



**Turfgrass species and varieties
for Scandinavian Putting Greens**

**Summary of
SCANGREEN 2015-2018**

By Trygve S. Aamlid, Pia Heltoft, Tatsiana Espevig & Wendy Waalen, Norwegian Institute for Bioeconomy (NIBIO), Anne Mette Dahl Jensen, University of Copenhagen and Gudni Thorvaldsson, Agricultural University of Iceland. English translation: Karin Juul Hesselsøe, NIBIO.

Turfgrass species and varieties for Scandinavian Putting Greens Summary of the SCANGREEN trials 2015-2018

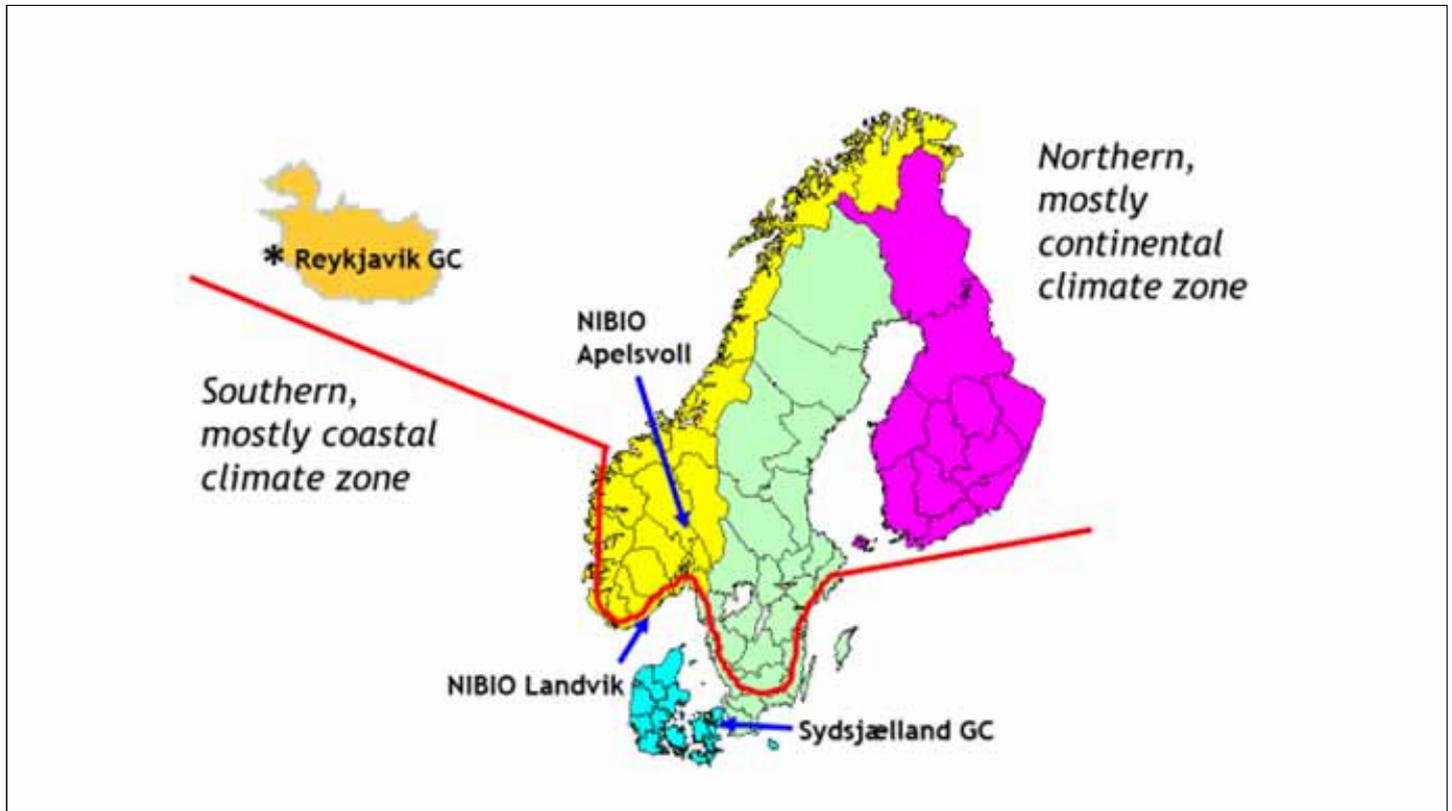


Figure 1. Map of the Nordic countries and the trial sites in the SCANGREEN divided into a northern and a southern test zone.

SCANGREEN – testing of species and varieties for Scandinavia - was initiated in 2003, and since then it has been part of the research programme for Scandinavian Turfgrass and Environment Research Foundation (STERF). In this article we summaries the general impressions and make recommendations for the best varieties of red fescue, colonial and creeping bentgrass based on the trials in 2015-2018.

The trials were established on USGA-spec. greens at Reykjavik GC, Iceland, NIBIO Apelsvoll and NIBIO Landvik, Norway and Sydsjælland GC, Denmark. Reykjavik and Apelsvoll were considered to represent the northern, and Landvik and Sydsjælland, the southern climatic zone of the Nordic countries (Figure 1, photo 1).

Generally, the demand for winter hardiness of the varieties is higher in the

northern than in the southern zone, but there are no rules without exceptions. The winter 2017-18 resulted in severe damages due to ice and melting water at Landvik, which was worse than at Apelsvoll.

The lists for recommended varieties can be found at www.scanturf.org and www.sterf.org



Photo 1. Test greens in the SCANGREEN: Upper left: Reykjavik GC, upper right: NIBIO Apelsvoll both in the northern test zone. Bottom left: Sydsjællands GC, bottom right: NIBIO Landvik both in the southern test zone. Photos: Gudni Thorvaldsson, Pia Heltoft, Anne Mette Dahl Jensen and Trygve S. Aamlid.

Management

The trials are established on sandbased USGA-spec greens and they are managed as realistic as possible with mowing, fertilizing, aeration, topdressing and further maintenance. Mowing height is 3 mm in creeping bentgrass, velvet bentgrass, colonial bentgrass, annual bluegrass and rough bluegrass, and 5 mm in red fescue, Kentucky bluegrass and perennial ryegrass. Fertilizer inputs are 150 -160 kg N/ha in creeping bentgrass, Kentucky and rough bluegrass and perennial ryegrass and 90-100 kg N/ha in red fescue, velvet and colonial bentgrass.

To evaluate the resistance to diseases and the competitiveness to weeds, no pesticides are used in the trials. The trials are not exposed to wear from



Photo 2. Wear drum used in the trial at Sydsjællands GC. Photo: Anne Mette Dahl Jensen.

golfers, but they are exposed to the wear and compaction from a friction wear drum, equipped with soft spikes. (photo 2).

Species and varieties

The trials included varieties from the following species and subspecies:

- 8 new varieties of creeping bentgrass
- 4 new varieties of colonial bentgrass
- 4 new varieties of Chewings fescue
- 3 new varieties of slender creeping fescue
- 2 new varieties of perennial ryegrass
- 3 new varieties of rough bluegrass
- 1 new variety of annual bluegrass

The Kentucky bluegrass variety 'Limousine' was included at NIBIO's own initiative to test the species' tolerance to low mowing, and if it could become an alternative species for greens often exposed to winter damage.

The new varieties were tested to the same reference varieties as in the previous trials: Chewings fescue 'Musica', slender creeping fescue 'Cezanne', colonial bentgrass 'Jorvik', creeping bentgrass 'Independence', perennial ryegrass 'Chardin' and rough bluegrass 'Dark Horse'. The reference varieties are well tested and widely used in Scandinavia. For a new variety to be recommended, it must perform as good or better than the control variety for at least one characteristic.

Recordings

The trials were evaluated monthly for tiller density, fineness of leaves, color, diseases, weeds and turf height growth (Photo 3). Summarized in a visual 'turfgrass quality', that is used to rank the varieties. Due to limited space (the plots are 1 x 1 m) the playing quality is not evaluated in these trials.



Photo 3. Turfgrass height of growth is evaluated the first Monday in every month. By subtracting the bench setting of the mower and divide it with the number of days since last mowing, we calculate the daily height of growth. Photo: Trygve S. Aamlid.

Summary on the different species

Half way through the project period the highest quality scores were obtained by the "outsider" Kentucky bluegrass due to less winter damages and better disease resistance than in any other species. At Sydsjællands GC the results were also good in the last two evaluation years, but at Landvik the plots with Kentucky bluegrass were invaded by annual bluegrass and other grass species. The plots with Kentucky bluegrass were uneven, and the leaves were coarse and stiff, and all in all it declined the playing quality. Though the trials confirmed that new and dense varieties of Kentucky bluegrass can tolerate lower mowing than we generally recommend. This information can be used when making seed blends and mixtures for tees.

Table 1 summarize the ranking of the different species as a green grass. Annual bluegrass 'Two Put' died in the winter due to microdochium patch

(photo 4) or physiological damages (photo 5) and it had to be reseeded in the spring in many of the plots. In earlier trials we have tested 'True Put', another variety of annual bluegrass randomly on the market in Scandinavia. The conclusion was the same: Those who want greens with annual bluegrass, should rely on the seedbank in the soil and not on seeds from the market. If there is a need for reseeding those greens many greenkeepers in Northern Sweden have experienced, that rough bluegrass can be a good alternative to get a fast reestablishment on greens with annual bluegrass.

As for annual and rough bluegrass perennial ryegrass is not a durable green grass. At Apelsvoll the rough bluegrass and the perennial ryegrass had to be reseeded every year in the project period, and at Iceland the density of the perennial ryegrass plots was very low, and it got invaded by a lot

Table 1. General impressions of the different species tested as a green grass. Numbers are means of the four trial sites.

| | Tiller-density (1-9, 9 is highest tiller number) | Leaf-texture (1-9, 9 is finest leaf) | Overall winter-damage, (% of plot area) | Moss at the end of the trial, (% of plot area) | Microdochium patch, (% of plot area) | | Take all patch, % of plot area |
|------------------------------------|---|---|--|---|---|-----------|-----------------------------------|
| | | | | | In spring after snowcover | In season | |
| Creeping bentgrass | 6.8 | 5.8 | 16 | 2.5 | 2.8 | 0.8 | 0.3 |
| Chewings fescue | 5.5 | 7.0 | 21 | 6.8 | 1.7 | 1.1 | 0.0 |
| Slender creeping fescue | 5.6 | 6.9 | 19 | 7.0 | 1.5 | 2.1 | 0.0 |
| Colonial bentgrass | 6.5 | 6.0 | 30 | 4.4 | 4.3 | 1.6 | 1.2 |
| Kentucky bluegrass | 5.7 | 4.2 | 15 | 3.6 | 0.5 | 0.1 | 0.0 |
| Perennial ryegrass | 4.3 | 3.7 | 47 | 8.7 | 0.5 | 0.4 | 0.0 |
| Rough bluegrass | 4.6 | 5.2 | 44 | 5.8 | 4.7 | 0.8 | 0.1 |
| | | | | | | | |
| Least significant difference (LSD) | 0.1 | 0.1 | 4 | 1.1 | 2.1 | 0.2 | 0.4 |

of moss. The plots with ryegrass died in winter of abiotic damages and not because of diseases (Table 1).

Table 1 shows as expected, that the «traditional» green grass species, as the bents had higher tiller density and wider leaves than the fescues.

Encroachment of moss became at the end of the period a big problem in the trial at Iceland, and the table shows, that this problem was mostly in plots with fescue compared to the bents. Milder winters with only a few periods with snow cover and more rain favours moss encroachment on golf greens at coastal areas in Scandinavia.

As for diseases table 1 shows that both colonial bentgrass and rough bluegrass are susceptible to microdochium patch in winter. Looking at microchium patch in season, the slender creeping fescue, was just as susceptible as the colonial bentgrass, and more than the creeping bentgrass. Take all patch was registered in the plots at Landvik and Sydsjælland GC, and here the colonial bentgrass was more affected than the creeping bentgrass. Dollarspot was not found in any of the trials.



Photo 4. Two rows with 'alternative' species in the SCANGREEN-trial at Landvik May 2016. The row to the left shows three plots of annual bluegrass 'Two Put' infected by microdochium patch, while the plots with rough bluegrass had managed the winter without damages. In the row to the right the dark green plots are the ryegrass, the lighter green plots are the Kentucky bluegrass. Photo: Trygve S. Aamlid.

Varieties of Chewings fescue

None of the four candidate varieties of Chewings fescue performed better than the control variety ‘Musica’ on average for four sites (Table 2), but ‘Humboldt’ and ‘Barchip’ were very close. They may nonetheless have a certain interest, because of darker color and ‘Humboldt’ also because of less height growth.

Data from the previous test period showed that both ‘Barlineus’ og ‘Caldris’ had better overall impression than ‘Musica’ at all four sites. From these data we can also recommend ‘Valetta’ and ‘Bargreen II’ in the northern test zone, and ‘Bodega’ in the southern test zone.

Table 2. Ranking of varieties of Chewings fescue, 2015-2018. Overall impression is split in the northern and the southern zone. Other registrations are means for both climate zones.

| | Overall impression (1-9) | | Tiller-density (1-9, 9 is highest tiller number) | Color (1-9, 9 is darkest green) | Moss at the end of the trial, (% of plot area) | Daily height increment, mm |
|------------------------------------|--------------------------|------------|--|---------------------------------|--|----------------------------|
| | North zone | South zone | | | | |
| Musica | 5.4 | 5.2 | 5.6 | 5.1 | 4.9 | 0.97 |
| Humboldt | 5.4 | 5.0 | 5.4 | 5.6 | 7.2 | 0.85 |
| Barchip | 5.4 | 4.9 | 5.5 | 5.9 | 7.8 | 0.96 |
| Wagner 1 | 5.3 | 4.8 | 5.3 | 5.9 | 5.9 | 0.96 |
| Aureline | 4.9 | 4.7 | 5.3 | 5.2 | 8.1 | 0.92 |
| Least significant difference (LSD) | 0.4 | 0.2 | 0.1 | 0.1 | 2.3 | 0.10 |

Varieties of slender creeping fescue

In slender creeping fescue, the situation resembled that in Chewings fescue (Table 3): None of the three candidate varieties outperformed the control variety ‘Cezanne’ at any site. On average for sites, their overall scores were significantly lower. ‘Borluna’ and ‘Mirador’ have been used in Iceland, but those two varieties and the new Danish variety ‘Aporina’ appeared to have a lower quality than ‘Cezanne’. Previous tests have shown that ‘Viktorka’ and ‘Nigella’ are good alternatives to ‘Cezanne’ in both climate zones. In the southern zone we can also recommend ‘Finesto’, and in the northern zone ‘Barroyal’.

Table 3. Ranking of varieties of slender creeping fescue, 2015-2018. Overall impression is split in the northern and the southern zone. Other registrations are means for both climate zones.

| | Overall impression (1-9) | | Tiller-density (1-9, 9 is highest tiller number) | Color (1-9, 9 is darkest green) | Moss at the end of the trial, (% of plot area) | Daily height increment, mm |
|------------------------------------|--------------------------|------------|--|---------------------------------|--|----------------------------|
| | North zone | South zone | | | | |
| Cezanne | 5.4 | 5.3 | 5.6 | 1.7 | 7.2 | 0.77 |
| Mirador | 5.2 | 5.1 | 5.5 | 1.4 | 8.1 | 0.86 |
| Aporina | 5.0 | 5.1 | 5.6 | 1.9 | 5.6 | 0.89 |
| Borluna | 5.0 | 4.9 | 5.4 | 2.0 | 7.0 | 0.83 |
| Least significant difference (LSD) | 0.4 | 0.2 | 0.1 | 0.4 | 2.9 | 0.09 |

Table 4. Ranking of varieties of colonial bentgrass, 2015-2018. Overall impression is split in the northern and the southern zone. Winter damage as mean for both zones. The remaining results are from the southern test zone.

| | Overall impression (1-9) | | Winter-damage, % of plot area | Tiller-density (1-9, 9 is highest tiller number) | Leaf-fineness (1-9, 9 is finest leaf) | Microdochium patch in season, % of plot area | Daily height increment, mm |
|------------------------------------|--------------------------|------------|-------------------------------|--|---------------------------------------|--|----------------------------|
| | North zone | South zone | | | | | |
| DLF-PS-AT3 | 4.5 | 5.0 | 27 | 6.5 | 5.9 | 1.0 | 1.13 |
| Heritage | 4.7 | 4.9 | 25 | 6.6 | 5.9 | 1.0 | 1.17 |
| Jorvik | 4.6 | 4.8 | 29 | 6.4 | 6.0 | 1.9 | 1.14 |
| Teetop | 4.5 | 4.8 | 28 | 6.7 | 6.1 | 1.7 | 1.33 |
| Charles | 2.9 | 4.6 | 41 | 6.8 | 6.3 | 3.4 | 0.97 |
| | | | | | | | |
| Least significant difference (LSD) | 0.4 | 0.4 | 8 | 0.3 | 0.1 | 1.3 | 0.09 |

Varieties of colonial bentgrass

New varieties of colonial bentgrass from Europe, USA and New Zealand were tested against the reference variety 'Jorvik'. 'Charles' is ranked as the no 1 variety of colonial bentgrass at Sports Turf Research Institute (STRI), and our trials confirmed that this variety from New Zealand was denser, had finer leaves and less height increment than the other varieties of colonial bentgrass (table 4). The fact about less height increment is important knowledge, because in mixtures with fescue, it is normally the colonial bentgrass that affects the green speed. But the winter survival of 'Charles' was not good and neither the resistance to microdochium patch, so we cannot recommend this variety in Scandinavia. In the northern zone 'Charles' was far behind the reference variety 'Jorvik' (photo 5), and in the southern zone it was much more susceptible to microdochium patch (photo 6). The new American varieties 'Heritage' and 'Rhinegold' seems to have a potential in the Nordic countries. Previous tests have shown that 'Cleek', 'Greenspeed' and 'Aberroyal' are good alternatives to 'Jorvik' in the southern zone.

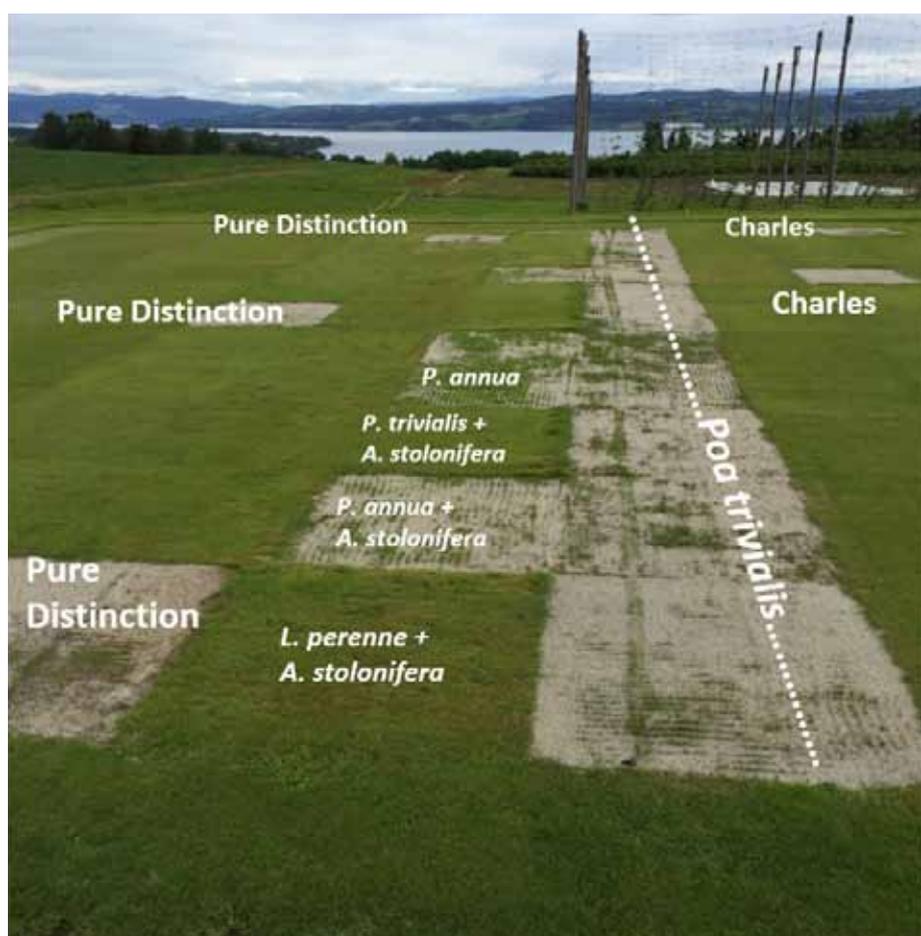


Photo 5. Annual bluegrass 'Two Put' and all varieties of rough bluegrass and ryegrass died every winter at Apelsvoll. Colonial bentgrass survived the winter except for 'Charles' and creeping bentgrass except for 'Pure Distinction'. All varieties of fescue survived. Photo: June 2017 after reseeding, Pia Heltoft.



Photo 6. New Zealand variety ‘Charles’ is ranked as the no 1 variety of colonial bentgrass at Sports Turf Research Institute (STRI), but in the SCANGREEN trials it was more susceptible to microdochium patch than the other varieties of colonial bentgrass. Photo from Landvik Feb 2019 after one month of snow cover. Photo: Tatsiana Espevig.

Varieties of creeping bentgrass

‘Independence’ has been the reference variety and the recommended variety of creeping bentgrass at putting greens in the Nordic countries since the SCANGREEN trials started in 2003-06. In the recent years result from USA, is questioning (1) if ‘Independence’ is more susceptible to dollar spot than the other varieties of creeping bentgrass, (2) if ‘Independence’ is slower than the other varieties in establishment/reestablishment at low temperatures.

Question (1) we are not able to answer since there was no dollar spot in any of the trials. We have preliminary results from screenings of resistance for dollar spot in different varieties of creeping bentgrass, but we still miss results from field trials before we can make any conclusions. Question (2) about the rather slow establishment of ‘Independence’ was partly confirmed in our trials (table 5), but this was also the case for ‘Flagstick’ and ‘Memorial’, and it should be investigated

further, whether it was genetically determined or due to the quality of the seed lot used in this test cycle.

Nevertheless table 5, shows some new and interesting varieties of creeping bentgrass on the market. In both climate zones the new varieties ‘Luminary’, ‘Riptide’ and ‘Ignite’ should be noticed. ‘Pure Distinction’ was the densest variety with the finest leaves, but this variety did not survive very well in the northern zone (photo 5), and it also was susceptible to take-all-patch and microdochium patch (table 5). ‘Pure Distinction’ has a light colour in many ways resembling velvet bentgrass. Otherwise ‘Crystal Blue’ was one of the darkest green varieties, but neither that nor ‘Valderrama’ were as good as expected. For ‘Valderrama’ this could be partly, because it was seeded two weeks later than the other varieties in the trial.

Another variety with high expectations among greenkeepers was ‘Memorial’, but it did not perform well in these trials with less density, coarser leaves and more height increment than the other varieties (photo 7). At Landvik ‘Memorial’ performed much like old ‘Penncross’.

We recommend ‘Luminary’, ‘Riptide’, ‘Flagstick’ and ‘Independence’. Based on results from previous test cycles we also recommend: ‘CY-2’, ‘Teone (T1)’ and ‘Penn G1’ for putting greens in the northern zone and ‘007’ and ‘Declaration’ for greens in the southern zone. Results from USA indicates that ‘Declaration’ is one of the best varieties against dollar spot, but we don’t know if this is the same with the dollar spot that infects golf courses in the Nordic countries.

Table 5. Ranking of varieties of creeping bentgrass, 2015-2018. Overall impression is split in the northern and the southern zone. Winter damage and coverage 3 weeks after sowing as mean of both climate zones. The remaining results are from the southern test zone.

| | Overall impression (1-9) | | Winter-damage, % of plot area | Coverage 3 weeks after sowing, % of plot area | Tiller-density (1-9, 9 is highest tiller number) | Take-all-patch, % of plot area | Microdochium patch in season, % of plot area | Daily height increment, mm |
|------------------------------------|--------------------------|------------|-------------------------------|---|--|--------------------------------|--|----------------------------|
| | North zone | South zone | | | | | | |
| Luminary | 6.0 | 5.8 | 16 | 54 | 7.3 | 0.4 | 1.4 | 0.92 |
| Riptide | 6.0 | 5.7 | 18 | 56 | 7.3 | 0.1 | 0.5 | 0.97 |
| Flagstick | 5.9 | 5.8 | 18 | 35 | 7.2 | 0.3 | 0.3 | 0.93 |
| Ignite (V8) | 5.9 | 5.5 | 16 | 67 | 7.0 | 0.1 | 1.4 | 1.02 |
| Independence | 5.8 | 5.6 | 17 | 46 | 7.0 | 0.1 | 0.6 | 0.96 |
| Crystal Blue | 5.6 | 5.3 | 18 | 68 | 7.0 | 0.1 | 1.3 | 1.04 |
| Valderrama | 5.4 | 5.3 | 13 | - ¹ | 6.8 | 0.3 | 1.0 | 1.01 |
| Memorial | 5.6 | 5.1 | 15 | 34 | 6.6 | 0.1 | 1.1 | 1.16 |
| Pure Distinction | 4.0 | 5.7 | 44 | 65 | 7.6 | 1.2 | 4.1 | 0.88 |
| Least significant difference (LSD) | 0.4 | 0.4 | 11 | 2 | 0.3 | 0.1 | 1.3 | 0.10 |

1) Valderrama was seeded two weeks after the other varieties, because the seeds arrived later.



Photo 7. Memorial had lower tiller density and coarser leaves than 'Ignite'. 'Ignite' performed good in both climate zones, 'Memorial' had low tiller density and coarse leaves Photo: June 2017, Trygve S. Aamlid