Shade Adaptation of Established Turfgrass Improved by Plant Growth Regulator

R.S. Tegg[1] and P.A. Lane[2]

[1]Tasmanian Institute of Agricultural Research, University of Tasmania, Burnie Tasmania.
[2] School of Agricultural Science, University of Tasmania, Hobart Tasmania.

ABSTRACT

Shading, through its impact on plant growth, reduces the quality and performance of turfgrass. This has been most recently demonstrated at the Docklands stadium in Victoria, Australia, where shading, combined with heavy wear, has resulted in an undesirable and at times sub-standard turf surface. Plant growth regulators (PGR's) offer an opportunity to modify a plant's growth habit to enable it to be better adapted to a shady environment. 'Primo' (trinexapac-ethyl) a PGR, was shown to significantly improve the shade adaptation of a number of turfgrass species commonly used in high quality turf surfaces and may offer the potential in reducing costs of managing turf in such an environment.

KEY WORDS

Shade adaptation, turf, turfgrass, Primo (trinexapac ethyl), plant growth regulator.

INTRODUCTION

Light, one of the critical factors for production of high quality turf, can be reduced by a number of sources, predominantly trees and buildings. In the past turfgrass species have been largely restricted from these shaded environments. However, modern stadiums such as Docklands in Victoria, Australia, create a shaded environment that requires turfgrass for sports usage. Some areas of a semi-enclosed arena receive little or no direct sunlight especially over the winter months. As such, the turf's ability to recover from wear will be severely diminished. Recent estimates have stated that areas of turf under severe shade will need replacing up to six times per year to maintain an acceptable turf quality, an expensive process (F. Casimaty, pers. comm.). Recent work in the USA has identified the PGR 'Primo'(trinexapac-ethyl) as a potential management tool to improve the performance of turfgrass under shade (1). Any management practice that can improve the shade adaptation of turfgrass may reduce the need for such frequent replacement of turf, and reduce the high costs of managing the turf in such a stadium.

METHODS AND MATERIALS

A field trial located at Richmond, Tasmania and a mini-sward experiment at the University of Tasmania, Hobart were initiated in December 1999 to investigate the impact of 'Primo', on established turfgrass swards, under a variety of shade treatments. The field trial was arranged as a split-split plot experimental design with three replicate, four shade levels (0, 30, 50 & 70% shade) five turf species or sward types (Kentucky bluegrass/perennial ryegrass, tall fescue, couch, supina bluegrass, and bentgrass) with and without Primo. The mini-sward experimental design was a split-plot design. Each of the three replicates comprised three shade levels (0, 50 & 70% shade), with each shade level split into six to accommodate the randomly allocated factorial (3 species (blue/rye, tall fescue, couch) x 2 Primo (P0 & P1)) treatments.

Shading was the first parameter applied with the Primo treatment applied one week later. Primo was applied at a rate of 20ml/10 L water per 100m^2 (P1) across all sward types, on one-half of the plots. The other half of the plots received no Primo (P0). A range of qualitative and quantitative measurements was taken from each experiment. In this paper results for quality or appearance (1 = poor, not uniform, 3 = acceptable, 5 = excellent) and vertical height increase (vertical growth over an 8 day period measured in mm.) are presented, and represent sampling periods from January to April, 2000. Quality assessments presented were made 10 to 20 days after application of Primo.

RESULTS AND DISCUSSION

In the field experiment, Primo improved the general appearance of the turf under shade by increasing the appearance ranking (Figure 1). The effect of Primo was dependent on the shade treatment i.e. Shade by Primo interaction was significant ($P<0.05$). The consistent trend indicated that Primo had a greater effect on appearance of the turf at the higher shade levels (50% shade (S50) & 70% shade (S70)). At the lower shade levels (S0 & S30), the effect was diminished. Figure (1) shows a shade intolerant (blue/rye) and a shade tolerant variety (tall fescue), with blue/rye receiving the greater benefit from the use of Primo.

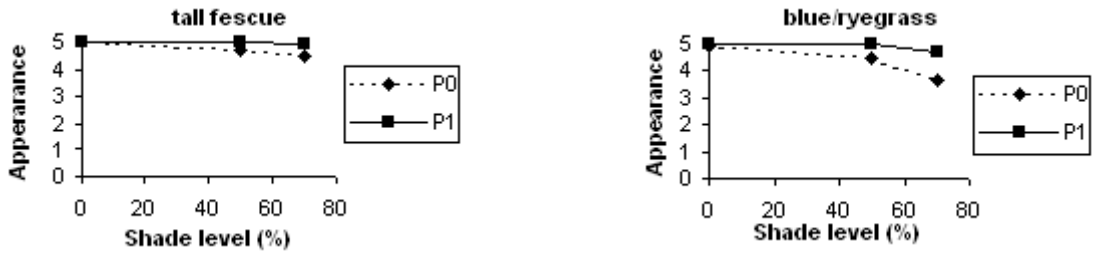

Figure 1. Effect of shade and Primo on appearance of blue/ryegrass and tall fescue (Feb 2000).

In the mini-sward experiment, vertical height increase of the sward showed a strong linear relationship with increasing shade levels (Figure 2), this relationship has been reported by other authors (1). The rate of increase in vertical growth with increasing shade levels (slope of the regression) although not a definitive representation of shade tolerance can give an indication of the shade tolerance of the species. The lesser slope infers shade tolerance whilst greater slope infers shade intolerance.

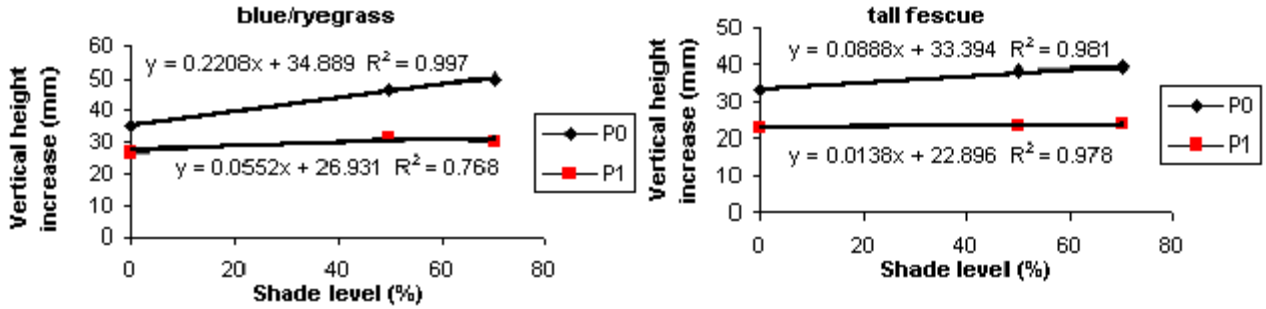

Figure 2. Effect of shade and Primo on vertical height increase (mm), for blue/ryegrass and tall fescue, with linear regression line, averaged over 4 assessment dates (March – April, 2000).

Where Primo was not applied (P0) slopes were 0.221 and 0.089, for blue/ryegrass and tall fescue respectively. This indicates that blue/ryegrass was shade intolerant whilst tall fescue had shade tolerant properties. Where Primo was applied (P1) there was a subsequent reduction in slope such that values declined to 0.055 and 0.014 for blue/ryegrass and tall fescue respectively. These lower slopes created by the use of Primo indicate that the shade tolerance of both sward types was improved significantly ($p<0.05$). These decreased slopes are not to the detriment of the turf as Primo reduces regrowth while channelling energy into root production and the manufacture of carbohydrate reserves (1).

CONCLUSION

Primo offers the potential to alter and improve the shade adaptation of turfgrass varieties and its use in sporting stadiums may reduce the costs of managing the turf in these light-deprived environments.

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REFERENCES

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