

The plant growth regulator Primo MAXX (trinexapac-ethyl) on Golf Courses: The Nordic Experience

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Introduction

In 2011 and 2013, the plant growth regulator Primo MAXX®, following called plant growth regulator (PGR), was approved for use on golf courses in Sweden and Finland, respectively. The registrations were based on trials carried out by independent research institutes in Norway and Finland. The use of a plant growth regulator was a new experience to Nordic greenkeepers as no such product had earlier been approved for turf.

In 2014, the Scandinavian Turfgrass and Environment Research Foundation (STERF) published a handbook summarizing several years of research and two years of practical experiences on the use of PGR on Nordic golf courses. The handbook can be downloaded from STERF's website www.sterf.org. This article highlights some of the key findings in our research.

PGR inhibits leaf elongation in long days

The mode of action of trinexapac-ethyl, the active component of the evaluated PGR, is by inhibiting plant synthesis of gibberellic acid, a hormone stimulating cell elongation. Since it is well documented that the high growth rates of grasses during long summer days is mediated by this plant hormone, it can be argued that the need for PGR is higher in the Nordic countries than in countries further south. This was recently confirmed in one of our greenhouse experiments where the growth rate of American cultivars of creeping bentgrass (*Agrostis stolonifera*) increased by 22 % as the daylength was prolonged from 15 to 20 hours (Figure 1). In this experiment, the light intensity was adjusted to give the same amount of energy in all treatments, so the difference was a true photoperiodic effect.

Located at approximately 60° N, the Nordic capitals Helsinki, Stockholm and Oslo experience about 20 h of daylight in midsummer. However, in

autumn, the inclination of the sun is much lower in the Nordic countries than at lower latitudes, and that results in long shades from trees surrounding greens and tees on golf courses (Figure 2). Shade from trees has implications for both light quality and light quantity and this is an important reason for inadequate hardening and poor winter survival.

PGR can improve turfgrass winter survival

Two of our trials on a Finnish golf courses showed significantly less infection of pink snow mold (*Microdochium nivale*) in spring after regular application of PGR during the previous summer (Figure 3, AAMLID et al., 2009). The effect was not strong enough to eliminate the need for fungicide applications in autumn, and further research will be needed to evaluation the potential reduction in fungicide use. Spring observations on an annual bluegrass (*Poa annua*) green at Bioforsk's Turfgrass Research Center in Southern Norway showed 23 % *Microdochium nivale* on unsprayed control plots, 14 % on plots treated regularly with



Fig. 1: Long photoperiods enhance leaf elongation. In this growth chamber experiment with creeping bentgrass (*Agrostis stolonifera*) maintained at fairway mowing height, the plot to the left had been exposed to 15 h and the pot to the right to 20 h photoperiod. The total irradiance was the same for both pots. (Photo: Trygve S. Aamlid)

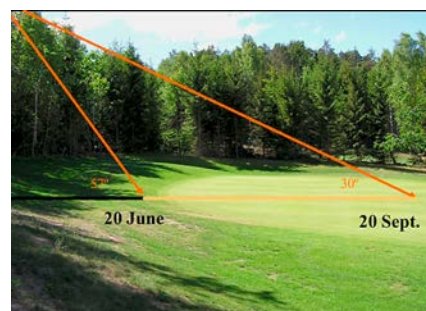


Fig. 2: At northern latitudes, the low sun angles in autumn result in much longer shades than during mid-summer. (Photo: Agnar Kvalbein)

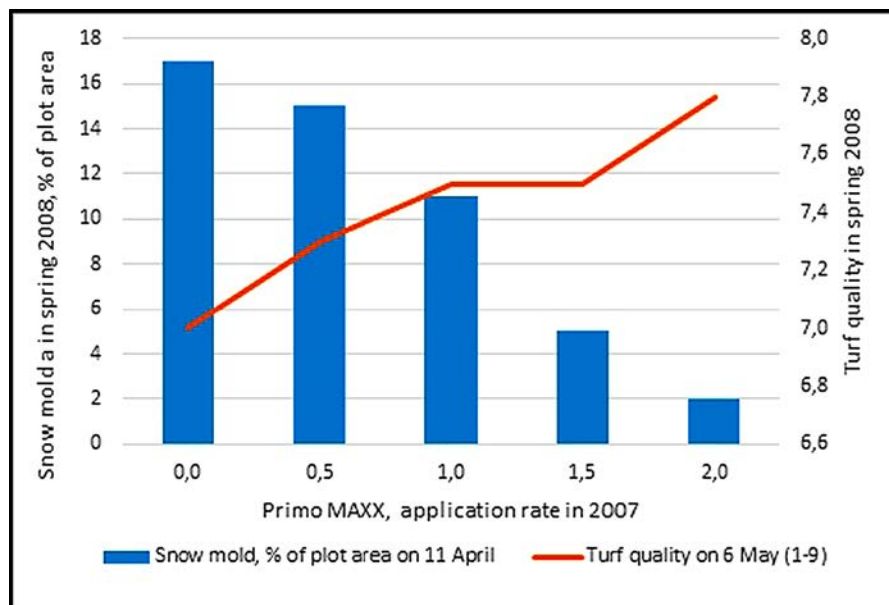


Fig. 3: Effect of increasing monthly application rates of PGR in 2007 on snow mold infection and turf quality in spring 2008. Results from a fairway trial in Finland with a predominant turf cover of Kentucky bluegrass (*Poa pratensis*).



Fig. 4: Kentucky bluegrass (*Poa pratensis*) on this semirough in the foreground was strongly retarded by PGR, and this caused perennial ryegrass (*Lolium perenne*) tufts to become more visible.

(Photo: Tatsiana Espevig)

PGR in the previous year and 1 % after two applications of fungicides before winter (AAMLID et al., 2012).

Application rates and intervals

From an environmental point of view, it's a good thing that PGR is broken down relatively fast in plant tissue. However, the low persistency of the product also means that turf managers have to repeat their applications and regular intervals, and our experience is that the optimal interval between applications is shorter in the Nordic countries than at lower latitudes. Kreuser and Soldat (2012), University of Wisconsin, recommended North-American superintendents to make one application of PGR for every 200 day degree units (e.g. 10 days with a mean diurnal temperature of 20 °C); and this may well be correct even in southernmost part of Scandinavia during warm periods in late summer. However, in central and northern areas with almost continuous light and a mean temperature for May and June not higher than 10-12 °C, 150 day degree units seems more appropriate to produce a consistent reduction in clipping yields.

Light and frequent

In our research on turfgrass management, we usually find that 'light and frequent' is better than 'heavy and infrequent'. Without going into detail, this applies to topdressing ('dusting' is good), fertilizer applications ('spoon-feeding' is good) and irrigation (light and frequent deficit irrigation saves water and is good to the turf). The same principle also applies to plant growth regulators; e.g. on fairways with a turf cover of Kentucky bluegrass, annual bluegrass and red fescue (*Festuca*



Fig. 5: Apart from the reductions in mowing requirement, one of the potential benefits of PGR on fairways is a better ball lie.

(Photo: Trygve S. Aamlid)

rubra), we have found that PGR at a rate of 1.0 l/ha every two weeks is both safer and gives a more consistent growth retardation than 2.0 l/ha every four weeks. Of particular importance is to avoid too high rate at the first seasonal application as this is likely to cause yellowing or other phytotoxic effects. A good rule of the thumb may be to start with one half of the fully intended rate. When starting to apply PGR, the grass plant has to adjust to a new physiological balance where more of its resources are used for tillering and carbohydrate storage, and less for leaf elongation.

Different response in various turfgrass species

All cool-season turfgrasses respond to PGR, but the greatest potential for reduction in clipping yields is probably found in the bluegrasses; Kentucky bluegrass on tees, fairways and semiroughs and annual bluegrass on greens, tees and fairways. Creeping bentgrass greens also show an improvement in playing quality and consistency throughout the day. The potential is probably less in red fescue, and few of the Scandinavian courses with a wall-to-wall cover of this species have started to use PGR.

The least sensitive species to PGR is perennial ryegrass (*Lolium perenne*) which requires higher rates than any of the other cool-season turfgrasses. Perennial ryegrass is usually not recommended on Scandinavian golf courses except in urgent need for repair, but those that have included this species in seed mixtures for fairway or semirough may well experience that the ryegrass tufts stand out as small 'islands' after treatment PGR (Figure 4). If applications rates are too high, it is also a

common observation that broadleaved weeds such as dandelions or plantains become more visible after use of the growth regulator. However if good weed control is practiced this will probably overcome the issue.

Recommended rates and benefits

There are no exact figures, but a fair guess is that approximately one third of the golf courses in Sweden and Finland have started using PGR on their greens. The corresponding figure for fairways is much lower, probably around 5 %. Less use on fairway is due to the costs of applying the product on larger areas, but on the other hand, the highest potential for reductions in clipping costs and energy use also exists on fairways. With the recommend rate of 1.0-1.2 l/ha every two to three weeks, our research shows that most golf courses will be able to cut the mowing budget by one third, and playing characteristics such as ball lie are also be improved (Figure 5). On greens, the recommended rate of 0.2-0.4 l/ha every one to two weeks will usually not allow greenkeepers to skip a high number of clippings, but the major advantage seems to be a fairly consistent improvement in playing quality. Greenkeepers are therefore encouraged to find the optimal application rate and interval for their own golf course.

References

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- Primo MAXX® is a registered brand name of Syngenta

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