.9	5.1	3.6	5.5	5.3	6.3	5.1	5.5	4.8	83	3	45	60	83	0.6	13	0
Alpha	4.7	5.1	2.8	5.8	4.9	3.7	5.1	5	6.2	4.9	5.3	4.6	82	4	42	60	86	0.6	12	1
P%	>20	14	>20	>20	6.0	>20	19	>20	<1	<0.1	<0.1	<5	>20	<5	<5	>20	7	>20	>20	13
LSD 5%	-	-	-	-	-	-	-	-	0.4	0.2	0.2	0.5	-	1	4.0	-	-	-	-	-
P%, site x variety	>20	>20	>20	20	14.0	>20	7	>20	10	<0.1	<0.1	15	>20	<5	6	>20	>20	>20	>20	-

Table 8. Chewings fescue (*Festuca rubra* ssp. *commutata*) varieties

	Visual merit (1-9)								Tiller density (1-9)	Leaf fineness (1-9)	Color (darkness) (1-9)	Dormancy color (1-9)	Turf cover mean %	In-season diseases %	Winter damage, %	Green-up, days after 28 Feb.	Coverage 2-3 wk after seeding %	Daily height increment, mm	Thickness of thatch/mat, mm	Moss after 3 years %
	Overall mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Spring	Summer	Autumn												
a) Apelsvoll, Norway (northern zone)																				
Musica	5.7	5.3	5.0	5.8	6.7	5.3	6.0	6.0	5.4	7.8	5.2	3.8	97	0	39	65	92	0.9	2	-
Barswing	5.6	5.4	4.7	6.1	6.2	4.9	5.9	5.6	5.3	7.8	4.9	3.7	97	0	40	66	90	0.7	2	-
SW RSC6028	5.4	4.5	5.3	5.3	6.0	5.6	5.7	5.2	5.0	7.8	5.0	3.7	97	0	36	65	92	0.7	3	-
Margret	5.4	4.8	5.1	5.1	6.2	5.5	5.6	5.2	5.0	7.8	5.0	3.4	97	0	36	65	88	0.6	2	-
Charme	5.4	5.0	5.1	5.3	6.0	5.5	5.6	5.2	4.8	7.8	5.2	3.4	97	0	38	65	90	0.7	3	-
Greensleeves	5.3	4.7	5.1	4.6	6.1	5.4	5.4	5.0	5.1	7.8	5.2	3.8	96	0	37	65	70	0.7	2	-
LøRc0215	5.3	4.2	5.3	4.9	6.0	5.5	5.5	5.1	4.9	7.8	5.0	3.4	97	0	37	65	93	0.8	2	-
Excellence	5.3	4.6	5.0	5.3	5.9	5.2	5.7	5.2	4.9	7.8	5.2	3.4	97	0	39	65	88	0.7	2	-
Center	5.2	4.7	4.7	5.2	6.0	5.0	5.5	5.1	5.0	7.8	5.0	3.3	95	0	43	65	88	0.7	2	-
SW RSC6101	5.0	4.2	5.3	4.3	5.4	5.4	5.1	4.7	4.7	7.8	5.0	3.3	97	0	34	65	92	0.7	2	-
LøRc0021	4.7	3.4	4.9	4.3	5.2	4.9	5.1	4.3	4.6	7.8	5.0	3.7	95	0	35	65	87	0.7	3	-
P%	<5	<0.1	>20	<0.1	<0.1	>20	<5	<0.1	<0.1	>20	<5	<5	>20	>20	>20	>20	<0.1	>20	15	-
LSD 5%	0.5	0.5	-	0.6	0.5	-	0.5	0.5	0.2	-	0.2	0.3	-	-	-	-	10	-	-	-

Table 8. Chewings fescue (*Festuca rubra* ssp. *commutata*) varieties (contd.)

	Visual merit (1-9)																			
	Over-all mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Sp-ring	Sum-mer	Au-tumn	Tiller den-sity (1-9)	Leaf fine-ness (1-9)	Color (dark-ness) (1-9)	Dor-mancy color (1-9)	Turf cover mean %	In-season disea-ses %	Win-ter dam-age, %	Green-up, days after 28 Feb.	Cover-age 2-3 wk after seeding %	Daily height incre-ment, mm	Thick-ness of thatch/ mat, mm	Moss after 3 years %
b) Korpa, Iceland (northern zone)																				
LøRc0215	6.8	-	7.7	6.8	6.5	-	-	-	5.9	8.5	5.1	4.2	95	1	10	77	90	-	-	-
Greensleeves	6.8	-	8.0	6.4	6.6	-	-	-	6.0	8.5	5.3	4.7	91	1	16	78	78	-	-	-
SW RSC6101	6.6	-	8.0	6.5	5.9	-	-	-	5.9	8.5	5.3	4.2	93	1	12	80	92	-	-	-
Charme	6.6	-	8.0	6.2	6.4	-	-	-	5.7	8.5	5.4	3.8	94	1	12	79	90	-	-	-
LøRc0021	6.5	-	7.0	6.4	6.3	-	-	-	5.8	8.5	5.3	3.9	93	1	12	80	87	-	-	-
Musica	6.4	-	7.0	6.4	6.2	-	-	-	5.9	8.5	5.3	4.5	93	1	8	79	93	-	-	-
Margret	6.4	-	8.3	5.9	6.0	-	-	-	5.5	8.5	5.1	4.0	93	2	10	78	92	-	-	-
Center	6.3	-	7.7	5.8	6.2	-	-	-	5.5	8.5	5.1	3.8	92	1	16	80	88	-	-	-
SW RSC6028	6.2	-	7.7	6.0	5.6	-	-	-	5.6	8.5	5.2	4.0	92	1	13	79	92	-	-	-
Barswing	6.1	-	7.0	6.0	5.6	-	-	-	5.7	8.5	5.1	4.2	93	1	12	79	90	-	-	-
Excellence	6.1	-	6.3	6.3	5.8	-	-	-	5.7	8.5	5.4	4.0	93	1	13	79	88	-	-	-
P%	<5	-	>20	>20	<5	-	-	-	>20	>20	<5	<5	<5	>20	<5	<1	8	-	-	-
LSD 5%	0.5	-	-	-	0.6	-	-	-			0.2	0.4	2		4	2	-	-	-	-

Table 8. Chewings fescue (*Festuca rubra* ssp. *commutata*) varieties (contd.)

	Visual merit (1-9)																			
	Over-all mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Sp-ring	Sum-mer	Au-tumn	Tiller den-sity (1-9)	Leaf fine-ness (1-9)	Color (dark-ness) (1-9)	Dor-mancy color (1-9)	Turf cover mean %	In-season disea-ses %	Win-ter dam-age, %	Green-up, days after 28 Feb.	Cover-age 2-3 wk after seeding %	Daily height incre-ment, mm	Thick-ness of thatch/ mat, mm	Moss after 3 years %
c) Mean of two sites, northern zone																				
Musica	6.1	5.3	6.0	6.1	6.5	5.3	6.0	6.0	5.7	8.2	5.3	4.2	95	1	24	72	93	0.9	2	-
LøRc0215	6.1	4.2	6.5	5.9	6.3	5.5	5.5	5.1	5.4	8.2	5.1	3.8	96	1	24	71	92	0.8	2	-
Greensleeves	6.1	4.7	6.6	5.5	6.4	5.4	5.4	5.0	5.6	8.2	5.3	4.3	94	1	27	72	74	0.7	2	-
Charme	6.0	5.0	6.6	5.8	6.2	5.5	5.6	5.2	5.3	8.2	5.3	3.6	96	1	25	72	90	0.7	3	
Margret	5.9	4.8	6.7	5.5	6.1	5.5	5.6	5.2	5.3	8.2	5.1	3.7	95	1	23	72	90	0.6	2	-
Barswing	5.9	5.4	5.9	6.1	5.9	4.9	5.9	5.6	5.5	8.2	5.0	4.0	95	1	26	73	90	0.7	2	-
SW RSC6101	5.8	4.2	6.7	5.4	5.7	5.4	5.1	4.7	5.3	8.2	5.2	3.8	95	1	23	73	92	0.7	2	-
SW RSC6028	5.8	4.5	6.5	5.7	5.8	5.6	5.7	5.2	5.3	8.2	5.1	3.9	95	1	25	72	92	0.7	3	-
Center	5.8	4.7	6.2	5.5	6.1	5.0	5.5	5.1	5.3	8.2	5.1	3.6	94	1	30	73	88	0.7	2	
Excellence	5.7	4.6	5.7	5.8	5.9	5.2	5.7	5.2	5.3	8.2	5.3	3.7	95	1	26	72	88	0.7	2	-
LøRc0021	5.6	3.4	6.0	5.4	5.8	4.9	5.1	4.3	5.2	8.2	5.2	3.8	94	1	24	73	87	0.7	3	-
P%	5	<0.1	>20	<5	<1	>20	<5	<0.1	<1	>20	<0.1	<0.1	<5	>20	14	<1	<0.1	>20	15	-
LSD 5%	0.3	0.5	-	0.5	0.4	-	0.5	0.5	0.2	-	0.1	0.3	2	-	-	1	6	-	-	-
P%, site x variety	<1	-	>20	<0.1	<0.1	-	-	-	<5	>20	>20	>20	>20	>20	>20	<1	>20	-	-	-

Table 8. Chewings fescue (*Festuca rubra* ssp. *commutata*) varieties (contd.)

	Visual merit (1-9)																			
	Over-all mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Sp-ring	Sum-mer	Au-tumn	Tiller den-sity (1-9)	Leaf fine-ness (1-9)	Color (dark-ness) (1-9)	Dor-mancy color (1-9)	Turf cover mean %	In-season disea-ses %	Win-ter dam-age, %	Green-up, days after 28 Feb.	Cover-age 2-3 wk after seeding %	Daily height incre-ment, mm	Thick-ness of thatch/ mat, mm	Moss after 3 years %
d) Landvik, Norway (southern zone)																				
Musica	6.1	5.5	6.7	6.0	6.0	6.4	6.8	5.4	6.4	8.1	5.0	3.8	99	1	2	30	95	1.4	22	1
Barswing	5.5	5.4	6.2	5.2	5.2	5.4	6.0	5.2	5.6	8.2	5.4	2.7	98	0	2	32	97	1.3	20	1
Greensleeves	5.4	5.2	5.8	5.2	5.3	5.9	5.7	4.9	5.6	8.0	5.5	3.5	98	0	2	30	94	1.3	20	2
Center	5.2	5.4	5.7	4.7	5.2	5.6	5.3	5.0	5.3	8.0	5.6	2.9	98	0	2	32	98	1.3	20	2
Margret	5.2	5.0	5.7	5.0	4.8	5.6	5.5	4.7	5.3	7.9	5.5	2.4	98	0	2	32	93	1.4	22	3
LøRc0021	5.0	4.1	5.2	5.0	5.2	5.5	5.4	4.5	5.1	7.8	5.1	2.7	97	0	1	32	97	1.3	22	2
Charme	4.9	5.1	5.5	4.6	4.5	5.7	5.0	4.4	5.0	7.9	5.7	2.5	97	1	2	31	97	1.3	22	3
SW RSC6028	4.8	4.7	5.3	4.7	4.6	5.5	5.1	4.3	5.1	7.9	5.2	2.4	97	0	1	32	97	1.4	22	4
Excellence	4.7	4.2	5.4	4.5	4.7	5.6	5.0	4.1	5.3	7.7	6.3	2.5	95	1	3	32	89	1.4	21	2
LøRc0215	4.5	4.6	5.2	4.3	4.0	5.3	4.6	4.0	4.7	7.9	5.1	2.6	96	1	2	31	98	1.3	20	5
SW RSC6101	4.4	4.3	5.0	4.2	4.0	5.2	4.6	3.7	4.5	7.8	5.4	2.5	96	1	1	31	95	1.3	19	6
P%	<0.1	<1	<0.1	<0.1	<1	<1	<0.1	<0.1	<0.1	<5	<0.1	<0.1	<1	<5	>20	<0.1	13	17	>20	<5
LSD 5%	0.5	0.7	0.4	0.6	0.9	0.5	0.6	0.5	0.4	0.3	0.2	0.4	2	1	-	1	-	-	-	3

Table 8. Chewings fescue (*Festuca rubra* ssp. *commutata*) varieties (contd.)

	Visual merit (1-9)																			
	Over-all mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Sp-ring	Sum-mer	Au-tumn	Tiller den-sity (1-9)	Leaf fine-ness (1-9)	Color (dark-ness) (1-9)	Dor-mancy color (1-9)	Turf cover mean %	In-season disea-ses %	Win-ter dam-age, %	Green-up, days after 28 Feb.	Cover-age 2-3 wk after seeding %	Daily height incre-ment, mm	Thick-ness of thatch/ mat, mm	Moss after 3 years %
e) Mean of three sites																				
Musica	6.1	5.4	6.2	6.1	6.3	5.8	6.4	5.7	5.9	8.1	5.1	4.0	96	1	16	58	93	1.1	12	1
Greensleeves	5.8	5	6.3	5.4	6	5.7	5.6	4.9	5.6	8.1	5.3	4.0	95	1	18	58	81	1	11	2
Margret	5.7	4.9	6.4	5.3	5.7	5.5	5.6	5.0	5.3	8.1	5.2	3.3	96	1	16	58	91	1	12	3
Charme	5.7	5.0	6.2	5.4	5.7	5.6	5.3	4.8	5.2	8.1	5.4	3.3	96	0	17	58	92	1	12	3
Barswing	5.7	5.4	6.0	5.8	5.7	5.2	5.9	5.4	5.5	8.2	5.2	3.5	96	0	18	59	92	1	11	1
Center	5.6	5.1	6.0	5.2	5.8	5.3	5.4	5.1	5.3	8.1	5.2	3.4	95	0	20	59	92	1	11	2
LøRc0215	5.5	4.4	6.0	5.3	5.5	5.4	5.1	4.5	5.2	8.1	5.1	3.4	96	1	16	58	94	1	11	5
SW RSC6028	5.5	4.6	6.1	5.3	5.4	5.6	5.4	4.7	5.2	8.1	5.1	3.4	96	0	17	59	93	1.1	12	4
LøRc0021	5.4	3.8	5.7	5.2	5.6	5.2	5.3	4.4	5.1	8.0	5.1	3.4	95	0	16	59	90	1	12	2
Excellence	5.4	4.4	5.6	5.4	5.5	5.4	5.3	4.6	5.3	8.0	5.7	3.3	95	0	18	59	88	1.1	12	2
SW RSC6101	5.3	4.3	6.1	5	5.1	5.3	4.9	4.2	5.0	8.0	5.2	3.3	95	1	15	59	93	1	11	6
P%	<0.1	<0.1	>20	<0.1	<0.1	13	<0.1	<0.1	<0.1	<1	<0.1	<0.1	11	>20	7	<0.1	<0.1	>20	<5	<5
LSD 5%	0.3	0.4	-	0.4	0.4	-	0.4	0.3	0.2	0.1	0.1	0.2	-	-	-	1	5	-	1	3
P%, site x variety	<0.1	>20	7	<0.1	<0.1	13	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<1	<5	>20	<0.1	14	>20	>20	-

Table 9. Slender creeping red fescue (*Festuca rubra* ssp. *litoralis*) varieties

	Visual merit (1-9)																			
	Over-all mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Sp-ring	Sum-mer	Au-tumn	Tiller den-sity (1-9)	Leaf fine-ness (1-9)	Color (dark-ness) (1-9)	Dor-mancy color (1-9)	Turf cover mean %	In-season disea-ses %	Win-ter dam-age, %	Green-up, days after 28 Feb.	Cover-age 2-3 wk after seeding %	Daily height incre-ment, mm	Thick-ness of thatch/ mat, mm	Moss after 3 years %
a) Apelsvoll, Norway (northern zone)																				
Cezanne	5.4	4.2	4.9	5.2	6.5	4.8	5.8	5.3	5.1	7.8	5.1	4.0	96	0	37	67	60	0.6	3	-
Finesto	5.0	4.5	4.5	4.7	5.9	4.3	5.3	5.2	5.0	7.8	4.8	4.0	95	0	43	66	88	0.7	2	-
Viktorka	4.9	4.7	3.8	4.9	6.0	4.2	5.1	5.2	4.9	7.8	5.2	4.1	93	0	47	67	87	0.6	2	-
Niola	4.8	3.8	4.9	4.4	5.5	4.6	5.2	4.9	4.9	7.8	5.1	4.3	96	0	36	67	88	0.6	2	-
Amarone	4.8	4.3	4.2	4.4	5.7	4.5	5.1	4.7	4.7	7.8	5.0	4.2	93	0	47	67	87	0.6	2	-
Corrida	4.6	3.9	4.3	4.0	5.6	4.7	4.9	4.4	4.6	7.8	5.1	3.8	94	0	43	66	88	0.6	2	-
P%	<5	<5	>20	>20	15.0	>20	<1	<5	<5	>20	20.0	<5	20	>20	>20	>20	<0.1	>20	>20	-
LSD 5%	0.4	0.6	-	0.6	-	-	0.4	0.5	0.3	-	-	0.3	-	-	-	-	14	-	-	-
b) Korpa, Iceland (northern zone)																				
Viktorka	6.6	-	6.7	6.8	6.3	-	-	-	6.0	8.5	5.0	4.7	92	1	16	81	90	-	-	-
Corrida	6.6	-	7.3	6.3	6.5	-	-	-	5.6	8.5	4.9	5.2	91	1	19	81	83	-	-	-
Amarone	6.5	-	7.7	6.5	6.1	-	-	-	5.7	8.5	4.9	4.6	91	0	18	80	85	-	-	-
Finesto	6.4	-	6.7	6.2	6.5	-	-	-	5.6	8.5	4.7	4.7	92	0	17	80	90	-	-	-
Cezanne	6.3	-	6.3	6.5	6.2	-	-	-	5.8	8.5	4.8	5.1	91	0	19	79	83	-	-	-
Niola	6.3	-	7.3	6.0	6.1	-	-	-	5.6	8.5	5.1	4.9	90	1	19	80	85	-	-	-
P%	>20	-	>20	>20	>20	-	-	-	<5	>20	6	13	19	<5	>20	12	7	-	-	-
LSD 5%	-	-	-	-	-	-	-	-	0.3	-	-	-	1	1	-	-	-	-	-	-

Table 9. Slender creeping red fescue (*Festuca rubra* ssp. *litoralis*) varieties (contd.)

	Visual merit (1-9)																			
	Over-all mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Spring	Summer	Autumn	Tiller density (1-9)	Leaf fineness (1-9)	Color (darkness) (1-9)	Dormancy color (1-9)	Turf cover mean %	In-season diseases %	Winter damage, %	Green-up, days after 28 Feb.	Coverage 2-3 wk after seeding %	Daily height increment, mm	Thickness of thatch/mat, mm	Moss after 3 years %
c) Mean of two sites, northern zone																				
Cezanne	5.9	4.2	5.6	5.9	6.4	4.8	5.8	5.3	5.5	8.2	5.0	4.6	94	0	28	73	72	0.6	3	-
Viktorka	5.8	4.7	5.3	5.9	6.2	4.2	5.1	5.2	5.5	8.2	5.1	4.4	93	1	32	74	88	0.6	2	-
Finesto	5.7	4.5	5.6	5.5	6.2	4.3	5.3	5.2	5.3	8.2	4.8	4.4	94	0	30	73	89	0.7	2	-
Amarone	5.7	4.3	6.0	5.5	5.9	4.5	5.1	4.7	5.2	8.2	5.0	4.4	92	0	33	74	86	0.6	2	-
Niola	5.6	3.8	6.1	5.2	5.8	4.6	5.2	4.9	5.3	8.2	5.1	4.6	93	1	28	74	87	0.6	2	-
Corrida	5.6	3.9	5.8	5.2	6.1	4.7	4.9	4.4	5.1	8.2	5.0	4.5	93	1	31	74	86	0.6	2	-
P%	>20	<5	>20	<5	>20	>20	<1	<5	<1	>20	<1	>20	>20	<5	>20	20	<0.1	>20	>20	-
LSD 5%	-	0.6		0.5		-	0.4	0.5	0.2	-	0.2	-	-	1	-	-	7	-	-	-
P%, site x variety	<5	-	>20	>20	>20	-	-	-	<5	>20	>20	<5	<5	<5	>20	15	<1	-	-	-
d) Landvik, Norway (southern zone)																				
Finesto	5.8	4.1	6.2	6.4	5.7	5.6	6.8	5.4	6.1	8.0	4.3	4.6	98	1	8	30	74	1.2	21	0
Viktorka	5.7	3.8	6.1	6.1	5.9	4.7	7.0	5.5	6.0	8.1	5.4	4.6	98	1	7	30	75	1.1	19	0
Amarone	5.4	4.7	5.9	5.7	5.1	5.1	6.2	5.1	5.8	8.0	4.6	4.2	98	1	4	30	90	1.1	21	2
Corrida	4.5	3.0	4.8	4.7	4.6	4.5	4.9	4.3	4.8	7.5	5.4	4.3	97	0	1	30	68	1.1	19	2
Cezanne	4.4	2.8	4.6	4.9	4.6	4.6	4.8	4.3	5.1	7.8	4.5	4.3	92	2	4	30	47	0.9	20	3
Niola	4.1	2.9	4.7	4.7	3.6	3.9	4.7	4.0	4.7	7.7	5.4	4.1	94	2	5	30	72	1.1	22	4
P%	<1	<5	<0.1	<1	<1	<5	<1	<1	<0.1	<5	<0.1	<5	<1	9	<5	>20	<1	<1	>20	20
LSD 5%	0.8	1.1	0.6	1.0	1.1	0.8	1.1	0.8	0.5	0.3	0.3	0.3	3	-	4	-	18	0.1	-	-

Table 9. Slender creeping red fescue (*Festuca rubra* ssp. *litoralis*) varieties (contd.)

	Visual merit (1-9)																			
	Over-all mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Sp-ring	Sum-mer	Au-tumn	Tiller den-sity (1-9)	Leaf fine-ness (1-9)	Color (dark-ness) (1-9)	Dor-mancy color (1-9)	Turf cover mean %	In-season disea-ses %	Win-ter dam-age, %	Green-up, days after 28 Feb.	Cover-age 2-3 wk after seeding %	Daily height incre-ment, mm	Thick-ness of thatch/ mat, mm	Moss after 3 years %
e) Mean of three sites																				
Finesto	5.8	4.3	5.8	5.8	6.0	5.0	6.0	5.3	5.6	8.1	4.6	4.4	95	0	23	58	84	0.9	12	0
Viktorka	5.7	4.3	5.5	5.9	6.1	4.4	6.0	5.3	5.6	8.1	5.2	4.5	94	0	23	59	84	0.8	10	0
Amarone	5.6	4.5	5.9	5.5	5.6	4.8	5.7	4.9	5.4	8.1	4.8	4.3	94	0	23	59	87	0.8	11	2
Cezanne	5.4	3.5	5.3	5.5	5.8	4.7	5.3	4.8	5.3	8.0	4.8	4.5	93	1	20	59	63	0.8	12	3
Corrida	5.2	3.4	5.5	5.0	5.5	4.6	4.9	4.3	5.0	7.9	5.2	4.4	94	0	21	59	80	0.9	11	2
Niola	5.1	3.4	5.6	5.0	5.1	4.2	4.9	4.4	5.1	8.0	5.2	4.4	93	1	20	59	82	0.8	12	4
P%	<0.1	<0.1	>20	<0.1	<1	13	<0.1	<0.1	<0.1	<1	<0.1	>20	7	<5	>20	18	<0.1	<5	>20	20
LSD 5%	0.3	0.6	-	0.5	0.5	-	0.5	0.4	0.2	0.1	0.2	-	-	1	-	-	7	0.1	-	-
P%, site x variety	<0.1	7.0	<5	<5	<1	<5	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<1	<5	18	>20	<1	8	>20	-

Table 10. Perennial ryegrass (*Lolium perenne*) varieties

	Visual merit (1-9)																			
	Over-all mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Sp-ring	Sum-mer	Au-tumn	Tiller den-sity (1-9)	Leaf fine-ness (1-9)	Color (dark-ness) (1-9)	Dor-mancy color (1-9)	Turf cover mean %	In-season disea-ses %	Win-ter dam-age, %	Green-up, days after 28 Feb.	Cover-age 2-3 wk after seeding %	Daily height incre-ment, mm	Thick-ness of thatch/ mat, mm	Moss after 3 years %
a) Apelsvoll, Norway (northern zone)																				
Chardin	4.1	4.3	2.6	4.9	5.1	3.1	4.5	4.4	3.5	3.1	5.1	3.9	88	1	76	63	100	0.9	1	-
Ligala	3.5	3.5	1.8	4.3	4.8	3.2	3.9	3.5	3.0	2.9	5.1	4.3	85	1	72	63	100	1.0	1	-
DP179974	3.5	3.7	1.8	4.0	4.8	3.1	3.7	3.5	2.9	2.9	5.8	4.6	85	1	72	63	100	1.1	1	-
Madrid	3.4	4.0	2.3	4.1	3.8	2.2	3.8	3.4	3.0	2.8	5.6	4.6	82	1	93	64	100	1.0	1	-
Mascot	2.9	3.2	1.7	3.6	3.6	2.7	3.1	3.0	2.9	2.8	5.1	4.2	82	1	83	63	100	1.0	1	-
P%	<1	<5	<1	<5	<0.1	<1	<1	<1	<0.1	6.0	<1	<1	<0.1	>20	<0.1	>20	>20	>20	>20	-
LSD 5%	0.4	0.6	0.5	0.7	0.5	0.4	0.5	0.6	0.2	0.2	0.4	0.3	2	-	7	-	-	-	-	
b) Korpa, Iceland (northern zone)																				
Chardin	5.3	-	8.7	5.6	3.4	-	-	-	5.3	5.1	4.9	5.7	76	0	30	83	85	-	-	-
Madrid	5.2	-	8.3	6.0	2.9	-	-	-	5.5	5.1	4.9	5.3	77	0	27	83	87	-	-	-
Mascot	5.1	-	8.0	5.7	2.9	-	-	-	5.3	5.1	4.9	5.8	75	0	27	82	87	-	-	-
DP179974	5.1	-	8.0	5.6	3.0	-	-	-	5.3	5.3	4.9	5.7	77	0	30	83	90	-	-	-
Ligala	4.9	-	8.3	5.3	2.9	-	-	-	5.2	5.3	4.6	5.3	76	0	36	83	92	-	-	-
P%	>20	-	>20	>20	>20	-	-	-	>20	19	<5	15	>20	>20	>20	>20	>20	-	-	-
LSD 5%	-	-	-	-	-	-	-	-	-	-	0.2	-	-	-	-	-	-	-	-	-
c) Mean of two sites, northern zone																				
Chardin	4.7	4.3	5.7	5.3	4.3	3.1	4.5	4.4	4.4	4.1	5.0	4.8	82	1	53	73	93	0.9	1	-
DP179974	4.3	3.7	4.9	4.8	3.9	3.1	3.7	3.5	4.1	4.1	5.4	5.2	81	1	51	73	95	1.1	1	-
Madrid	4.3	4.0	5.3	5.1	3.4	2.2	3.8	3.4	4.3	4.0	5.3	5.0	80	1	60	74	93	1.0	1	-
Ligala	4.2	3.5	5.1	4.8	3.9	3.2	3.9	3.5	4.1	4.1	4.9	4.8	81	1	54	73	96	1.0	1	-
Mascot	4.0	3.2	4.9	4.7	3.3	2.7	3.1	3.0	4.1	4.0	5.0	5.0	79	1	55	73	93	1.0	1	-
P%	<5	<5	5	13	<1	<1	<1	<1	6	12	<0.1	14	>20	>20	11	>20	>20	>20	>20	-
LSD 5%	0.4	0.6	0.6	-	0.5	0.4	0.5	0.6	-	-	0.2	-	-	-	-	-	-	-	-	-
P%, site x variety	18	-	>20	<5	<5	-	-	-	10	5	<5	<1	13	>20	<1	>20	>20	-	-	-

Table 10. Perennial ryegrass (*Lolium perenne*) varieties (contd.)

	Visual merit (1-9)																			
	Over-all mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Sp-ring	Sum-mer	Au-tumn	Tiller den-sity (1-9)	Leaf fine-ness (1-9)	Color (dark-ness) (1-9)	Dor-mancy color (1-9)	Turf cover mean %	In-season disea-ses %	Win-ter dam-age, %	Green-up, days after 28 Feb.	Cover-age 2-3 wk after seeding %	Daily height incre-ment, mm	Thick-ness of thatch/ mat, mm	Moss after 3 years %
d) Landvik, Norway (southern zone)																				
Chardin	4.0	5.0	4.6	2.9	4.0	3.9	4.2	4.1	4.1	5.0	4.8	4.5	93	2	5	29	91	1.8	15	3
Ligala	3.5	4.6	4.1	2.3	3.6	3.6	3.6	3.5	3.6	4.7	5.4	4.1	93	1	4	31	95	1.9	17	6
DP179974	3.3	4.4	3.8	2.1	3.3	3.4	3.1	3.4	3.7	4.4	6.5	4.4	91	2	5	31	82	1.6	17	6
Madrid	3.3	4.6	3.2	2.5	3.5	3.0	3.1	3.5	3.2	3.8	6.2	4.2	91	2	18	31	87	1.7	15	5
Mascot	3.0	4.4	3.6	1.8	2.8	3.2	2.7	3.1	3.2	4.6	5.2	4.0	89	2	2	30	83	1.5	17	10
P%	<5	>20	<1	<5	6	6	<1	>20	<5	<1	<0.1	<5	>20	>20	<0.1	<1	>20	<0.1	>20	8
LSD 5%	0.6	-	0.6	0.5	-	-	0.5	-	0.5	0.4	0.3	0.3	-	-	4	1	-	0.1	-	-
e) Mean of three sites																				
Chardin	4.5	4.6	5.3	4.5	4.2	3.5	4.3	4.2	4.3	4.4	4.9	4.7	85	1	37	58	92	1.4	8	3
Ligala	4.0	4.1	4.8	3.9	3.8	3.4	3.7	3.5	4.0	4.3	5.0	4.6	85	1	37	59	95	1.4	9	6
DP 179974	3.9	4.1	4.5	3.9	3.7	3.3	3.4	3.4	4.0	4.2	5.8	4.9	84	1	36	59	91	1.3	9	6
Madrid	3.9	4.3	4.6	4.2	3.4	2.6	3.5	3.5	3.9	3.9	5.6	4.7	83	1	46	59	91	1.4	8	5
Mascot	3.6	3.8	4.4	3.7	3.1	2.9	2.9	3.0	3.8	4.2	5.1	4.7	82	1	37	58	90	1.2	9	10
P%	<0.1	<1	<1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<5	<5	>20	<0.1	6	>20	<5	>20	10
LSD 5%	0.3	0.4	0.4	0.4	0.4	0.3	0.3	0.5	0.2	0.2	0.2	0.2	2	-	5	-	-	0.1	-	8
P%, site x variety	>20	>20	>20	7	11	>20	>20	>20	<5	<0.1	<0.1	<1	>20	>20	<0.1	18	>20	<5	>20	-

Table 11. Rough bluegrass (*Poa trivialis*) varieties

	Visual merit (1-9)																			
	Over-all mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Sp-ring	Sum-mer	Au-tumn	Tiller den-sity (1-9)	Leaf fine-ness (1-9)	Color (dark-ness) (1-9)	Dor-mancy color (1-9)	Turf cover mean %	In-season disea-ses %	Win-ter dam-age, %	Green-up, days after 28 Feb.	Cover-age 2-3 wk after seeding %	Daily height incre-ment, mm	Thick-ness of thatch/ mat, mm	Moss after 3 years %
a) Apelsvoll, Norway (northern zone)																				
Race Horse	4.4	4.9	2.6	5.8	5.1	3.4	4.6	5.0	4.3	3.9	5.0	3.2	89	0	67	60	95	0.6	1	-
Qasar	4.3	5.3	2.4	5.4	5.2	3.3	4.5	4.9	4.3	3.9	5.0	3.2	88	0	67	60	93	0.8	1	-
P%	>20	6	18	>20	>20	>20	>20	>20	20	>20	>20	>20	>20	>20	>20	>20	>20	9	>20	-
LSD 5%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
b) Korpa, Iceland (northern zone)																				
Race Horse	4.5	-	6.0	6.7	1.5	-	-	-	6.2	5.3	6.0	5.2	72	0	37	81	92	-	-	-
Qasar	4.4	-	6.0	6.6	1.4	-	-	-	6.2	5.3	6.0	5.1	72	0	38	81	93	-	-	-
P%	>20	-	>20	>20	>20	-	-	-	>20	>20	>20	>20	>20	>20	>20	>20	>20	-	-	-
LSD 5%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
c) Mean of two sites, northern zone																				
Race Horse	4.5	4.9	4.3	6.3	3.3	3.4	4.6	5.0	5.3	4.6	5.5	4.2	81	0	52	71	93	0.6	1	-
Qasar	4.4	5.3	4.2	6.0	3.3	3.3	4.5	4.9	5.3	4.6	5.5	4.2	80	0	53	71	93	0.8	1	-
P%	>20	6	12	>20	>20	>20	>20	>20	>20	>20	>20	>20	>20	>20	>20	>20	>20	9	>20	-
LSD 5%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P%, site x variety	>20	-	12	>20	>20	-	-	-	>20	>20	>20	>20	>20	>20	>20	>20	>20	-	-	-

Table 11. Rough bluegrass (*Poa trivialis*) varieties (contd.)

	Visual merit (1-9)																			
	Over-all mean	Seeding year (2007)	Green year 1 (2008)	Green year 2 (2009)	Green year 3 (2010)	Sp-ring	Sum-mer	Au-tumn	Tiller den-sity (1-9)	Leaf fine-ness (1-9)	Color (dark-ness) (1-9)	Dor-mancy color (1-9)	Turf cover mean %	In-season disea-ses %	Win-ter dam-age, %	Green-up, days after 28 Feb.	Cover-age 2-3 wk after seeding %	Daily height incre-ment, mm	Thick-ness of thatch/ mat, mm	Moss after 3 years %
d) Landvik, Norway (southern zone)																				
Qasar	3.1	6.4	4.3	2.2	1.1	3.1	2.7	3.0	4.2	5.5	6.3	1.9	61	2	1	32	99	1.0	19	0
Race Horse	3.0	6.3	3.9	2.2	1.1	3.0	2.6	2.9	4.1	5.4	6.2	2.2	60	2	1	32	99	1.0	19	0
P%	<1	>20	12	>20	>20	>20	>20	>20	17	>20	16	>20	>20	>20	>20	>20	>20	6	>20	>20
LSD 5%	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
e) Mean of three sites																				
Qasar	3.9	5.8	4.2	4.8	2.6	3.2	3.6	3.9	4.9	4.9	5.8	3.4	74	1	35	58	95	0.9	10	0
Race Horse	3.9	5.6	4.2	4.9	2.5	3.2	3.6	3.9	4.9	4.8	5.7	3.5	74	1	35	58	95	0.8	10	0
P%	>20	5	>20	>20	>20	>20	>20	>20	>20	>20	12	>20	>20	>20	>20	>20	>20	12	>20	>20
LSD 5%	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
P%, site x variety	>20	>20	>20	>20	>20	>20	>20	>20	20	20	>20	>20	>20	>20	>20	>20	>20	<5	>20	-