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

Results from the sowing year 2007 and first green year 2008

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Sammendrag:
Dette er en rapport med resultater fra såingsåret 2007 og første greenår 2008 i et prosjekt med testing av grassorter til bruk på skandinaviske golfgreener. Hele prosjektperioden er 2007-2010.

Summary:
This report gives the summary results of the sowing year 2007 and first green year 2008 from testing of turfgrass varieties for use on Scandinavian golf greens. The total project period is 2007-2010.

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1. Abstract

Evaluation of turfgrass varieties for use on Scandinavian golf greens started in 2007 as a new project for the period 2007-2010. Four trials were established on greens constructed according to USGA standard at Östra Ljungby Naturgymnasium, Sweden, and Bioforsk Landvik, Norway, in climate zone 1; and Bioforsk Apelsvoll, Norway, and Keldnaholt Golf Course, Iceland, in climate zone 2.

A total of 42 varieties of seven species and subspecies were entered into the project. The trials were established according to a split plot design with the species chewings fescue (*Festuca rubra* var. *commutata*), slender creeping red fescue (*Festuca rubra* var. *trichophylla*), velvet bentgrass (*Agrostis canina*), colonial bentgrass (*Agrostis capillaris*), creeping bentgrass (*Agrostis stolonifera*), rough-stalked meadow grasses (*Poa trivialis*) and perennial ryegrass (*Lolium perenne*) on main plots and varieties on subplots.

The experiments at Apelsvoll, Landvik and Östra Ljungby were mowed at least three times per week to a height of 5 mm for perennial ryegrass, red fescue and rough-stalked meadow grasses and 3 mm for the bentgrasses. The mowing height at Keldnaholt was 20 mm. While the trials at Apelsvoll and Landvik were rated at monthly intervals for visual merit (overall turfgrass quality) and other characters, registrations at Keldnaholt and Östra Ljungby were incomplete due to low plant cover, reseeding, and other experimental problems. The preliminary recommendations in this report are therefore mostly based on the registrations at Landvik in climate zone 1 and at Apelsvoll in climate zone 2.

The rather tough winter 2007-08 in both climate zones revealed significant variation among species and varieties. Several varieties showed promising results for golf greens in Scandinavia.

On average for varieties within species, chewings fescue and slender creeping red fescue had significantly better winter survival than colonial-, velvet and creeping bentgrass, perennial ryegrass and rough-stalked meadow grass in both climatic zones. After two years, the fescues were therefore ranked before the bentgrasses in this study. Among the bentgrasses, the ranking order after two years is velvet bentgrass > creeping bentgrass > colonial bentgrass. The two “new” green-species in this project, perennial ryegrass and rough stalked meadow grass, germinated rapidly and had high scores in the seeding year, but after two years they have not produced green surfaces of sufficient quality or been sufficiently persistent to replace any of the “established” species on golf greens.

The preliminary result from **colonial bentgrass** confirms earlier findings that different varieties have to be used in climate zones 1 and 2. ‘**Aberroyal**’ and ‘**TAT 720**’ tended to have higher overall scores than the control variety ‘**Jorvik**’ in climate zone 1, while ‘**LøEk 0015**’ may be an alternative to the control variety ‘**Leirin**’ in climate zone 1.

The control variety ‘**Villa**’ of **velvet bentgrass** had significantly higher overall score, significantly less “in season diseases” and also tended to have better winter survival than ‘**Vesper**’ and ‘**Legendary**’ in climate zone 2. Differences among these varieties were small in climate zone 1.

The Norwegian **creeping bentgrass** variety ‘**Nordlys**’ had the best winter survival in both climate zones, and should be the number one variety for climate zone 2. ‘**Declaration**’, ‘**CY-2**’ and ‘**IS AP 14**’, along with the control variety ‘**Independence**’, seem to be interesting alternatives in climate zone 1.

‘**Musica**’ had higher overall scores than the other **chewings fescues** at both Apelsvoll and Landvik and might become a new variety for the whole of Scandinavia. In climate zone 1, other chewings fescues equal to or better than the control variety ‘**Center**’ were ‘**Barswing**’ and ‘**Greensleeves**’. Within slender creeping red fescue, ‘**Amarone**’ ‘**Frt 04213**’ and ‘**Viktorka**’ showed promising results in climate zone 1, while and the control variety ‘**Cezanne**’ was one of the best ones in zone 2.

Within perennial ryegrass, ‘**DP17-2147**’ was more promising than the other varieties, and within rough-stalked meadow grass, ‘**Qasar**’ was slightly, but not significantly, better than ‘**Race Horse**’.

The second and third green years (2009 and 2010) will tell us more about the varieties.

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. The seed industry has signaled that variety testing for greens must, at least for the most part, be funded by the golf sector itself.

On this background, we thank The Scandinavian Turfgrass and Environment Research Foundation (STERF) for a financial grant, and a number of breeding- and seed companies for submitting varieties and paying entrance fees, to fund a variety testing project on Scandinavian golf greens for the period 2007-2010.

The objectives for the project are:

- To clarify which varieties of *Agrostis*, *Festuca*, *Poa* and *Lolium* are best suited for golf greens at four experimental sites representing the two major climate zones in the Nordic countries
- To create meeting places for discussions between plant breeders, seed companies and greenkeepers in order to encourage cultivar awareness and continued efforts into turfgrass breeding for northern environments

Preliminary results from the sowing year of the project have been presented in a previous report to STERF in December 2007 (Molteberg et al. 2007) and at conferences, meetings, seminars and field days etc. in Norway, Sweden and Denmark in 2007-2008. The present report provides an update for the sowing year (2007) and first green year (2008).

3. Methods

3.1 Plant material

A total of 42 varieties, including controls, were entered into the project. The distribution between species was as follows:

- Velvet bentgrass (*Agrostis canina*): 3 varieties
- Creeping bentgrass (*Agrostis stolonifera*): 10 varieties
- Colonial bentgrass (*Agrostis capillaris*): 5 varieties
- Slender creeping red fescue (*Festuca rubra* var. *trichophylla*): 6 varieties
- Chewings fescue (*Festuca rubra* var. *commutata*): 11 varieties
- Perennial ryegrass (*Lolium perenne*): 5 varieties
- Rough-stalked meadow grass (*Poa trivialis*): 2 varieties

Table 1 gives a complete list of varieties included in the project.

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

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

C = Control variety (reference)

3.2 Experimental sites and climatic conditions

Trials were established at the experimental locations Östra Ljungby Naturgymnasium, Sweden, Bioforsk Landvik and Bioforsk Apelsvoll, Norway, and Keldnaholt Golf Course, Iceland. The following meteorological data indicate that these locations cover the variation in climates found in the Nordic countries:

	Northern latitude	Altitude	Mean monthly temperature June-August	Mean monthly temperature December-February	Annual precipitation
Östra Ljungby ¹	56° 11'N	38 m a.s.l	16.3°C	0.3°C	594 mm
Landvik	58° 20'N	6 m a.s.l	15.4°C	-1,1°C	1230 mm
Apelsvoll	61° 42'N	250 m a.s.l	14.0°C	-7.2°C	600 mm
Keldnaholt	64° 09'N	30 m a.s.l.	10.5°C	-0.5°C	950 mm

¹ Data for Alnarp

The four locations can roughly be said to represent the two main climatic zones in Scandinavia (Fig 1). Östra Ljungby and Landvik represent climate zone 1, which includes Denmark, Skåne (the southernmost part of Sweden) and the coastal regions of southern Sweden and Norway. In addition, Östra Ljungby represents the growing conditions for golf courses in the densely populated regions of eastern Denmark and Skåne. Apelsvoll and Keldnaholt represent climate zone 2, which includes Iceland, Finland, central and northern parts of Sweden and Norway, plus continental areas in southern Sweden and Norway. Keldnaholt has a climate representing not only Iceland, since it is similar to the climates of coastal areas in central and northern Norway. Apelsvoll can have snow cover for more than five months and sometimes ice cover for more than three months. This is in contrast to Landvik and Östra Ljungby, which usually have snow cover more sporadically during wintertime.

More about the winter conditions 2007-08 in a separate chapter.

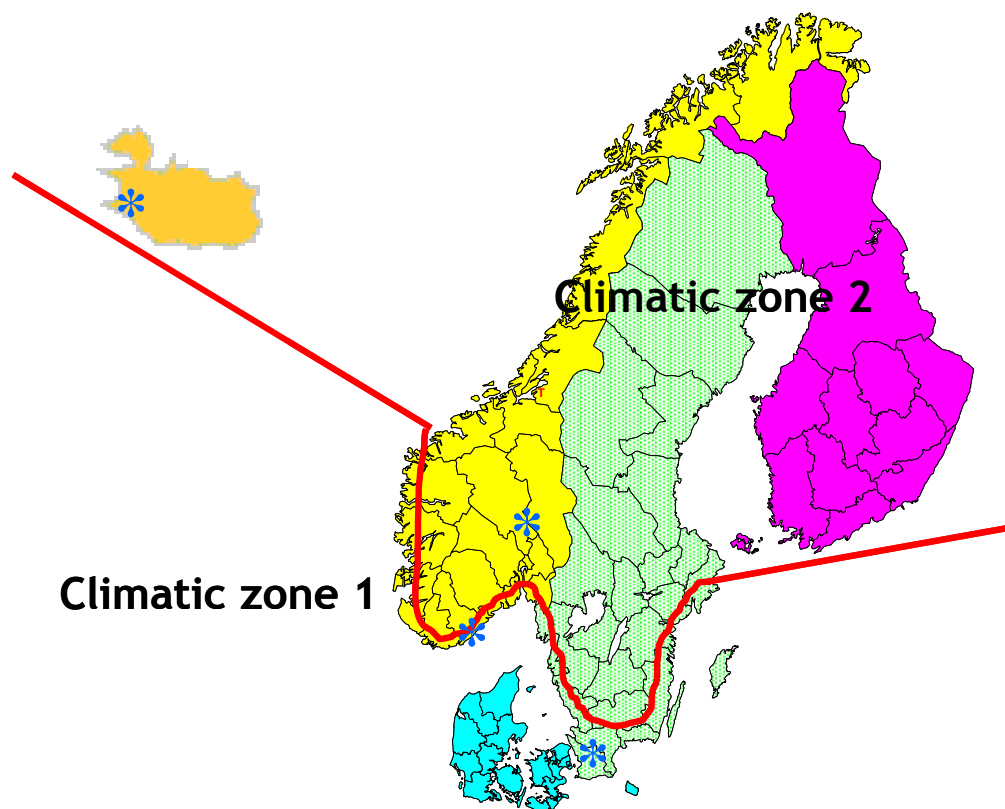


Fig. 1. Division of Scandinavia in two climate zones. The trial sites are indicated with blue stars.

3.3 Green construction, experimental design and grow-in 2007

Detailed descriptions of green construction, experimental design and turfgrass establishment in 2007 were presented by Molteberg et al. (2007). Some of the major points from the sowing year were as follows:

- Seeding dates in 2007 were 26 June, at Apelsvoll, 11 July at Landvik, 17 August at Keldnaholt and 6 September at Östra Ljungby
- The trials at Apelsvoll and Landvik had a good establishment and the average percentage of plant cover in autumn of 2007 was more than 90 %.
- The trial at Keldnaholt was not seeded until August due to delayed construction of the green. The time for grasses to establish was short, but percent plant cover in the autumn was more than 80 % for most varieties. However, because of poor root systems, this trial faced great risks for damages from freezing, wind erosion, and water erosion during winter.
- For the trial at Östra Ljungby, seeding was delayed due to heavy rainfall in the summer months. The time to grow in was very short even for southern Sweden. Plant cover in the autumn was only 10-20 % on average for most of the varieties.

3.4 Winter conditions 2007-08

Apelsvoll: The first snow covered the green in mid November. In December it started to rain and by the end of December the green was again covered with snow, at this time also with a 1-2 cm layer of ice under the snow. From January through March the green got more snow and a thicker layer of ice built up. On 27 March the green had 30 cm of snow and a 5 cm layer of ice. The green was free for snow in mid April, but the growing season didn't start before the end of April, due to cold weather. This means that the experimental green had a continuous layer of snow and ice for at least 3.5 months, and these winter conditions caused a lot of damage. The worst damages were observed in creeping bentgrass, perennial ryegrass, and rough-stalked meadow grass, but colonial bentgrass also had a great deal of damages (Photos 1-3).

Landvik: As usual on the Norwegian south coast, the winter 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 (Photo 4).

Keldnaholt: The autumn was unusually wet and windy. After a drop in temperature in late December it remained relatively cold until May. The winter was also very windy. Due to late sowing and consequently a poor development of the root system during the autumn, the wind blew up the soil in plots where the plant cover was bad. In spring, all of the bentgrasses and rough-stalked meadow grasses seemed to be dead. Nevertheless, some varieties of these species were still alive later in the spring (Photo 5).

Östra Ljungby: The autumn and winter period were characterized by very rich and heavy rainfall. Due to this, late sowing and bad plant cover in the autumn, the grasses got a tough start in the spring, with late green-up and slow growth (Photo 6).

3.5 Mowing, fertilization and regular maintenance 2008

Apelsvoll, Landvik and Östra Ljungby:

The experiments were mowed at least three times per week to a height of 5 mm for perennial ryegrass, red fescue and rough-stalked meadow grass and 3 mm for the bentgrasses. Gradually higher mowing heights (up to 6 mm in bentgrasses and 8 mm in the others) were practiced in the beginning and end of the growing season. The mowing was carried out with “John Deere” walk-behind mowers and clippings collected.

The trials at Apelsvoll, Landvik and Östra Ljungby received inorganic fertilizer (mostly Yara’s ‘Arena’ program) at biweekly intervals, totaling 0.9 kg N/100 m² for perennial ryegrass, red fescue, colonial bentgrass and velvet bentgrass and 1.8 kg N/100 m² for creeping bentgrass and rough-stalked meadow grass. At Apelsvoll and Landvik, these total amounts of nitrogen also included ammonium sulphate and manganese-products (Landvik only) to prevent take-all patch (*Gaeumannomyces graminis*).

In May, due to winter damages at Apelsvoll and poor plant cover and growth at Östra Ljungby, the plots with colonial and creeping bentgrass, perennial ryegrass and rough-stalked meadow grass at Apelsvoll, and the whole trial at Östra Ljungby, were reseeded (Photo 6 and 7). At Landvik reseeding was not practised after the winter damage (mostly snow mold), and plots were left to recover naturally.

Topdressing with 0.4-0.5 mm washed Baskarp sand (grain size 0.2-0.8 mm) was carried out once a week at Landvik and two times (July and September) at Apelsvoll. The green at Östra Ljungby was top-dressed with 2-3 mm fine sand in August.

Vertical cutting was carried out three times in all species at Apelsvoll (two in perennial ryegrass, red fescues and rough-stalked meadow grasses) and Landvik, but not at Östra Ljungby.

The greens were subjected to artificial wear three times per week corresponding to 20.000 rounds of golf per year at Landvik, but only two times at Apelsvoll and none at Östra Ljungby.

Keldnaholt:

This trial was, as mentioned before, exposed to a tough winter with much erosion of wind and water and great winter damages as a result. All bentgrasses and rough-stalked meadow grasses were reseeded but the living plants from the autumn were not destroyed. Plots of other species were also repaired but generally they were in much better shape than plots with bentgrasses and rough-stalked meadow grasses. The spring was very dry and the seed took a long time to germinate and grow even though the plots were irrigated regularly. The growing season of 2008 was therefore 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 (Photo 8). The total fertilizer input to all species was 1.6 kg N/100 m² in Yara’s ‘Arena’-products. No topdressing, vertical cutting or artificial wear was carried out in this trial.

For all sites:

No pesticides or growth regulators were used in the trials. All trials were irrigated after fertilization, topdressing and otherwise whenever 15 mm deficit was reached.

3.6 Registrations, statistical calculations, and presentation of results

The trials at Apelsvoll and Landvik were rated at monthly intervals for visual merit (overall turfgrass quality) and most other characters. Due to low plant cover and reseeding, not all characters were registered at Keldnaholt and Östra Ljungby. Turfgrass height growth was recorded at Landvik only.

The characters presented in tables 2-9 in chapter 7 Appendix, were defined as follows:

- **Visual merit:** Overall turf quality (1-9, 9 is best quality). The overall mean has been weighed with 1/3 on the sowing year and 2/3 on the first green year. Spring, summer and

autumn values are means of all ratings only in the first green year during the periods 15 March-10 June, 11 June-10 September and 11 September -15 November, respectively.

- **Tiller density** (1-9, 9 is highest density): Mean values have been weighed with 1/3 on the sowing year (assessment in late autumn) and 2/3 on the first green year.
- **Plant cover**: Per cent of plot area covered with healthy turf of the sown species. Mean values have been weighed with 1/3 on the sowing year (assessment in late autumn) and 2/3 on the first green year.
- **Date for green-up in spring** (=earliness): Recorded as a day no after 28 February at Apelsvoll and Landvik.
- **Winter damage** (Per cent of plot area): Values include both biotic and abiotic winter damages and are means of measurements in the spring of the first green year. Plant samples taken in spring 2008 at Apelsvoll confirmed the presence of *Pythium* in *Agrostis*, but the turf was most likely also attacked by *Microdochium nivale*. Winter damages at Landvik were mostly due to *Microdochium nivale* and at Keldnaholt to abiotic factors. No winter damage was recorded at Östra Ljungby.
- **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 can be *Pythium*, *Fusarium*, *Microdochium nivale*, *Laetisaria fuciformis* (red tread), *Colletotrichum* (Anthracnose) and possibly *Sclerotinia homeocarpa* (dollar spot). Only *Colletotrichum* (anthracnose) was confirmed by Bioforsk Plant health laboratory, but there was most likely infestation also of *Pythium* and *Microdochium nivale*. Mean values have been weighed with 1/3 on the sowing year (assessment in late autumn) and 2/3 on the first green year.
- **Colour** (1-9, 9 is darkest green): Mean values only of the first green year (not determined in the sowing year).
- **Dormancy colour** (1-9, 1 is very pale or brown and 9 is most intensely green): Intensity of green colour outside the growing season. Mean of registration before green-up and after growth cessation in late autumn.
- **Leaf fineness** (=texture) (1-9, 9 is finest leaves): Mean values of assessments in bentgrass species in July and September of the first green year. (Not assessed in the sowing year and not in *Festuca* spp except at Landvik).
- **Height increment**: Calculated from height measurements with a prism device on one Monday per month (only at Landvik). The green had been left uncut since Friday.

The experimental data were analyzed using the Minitab 15 procedure Proc Anova, GLM. Analyses of variance were accomplished separately for each species and with block number as the random variable. Whenever significant differences occurred, least significant differences (LSD) at the 5% probability level were calculated for direct comparisons between varieties. In a few cases, *P*-values between 5% and 15% were reported as 'tendencies'. The results from the project are presented in Tables 2-9. In these tables, species or varieties are ranked for visual merit overall mean scores. In cases where two or more varieties have the same scores, they are further ranked for tiller density, and, if necessary, also for winter damage.

4. Results and discussion

Due to the high mowing (Keldnaholt), low plant cover, reseeding, slow progress of growth and several missing characters at Keldnaholt and Östra Ljungby, most emphasis will be placed on the trial at Landvik in climate zone 1 and the trial at Apelsvoll in climate zone 2.

4.1 Comparison of species (Table 2)

On average for varieties within species, chewings fescue had significantly higher visual merit score than any other species in this project (Photo 9). This was primarily due to less winter damage at Apelsvoll, Landvik and Keldnaholt. Nevertheless, and as expected, velvet bent produced significantly higher tiller density than any other species at both Apelsvoll and Landvik. Other advantages of velvet bentgrass were that it had lower height increments than any other species at Landvik and that its leaf texture was almost as fine as for the red fescues.

At Apelsvoll (climate zone 2) all varieties of perennial ryegrass and rough-stalked meadow grass were completely dead and most of the creeping bentgrass varieties extremely injured after the first winter. Colonial and velvet bentgrasses were also injured. At Landvik (climate zone 1) the worst winter damages, mainly of snow mould, were observed in creeping and velvet bentgrass. But also in this climate zone was colonial bent significantly more injured than the fescues. Rough-stalked meadow grass was here quite similar to red fescue in winter survival, while perennial ryegrass, unexpectedly, tended to have better winter survival than colonial bentgrass.

At Keldnaholt (climate zone 2) perennial ryegrass was ranked on top together with the fescues. Perennial ryegrass had the fastest germination in 2007 and therefore probably a better root system and better resistance to erosion during winter than the other species. In addition, as mentioned earlier, this trial was mown to 20 mm. The results for Keldnaholt are therefore not representative for greens in general.

Rough-stalked meadow grass had one of the best dormancy colours (most green) at all sites except at Landvik where it got the lowest score (Photo 10). This might be because the turf was made up of mature plants at Landvik, while it mostly consisted of seedlings at the other sites. As expected, perennial ryegrass and velvet bentgrass also had high scores for dormancy colour. At Landvik, slender creeping red fescue was lighter green during the growing season and maintained better colour during the winter than chewings fescue.

At both Apelsvoll and Landvik, colonial bentgrass was significantly more infected by “in season diseases”, mainly *Pythium* and *Microdochium nivale*, than velvet and creeping bentgrass. Colonial bentgrass, especially the Norwegian varieties, seemed to be more adapted to climate zone 2 than to climate zone 1.

Perennial ryegrass had, as expected, vigorous height growth and was not as dense as the other species. Together with rough-stalked meadow grass, perennial ryegrass is a “new” species for golf greens in Scandinavia, and probably also in the rest of Europe. It will be interesting to follow perennial ryegrass over the next two green years, but so far it seems to have too poor winter survival and make too open turfs to be recommended on greens.

4.2 Colonial bentgrass varieties (Table 3)

There were no significant differences in overall scores among the colonial bentgrass varieties in climate zone 1 (Landvik). In climate zone 2 (Apelsvoll) the Norwegian varieties ‘Leirin’ and ‘LøEk 0015’ had highest visual merit because of better winter survival. The Norwegian varieties had less

winter damage even in the southern/coastal zone, but at Landvik this was counteracted by wider leaves, lower dormancy colour scores and lower densities than for 'Jorvik', 'TAT 720' and 'AberRoyal' (Photo 11). 'LøEk 0015' may be an interesting variety for climate zone 2 as it represents an improvement in many of these characters compared with 'Leirin'.

'AberRoyal' and 'TAT 720' were the least winter-hardy varieties at Apelsvoll. 'Jorvik', which was the best colonial bentgrass variety in our previous project (Aamlid et al. 2006), was ranked intermediate at Apelsvoll but last at Landvik, primarily because of "in season diseases".

4.3 Velvet bentgrass varieties (Table 4)

In climate zone 1 (Landvik), differences in visual merit and most other characters among the three varieties of velvet bentgrass were not significant except for colour and dormancy colour. 'Vesper' was darker (Photo 12) and maintained greener colour during the dormancy period than 'Legendary' and 'Villa'. This was also the tendency in climate zone 2.

In climate zone 2 (Apelsvoll) 'Villa' had significantly higher visual merit scores than 'Vesper' and 'Legendary' because of better winter survival, more complete plant cover and less "in season diseases" such *Pythium*. On the other hand, 'Villa' had the lowest density in both zones, but these differences were not significant.

4.4 Creeping bentgrass varieties (Table 5)

Within creeping bentgrass in climate zone 1 (Landvik), the reference variety 'Independence' (which was one of the best in the last variety testing period 2003-2006 (Aamlid et al. 2006)), 'Declaration', and the new breeding lines 'CY-2' and 'IS AP 14' were ranked highest in overall visual merit, but the differences were not significant. Among these varieties, 'Independence' had the highest tiller density and darkest colour, 'Declaration' the finest leaves and 'CY-2' the best dormancy colour. The Norwegian reference variety 'Nordlys', had significantly higher scores than the other varieties in spring due to less *Microdochium nivale* and better plant cover. However, on average for the whole season, 'Nordlys' had wider leaves, more height growth and was not as dense as many of the other varieties at Landvik (Photo 13).

In climate zone 2 (Apelsvoll), 'Nordlys' was in a class of its own with respect to winter survival and visual merit scores. Most other varieties were almost dead after a continuous layer of snow and ice for at least 3.5 months. However, all creeping bentgrass varieties were reseeded in May and recovered well, and in the autumn there were no differences in visual merits between the varieties.

As also observed in the sowing year (Molteberg et al. 2007), 'L-93', was less infected by "in season diseases" such as *Pythium*, than the other varieties.

4.5 Chewings fescue varieties (Table 6)

On average for two years at Landvik, 'Musica' was ranked highest for visual merit, density, and fineness of leaves, followed closely by 'Barswing' (Photo 14). But also the reference variety 'Center' and 'Greensleeves' were dense and had high scores in this zone. Among these varieties, 'Musica' and 'Greensleeves' were ranked significantly before the others for dormancy colour. Significantly behind the other varieties in density, and with a clear tendency for low visual merit scores, were 'LøRc 0021' (Linda) and 'SW RSC6101'.

There were no significant differences in visual merit among chewings fescues in climate zone 2 (Apelsvoll), but 'Musica' was ranked highest even here. 'Musica' also had significantly higher tiller density and maintained better dormancy colour than most of the other varieties. Like in climate zone 1 (Landvik), 'LøRc 0021' (Linda) was at the bottom of the list. One explanation of the bad score for this

variety can be that the seed lot submitted from the breeding company in 2007 was contaminated with weeds.

Differences in winter damage among chewing fescues were not significant at either Apelsvoll or Landvik. Nevertheless it seems that the control variety 'Center' was more injured than the other chewing fescues. This also explains its relatively low scores for visual merit and plant cover in climate zone 2 (Apelsvoll). This result is partly in contrast to previous observations (Aamlid et al. 2006). 'Excellence' distinguished itself as a dark variety.

In both climate zones (Landvik and Apelsvoll) there were only minor observations of "in season diseases" in chewing fescue.

4.6 Slender creeping red fescue varieties (Table 7)

In climate zone 1 (Landvik) there were significant differences in visual merit and tiller density between the three slender creeping red fescue varieties at the top ('Amarone' 'Frt 04213' and 'Viktorka') and the three at the bottom ('Niola', 'Corrida' and 'Cezanne') of the ranking list. The reference variety 'Cezanne', which was one of the most highly ranked in the previous testing period 2003-2006 (Aamlid et al. 2006) had low scores for plant cover which may be explained by poor establishment in the sowing year.

In climate zone 2, there were no significant differences in visual merit among slender creeping red fescues, but 'Niola' and the control variety 'Cezanne' were ranked highest at Apelsvoll.

Even for this subspecies of red fescue there were only minor observations of "in season diseases" at Landvik and Apelsvoll.

4.7 Perennial ryegrass varieties (Table 8)

Within perennial ryegrass the breeding line 'DP17-2147' was ranked significantly better than the other varieties in climate zone 1 (Photo 15). The variety was significantly denser and had an earlier green-up than the other ryegrasses in the test. At the bottom of the list, 'Madrid', had the lowest visual merit score and significantly more winter damage than 'DP17-2147', 'Ligala', 'DP17-0074' and 'INLP 634'.

In climate zone 2 (Apelsvoll), all varieties were dead in the spring. The ryegrass plots were reseeded in May and recovered well, and in the autumn there were no differences in visual merit scores among the varieties. The plant cover was around 90 percent (not shown in the table). Like in the sowing year and in climate zone 1 (Landvik), the breeding line 'DP17-2147' made the best impression.

Just traces of "in season diseases" were observed in perennial ryegrass at Landvik and Apelsvoll.

4.8 Rough-stalked meadow grass varieties (Table 9)

This species had only two varieties with minor differences regardless of climate zone. Nevertheless, 'Qasar' was darker and tended to have higher overall score than 'Race Horse' at Landvik.

5. Conclusions

The rather tough winter 2007-08 in both climate zones revealed significant variation among species and varieties. Several varieties showed promising results for golf greens in Scandinavia.

On average for varieties within species, chewings fescue and slender creeping red fescue had significantly better winter survival than colonial-, velvet and creeping bentgrass, perennial ryegrass and rough-stalked meadow grass in both climate zones. After two years, the fescues are therefore ranked before the bentgrasses in this study. Among the bentgrasses, the ranking order after two years is velvet bentgrass > creeping bentgrass > colonial bentgrass. The two “new” green-species in this project, perennial ryegrass and rough stalked meadow grass, germinated rapidly and had high scores in the seeding year, but after two years they have not produced green surfaces of sufficient quality or been sufficiently persistent to replace any of the “established” species on golf greens.

The preliminary result from **colonial bentgrass** confirms earlier findings that different varieties have to be used in climate zones 1 and 2. ‘**Aberroyal**’ and ‘**TAT 720**’ tended to have higher overall scores than the control variety ‘**Jorvik**’ in climate zone 1, while ‘**LøEk 0015**’ may become an alternative to the control variety ‘**Leirin**’ in zone 1.

The control variety ‘**Villa**’ of **velvet bentgrass** had significantly higher overall score, significantly less “in season diseases” and also tended to have better winter survival than ‘**Vesper**’ and ‘**Legendary**’ in climate zone 2. Differences among these varieties were small in zone 1.

The Norwegian **creeping bentgrass** variety ‘**Nordlys**’ had the best winter survival in both climate zones, and should be the number one variety for climate zone 2. ‘**Declaration**’, ‘**CY-2**’ and ‘**IS AP 14**’, along with the control variety ‘**Independence**’, seem to be interesting alternatives in climate zone 1.

‘**Musica**’ had higher overall scores than the other **chewings fescues** at both Apelsvoll and Landvik and might become a new variety for the whole of Scandinavia. In climate zone 1, other chewings fescues equal to or better than the control variety ‘**Center**’ were ‘**Barswing**’ and ‘**Greensleeves**’. Within slender creeping red fescue, ‘**Amarone**’ ‘**Frø 04213**’ and ‘**Viktorka**’ showed promising results in climate zone 1, while and the control variety ‘**Cezanne**’ was one of the best ones in zone 2.

Within perennial ryegrass, ‘**DP17-2147**’ was more promising than the other varieties, and within rough-stalked meadow grass, ‘**Qasar**’ was slightly, but not significantly, better than ‘**Race Horse**’.

The second and third green years (2009 and 2010) will tell us more about the varieties.

6. References

Aamlid, T.S., B. Molteberg, F. Enger, A.A. Steensohn & Å. Susort 2006. Evaluation of *Agrostis* and *Festuca* varieties for use on Scandinavian golf greens. Results from variety testing at Landvik and Apelsvoll 2003-2006. Bioforsk Report 1 (189), 32 pp.

Molteberg, B., T.S. Aamlid, G. Thorvaldsson, A. Hammarlund, F. Enger, T. Espevig, Å. Susort & D. Nord 2008. Evaluation of turfgrass varieties for use on Scandinavian putting greens, 2007-2010. Results from the sowing year 2007. Bioforsk Report 3 (170), 26 pp.

7. Appendix (photos and tables)

Table 2: Comparison on species

Species	Visual merit (1-9)						Tiller density (1-9)	Plant cover %	Greenup days after 28.Feb	Winter damage %	In season diseases (1-9)	Colour (1-9)	Dormancy colour (1-9)	Leaf fineness (1-9)	Height increment mm/day
	Overall mean	Sowing Year	Green Year 1	Spring	Summer	Autumn									
A) Mean of four sites															
<i>F. rubra com.</i>	5.0	4.6	6.3	5.3	6.3	5.7	5.0	84	7	13	2	5.2	3.3	7.3	1.3
<i>F. rubra trich.</i>	4.6	3.7	5.9	4.0	6.0	5.5	5.0	81	7	17	1	5.0	4.1	6.9	1.0
<i>Poa trivialis</i>	4.3	5.6	5.0	3.2	4.3	4.9	4.5	78	16	64	1	5.5	4.6	3.4	1.0
<i>Lolium perenne</i>	4.2	4.1	5.3	2.9	4.8	4.4	3.5	77	9	47	1	5.1	4.6	3.5	1.2
<i>A. canina</i>	3.9	5.4	4.5	3.3	4.0	5.5	6.2	70	10	62	8	5.2	5.3	6.8	0.6
<i>A. stolonifera</i>	3.7	4.8	4.3	2.9	3.5	5.7	5.3	71	8	74	7	5.4	4.0	4.8	1.0
<i>A. capillaris</i>	3.4	4.2	4.0	3.3	2.9	5.1	5.0	67	11	63	9	5.3	4.1	4.5	0.9
P % species	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSD 5%	0.4	0.6	0.5	0.9	0.7	0.5	0.4	4	2	13	3	0.3	0.5	0.6	0.2
P % species x sites	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Number of sites	4	2	4	2	3	3	3	4	1	3	3	3	4	2	1
B) Apelsvoll															
<i>F. rubra com.</i>	4.8	4.3	5.0	4.3	5.1	5.7	5.0	94	58	13	0	4.9	3.4	7.5	
<i>A. canina</i>	4.7	5.7	4.3	3.3	4.5	4.7	7.4	88	64	43	13	5.0	5.0	6.0	
<i>F. rubra trich.</i>	4.3	3.9	4.4	3.4	4.7	4.9	4.9	90	58	26	0	4.7	4.6	7.5	
<i>A. stolonifera</i>	4.1	5.6	3.3	1.6	3.5	4.7	4.8	78		84	9	4.9	4.1	4.3	
<i>A. capillaris</i>	3.7	4.6	3.3	2.3	3.4	3.9	5.2	78	66	69	18	5.2	3.5	4.7	
<i>Poa trivialis</i>	3.3	4.9	2.5	1.0	2.4	4.3	3.2	76		100	0	5.5	6.0	3.5	
<i>Lolium perenne</i>	2.5	3.4	2.0	1.0	2.2	2.8	2.3	72		100	2	4.5	5.0	3.0	
P % species	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
LSD 5%	0.8	0.7	1.1	1.4	1.2	0.9	0.6	9	2	33	5	0.3	1.1	0.3	

Table 2 continued: Comparison on species

	Visual merit (1-9)						Tiller density (1-9)	Plant cover %	Greenup days after 28.Feb	Winter damage %	In season diseases (1-9)	Colour (1-9)	Dormancy colour (1-9)	Leaf fineness (1-9)	Height increment mm/day
	Overall mean	Sowing Year	Green Year 1	Spring	Summer	Autumn									
C) Keldnaholt															
<i>Lolium perenne</i>	5.5		8.3		8.3		5.0	90		29	0	4.5	4.3	4.0	
<i>F. rubra com.</i>	5.0		7.5		7.5		5.3	91		24	5	4.7	3.5		
<i>F. rubra trich</i>	4.7		7.0		7.0		5.3	90		24	4	4.2	3.6		
<i>Poa trivialis</i>	4.0		6.0		6.0		4.3	84		90	0	4.8	4.8	3.0	
<i>A. stolonifera</i>	0.7		1.0		1.0		0.7	60		100	9	2.4	4.1		
<i>A. canina</i>	0.7		1.0		1.0		0.7	54		100	5	2.4	5.0		
<i>A. capillaris</i>	0.7		1.0		1.0		0.7	46		100	1	2.4	5.1		
P % species	0.0		0.0		0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
LSD 5%	0.7		1.1		1.1		0.0	10		9	6	0.2	0.4	0.0	
D) Landvik															
<i>F. rubra com.</i>	5.4	5.0	5.6	6.4	6.2	4.3	5.8	99	7	3	0	5.6	2.3	7.4	1.3
<i>A. canina</i>	5.1	5.1	5.0	3.4	6.7	3.9	6.8	87	10	43	5	5.6	6.9	7.6	0.6
<i>Poa trivialis</i>	4.8	6.3	4.1	5.4	4.4	2.8	5.4	96	16	3	4	6.2	1.6	4.9	1.0
<i>F. rubra trich.</i>	4.8	3.6	5.4	4.5	6.3	4.8	5.7	94	7	3	0	5.3	4.1	7.3	1.0
<i>A. stolonifera</i>	4.7	4.0	5.0	4.2	6.0	4.4	5.9	89	8	37	3	5.9	2.9	5.3	1.0
<i>Lolium perenne</i>	4.2	4.8	3.9	4.7	3.9	3.2	4.0	96	9	10	1	5.6	4.1	4.7	1.2
<i>A. capillaris</i>	3.9	3.8	4.0	4.4	4.2	3.4	5.2	91	11	21	8	5.7	2.8	4.3	0.9
P % species	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LSD 5%	0.9	0.9	1.0	1.2	1.3	1.1	0.9	5	2	20	4	0.9	1.2	1.1	0.2
E) Östra Ljungby															
<i>A. stolonifera</i>	5.3		8.0			8.0	5.2	57				5.2	5.1		
<i>A. capillaris</i>	5.3		7.9			7.9	4.6	55				5.1	5.0		
<i>A. canina</i>	5.2		7.8			7.8	4.5	52				5.1	4.3		
<i>Poa trivialis</i>	5.0		7.5			7.5	5.0	58				4.8	6.0	2.0	
<i>F. rubra com</i>	4.8		7.2			7.2	4.2	50				5.2	4.0	7.0	
<i>Lolium perenne</i>	4.7		7.1			7.1	4.2	50				5.2	5.0	2.5	
<i>F. rubra trich</i>	4.6		6.8			6.8	4.3	49				5.1	4.0	6.0	
P % species	0.0		0.0			0.0	0.0	0.0				0.0	0.0	0.0	
LSD 5%	0.4		0.6			0.6	0.3	6				0.2	0.3	0.0	

Table 3: Varieties of colonial bentgrass (*Agrostis capillaris*)

Variety	Visual merit (1-9)						Tiller density (1-9)	Plant cover %	Greenup days after 28.Feb	Winter damage %	In season diseases (1-9)	Colour (1-9)	Dormancy colour (1-9)	Leaf fineness (1-9)	Height increment mm/day
	Overall mean	Sowing Year	Green Year 1	Spring	Summer	Autumn									
A) Mean of four sites															
Leirin (C)	3.6	4.2	4.3	4.4	3.2	5.1	3.8	72	37	47	8	4.5	3.0	3.6	1.1
LøEk 0015	3.5	4.0	4.2	4.3	3.2	5.0	3.9	70	39	51	7	4.9	3.5	4.6	0.8
TAT 720	3.3	4.4	3.9	2.5	2.7	5.1	3.8	65	40	76	10	4.4	4.7	4.6	0.8
Jorvik (C)	3.3	4.2	3.9	2.7	2.8	5.1	4.2	66	39	67	10	4.7	4.5	5.0	0.8
AberRoyal	3.3	4.3	3.9	2.8	2.5	5.1	3.9	65	40	76	8	4.5	4.8	4.6	1.0
P % varieties	ns	ns	3.2	0.0	4.4	ns	0.3	0.0	0.1	0	ns	0.0	0.0	1.2	0.0
LSD 5%			0.3	0.8	0.5		0.2	3	1	12		0.2	0.4	0.7	0.1
P % varieties x sites	0.0	ns (5)	0.0	0.7	0.1	0.4	0.0	0.0	0.0	0.2	0.6	0.1	0.0	ns	
Number of sites	4	2	4	2	3	3	4	4	2	3	3	4	4	2	1
B) Apelsvoll															
Leirin (C)	4.4	4.7	4.2	3.8	4.4	4.3	5.4	88	64	32	20	5.0	1.7	4.3	
LøEk 0015	4.3	4.2	4.4	3.7	4.7	4.4	5.5	89	64	50	12	5.4	3.0	4.7	
Jorvik (C)	3.8	5.0	3.2	2.0	3.3	4.3	5.7	78	66	69	15	5.4	4.7	5.0	
TAT 720	3.2	4.6	2.4	1.0	2.6	3.4	4.5	68	69	98	23	4.9	4.0	4.5	
AberRoyal	3.0	4.5	2.2	1.0	2.2	3.2	4.8	67	69	93	19	5.3	4.0	5.0	
P % varieties	0.1	ns (6)	0.1	0.0	0.5	0.4	0.6	0.0	ns	1.1	ns (9)	ns (6)	0.4	ns	
LSD 5%	0.6		0.8	1.0	1.2	0.6	0.6	7		35			1.3		
C) Keldnaholt															
Leirin (C)	0.7		1.0		1.0		0.7	51		100	1	2.4	3.7		
LøEk 0015	0.7		1.0		1.0		0.7	46		100	0	2.4	4.3		
AberRoyal	0.7		1.0		1.0		0.7	45		100	0	2.4	6.3		
TAT 720	0.7		1.0		1.0		0.7	45		100	1	2.4	5.3		
Jorvik (C)	0.7		1.0		1.0		0.7	44		100	1	2.4	5.7		
P % varieties	ns		ns		ns		ns	ns		ns	ns	ns	0.8		
LSD 5%													1.3		

Table 3 continued: Varieties of colonial bentgrass (*Agrostis capillaris*)

Variety	Visual merit (1-9)						Tiller density (1-9)	Plant cover %	Greenup days after 28.Feb	Winter damage %	In season diseases (1-9)	Colour (1-9)	Dormancy colour (1-9)	Leaf fineness (1-9)	Height increment mm/day
	Overall mean	Sowing Year	Green Year 1	Spring	Summer	Autumn									
D) Landvik															
AberRoyal	4.2	4.0	4.4	4.7	4.3	4.2	5.5	91	10	34	5	5.4	3.8	4.3	1.0
TAT 720	4.2	4.1	4.2	3.9	4.6	3.8	5.5	91	10	29	7	5.1	4.5	4.7	0.8
Leirin (C)	3.9	3.7	3.9	4.9	4.1	3.1	4.8	94	9	9	3	5.4	1.5	2.9	1.1
LøEk 0015	3.8	3.8	3.8	5.0	3.9	2.9	4.8	92	14	4	9	6.6	1.5	4.5	0.8
Jorvik (C)	3.5	3.4	3.5	3.3	4.0	3.0	5.4	86	13	31	16	5.8	2.8	5.0	0.8
P % varieties	ns	ns	ns	ns (9)	ns	ns	1.5	ns	2.3	1.1	ns (11)	1.7	0.0	5.0	0.0
LSD 5%							0.5		3	17		0.8	0.4	1.3	0.1
E) Östra Ljungby															
Jorvik (C)	5.3		8.0				8.0	4.8	56			5.1	5.0		
AberRoyal	5.3		8.0				8.0	4.7	58			5.1	5.0		
TAT 720	5.3		8.0				8.0	4.6	54			5.2	5.0		
Leirin (C)	5.3		8.0				8.0	4.5	53			5.1	5.0		
LøEk 0015	5.1		7.7				7.7	4.5	53			5.1	5.0		
P % varieties	ns		ns				ns	ns (7)	ns			ns	ns		
LSD 5%															

Table 4: Varieties of velvet bentgrass (*Agrostis canina*)

Variety	Visual merit (1-9)						Tiller density (1-9)	Plant cover %	Greenup days after 28.Feb	Winter damage %	In season diseases (1-9)	Colour (1-9)	Dormancy colour (1-9)	Leaf fineness (1-9)	Height increment mm/day
	Overall mean	Sowing Year	Green Year 1	Spring	Summer	Autumn									
A) Mean of four sites															
Villa (C)	4.0	5.4	4.7	3.7	4.2	5.7	4.8	70	37	61	6	4.3	4.8	6.7	0.7
Vesper	3.9	5.5	4.5	3.3	4.0	5.5	4.9	71	37	62	9	4.9	5.8	6.9	0.6
Legendary	3.8	5.4	4.3	3.0	3.9	5.2	4.9	69	37	63	8	4.4	5.3	6.9	0.5
P % varieties	0.8	ns	0.2	0.2	4.8	2.6	ns	ns	ns	ns	ns (8)	0.0	0.0	ns	ns
LSD 5%	0.2		0.2	0.4	0.3	0.4						0.2	0.2	0.0	
P % varieties x sites	2.5	ns	1.4	3.4	0.8	ns	ns	ns	ns	1.3	3	0.0	0.0	ns	
Number of sites	4	2	4	2	3	3	4	4	2	3	3	4	4	2	1
B) Apelsvoll															
Villa (C)	5.2	5.8	4.8	3.8	5.1	5.1	7.3	91	64	30	9	4.8	4.7	6.0	
Vesper	4.7	5.8	4.2	3.3	4.3	4.8	7.5	88	64	43	13	5.3	5.7	6.0	
Legendary	4.4	5.6	3.8	2.7	4.0	4.3	7.4	84	64	55	16	4.9	4.7	6.0	
P % varieties	3.9	ns	1.1	ns (5)	0.4	ns (11)	ns	3.1	ns	ns (9)	0.4	ns (7)	ns	ns	
LSD 5%	0.5		0.5		0.4			4			2				
C) Keldnaholt															
Vesper	0.7		1.0		1.0		0.7	57		100	7	2.4	5.0		
Legendary	0.7		1.0		1.0		0.7	54		100	2	2.4	5.7		
Villa (C)	0.7		1.0		1.0		0.7	51		100	6	2.4	4.3		
P % varieties	ns		ns		ns		ns	ns		ns	ns (14)	4.0	ns		
LSD 5%												0.9			

Table 4 continued: Varieties of velvet bentgrass (*Agrostis canina*)

Variety	Visual merit (1-9)						Tiller density (1-9)	Plant cover %	Greenup days after 28.Feb	Winter damage %	In season diseases (1-9)	Colour (1-9)	Dormancy colour (1-9)	Leaf fineness (1-9)	Height increment mm/day
	Overall mean	Sowing Year	Green Year 1	Spring	Summer	Autumn									
D) Landvik															
Legendary	5.1	5.2	5.1	3.4	6.7	3.9	6.9	88	11	34	5	5.1	6.7	7.8	0.5
Vesper	5.0	5.3	4.9	3.3	6.7	3.7	6.8	87	10	42	7	6.5	7.7	7.8	0.6
Villa (C)	5.0	5.0	5.1	3.5	6.6	4.1	6.6	87	10	54	3	5.1	6.3	7.3	0.7
P % varieties	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	0.7	1.8	ns	ns
LSD 5%												0.7	0.8		
E) Östra Ljungby															
Vesper	5.3		8.0			8.0	4.5	52				5.2	5.0		
Villa (C)	5.3		8.0			8.0	4.5	52				5.1	4.0		
Legendary	4.9		7.3			7.3	4.5	51				5.2	4.0		
P % varieties	ns (11.1)		ns (11)			ns (11)	ns	ns				4.9	ns		
LSD 5%												0.1			

Table 5: Varieties of creeping bentgrass (*Agrostis stolonifera*)

Variety	Visual merit (1-9)						Tiller density (1-9)	Plant cover %	Greenup days after 28.Feb	Winter damage %	In season diseases (1-9)	Colour (1-9)	Dormancy colour (1-9)	Leaf fineness (1-9)	Height increment mm/day
	Overall mean	Sowing Year	Green Year 1	Spring	Summer	Autumn									
A) Mean of four sites															
Nordlys (C)	4.0	4.8	4.7	4.7	4.0	5.5	4.3	73	11	42	4	4.8	3.3	4.5	1.2
CY-2	3.8	5.3	4.4	2.5	3.5	6.0	4.1	67	9	82	4	4.5	4.8	4.8	0.9
Independence (C)	3.8	5.1	4.4	3.1	3.6	5.7	4.3	73	8	78	7	4.7	4.2	5.3	0.9
Declaration	3.7	4.5	4.4	3.0	3.6	5.9	4.2	71	8	73	6	4.5	4.4	5.4	0.9
IS AP 14	3.7	4.7	4.4	3.0	3.6	5.7	4.2	71	8	83	9	4.6	3.8	5.3	0.9
Sandhill	3.7	4.7	4.3	2.5	3.5	5.8	4.1	71	8	76	6	4.8	4.3	4.5	0.9
Mackenzie	3.7	4.9	4.3	2.7	3.5	5.6	4.1	69	8	79	7	4.5	4.1	5.1	0.9
L93	3.6	4.8	4.2	2.8	3.3	5.6	4.0	73	9	73	6	4.6	3.6	4.1	0.9
Bengal	3.6	4.8	4.2	2.2	3.2	5.7	4.1	71	8	79	10	4.7	4.0	5.0	0.8
Alpha	3.5	4.6	4.1	2.5	3.1	5.4	3.9	71	8	75	9	4.6	4.0	4.2	1.0
P % varieties	ns (7)	ns (12)	2.6	0.0	ns (6)	ns	0.1	ns (6)	ns	0.0	0.3	0.1	0.0	0.0	ns
LSD 5%			0.3	0.5			0.2			9	3	0.2	0.4	0.3	
P % varieties x sites	0.2	ns	0.0	0.6	0.0	ns	0.0	0.0		0.0	ns (6)	0.9	0.0	0.0	
Number of sites	4	2	4	2	3	3	4	4	1	3	3	4	4	2	1
B) Apelsvoll															
Nordlys (C)	5.3	5.6	5.2	4.2	5.8	4.8	5.9	94		16	7	5.2	3.0	4.7	
CY-2	4.1	6.0	3.2	1.3	3.3	4.8	4.7	74		92	8	4.8	4.0	4.0	
Sandhill	4.1	5.7	3.4	1.2	3.6	4.8	4.7	77		96	7	5.1	5.0	4.0	
L93	4.1	5.8	3.2	1.7	3.2	4.8	4.8	79		86	4	4.9	4.0	4.2	
Independence (C)	4.0	5.7	3.1	1.3	3.3	4.7	4.8	78		93	12	4.9	4.7	4.5	
Mackenzie	4.0	5.6	3.2	1.3	3.3	4.8	4.7	75		94	10	4.9	4.3	4.2	
Alpha	3.9	5.5	3.1	1.3	3.2	4.5	4.5	75		92	11	4.8	4.0	4.2	
Bengal	3.8	5.6	3.0	1.0	3.2	4.5	4.6	75		97	12	4.9	4.0	4.5	
IS AP 14	3.8	5.4	3.1	1.3	3.2	4.5	4.7	75		93	11	4.8	3.7	4.5	
Declaration	3.8	5.3	3.0	1.7	2.9	4.8	4.8	76		88	7	4.8	4.0	4.2	
P % varieties	0.0	ns	0.0	0.0	0.0	ns	0.0	0.0		0.0	1.8	0	0	0.6	
LSD 5%	0.4		0.4	0.6	0.4		0.3	4		9	4	0.1	0.5	0.4	

Table 5 continued: Varieties of creeping bentgrass (*Agrostis stolonifera*)

Variety	Visual merit (1-9)						Tiller density (1-9)	Plant cover %	Greenup days after 28.Feb	Winter damage %	In season diseases (1-9)	Colour (1-9)	Dormancy colour (1-9)	Leaf fineness (1-9)	Height increment mm/day
	Overall mean	Sowing Year	Green Year 1	Spring	Summer	Autumn									
C) Keldnaholt															
Independence (C)	0.7		1.0		1.0		0.7	66		100	8	2.4	3.7		
Bengal	0.7		1.0		1.0		0.7	65		100	13	2.4	4.0		
Alpha	0.7		1.0		1.0		0.7	65		100	13	2.4	4.7		
L93	0.7		1.0		1.0		0.7	64		100	10	2.5	3.3		
IS AP 14	0.7		1.0		1.0		0.7	63		100	14	2.4	3.3		
Sandhill	0.7		1.0		1.0		0.7	61		100	8	2.4	4.0		
Declaration	0.7		1.0		1.0		0.7	59		100	10	2.4	4.3		
MacKenzie	0.7		1.0		1.0		0.7	57		100	8	2.5	4.3		
CY-2	0.7		1.0		1.0		0.7	50		100	1	2.5	5.7		
Nordlys (C)	0.7		1.0		1.0		0.7	45		100	1	2.5	3.7		
P % varieties	ns		ns		ns		ns	ns (9)		ns	ns (7)	ns	ns (11)		
LSD 5%															
D) Landvik															
CY-2	5.2	4.6	5.4	3.8	6.3	5.3	5.9	88	9	53	3	5.4	3.7	5.5	0.9
Independence (C)	5.1	4.5	5.4	4.9	6.5	4.3	6.5	89	8	41	3	6.3	3.3	6.1	0.9
Declaration	5.0	3.8	5.7	4.3	7.0	4.9	6.3	91	8	31	2	5.6	4.2	6.7	0.9
IS AP 14	5.0	4.0	5.5	4.7	6.6	4.5	6.4	87	8	57	2	5.7	3.0	6.1	0.9
MacKenzie	4.7	4.1	5.0	4.1	6.1	4.1	6.1	88	8	42	3	5.6	2.7	6.1	0.9
Sandhill	4.6	3.8	4.9	3.8	5.8	4.6	5.7	89	8	33	4	6.3	3.0	4.9	0.9
Nordlys (C)	4.5	4.1	4.7	5.3	5.1	3.8	5.4	96	11	9	3	6.4	1.5	4.3	1.2
L93	4.4	3.9	4.7	3.9	5.7	3.9	5.5	92	9	34	2	5.9	2.0	4.1	0.9
Bengal	4.4	3.9	4.6	3.3	5.4	4.5	5.8	87	8	40	5	6.1	3.2	5.6	0.8
Alpha	4.2	3.8	4.4	3.7	5.1	3.8	5.3	87	8	33	3	5.9	2.5	4.2	1.0
P % varieties	ns	ns	ns	0.9	ns	ns	0.9	0.2	ns	ns (6)	ns	ns (6)	0.0	0.0	ns
LSD 5%				0.9			0.7	4					0.8	0.6	

Table 5 continued: Varieties of creeping bentgrass (*Agrostis stolonifera*)

Variety	Visual merit (1-9)						Tiller density (1-9)	Plant cover %	Greenup days after 28.Feb	Winter damage %	In season diseases (1-9)	Colour (1-9)	Dormancy colour (1-9)	Leaf fineness (1-9)	Height increment mm/day
	Overall mean	Sowing Year	Green Year 1	Spring	Summer	Autumn									
E) Östra Ljungby															
L93	5.3		8.0			8.0	5.2	59				5.2	5.0		
Declaration	5.3		8.0			8.0	5.2	58				5.3	5.0		
Bengal	5.3		8.0			8.0	5.2	57				5.3	5.0		
Independence (C)	5.3		8.0			8.0	5.2	57				5.2	5.0		
Alpha	5.3		8.0			8.0	5.2	57				5.3	5.0		
CY-2	5.3		8.0			8.0	5.2	57				5.2	5.7		
Sandhill	5.3		8.0			8.0	5.2	57				5.2	5.0		
Nordlys (C)	5.3		8.0			8.0	5.2	56				5.2	5.0		
IS AP 14	5.3		8.0			8.0	5.1	57				5.3	5.0		
MacKenzie	5.3		8.0			8.0	5.1	57				5.2	5.0		
P % varieties	ns		ns			ns	ns	ns				ns	0.6		
LSD 5%													0.3		

Table 6: Varieties of chewing fescue (*Festuca rubra* var. *commutata*)

Variety	Visual merit (1-9)						Tiller density (1-9)	Plant cover %	Greenup days after 28.Feb	Winter damage %	In season diseases (1-9)	Colour (1-9)	Dormancy colour (1-9)	Leaf fineness (1-9)	Height increment mm/day
	Overall mean	Sowing Year	Green Year 1	Spring	Summer	Autumn									
A) Mean of four sites															
Greensleeves	5.3	4.7	6.7	5.5	6.4	6.1	5.2	82	32	17	2	5.1	3.8	7.3	1.3
Barswing	5.2	5.2	6.5	5.3	6.2	6.1	5.4	85	33	15	2	5.1	3.4	7.4	1.3
Musica	5.2	5.3	6.4	5.6	6.5	6.1	5.4	85	32	11	2	5.1	3.8	7.4	1.3
Margret	5.1	4.7	6.5	5.5	6.5	5.8	5.1	84	32	11	3	5.1	3.1	7.3	1.3
Frc 04210	5.1	4.9	6.4	5.5	6.4	5.6	5.0	83	32	14	2	5.2	3.1	7.3	1.2
Center (C)	5.0	4.9	6.3	5.1	6.2	5.6	5.0	82	32	19	1	5.1	3.2	7.3	1.2
SW RSC6028	5.0	4.5	6.3	5.3	6.4	5.6	5.0	84	33	12	2	5.0	3.1	7.3	1.3
LøRc 0215	4.9	4.5	6.3	5.4	6.2	5.6	5.0	85	32	10	1	5.1	3.0	7.3	1.2
SW RSC6101	4.9	4.2	6.3	5.3	6.3	5.4	4.8	84	33	8	2	5.0	3.2	7.2	1.3
Excellence	4.7	4.3	5.9	5.2	5.9	5.5	5.0	83	33	14	1	5.3	3.3	7.2	1.4
LøRc 0021	4.7	3.8	6.0	5.2	5.9	5.4	4.9	83	33	10	1	5.0	3.4	7.2	1.1
P % varieties	0.4	0.0	ns (10)	ns	ns	0.2	0.0	ns (6)	0.0	ns	ns	0	0.0	0.3	ns
LSD 5%	0.3	0.4				0.4	0.1		1			0.1	0.3	0.1	
P % varieties x sites	0.9	ns	1.2	ns (6)	2.3	5.0	0.0	ns	0.0	ns	ns	0.0	0.1	0.0	
Number of sites	4	2	4	2	3	3	4	4	2	3	3	4	4	3	1
B) Apelsvoll															
Musica	5.0	5.0	5.0	3.8	5.0	6.2	5.3	95	58	16	0	4.9	4.0	7.5	
SW RSC6028	4.9	4.2	5.3	4.3	5.5	5.8	5.0	95	58	8	0	5.0	3.3	7.5	
Frc 04210	4.9	4.6	5.1	4.3	5.1	5.6	4.9	95	58	15	0	5.0	3.0	7.5	
SW RSC6101	4.9	4.0	5.3	4.7	5.4	5.7	4.8	96	58	2	0	4.7	3.0	7.5	
LøRc 0215	4.8	4.0	5.3	4.7	5.2	5.9	5.0	96	58	11	0	4.8	3.0	7.5	
Barswing	4.8	5.1	4.7	3.7	4.7	5.6	5.4	94	58	19	1	4.8	3.7	7.5	
Margret	4.8	4.3	5.0	4.5	4.9	5.8	4.9	95	58	7	0	4.9	3.3	7.5	
Greensleeves	4.8	4.3	5.0	4.5	5.0	5.6	5.2	93	58	12	0	4.8	4.0	7.5	
Excellence	4.8	4.2	5.1	4.2	5.1	5.8	4.9	94	58	17	0	4.9	3.3	7.5	
Center (C)	4.6	4.5	4.7	3.7	4.8	5.4	4.9	90	58	29	0	4.8	3.0	7.5	
LøRc 0021	4.4	3.4	4.9	4.7	5.0	5.2	4.5	93	58	5	0	4.7	3.7	7.5	
P % varieties	ns	0.0	ns	ns	ns	ns	1.1	ns	ns	ns	4.8	ns	1.4	ns	
LSD 5%		0.5					0.4				0		0.7		

Table 6 continued: Varieties of chewing fescue (*Festuca rubra* var. *commutata*)

Variety	Visual merit (1-9)						Tiller density (1-9)	Plant cover %	Greenup days after 28.Feb	Winter damage %	In season diseases (1-9)	Colour (1-9)	Dormancy colour (1-9)	Leaf fineness (1-9)	Height increment mm/day
	Overall mean	Sowing Year	Green Year 1	Spring	Summer	Autumn									
C) Keldnaholt															
Margret	5.6		8.3		8.3		5.3	92		22	10	4.6	3.0		
SW RSC6101	5.3		8.0		8.0		5.3	92		20	6	4.8	3.7		
Frc 04210	5.3		8.0		8.0		5.3	91		25	4	5.0	3.3		
Greensleeves	5.3		8.0		8.0		5.3	85		37	7	4.4	4.0		
Center (C)	5.1		7.7		7.7		5.4	90		23	4	4.5	3.3		
LøRc 0215	5.1		7.7		7.7		5.3	93		18	4	4.7	2.7		
SW RSC6028	5.1		7.7		7.7		5.3	92		25	6	4.7	3.3		
Musica	4.7		7.0		7.0		5.3	93		15	7	4.7	4.0		
Barswing	4.7		7.0		7.0		5.3	92		25	4	4.7	3.7		
LøRc 0021	4.7		7.0		7.0		5.3	89		25	3	4.7	3.7		
Excellence	4.2		6.3		6.3		5.3	90		25	3	4.8	4.0		
P % varieties	ns		ns		ns		ns	0.7		ns (11)		3.7	ns (6)		
LSD 5%								5				0.3			
D) Landvik															
Musica	6.3	5.6	6.6	7.4	7.3	5.2	6.7	99	6	4	0	5.5	3.2	7.8	1.3
Barswing	5.9	5.4	6.2	6.9	7.0	4.7	6.4	99	7	2	0	5.6	2.3	7.8	1.3
Center (C)	5.6	5.4	5.7	6.5	6.3	4.3	5.7	99	6	6	0	5.7	2.5	7.5	1.2
Greensleeves	5.6	5.1	5.8	6.5	6.3	4.7	6.1	98	5	3	0	6.1	3.0	7.5	1.3
Margret	5.5	5.1	5.7	6.5	6.3	4.4	5.8	98	6	5	0	5.6	2.0	7.4	1.3
Frc 04210	5.4	5.2	5.5	6.7	6.0	4.2	5.7	99	7	2	0	5.7	2.0	7.5	1.2
SW RSC6028	5.2	4.9	5.3	6.2	5.9	3.9	5.6	99	7	3	0	5.1	1.7	7.4	1.3
LøRc 0215	5.1	5.0	5.1	6.1	5.7	3.8	5.4	99	7	2	0	5.4	2.5	7.3	1.2
Excellence	5.0	4.3	5.4	6.2	6.1	3.9	5.6	98	7	1	0	6.4	1.7	7.1	1.4
LøRc 0021	4.9	4.3	5.2	5.7	5.8	4.1	5.3	99	8	1	0	5.4	2.3	7.2	1.1
SW RSC6101	4.8	4.5	5.0	5.9	5.5	3.6	5.1	99	8	1	0	5.4	2.0	7.1	1.3
P % varieties	0.0	1.4	0.0	0.4	0.0	0.2	0.0	ns (15)	0.2	ns	ns	0.0	0.0	1.5	ns
LSD 5%	0.5	0.7	0.5	0.7	0.4	0.7	0.3		1			0.3	0.5	0.4	

Table 6 continued: Varieties of chewing fescue (*Festuca rubra* var. *commutata*)

Variety	Visual merit (1-9)						Tiller density (1-9)	Plant cover %	Greenup days after 28.Feb	Winter damage %	In season diseases (1-9)	Colour (1-9)	Dormancy colour (1-9)	Leaf fineness (1-9)	Height increment mm/day
	Overall mean	Sowing Year	Green Year 1	Spring	Summer	Autumn									
E) Östra Ljungby															
Barswing	5.3		8.0			8.0	4.4	54				5.1	4.0	7.0	
Greensleeves	5.3		8.0			8.0	4.2	50				5.2	4.0	7.0	
LøRc 0021	4.7		7.0			7.0	4.3	52				5.0	4.0	7.0	
LøRc 0215	4.7		7.0			7.0	4.3	51				5.2	4.0	7.0	
SW RSC6028	4.7		7.0			7.0	4.3	51				5.0	4.0	7.0	
Frc 04210	4.7		7.0			7.0	4.2	49				5.1	4.0	7.0	
Musica	4.7		7.0			7.0	4.2	52				5.2	4.0	7.0	
Margret	4.7		7.0			7.0	4.2	50				5.2	4.0	7.0	
Excellence	4.7		7.0			7.0	4.1	49				5.3	4.0	7.0	
SW RSC6101	4.7		7.0			7.0	4.1	48				5.2	4.0	7.0	
Center (C)	4.7		7.0			7.0	4.1	48				5.2	4.0	7.0	
P % varieties	ns		ns			ns	ns	ns				ns (5.2)	ns	ns	
LSD 5%															

Table 7: Varieties of slender creeping fescue (*Festuca rubra* var. *trichophylla*)

Variety	Visual merit (1-9)						Tiller density (1-9)	Plant cover %	Greenup days after 28.Feb	Winter damage %	In season diseases (1-9)	Colour (1-9)	Dormancy colour (1-9)	Leaf fineness (1-9)	Height increment mm/day
	Overall mean	Sowing Year	Green Year 1	Spring	Summer	Autumn									
A) Mean of four sites															
Amarone	5.0	4.4	6.5	4.3	6.3	5.9	5.1	81	33	22	1	4.7	4.0	7.0	1.1
Frt 04213	4.8	4.1	6.1	4.3	6.3	5.9	5.3	82	33	16	1	4.7	3.8	7.0	1.2
Corrida	4.5	3.3	5.9	3.8	5.8	5.4	4.8	81	33	17	1	4.9	4.4	6.8	1.1
Viktorka	4.4	4.1	5.6	3.7	5.9	5.4	5.2	81	33	22	2	5.0	4.0	7.1	1.0
Niola	4.4	3.3	5.7	4.0	6.1	5.0	5.0	82	32	11	2	4.9	4.2	6.9	1.1
Cezanne (C)	4.3	3.3	5.7	3.7	5.6	5.5	4.8	78	33	15	1	4.7	4.0	6.9	0.8
P % varieties	0.1	0.0	1.3	ns	ns (14)	1.0	0.0	1.0	0.8	ns	1.1	0.4	2.2	3.4	i.s (15)
LSD 5%	0.3	0.5	0.5			0.5	0.2	3	0		1	0.2	0.3	0.2	
P % varieties x sites	0.0	2.8	0.1	ns (6)	0.2	0.0	0.0	4.6	0.8	ns	0.6	0.3	0.0	1.4	
Number of sites	4	2	4	2	3	3	4	4	2	3	3	4	4	3	1
B) Apelsvoll															
Cezanne (C)	4.5	3.8	4.9	3.7	5.2	5.3	5.0	91	58	10	0	4.8	4.3	7.5	
Niola	4.5	3.6	4.9	4.2	5.0	5.3	5.0	94	58	7	0	4.7	5.3	7.5	
Frt 04213	4.4	4.2	4.5	3.2	4.8	5.2	5.0	92	58	28	0	4.4	4.0	7.5	
Amarone	4.1	4.0	4.2	3.2	4.6	4.5	4.7	87	58	42	0	4.6	5.0	7.5	
Corrida	4.1	3.6	4.3	3.5	4.6	4.6	4.8	91	58	28	0	4.7	4.3	7.5	
Viktorka	4.0	4.3	3.8	2.8	3.8	4.7	4.9	87	58	40	0	4.7	4.7	7.5	
P % varieties	ns	ns (5)	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns (5)	ns	ns	
LSD 5%															

Table 7 continued: Varieties of slender creeping fescue (*Festuca rubra* var. *trichophylla*)

Variety	Visual merit (1-9)						Tiller density (1-9)	Plant cover %	Greenup days after 28.Feb	Winter damage %	In season diseases (1-9)	Colour (1-9)	Dormancy colour (1-9)	Leaf fineness (1-9)	Height increment mm/day
	Overall mean	Sowing Year	Green Year 1	Spring	Summer	Autumn									
C) Keldnaholt															
Amarone	5.1		7.7		7.7		5.3	90		22	3	4.1	3.0		
Niola	4.9		7.3		7.3		5.3	90		23	7	4.2	3.3		
Corrida	4.9		7.3		7.3		5.3	89		23	4	4.3	4.7		
Frt 04213	4.4		6.7		6.7		5.3	92		18	2	4.2	3.3		
Viktorka	4.4		6.7		6.7		5.3	92		22	5	4.2	3.0		
Cezanne (C)	4.2		6.3		6.3		5.3	87		33	3	4.2	4.0		
P % varieties	ns		ns		ns		ns	ns		0.8	4.5	ns	3.0		
LSD 5%										7	3		1.0		
D) Landvik															
Amarone	5.5	4.8	5.9	5.3	6.7	5.2	6.2	98	7	4	0	5.0	4.0	7.6	1.1
Frt 04213	5.5	4.0	6.2	5.3	7.3	5.4	6.4	96	7	3	0	4.9	4.0	7.5	1.2
Viktorka	5.4	3.8	6.1	4.6	7.2	5.7	6.3	96	8	4	0	5.9	4.3	7.8	1.0
Corrida	4.2	3.0	4.8	4.2	5.4	4.6	5.0	94	7	1	1	5.6	4.7	7.0	1.1
Niola	4.1	3.0	4.7	3.8	5.8	3.8	5.3	93	6	3	1	5.8	4.0	7.1	1.1
Cezanne (C)	4.0	2.8	4.6	3.7	5.2	4.3	4.9	86	7	3	1	4.9	3.7	7.2	0.8
P % varieties	0.1	0.9	0.0	0.1	0.0	0.4	0.0	0.0	2.3	ns	ns	0.4	3.8	i.s (8)	i.s (15)
LSD 5%	0.7	1.0	0.6	0.7	0.7	0.8	0.6	4	1			0.5	0.6		
E) Östra Ljungby															
Amarone	5.3		8.0			8.0	4.3	50				5.2	4.0	6.0	
Frt 04213	4.7		7.0			7.0	4.3	49				5.1	4.0	6.0	
Corrida	4.7		7.0			7.0	4.2	48				5.1	4.0	6.0	
Cezanne (C)	4.7		7.0			7.0	4.2	46				4.9	4.0	6.0	
Niola	4.0		6.0			6.0	4.5	52				5.1	4.0	6.0	
Viktorka	4.0		6.0			6.0	4.3	48				5.1	4.0	6.0	
P % varieties	ns		ns			ns	ns	ns				ns	ns	ns	
LSD 5%															

Table 8: Varieties of perennial ryegrass (*Lolium perenne*)

Variety	Visual merit (1-9)						Tiller density (1-9)	Plant cover %	Greenup days after 28.Feb	Winter damage %	In season diseases (1-9)	Colour (1-9)	Dormancy colour (1-9)	Leaf fineness (1-9)	Height increment mm/day
	Overall mean	Sowing Year	Green Year 1	Spring	Summer	Autumn									
A) Mean of four sites															
DP 17-2147	4.6	4.5	5.7	3.3	5.5	4.6	4.2	78	6	45	1	4.7	4.5	3.8	1.4
Ligala	4.2	4.0	5.3	3.1	4.8	4.3	3.9	77	10	44	1	4.8	4.3	3.6	1.4
Madrid	4.2	4.2	5.3	2.1	4.6	4.6	3.7	77	11	57	1	5.2	4.7	3.3	1.2
DP 17-9974	4.1	4.0	5.1	3.0	4.5	4.1	3.9	77	10	42	1	5.3	5.0	3.5	1.2
INLP 634	4.0	3.8	5.1	2.8	4.5	4.1	3.7	76	10	45	1	4.8	4.5	3.5	1.1
P % varieties	0.1	1.7	0.4	0.0	0.0	3.0	0.0	ns	1.2	0.0	ns	0.0	0.2	0.0	ns
LSD 5%	0.3	0.4	0.3	0.5	0.4	0.4	0.1		2	4		0.2	0.3	0.2	
P % varieties x sites	ns (7)	ns	ns (10)	0.0	5.0	ns	0.0	ns (7)		0.0	ns	0.0	0.0	0.0	
Number of sites	4	2	4	2	3	3	4	4	1	3	3	4	4	4	1
B) Apelsvoll															
DP 17-2147	3.1	4.0	2.6	1.0	3.0	3.4	2.7	77		100	2	4.2	4.0	3.0	
Madrid	2.7	3.6	2.3	1.0	2.5	3.1	2.2	74		100	2	4.7	6.0	3.0	
Ligala	2.3	3.2	1.8	1.0	1.9	2.6	2.3	70		100	2	4.4	5.0	3.0	
DP 17-9974	2.3	3.3	1.8	1.0	1.8	2.5	2.1	70		100	2	4.8	5.3	3.0	
INLP 634	2.1	3.0	1.7	1.0	1.7	2.4	2.1	70		100	2	4.4	4.7	3.0	
P % varieties	0.4	1.6	0.7		0.2	ns (7)	0	1		ns	ns	3.2	0.3	ns	
LSD 5%	0.4	0.5	0.5		0.5		0.2	4				0.4	0.8		
C) Keldnaholt															
DP 17-2147	5.8		8.7		8.7		5.0	88		32	0	4.5	4.3	4.0	
Ligala	5.6		8.3		8.3		5.0	92		27	0	4.6	3.7	4.0	
Madrid	5.6		8.3		8.3		5.0	90		28	0	4.5	3.7	4.0	
DP 17-9974	5.3		8.0		8.0		5.0	92		25	0	4.6	5.0	4.0	
INLP 634	5.3		8.0		8.0		5.0	88		35	0	4.5	4.7	4.0	
P % varieties	ns		ns		ns		ns	ns		ns	ns	ns	4.5	ns	
LSD 5%															1.0

Table 8 continued: Varieties of perennial ryegrass (*Lolium perenne*)

Variety	Visual merit (1-9)						Tiller density (1-9)	Plant cover %	Greenup days after 28.Feb	Winter damage %	In season diseases (1-9)	Colour (1-9)	Dormancy colour (1-9)	Leaf fineness (1-9)	Height increment mm/day
	Overall mean	Sowing Year	Green Year 1	Spring	Summer	Autumn									
D) Landvik															
DP 17-2147	4.8	5.1	4.6	5.7	4.9	3.5	4.8	95	6	3	1	4.6	4.5	5.7	1.4
Ligala	4.4	4.9	4.1	5.2	4.2	3.3	4.2	98	10	4	1	5.1	3.7	5.0	1.4
DP 17-9974	4.0	4.6	3.7	5.1	3.8	2.8	4.3	96	10	1	1	6.8	4.5	4.5	1.2
INLP 634	4.0	4.6	3.6	4.5	3.8	2.9	3.7	96	10	1	1	5.3	3.8	4.7	1.1
Madrid	3.7	4.8	3.2	3.3	3.0	3.4	3.2	94	11	43	1	6.4	4.0	3.5	1.2
P % varieties	4.8	ns	1.3	0.4	0.2	ns	0.2	ns	1.2	0.0	ns	0.2	1.2	0.5	ns
LSD 5%	0.7		0.7	1.0	0.6		0.6		2	9		0.8	0.5	0.9	
E) Östra Ljungby															
Madrid	4.9		7.3			7.3	4.3	50				5.2	5.0	2.5	
DP 17-2147	4.7		7.0			7.0	4.3	54				5.3	5.0	2.5	
DP 17-9974	4.7		7.0			7.0	4.1	50				5.2	5.0	2.5	
Ligala	4.7		7.0			7.0	4.1	51				5.2	5.0	2.5	
INLP 634	4.7		7.0			7.0	4.1	49				5.1	5.0	2.5	
P % varieties	ns		ns			ns	ns (6)	ns				ns	ns	ns	
LSD 5%															

Table 9: Varieties of rough-stalked meadow grass (*Poa trivialis*)

Variety	Visual merit (1-9)						Tiller density (1-9)	Plant cover %	Greenup days after 28.Feb	Winter damage %	In season diseases (1-9)	Colour (1-9)	Dormancy colour (1-9)	Leaf fineness (1-9)	Height increment mm/day
	Overall mean	Sowing Year	Green Year 1	Spring	Summer	Autumn									
A) Mean of four sites															
Race horse	4.3	5.5	5.1	3.2	4.2	5.1	4.5	79	16	64	2	5.3	4.6	3.3	0.9
Qasar	4.2	5.7	4.9	3.3	4.4	4.6	4.5	78	16	65	1	5.4	4.6	3.4	1.0
P % varieties	0.8	ns (8)	0.2	ns	ns (6)	0.2	ns	ns	ns	ns	ns	0.0	ns	ns	ns
LSD 5%	0.1		0.1			0.2						0.0			
P % varieties x sites	0.0	ns	0.0	ns	1.1	0.4	ns	ns (11)		ns	ns	0.0	ns	ns	
Number of sites	4	2	4	2	3	3	4	4	1	3	3	4	4	4	1
B) Apelsvoll															
Race horse	3.3	4.8	2.6	1.0	2.5	4.5	3.2	77		100	0	5.5	6.0	3.5	
Qasar	3.3	5.0	2.4	1.0	2.3	4.1	3.2	75		100	0	5.5	6.0	3.5	
P % varieties	ns	ns (7)	ns	ns	ns	ns	ns	ns (7)	ns	ns	ns	ns	ns	ns	
LSD 5%															
C) Keldnaholt															
Qasar	4.0		6.0		6.0		4.3	84		90	0	4.8	4.7	3.0	
Race horse	4.0		6.0		6.0		4.3	83		90	0	4.8	5.0	3.0	
P % varieties	ns		ns		ns		ns	ns		ns	ns	ns	ns	ns	
LSD 5%															
D) Landvik															
Qasar	5.0	6.4	4.3	5.5	4.8	2.8	5.5	97	16	4	3	6.4	1.7	5.0	1.0
Race horse	4.7	6.2	3.9	5.3	4.1	2.7	5.3	95	16	3	5	6.0	1.5	4.8	0.9
P % varieties	ns (8)	ns	ns (13)	ns	ns (9)	ns	ns	ns	ns	ns	ns	2.0	ns	ns	ns
LSD 5%												0.2			

Table 9 continued: Varieties of rough-stalked meadow grass (*Poa trivialis*)

Variety	Visual merit (1-9)						Tiller density (1-9)	Plant cover %	Greenup days after 28.Feb	Winter damage %	In season diseases (1-9)	Colour (1-9)	Dormancy colour (1-9)	Leaf fineness (1-9)	Height increment mm/day
	Overall mean	Sowing Year	Green Year 1	Spring	Summer	Autumn									
E) Östra Ljungby															
Race horse	5.3		8.0			8.0	5.0	59				4.8	6.0	2.0	
Qasar	4.7		7.0			7.0	5.0	57				4.8	6.0	2.0	
P % varieties	ns		ns			ns	ns	ns				ns	ns	ns	
LSD 5%															

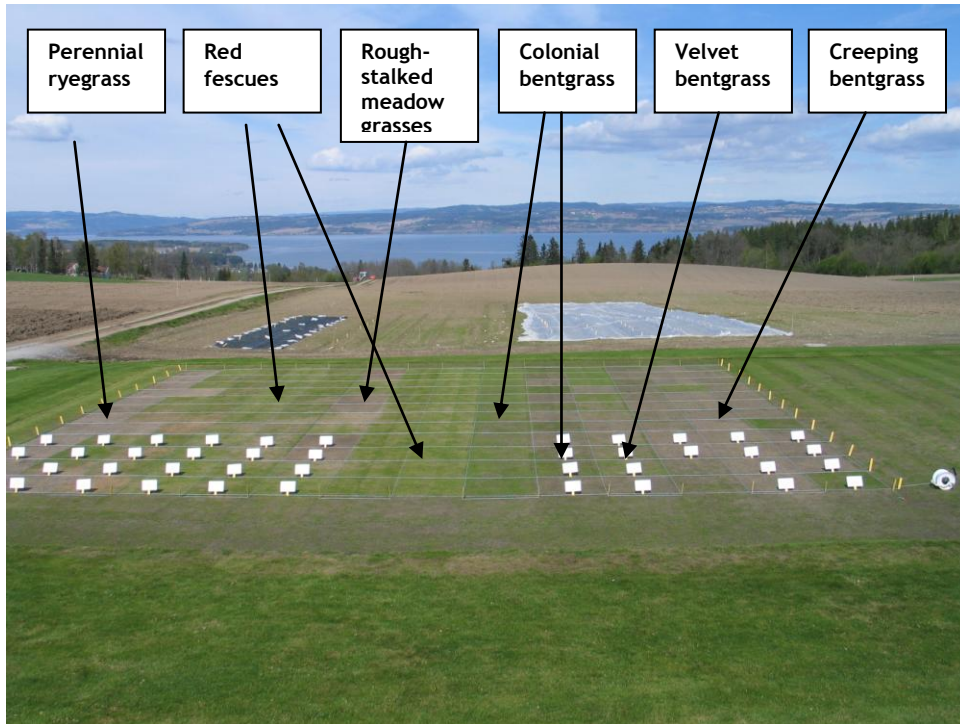


Photo 1. The variety green at Apelsvoll, 5 May 2008. Great differences in winter survival. (Photo: Bjørn Molteberg)

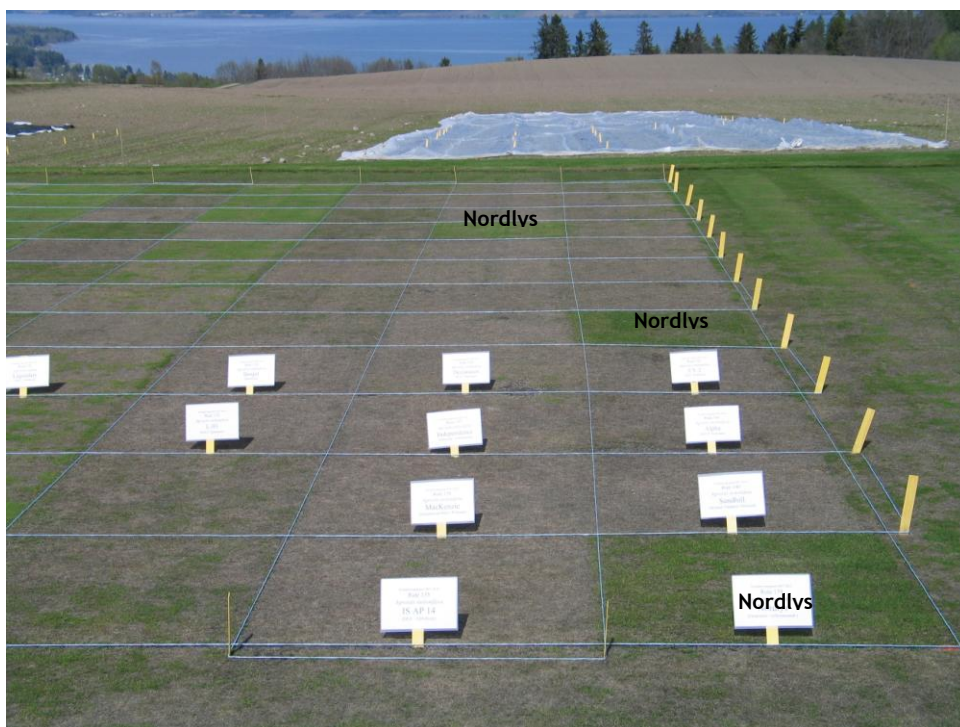


Photo 2. Winter damages in creeping bentgrasses at Apelsvoll, 5 May 2008. The variety 'Nordlys' with good winter survival. (Photo: Bjørn Molteberg)

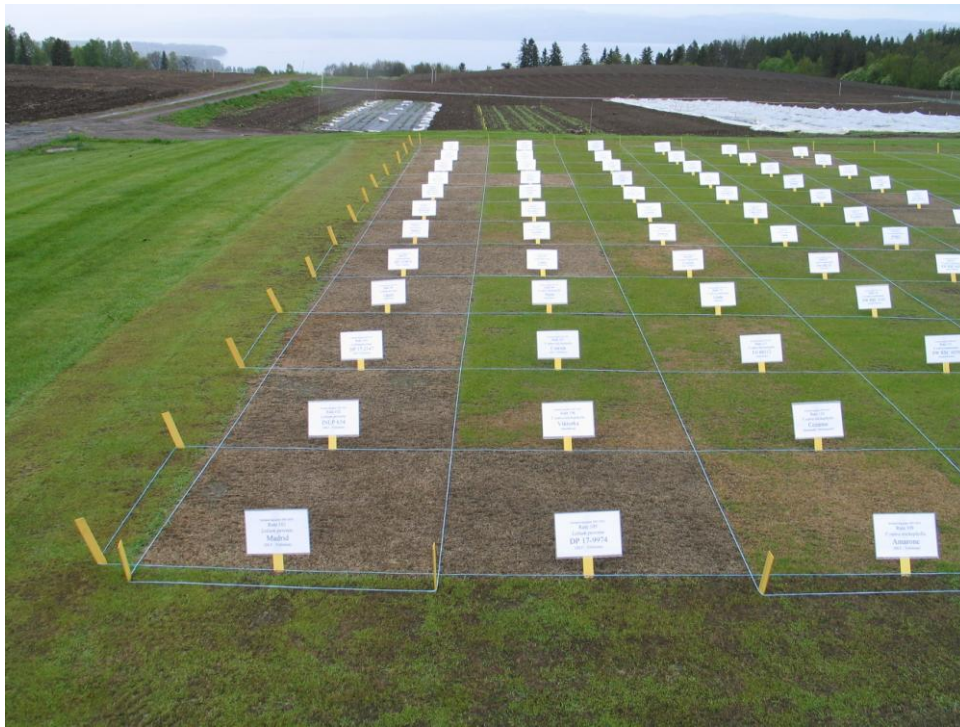


Photo 3. Dead perennial ryegrass to the left, red fescues to the right. Apelsvoll 16 May 2008. (Photo: Bjørn Molteberg)

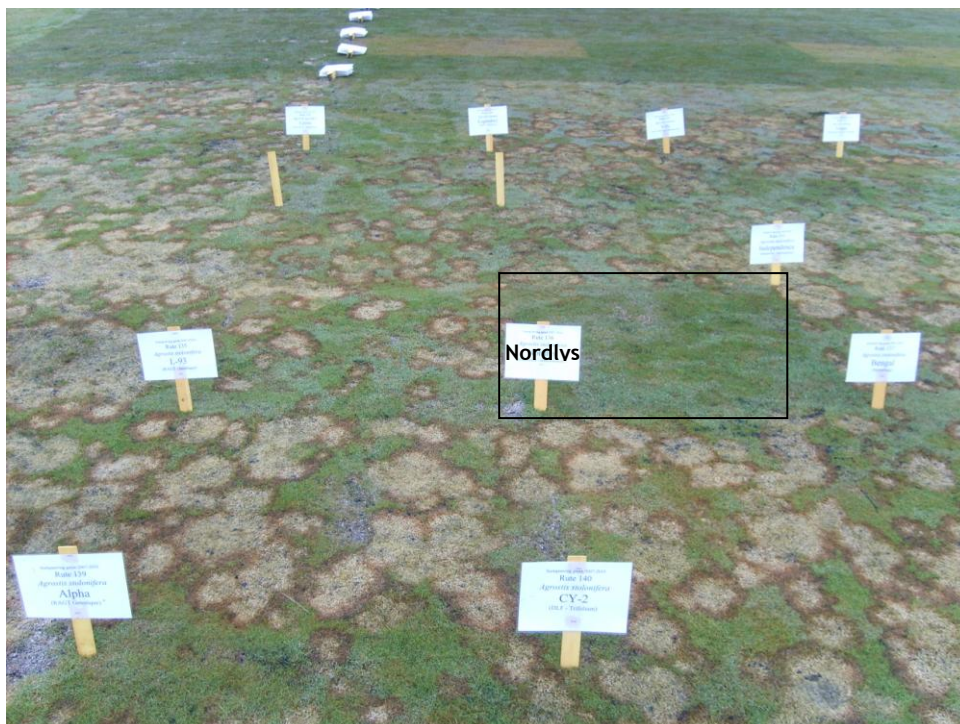


Photo 4. Attacks of pink snow mould (*Microdochium nivale*) in the creeping bentgrasses at Landvik, 22 April 2008. The variety 'Nordlys' had good resistance. (Photo: Trygve S. Aamlid)

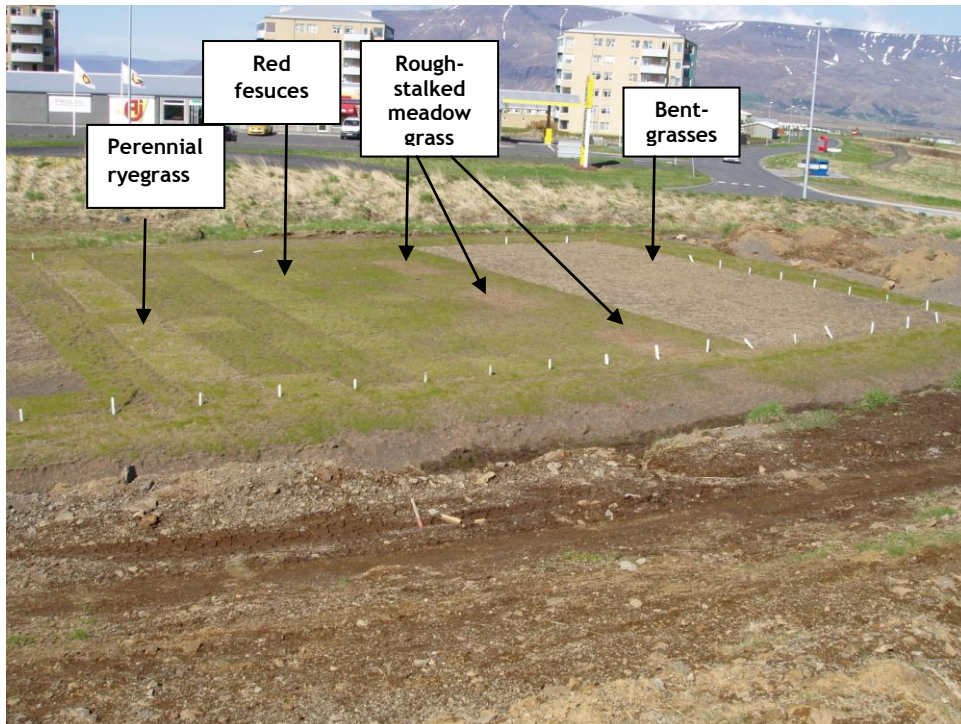


Photo 5. The variety green at Keldnaholt, 14 May 2008. All the bentgrasses and rough-stalked meadow grasses seemed to be dead. Perennial ryegrass and red fescues survived.
(Photo: Gudni Thorvaldsson)



Photo 6. The variety green at Östra Ljungby, 18 September 2008, after reseeding in May.
(Photo: Daniel Nord)



**Photo 7. The variety green at Apelsvoll, 1 September 2008 after reseeding in May.
(Photo: Bjørn Molteberg)**



**Photo 8. The variety green at Keldnaholt, 18 September 2008 after reseeding in May.
(Photo: Gudni Thorvaldsson)**



Photo 9. Nice chewings fescue at Landvik 3 September 2008. (Photo: Trygve S. Aamlid)



Photo 10. Dormancy colour at Landvik, 17 November 2008. (Photo: Trygve S. Aamlid)



Photo 11. 'Leirin' has wider leaves and lower density than 'Jorvik'. Landvik, 3 September 2008. (Photo: Trygve S. Aamlid)



Photo 12. 'Vesper' is darker than 'Villa'. Landvik, 3 September 2008. (Photo: Trygve S. Aamlid)



Photo 13. 'Nordlys' has broader leaves and lower density than 'L-93'. Landvik, 3 September 2008. (Photo: Trygve S. Aamlid)



Photo 14. 'Musica' was ranked highest for visual merits, density and fineness of leaves. Landvik, 3 September 2008. (Photo: Trygve S. Aamlid)



Photo 15. 'DP 17-2147' was ranked significantly before the other perennial ryegrass varieties in climate zone 1. Landvik, 3 September 2008. (Photo: Trygve S. Aamlid)

