# Wear tolerance and recovery of Zoysia japonica as affected by clipping frequency, rooting media, and mineral nutrient supply

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**Justin H. A. Springer and Francis B. Lopez**

**Department of Biological & Chemical Sciences, The University of the West Indies, Cave Hill Campus, Barbados**

## Introduction

- The sand-capped outfield at the 3Ws Oval, Barbados (Fig. 1) was originally planted with Bermuda grass, *Cynodon dactylon* (L.) Pers. 'Princess-77', for Cricket World Cup 2007.
- Zoysia grass (*Zoysia japonica* Steud., variety 'El Toro'), was possibly introduced in turf sods used for field repairs, and it has now colonized large sections of the field.
- Generally, Zoysia grass is not recommended for sports fields due to slow growth and poor recovery from wear injury (Wiecko, 2006).
- This Zoysia grass appears to be thriving well in heavily trafficked areas on the field, and has several desirable characteristics including weed suppression. Varietal expansion in Barbados is being considered.
- Information is required on wear tolerance and recovery characteristics of this variety under different agronomic conditions.

Fig. 1. The 3Ws Oval, Barbados

Fig. 2. Wear simulator device

Fig. 3. Wear treatment application

## Objectives

- To develop a method for applying simulated wear treatments without compaction to potted turf.
- To investigate the effects of simulated wear on turf growth, quality and recovery of *Zoysia japonica*.
- To determine the effects of clipping frequency, rooting media and mineral nutrient supply on wear tolerance and recovery.

## Methods

- Zoysia grass was established in 2.5L pots (Fig. 2, 3) using sod taken from the outfield at the 3Ws Oval, Barbados.
- Pots were watered daily, and a soluble fertilizer (NPK 20:20:20) was applied once per week up to two weeks before the start of experimental treatments.
- Two experiments were conducted under field conditions at the Cave Hill Campus of the University of the West Indies, Barbados.
- A multi-split-plot design was used for both studies with wear treatments as the smallest sub-plot units and with 5 replications (blocks).

**Experiment #1**

- Effects of clipping frequency rooting media and fertilizer regime on turf wear tolerance and recovery.
- Conducted: 21 July 2011 to 16 February 2012
- Two rooting media: sand, sand/soil (1:1) mixture using a heavy clay soil
- Two clipping frequencies: once, twice (per week). Turf clipped back to the rim of the pot each time.
- Two N:K fertilizer ratios: High N (24:8:16 NPK, Miracle-Gro, USA), High K (14:10:27 NPK, Phostrogen, UK). Both applied as watering solutions once per week at recommended concentrations.

**Experiment #2**

- Effects of fertilizer type and rate on turf wear tolerance and recovery in a sand rooting medium.
- Conducted: 13 December to 5 April 2012
- Two N:K fertilizer ratios (as in experiment #1). All fertilizers applied once per week
- Three fertilizer rates: 0.5x, 1x, and 2x recommended watering concentrations for each fertilizer

## Wear Treatment

- Turf was subjected to wear by the action of the rotating arm of a ceramic tile hole-cutter fitted to a Power Drill (DR201, Black and Decker, USA. Fig. 2)
- The Drill was powered by a 12V battery with AC inverter (Power Dome, Wagan Tech, USA) and the cutting arm of the hole-cutter was pressed into the turf while rotating at full power for 3 seconds (Fig. 3)
- The wear treatment was applied at 3 overlapping locations within a pot, each covering a circular area (4 cm radius) with a cutting depth of 1.8 cm (Fig. 4).
- Wear was applied twice in experiment #1 (at 11 and 12 weeks after planting), and once in experiment #2 (at 8 weeks after planting).

Before   After

Fig. 4. Before and After wear treatment

## Observations

- Greenness Index was measured using a Chlorophyll Index Meter (CM 1000 Spectrum Technologies Inc., USA). Measurements were taken between 11am and 2pm.
- Percentage green cover was obtained using digital image analysis software (Version 2.0, Assess, APS, USA). Images of individual pots were taken before and following wear treament application.
- Clippings were collected and dry mass determined after drying in an oven at 80ºC for 7 days.
- Turf height was measured using a modified version of the NZSTI 'rising disk technique' (Fig. 5) at 4 days after clipping for all treatments.
- Soil moisture content (%, v/v) was measured using a 5cm-length probe (EC5, Decagon Devices Inc., USA) in the late afternoon following early morning watering.

Fig. 5. Measurement of turf height

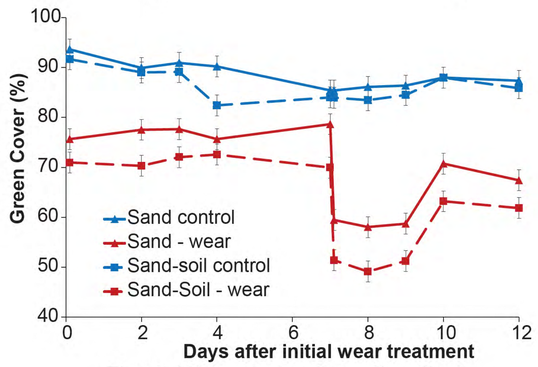


Fig. 6. Wear and soil media effects

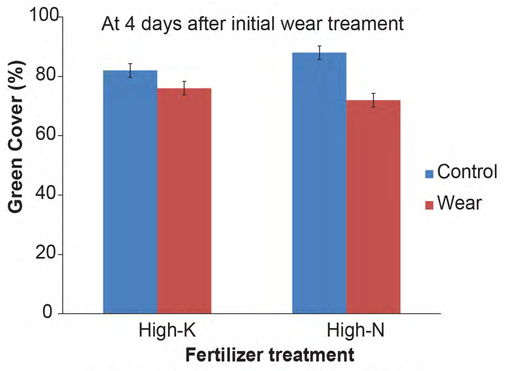


Fig. 7. Wear and fertilizer effects

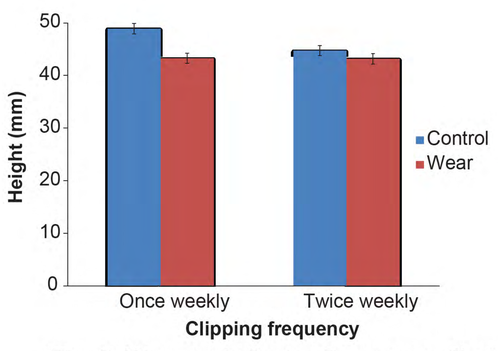


Fig. 8. Wear and clipping frequency effects

## Results and Discussion

- Wear treatment application was achieved without soil compaction in this study. The need to separate these two components of traffic injury has been stressed previously (Carrow and Petrovic, 1992).
- There was a significant interaction between wear treatment and rooting medium with regard to green cover percentage (Fig. 6) and greenness index (data not shown).
- Turf grown in sand appears to be more resistant to the effects of wear compared to turf grown in the sand/soil mixture (Fig. 6). With higher soil (clay) content in the rooting medium, turf roots are likely to be more superficial and perhaps more vulnerable.
- Rates of recovery following wear application appears to be similar for turf grown in sand and in the sand/soil mixture (Fig. 6).
- A significant interaction between wear treatment and fertilizer type was observed for green cover (%) after the intitial wear treatment in experiment #1 (Fig. 7), but not in experiment #2, where dry season conditions affected turf growth (data not shown).
- The effects of wear on green cover (%) was more pronounced for turfgrass exposed to the High-N compared to turf receiving High-K fertilizer (Fig. 7).
- Turf height (at 4 days after clipping of all pots) was reduced by increased clipping frequency and was more affected by the wear treatment at the lower clipping frequency (Fig. 8).
- A significant correlation was observed between green cover (%) and clipping height for wear treated turf following the initial wear treatment (Fig. 9).
- Interactions involving wear treatments were generally not significant for clipping dry mass and soil moisture content (data not shown).

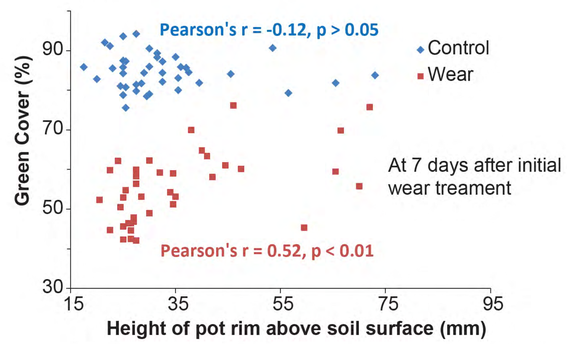


Fig. 9. Correlation: Green cover vs. clipping height

## Conclusions

- Wear treatments were applied without soil compaction to potted turfgrass in this study.
- Turf wear tolerance in Zoysia grass appears to be enhanced in a more sandy rooting medium.
- Wear tolerance and/or recovery in Zoysia grass may be associated with increased clipping frequency, lower N:K fertilizer ratio and higher clipping heights.

## References

- Carrow, R. N., and A. M. Petrovic. 1992. Effects of traffic on turfgrass. In *Turfgrass. Number 32 in the series Agronomy*, edited by D. V. Waddington, R. N. Carrow, and R. C. Shearman. USA: American Society of Agronomy.
- Wiecko, G. 2006. *Fundamentals of tropical turf management*. Wallingford UK; Cambridge MA: CABI Pub.