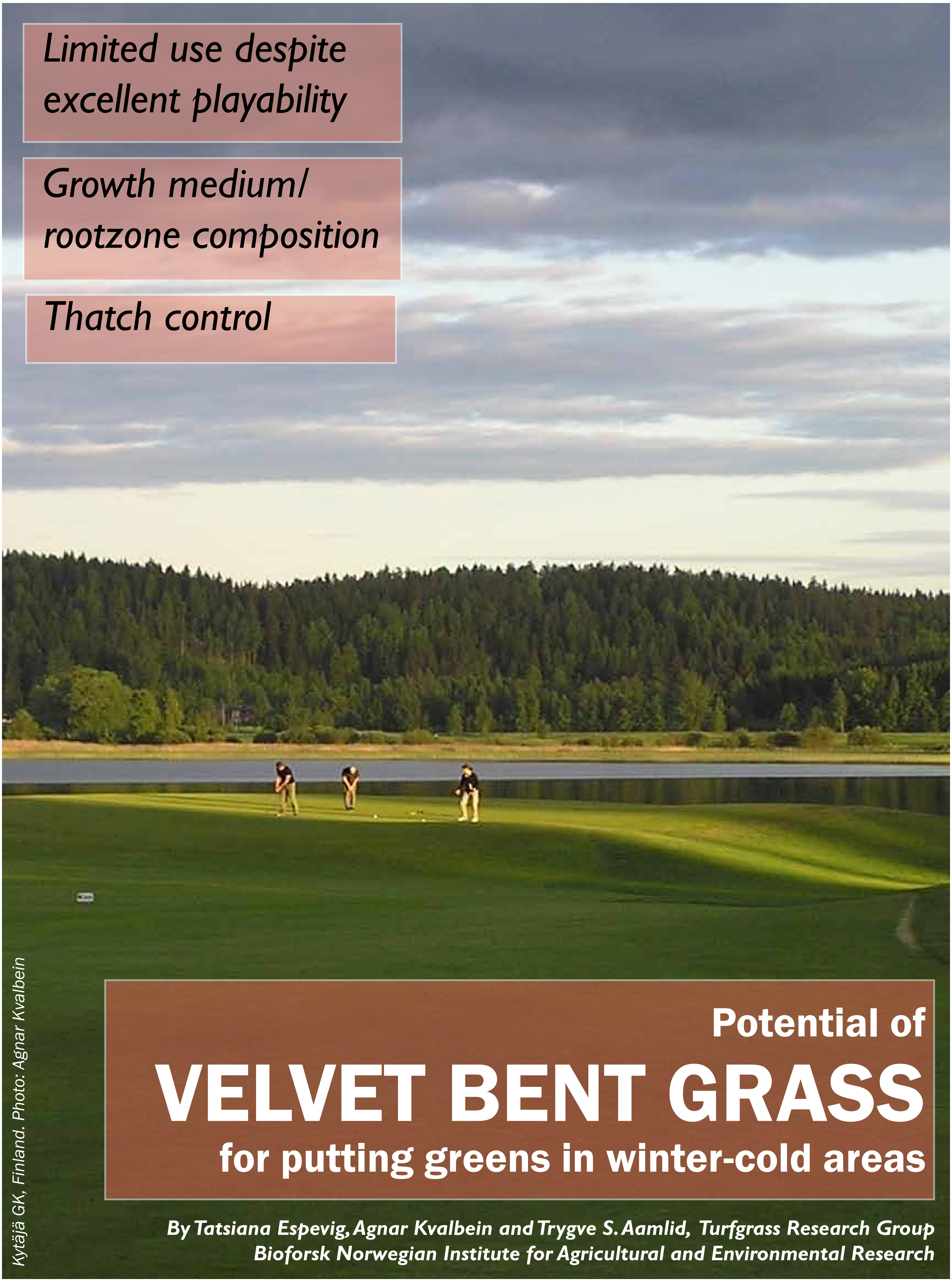

Kytäjä GK, Finland. Photo: Agnar Kvalbein

Limited use despite excellent playability

Growth medium/ rootzone composition

Thatch control

Potential of VELVET BENT GRASS for putting greens in winter-cold areas

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Kytäjä Golf Club, Finland.
Photo: Agnar Kvalbein

The number of cool-season turfgrasses seeded on golf greens can be counted on the fingers of one hand.

One of these is velvet bent grass (*Agrostis canina* L.), although the use of this species is small compared with that of annual bluegrass (*Poa annua* L.), creeping bent grass (*Agrostis stolonifera* L.) and red fescue (*Festuca rubra* L.), the latter often in mixture with colonial bent grass (*Agrostis capillaris* L.). Historically and probably due to climate reasons, the greatest use of velvet bent grass in North America has been in the New England region. In the Nordic countries, velvet bent grass has been seeded on approximately 15% of the golf greens in Finland, but less than 3% of the golf greens in Denmark, Sweden and Norway.

Based on our recently finished project 'Potential for velvet bent grass (*Agrostis canina*) on Scandinavian putting greens', SCANGREEN variety evaluation and a couple of other STERF projects, this article discusses some of the advantages and disadvantages of this, perhaps underutilised, species, and makes recommendations for greenkeepers wondering whether velvet bent grass could be an alternative for their golf course.

Limited use despite excellent playability

Why is the use of velvet bent grass so limited?

The most important reason is probably little experience and knowledge about velvet bent grass management, especially regarding thatch control. Secondly, turfgrass breeding and variety development during the past 50 years has mostly focused on creeping bent grass. However, during the past couple of decades, there has been a resurgence in interest for velvet bent grass, with varieties such as 'SR 7200' (Europe: 'Avalon'), 'Vesper', 'Greenwich', 'Legendary', 'Villa' and 'Venus' coming onto the market. According to SCANGREEN trials, 'Villa' is currently the most highly ranked variety in Scandinavia (www.scanturf.com, http://sterf.golf.se).

Well-kept velvet bent grass greens have a beautiful, light green colour and are fast due to an extremely high tiller density, fine leaves and a slow growth rate. They tolerate mowing to 2.5-3 mm, and stimpmeter readings 24 h after mowing show 0.5-1.0 foot better ball roll than with creeping bent grass and red fescue. Because of the low vertical growth rate, greenkeepers often cut velvet bent grass only 3-4 times per week. On the negative side, the low growth rate results in poor recuperative capacity and slow repair of ball marks. Since velvet bent grass requires less nitrogen and irrigation water, it is usually considered friendlier to the environment than creeping bent grass.

Winter hardiness of velvet bent grass

Winter hardiness is perhaps the most important criterion when selecting turfgrasses for Nordic climate conditions.

The winter hardiness of velvet bent grass was evaluated at Bioforsk Landvik (coastal location, 58°N) and Bioforsk Apelsvoll (61°N, 250 m.a.s.l.) during the first Scandinavian round of variety testing on golf greens, 2003-2006. The results from these tests triggered the current interest in velvet bent grass among Scandinavian researchers and greenkeepers (Table 1, Photo 1).

We do not know exactly which features or combinations of features enable velvet bent grass to survive the Scandinavian winter better than creeping bent grass. Winter hardiness is a very complex character.

The most detrimental conditions are long-lasting ice cover or standing water causing oxygen deficiency, depletion of turfgrass reserves and/or accumulation of toxic gases.

Another type of damage is caused by snow on unfrozen ground, which among other things increases the risk of snow mould damage. On the other hand, if not protected by snow, the turf may die from freezing temperatures, especially if these low temperatures are combined with strong winds that dry out plants unable to absorb water from the frozen soil.

It is the ability of the turf to withstand these stresses, both separately and in combination, which is referred to as 'winter hardiness'. It is determined entirely by genetics and considerable differences exist, both among species and among varieties within species.

While the specific reasons for winter-kill were not identified in SCANGREEN 2003-06 and 2007-10, we are now trying to separate biotic and abiotic factors in trials started in 2011.

Photo 1. *Winter survival of creeping bent grass and velvet bent grass at Apelsvoll, April 2005. Photo: Bjørn Molteberg*

The ability of turfgrasses to tolerate winter stresses normally increases upon exposure to low temperatures and altered light conditions in autumn. This process is referred to as 'hardening' or 'cold acclimation'. Temperatures in the range -2 to -6°C for two or more weeks in autumn result in more winter-hardy plants. The periods of subfreezing acclimation at temperatures -2-6°C are required to obtain maximum hardiness. Conversely, mild periods during winter result in deacclimation, i.e. less winter hardiness.

Table 1. Results from SCANGREEN trials at Apelsvoll, Norway, 2003-2006 and 2007-2010. Values are means of 1-15 varieties within each species

Turfgrass species	2003-2006		2007-2010		
	General impression (1-9)	Winter damage %	General impression (1-9)	Winter damage %	In-season disease* %
Velvet bent grass	6.7	25	5.3	48	11
Colonial bent grass	5.8	20	4.3	56	9
Creeping bent grass	5.3	59	4.7	64	6
Chewings fescue	4.8	37	5.3	38	0
Slender creeping red fescue	5.0	44	4.9	42	0
Annual bluegrass	2.6	59	-	-	-
Rough bluegrass	-	-	4.3	67	0
Perennial ryegrass	-	-	3.5	79	1
LSD 5%	0.5	9	0.3	5	1

** mostly microdochium patch*

Photo 2. *Sampling of six turfgrass species on 25th November 2010 to test their deacclimation ability. Photo: Tatsiana Espevig*

As part of the ongoing STERF project 'Turfgrass winter survival in a changing climate', we tested different species for their ability to resist deacclimation during 12 days at 10°C in the end of November (Photo 2). Acclimated in the field, creeping bent grass, velvet bent grass, chewings fescue, colonial bent grass and annual bluegrass were able to tolerate temperatures down to -30, -23, -21, -18, and -13°C, respectively. After deacclimation, the corresponding lethal temperatures were -23, -22, -17, -12 and -6°C.

Although the freezing tolerance after deacclimation was slightly better in creeping bent grass than in velvet bent grass, the moderate loss for velvet bent grass, both in relative and absolute terms, probably reflects a lower respiration rate and thus less depletion of storage compounds than in other turfgrass species. A lower respiration rate also implies less risk of oxygen deficiency during a long period with ice cover or standing water.

Photo 3. *Pink snow mould (left) and grey snow mould (right) on velvet bent grass greens. Photos: Tatsiana Espevig.*

Susceptibility to *Microdochium nivale*

The most common low-temperature fungal diseases affecting turfgrasses in Scandinavia are pink snow mould caused by *Microdochium nivale* and grey snow mould caused by *Typhula incarnata. (Photo 3)*

In contrast to *Typhula*, which only develops under snow cover, *M. nivale* affects grasses both under snow, causing pink snow mould, and during the growing season, causing microdochium patch.

None of the turfgrasses currently used on greens has absolute resistance to *M. nivale*. Our research under controlled climate conditions showed that velvet bent grass is more susceptible to microdochium patch than creeping

Photo 4. *Symptoms of Microdochium nivale infection on nonacclimated (left) and acclimated (right) turf. Velvet bent grass cultivars: A = Avalon, V = Villa, G = Greenwich, L = Legendary. A4 = Penn A-4 (creeping bent grass control) Photo: Katarina Gundsø Jensen.*

bent grass in the nonacclimated state (Photo 4). This was confirmed by field observations of 'in-season disease' in the SCANGREEN trials from 2007 to 2010 (Table 1). Small microdochium patches may occur during cool and wet summer months (Photo 5). On the other hand, our studies showed no difference between velvet and creeping bent grass in susceptibility to *M. nivale* after acclimation (Photo 4). In practice, we always recommend spraying both velvet bent grass and creeping bent grass with fungicides before winter.

Photo 5. *Microdochium patch on velvet bent grass green in early autumn. Photo: Tatsiana Espevig.*

Photo 6. *Less microdochium patch on velvet bent grass plots with 20% (v/v) garden compost (right) in the USGA rootzone compared with straight sand (left). Photo: Trygve S. Aamlid.*

Growth medium/rootzone composition for velvet bent grass greens

According to USGA recommendations, putting greens can be constructed with or without organic amendment to the sand-based root zone.

Velvet bent grass greens benefit from a growing medium with a relatively high water retention capacity, enabling it to withdraw water from the thatch/mat layer. Compared with straight sand greens, the inclusion of 1.5-2% (w/w) organic matter (or even 5% (v/v) of a sandy loam soil) in the root zone reduces the risk of development of a separate thatch/mat layer very distinct from the root zone underneath. When choosing organic material, one of the advantages of a well-defined and homogeneous compost is the higher microbial activity than the more common peat amendment. Our experiments also showed less microdochium patch on compost-amended greens than on straight sand greens (Photo 6). However, use of compost may result in dark-coloured soft patches caused by white-rot fungi, which are able to decompose lignin (Photo 7).

Photo 7. *Left: Samples from a velvet bent grass green with (left) and without (right) degraded lignin in the thatch/mat layer. Right: The decomposing white-rot fungi caused soft indents with darker turf due to mineralisation of nitrogen. Photo: Trygve S. Aamlid.*

Photo 8. *Samples from an one-year old experimental putting green showing thickness of the mat layer. Photo: Trygve S. Aamlid.*

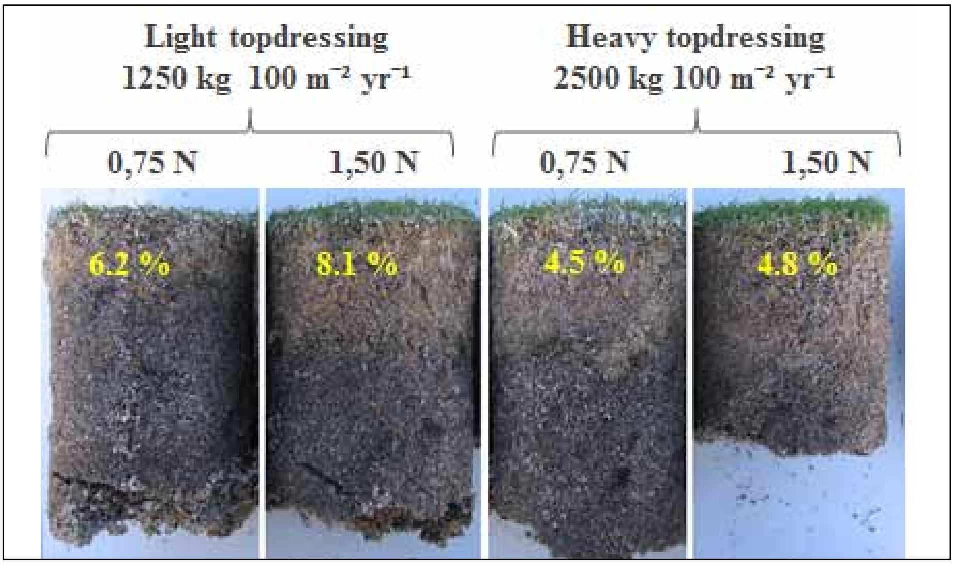

Photo 9. *Thatch formation resulting from the interaction between nitrogen and topdressing. Doubling the N rate resulted in a significantly higher concentration of organic matter in the mat under light topdressing but not under heavy topdressing. Doubling the topdressing rate resulted in a higher reduction of organic matter content under moderate nitrogen than under low nitrogen. Samples taken from 2-year old velvet bent grass green, nitrogen rates given as kg per 100 m^2 per year. Photo: Tatsiana Espevig.*

Thatch control

The greatest problem on velvet bent grass greens is thatch development (Photo 8).

A moderate thatch layer plays an important role in green stability, wear tolerance and prevention of weeds, but too much thatch results in soft greens with an increased risk of diseases, dry spots, scalping, reduced infiltration and poor root development. With inappropriate management, we have seen velvet bent grass greens develop a 20 mm mat layer with an organic matter content of 10% (w/w) in one year (Photo 8).

Thatch can be controlled by (1) reducing growth, (2) stimulation of microbial thatch degradation, (3) dilution of the thatch with sand and (4) mechanical thatch removal. A combination of all four methods gives the best results, but nitrogen and topdressing are always key factors (Photo 9). Topdressing not only dilutes the thatch but also stimulates thatch degradation by creating aerobic conditions for thatch decomposers. This may be especially important in Scandinavia, where thatch degradation is often limited by a short and cool growing season. We recommend up to 2500 kg annual topdressing per 100 m^2, applied at two weeks intervals and it is important to start this programme already in the seeding year. On newly established velvet bent grass greens the nitrogen dose can be up to 1.8-2.2 kg per 100 m^2 per year. A high nitrogen input not only enhances grow-in and prevents open spots that can be invaded by *Poa annua*, but also decreases the C:N ratio and stimulates microbial activity. On established velvet bent grass greens, the nitrogen dose should be reduced to about 0.9-1.0 kg per 100 m^2 per year depending on site and root zone composition.

Frequent grooming, spiking and slicing are necessary measures on established velvet bent grass greens. Coring and light vertical cutting reduce mat thickness, but a significant reduction in the organic matter concentration in the mat can only be achieved when mechanical thatch removal methods are combined with topdressing. On the other hand, light mechanical treatments may be necessary to facilitate the incorporation of sand in this very dense species.

Photo 10. *Field trial on effects of N-fertilisation, topdressing, and mechanical treatments on thatch formation and performance of velvet bentgrass green. Photo: Tatsiana Espevig*

Nursery greens for repair purposes

Velvet bent grass maintenance is a delicate balance. In order to promote faster repair of ball marks, and other damage, greenkeepers will always be tempted to apply more nitrogen and irrigation water. However, this can increase turfgrass growth to such an extent that the thatch gets out of control. Instead of pushing growth, we therefore recommend the establishment of a nursery green from which damaged areas can be replaced.

Concluding remarks

We do not recommend velvet bent grass as an alternative for golf courses with poor finances or inexperienced greenkeepers. In our opinion, velvet bent grass is primarily an alternative for high profile courses aiming for spectacular greens with extraordinary playing quality.

While it is true that velvet bent grass requires less water and nitrogen than creeping bent grass, it is not a low-input species with regard to topdressing, fungicides or greenkeeper expertise. Managing velvet bent grass is a challenge, but it can be a rewarding species for the right course and the right greenkeeper.

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